



# HARTNER

Precision Cutting Tools



**BOHRWERKZEUGE**





**HARTNER**

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Precision Cutting Tools

# Typenbezeichnungen

Typ	Anwendung	Seiten- spanwinkel	Spitzen- winkel	Spitzenanschliff	
<b>N</b>	für normal zerspanbare Werkstoffe (z.B. Stahl, GS, GG)	20°-30°	118°	Kegelmantelschliff Normalanschliff	Schnelstahl-Bohrer
<b>H</b>	für harte, kurzspanende Werkstoffe (z.B. MS, Bronze, Elektron)	12°-16°	118°	Kegelmantelschliff Normalanschliff	
<b>W</b>	für weiche, langspanende Werkstoffe (z.B. Al-Legierungen, Kupfer)	35°-40°	130°	Kegelmantelschliff Normalanschliff	
<b>FN</b>	für normal zerspanbare Werkstoffe für besonders tiefe Bohrungen	35°	130°	Kegelmantelschliff Normalanschliff	
<b>FN 500</b>	für langspanende, zähe Werkstoffe (z.B. hochlegierte Stähle, Vergütungs - u. Einsatzstähle)	20°-30°	130°	Kegelmantelschliff Normalanschliff	
<b>FU 500</b> <b>FU 500 DZ</b>	für universelle Anwendungen (z.B. legierte und nicht legierte Stähle bis 800 mm <sup>2</sup> ) DZ = durchgängig zylindrischer Schaft	35°	118°	2-Flächen Spezialanschliff	
<b>FW</b>	für weiche, langspanende Werkstoffe für besonders tiefe Bohrungen	35°-40°	130°	Kegelmantelschliff Normalanschliff	
<b>S</b>	für schwer zerspanbare Werkstoffe (z.B. rostfreie und hitzebeständige Stähle)	35°	130°	Kegelmantelschliff Normalanschliff	
<b>IS</b>	für zähe, rost-, säure- und hitzebeständige Stähle	40°	130°	Kegelmantelschliff Normalanschliff	
<b>HX500</b>	Für verschleißfeste Materialien wie Hardox	22°	135°	2-Flächen Spezialanschliff	
<b>V</b>	für harte, schwer zerspanbare Werkstoffe (z.B. Federstähle)	20°-30°	130°	Kegelmantelschliff Normalanschliff	Hartmetall-Bohrer
<b>TS 3 G</b>	für positions- und formgenaue Bohrungen	28°	150°	Spezialanschliff	
<b>TS 80 U</b>	für universelle Anwendungen (z.B. GG, GGG, Stahl bis ca. 1000 N/mm <sup>2</sup> )	20°-30°	140°	Kegelmantelschliff Spezialausspitzung Typ U	
<b>TS 100 U</b>	für Stähle bis ca. 1000 N/mm <sup>2</sup> , universelle Anwendung	25°-35°	140°	Flächenanschliff	
<b>TS 100 HPC</b>	Für Hochleistungsbearbeitung in Bau- und Einsatzstähle bis 1400N/mm <sup>2</sup> , rostfreie Stähle, Titan, als auch Sonderlegierungen	25°-30°	140°	optimierter Kegelmantelschliff	
<b>TS 150 GG</b>	für kurzspanende Gusswerkstoffe, Aluminium und Al-Legierungen mit hohem Si-Gehalt	0° (gerade genutet)	120°	Flächenanschliff Spezialausspitzung Typ GG	
<b>TS 100 R</b>	für neue Gusswerkstoffe GGV und ADI, Gusseisen und Kugelgraphit-/Temperguss	30°	-	Radiusanschliff	
<b>TS 100 T</b>	für tiefe Bohrungen in Stahl und Guss	30°	135°	Kegelmantelschliff	
<b>TS 100 INOX</b>	für rostfreie Stähle	30°	140°	Flächenanschliff	
<b>TS 100 H</b>	für hochfeste und gehärtete Stähle sowie Sonderlegierungen	30°	140°	Kegelmantelschliff	
<b>TS 100 EG</b>	VHM Entgratgabel				Entgrater
<b>TS 100 VR</b>	Vor- und Rückwärtsentgrater 90°				
<b>TLB E80</b>	Einlippen-Tieflochbohrer mit gelötetem HM-Kopf				Tieflochbohrer
<b>TLB E100</b>	Einlippen-Tieflochbohrer aus VHM				
<b>TLB E800</b>	Einlippen-Tieflochbohrer mit Wechselplatten				
<b>TLB Z80</b>	Zweilippen-Tieflochbohrer mit gelötetem HM-Kopf				

# ISO-Code

<b>P</b>	Stahl, hochlegierter Stahl
<b>M</b>	Rostfreier Stahl
<b>K</b>	Grauguss, Sphäroguss und Temperguss
<b>N</b>	Aluminium und andere Nichteisenmetalle
<b>S</b>	Sonder-, Super- und Titanlegierungen
<b>H</b>	Gehärteter Stahl und Hartguss

# Piktogramme

Schneidstoff	<b>HSS</b>	<b>HSS-E</b>	<b>M42</b>	<b>HSS-E-PM</b>	<b>VHM</b>	<b>HM</b>						
	Schnellstahl				Vollhartmetall		Hartmetall					
Oberfläche												
Typ	<b>N</b>	<b>H</b>	<b>W</b>	<b>FN</b>	<b>FN500</b>	<b>FU500</b>	<b>FU500 DZ</b>	<b>FW</b>	<b>S</b>	<b>IS</b>		
	<b>HX500</b>	<b>V</b>	<b>TS3 G</b>	<b>TS80 U</b>	<b>TS100 U</b>	<b>TS100 HPC</b>	<b>TS150 GG</b>	<b>TS100 R</b>	<b>TS100 T</b>	<b>TS100 INOX</b>		
	<b>TS100 H</b>	<b>TS100 EG</b>	<b>TS100 VR</b>	<b>TLB E 80</b>	<b>TLB E 100</b>	<b>TLB E 800</b>	<b>TLB Z 80</b>					
Erklärung Typenbezeichnungen siehe Rückseite Ausklappseite												
Form	<b>R</b>	<b>A</b>	<b>B</b>	<b>C</b>								
Bohrtiefe	<b>3xD</b>	<b>5xD</b>	....	<b>~3xD</b>	<b>~5xD</b>	....	<b>SPL 45,00</b>	<b>SPL 80,00</b>	....			
							mm	mm				
Norm	<b>DIN 333</b>	<b>DIN 338</b>	<b>DIN 339</b>	<b>DIN 340</b>	<b>DIN 343</b>	<b>DIN 344</b>	<b>DIN 345</b>	<b>DIN 1869</b>	<b>DIN 1897</b>	....		
	<b>DIN 8374</b>	<b>DIN 8375</b>	<b>DIN 8376</b>	<b>DIN 8377</b>	<b>DIN 8378</b>	<b>DIN 8379</b>	<b>DIN 6537K</b>	<b>DIN 6537L</b>	<b>DIN 6527K</b>	nach DIN		
		nach Hartner Standard										
Spitzenwinkel												
	<b>90°</b>	<b>118°</b>	<b>120°</b>	<b>130°</b>	<b>135°</b>	<b>140°</b>	<b>142°</b>	<b>150°</b>				
Ø-Toleranz	<b>m7</b>	<b>h5</b>	<b>h6</b>	<b>h7</b>	<b>h8</b>	<b>0/-0,004</b>						
Schneidrichtung												
	rechts	links										
Schafform												
	nach DIN 6535			zylindrisch			Morsekegel	Steilkegel				
Ausspitzung												
Innenkühlung												
	mit IK	ohne IK										



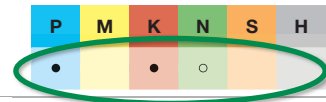
## Bestellmöglichkeiten

Bitte geben Sie bei Ihrer Bestellung immer  
**die Artikel-Nr. und den Nenn-Ø** an, z.B.:  
 „Spiralbohrer kurz, für Nenn-Ø 0,20 mm“  
 = **81010 0,200**

Artikel-Nr.

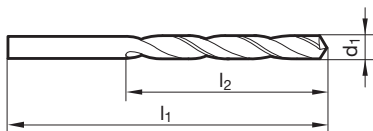
### Spiralbohrer kurz

**Artikel-Nr. 81010**



Ausspitzung  $\geq \text{Ø } 1,000$  • Kegelmantelschliff

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen und Graphit



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,200		19,000	2,500	0,640		26,000	8,000
0,220		19,000	2,500	0,650		26,000	8,000
0,230		19,000	2,500	0,660		26,000	8,000
0,240		19,000	2,500	0,670		26,000	8,000
0,250		19,000	3,000	0,680		28,000	9,000
0,260		19,000	3,000	0,690		28,000	9,000
0,270		19,000	3,000	0,700		28,000	9,000

Nenn-Ø

Auf den folgenden Programmseiten finden Sie zu jedem Werkzeug Empfehlungen zur Eignung für die Anwendungsgruppen:

- optimal geeignet
- bedingt geeignet



## Wichtige Hinweise

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### Allgemeine Verkaufsbedingungen

Wir liefern ausschließlich zu unseren allgem. Verkaufsbedingungen.  
Diese können bei uns angefordert werden.

Werden Sonderwerkzeuge in Auftrag gegeben, so darf die Bestellmenge um ca. 10%, mindestens jedoch um 2 Stück, über- oder unterschritten werden. Berechnet wird die Liefermenge.

### Lieferbedingungen für Kleinstmengen

Wir behalten uns vor, bei einem Auftragswert unter € 100,00 netto einen angemessenen Mindermengenzuschlag anzurechnen.

Werkzeuggruppe	Norm	Verpackungseinheit
Spiralbohrer mit Zylinderschaft aus Schnellarbeitsstahl	DIN 338 DIN 1897 und ähnl. Werksnormen	≤ Ø 7,50 mm in Packungen zu 10 Stück > Ø 7,50 ... Ø 10,60 mm in Packungen zu 5 Stück > Ø 10,60 mm in Verpackungen mit 1 Stück
	DIN 339 DIN 340 und ähnl. Werksnormen	≤ Ø 6,70 mm in Packungen zu 10 Stück > Ø 6,70 ... Ø 10,60 mm in Packungen zu 5 Stück > Ø 10,60 mm in Verpackungen mit 1 Stück
	DIN 1869	≤ Ø 7,50 mm in Packungen zu 10 Stück > Ø 7,50 ... Ø 10,60 mm in Packungen zu 5 Stück > Ø 10,60 mm in Verpackungen mit 1 Stück
Spiralbohrer mit Morsekegel aus Schnellarbeitsstahl	alle DIN und Werksnormen	alle Abmessungen in Verpackungen mit 1 Stück
Spiralbohrer aus Hartmetall und hartmetallbestückte Werkzeuge	alle DIN und Werksnormen	alle Abmessungen in Verpackungen mit 1 Stück
Kleinstbohrer	DIN 1899	alle Abmessungen in Verpackungen zu 10 Stück
Zentrierbohrer	DIN 333 Form A, Form R	≤ Ø 4,00 mm in Packungen zu 10 Stück > Ø 4,00 mm in Packungen mit 1 Stück
	DIN 333 Form B	≤ Ø 2,50 mm in Packungen zu 10 Stück > Ø 2,50 mm in Packungen mit 1 Stück

### Bankverbindung

Deutsche Bank AG  
IBAN DE74 6537 0075 0014 6415 00  
BIC DEUTDESS653

BW Bank  
IBAN DE45 6005 0101 0002 5924 44  
BIC SOLADEST600

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**HARTNER**

## Registerübersicht

### **SPIRALBOHRER MIT ZYLINDERSCHAFT**

aus HSS, HSS-E, HSS-E-PM, Vollhartmetall, Hartmetall-bestückt  
blank und beschichtet

### **SPIRALBOHRER MIT MORSEKEGEL**

aus HSS, HSS-E, Hartmetall-bestückt  
blank und beschichtet

### **TS-DRILLS**

High-Tech-Werkzeuge aus Vollhartmetall  
blank und beschichtet

### **EIN- UND ZWEILIPPEN-TIEFLOCHBOHRER**

aus Vollhartmetall, mit HM-Kopf oder mit Wechselplatten  
blank und beschichtet

### **KLEINSTBOHRER**

aus Vollhartmetall und HSS-E-PM  
blank und beschichtet

### **STUFEN- UND ZENTRIERBOHRER**

aus HSS, HSS-E, Vollhartmetall  
blank und beschichtet

### **SENK- UND ENTGRATWERKZEUGE**

aus HSS, HSS-E, Vollhartmetall  
blank und beschichtet

### **MULTIPLEX / MULTIPLEX HPC**

Wechselplatten-Spiralbohrer mit Innenkühlung  
Wechselplatten aus HSS-E, HSS-E PM, Vollhartmetall  
blank und beschichtet

### **TECHNISCHER TEIL**

Baumaße, Begriffe, Einsatzempfehlungen





Artikel-Nr.	Seite	Bohrtiefe	Norm	Oberfläche	Bezeichnung	Schneidstoff	Typ
<b>80495</b>	388		Werksnorm	AlTiN nano	Vor- und Rückwärtsentgrater 90°	VHM	TS 100 VR
<b>81000</b>	104	3xD	Werksnorm	TiAlZrN		M42	HX 500
<b>81010</b>	53	~5xD	DIN 338	dampfbehandelt	Spiralbohrer kurz	HSS	N
<b>81011</b>	83	~5xD	DIN 338	dampfbehandelt	Spiralbohrer kurz	HSS-E	N
<b>81012</b>	77	~5xD	DIN 338	blank	Spiralbohrer kurz	M42	N
<b>81013</b>	85	~5xD	DIN 338	blank	Spiralbohrer kurz	HSS-E	IS
<b>81015</b>	57	~5xD	DIN 338	dampfbehandelt	Spiralbohrer kurz	HSS	N
<b>81017</b>	59	~5xD	DIN 338	dampfbehandelt	Spiralbohrer kurz	HSS	N
<b>81018</b>	79	~5xD	DIN 338	Bronze-Oxid	Spiralbohrer kurz	M42	N
<b>81019</b>	81	~5xD	DIN 338	nanoFIRE	Spiralbohrer kurz	M42	N
<b>81020</b>	60	~5xD	DIN 338	blank	Spiralbohrer kurz	HSS	H
<b>81025</b>	62	~5xD	DIN 338	blank	Spiralbohrer kurz	HSS	H
<b>81030</b>	64	~5xD	DIN 338	blank	Spiralbohrer kurz	HSS	W
<b>81035</b>	66	~5xD	DIN 338	blank	Spiralbohrer kurz	HSS	W
<b>81040</b>	67	~5xD	DIN 338	Fasen nitriert	Spiralbohrer kurz	HSS	FN
<b>81041</b>	87	~5xD	DIN 338	Fasen nitriert	Spiralbohrer kurz	HSS-E	FN
<b>81045</b>	69	~5xD	DIN 338	Fasen nitriert	Spiralbohrer kurz	HSS	FN
<b>81061</b>	89	~5xD	DIN 338	blank	Spiralbohrer kurz	HSS-E	S
<b>81078</b>	97	~5xD	DIN 338	AlTiZrN	Spiralbohrer kurz	HSS-E	IS
<b>81110</b>	24	~3xD	DIN 1897	dampfbehandelt	Spiralbohrer extra kurz	HSS	N
<b>81112</b>	35	~3xD	DIN 1897	blank	Spiralbohrer extra kurz	M42	N
<b>81115</b>	26	~3xD	DIN 1897	blank	Spiralbohrer extra kurz	HSS	N
<b>81120</b>	28	~3xD	DIN 1897	blank	Spiralbohrer extra kurz	HSS	H
<b>81130</b>	29	~3xD	DIN 1897	blank	Spiralbohrer extra kurz	HSS	W
<b>81140</b>	30	~3xD	DIN 1897	Fasen nitriert	Spiralbohrer extra kurz	HSS	FN
<b>81145</b>	31	~3xD	DIN 1897	Fasen nitriert	Spiralbohrer extra kurz	HSS	FN
<b>81171</b>	37	~3xD	DIN 1897	dampfbehandelt	Spiralbohrer extra kurz	HSS-E	V
<b>81173</b>	39	~3xD	DIN 1897	blank	Spiralbohrer extra kurz	HSS-E	IS
<b>81178</b>	44	~3xD	DIN 1897	AlTiZrN	Spiralbohrer extra kurz	HSS-E	IS
<b>81190</b>	119		Werksnorm	dampfbehandelt	Karosseriebohrer	HSS	N
<b>81191</b>	115		Werksnorm	blank	NC-Anbohrer	HSS	N
<b>81192</b>	116		Werksnorm	blank	NC-Anbohrer	HSS	N
<b>81210</b>	122	~10xD	DIN 339	dampfbehandelt	Bohrbuchsenbohrer	HSS	N
<b>81310</b>	124	~10xD	DIN 340	dampfbehandelt	Spiralbohrer lang	HSS	N
<b>81311</b>	138	~10xD	DIN 340	dampfbehandelt	Spiralbohrer lang	HSS-E	N
<b>81315</b>	126	~10xD	DIN 340	dampfbehandelt	Spiralbohrer lang	HSS	N
<b>81317</b>	127	~10xD	DIN 340	dampfbehandelt	Spiralbohrer lang	HSS	N
<b>81320</b>	128	~10xD	DIN 340	blank	Spiralbohrer lang	HSS	H
<b>81330</b>	129	~10xD	DIN 340	blank	Spiralbohrer lang	HSS	W
<b>81340</b>	131	~10xD	DIN 340	Fasen nitriert	Spiralbohrer lang	HSS	FN
<b>81341</b>	139	~10xD	DIN 340	Fasen nitriert	Spiralbohrer lang	HSS-E	FN
<b>81350</b>	133	~10xD	DIN 340	blank	Spiralbohrer lang	HSS	FW
<b>81361</b>	141	~10xD	DIN 340	blank	Spiralbohrer lang	HSS-E	S
<b>81362</b>	141	~10xD	DIN 340	TiN	Spiralbohrer lang	HSS-E	S
<b>81410</b>	147	~15xD	DIN 1869	dampfbehandelt	Spiralbohrer überlang, Reihe 1	HSS	N
<b>81440</b>	148	~15xD	DIN 1869	Fasen nitriert	Spiralbohrer überlang, Reihe 1	HSS	FN
<b>81441</b>	151	~15xD	DIN 1869	Fasen nitriert	Spiralbohrer überlang, Reihe 1	HSS-E	FN
<b>81450</b>	149	~15xD	DIN 1869	blank	Spiralbohrer überlang, Reihe 1	HSS	FW
<b>81510</b>	152	~20xD	DIN 1869	dampfbehandelt	Spiralbohrer überlang, Reihe 2	HSS	N
<b>81540</b>	153	~20xD	DIN 1869	Fasen nitriert	Spiralbohrer überlang, Reihe 2	HSS	FN
<b>81541</b>	155	~20xD	DIN 1869	Fasen nitriert	Spiralbohrer überlang, Reihe 2	HSS-E	FN
<b>81610</b>	156	~25xD	DIN 1869	dampfbehandelt	Spiralbohrer überlang, Reihe 3	HSS	N
<b>81640</b>	157	~25xD	DIN 1869	Fasen nitriert	Spiralbohrer überlang, Reihe 3	HSS	FN
<b>81641</b>	158	~25xD	DIN 1869	Fasen nitriert	Spiralbohrer überlang, Reihe 3	HSS-E	FN
<b>81740</b>	159	>25xD	Werksnorm	Fasen nitriert	Spiralbohrer extra lang	HSS	FN
<b>81750</b>	160	>25xD	Werksnorm	blank	Spiralbohrer extra lang	HSS	FN
<b>81760</b>	161	>25xD	Werksnorm	blank	Spiralbohrer extra lang	HSS	FN
<b>81810</b>	162		DIN 1898	dampfbehandelt	Stiftlochbohrer	HSS	N
<b>82010</b>	173	~5xD	DIN 345	dampfbehandelt	Spiralbohrer	HSS	N
<b>82011</b>	177	~5xD	DIN 345	dampfbehandelt	Spiralbohrer	HSS-E	N
<b>82012</b>	178	~5xD	DIN 345	blank	Spiralbohrer mit Morsekegel	HSS-E	IS
<b>82030</b>	175	~5xD	DIN 345	blank	Spiralbohrer	HSS	W
<b>82191</b>	183		Werksnorm	dampfbehandelt	NC-Anbohrer	HSS	N
<b>82192</b>	183		Werksnorm	dampfbehandelt	NC-Anbohrer	HSS	N
<b>82210</b>	184	~10xD	DIN 341	dampfbehandelt	Spiralbohrer lang	HSS	N
<b>82211</b>	185	~10xD	DIN 341	dampfbehandelt	Spiralbohrer lang	HSS-E	N

Artikel-Nr.	Seite	Bohrtiefe	Norm	Oberfläche	Bezeichnung	Schneidstoff	Typ
<b>82310</b>	186	~15xD	DIN 1870	dampfbehandelt	Spiralbohrer überlang, Reihe 1	HSS	N
<b>82340</b>	187	~15xD	DIN 1870	Fasen nitriert	Spiralbohrer überlang, Reihe 1	HSS	FN
<b>82341</b>	188	~15xD	DIN 1870	Fasen nitriert	Spiralbohrer überlang, Reihe 1	HSS-E	FN
<b>82410</b>	189	~20xD	DIN 1870	dampfbehandelt	Spiralbohrer überlang, Reihe 2	HSS	N
<b>82440</b>	190	~20xD	DIN 1870	Fasen nitriert	Spiralbohrer überlang, Reihe 2	HSS	FN
<b>82466</b>	191	>20xD	Werksnorm	Fasen nitriert	Spiralbohrer extra lang	HSS	FN
<b>82467</b>	192	20xD	Werksnorm	Fasen nitriert	Spiralbohrer extra lang	HSS	FN
<b>82468</b>	193	>20xD	Werksnorm	blank	Spiralbohrer extra lang	HSS	FN
<b>82469</b>	194	>20xD	Werksnorm	blank	Spiralbohrer extra lang	HSS	FN
<b>82515</b>	198	~15xD	Werksnorm	dampfbehandelt	Kühlkanalbohrer überlang	HSS-E	FN
<b>82521</b>	195	~10xD	Werksnorm	dampfbehandelt	Kühlkanalbohrer lang	HSS	N
<b>82525</b>	197	~10xD	Werksnorm	dampfbehandelt	Kühlkanalbohrer lang	HSS-E	FN
<b>82535</b>	196	~10xD	Werksnorm	dampfbehandelt	Kühlkanalbohrer lang	HSS	FN
<b>82571</b>	423		Werksnorm	dampfbehandelt	Kühlmittelzuführrohre		
<b>82578</b>	424		Werksnorm		Schnellverschlusskupplung		
<b>82710</b>	121	~10xD	Werksnorm	blank	Kühlkanalbohrer	HSS	FN
<b>82761</b>	120	~5xD	Werksnorm	blank	Kühlkanalbohrer	HSS-E	FN
<b>82810</b>	202		DIN 1898	dampfbehandelt	Stiftlochbohrer	HSS	N
<b>82971</b>	181	~3xD	Werksnorm	dampfbehandelt	Spiralbohrer kurz	HSS-E	V
<b>82972</b>	182	~3xD	Werksnorm	blank	Spiralbohrer mit Morsekegel	HSS-E	IS
<b>83000</b>	368		DIN 333	blank	Zentrierbohrer ohne Fläche	HSS	N
<b>83005</b>	371		DIN 333	blank	Zentrierbohrer ohne Fläche	HSS	N
<b>83100</b>	366		DIN 333	blank	Zentrierbohrer ohne Fläche	HSS	N
<b>83101</b>	373		DIN 333	blank	Zentrierbohrer ohne Fläche	HSS-E	N
<b>83102</b>	374		DIN 333	nanoFIRE	Zentrierbohrer ohne Fläche	HSS-E	N
<b>83105</b>	367		DIN 333	blank	Zentrierbohrer ohne Fläche	HSS	N
<b>83110</b>	372		Werksnorm	blank	Zentrierbohrer ohne Fläche	HSS	N
<b>83200</b>	370		DIN 333	blank	Zentrierbohrer ohne Fläche	HSS	N
<b>83300</b>	369		DIN 333	blank	Zentrierbohrer ohne Fläche	HSS	N
<b>83370</b>	375		Werksnorm	blank	Zentrierbohrer ohne Fläche	VHM	N
<b>83500</b>	376		DIN 333	blank	Zentrierbohrer mit Fläche	HSS	N
<b>83600</b>	376		DIN 333	blank	Zentrierbohrer mit Fläche	HSS	N
<b>83700</b>	377		DIN 333	blank	Zentrierbohrer mit Fläche	HSS	N
<b>84100</b>	386		Werksnorm	blank	Entgratgabeln	VHM	TS 100 EG
<b>84101</b>	387		Werksnorm	blank	Entgratgabeln	VHM	TS 100 EG
<b>84400</b>	33	~3xD	DIN 1897	TiN	Spiralbohrer extra kurz	HSS	N
<b>84405</b>	71	~5xD	DIN 338	TiN	Spiralbohrer kurz	HSS	N
<b>84406</b>	73	~5xD	DIN 338	TiN Kopf	Spiralbohrer kurz	HSS	N
<b>84415</b>	75	~5xD	DIN 338	TiN	Spiralbohrer kurz	HSS	FN
<b>84418</b>	135	~10xD	DIN 340	TiN	Spiralbohrer lang	HSS	N
<b>84423</b>	136	~10xD	DIN 340	TiN	Spiralbohrer lang	HSS	FN
<b>84425</b>	150	~15xD	DIN 1869	TiN	Spiralbohrer überlang, Reihe 1	HSS	FN
<b>84426</b>	154	~20xD	DIN 1869	TiN	Spiralbohrer überlang, Reihe 2	HSS	FN
<b>84434</b>	115		Werksnorm	TiN	NC-Anbohrer	HSS	N
<b>84435</b>	116		Werksnorm	TiN	NC-Anbohrer	HSS	N
<b>84445</b>	348		Werksnorm	TiN	Kurzstufenbohrer mit Zylinderschaft	HSS	N
<b>84448</b>	368		DIN 333	TiN	Zentrierbohrer ohne Fläche	HSS	N
<b>84450</b>	366		DIN 333	TiN	Zentrierbohrer ohne Fläche	HSS	N
<b>84460</b>	176	~5xD	DIN 345	TiN	Spiralbohrer	HSS	N
<b>84461</b>	120	~5xD	Werksnorm	TiN	Kühlkanalbohrer	HSS-E	FN
<b>84501</b>	33	~3xD	DIN 1897	nanoFIRE	Spiralbohrer extra kurz	HSS	N
<b>84502</b>	75	~5xD	DIN 338	nanoFIRE	Spiralbohrer kurz	HSS	FN
<b>84503</b>	40	~3xD	DIN 1897	nanoFIRE	Spiralbohrer extra kurz	HSS-E	V
<b>84504</b>	91	~5xD	DIN 338	nanoFIRE	Spiralbohrer kurz	HSS-E	FN
<b>84505</b>	95	~5xD	DIN 338	nanoFIRE	Spiralbohrer kurz	HSS-E	S
<b>84506</b>	136	~10xD	DIN 340	nanoFIRE	Spiralbohrer lang	HSS	FN
<b>84507</b>	109	~5xD	Werksnorm	nanoFIRE	Spiralbohrer mit verst. Zylinderschaft	HSS-E-PM	FN 500
<b>84508</b>	145	~10xD	DIN 340	nanoFIRE	Spiralbohrer lang	HSS-E	FN
<b>84511</b>	46	~3xD	DIN 1897	nanoFIRE	Spiralbohrer extra kurz	HSS-E-PM	FN 500
<b>84660</b>	179	~5xD	DIN 345	TiAlN	Spiralbohrer	HSS-E	FN
<b>84800</b>	91	~5xD	DIN 338	TiN	Spiralbohrer kurz	HSS-E	FN
<b>84801</b>	107	~5xD	Werksnorm	nanoFIRE	Spiralbohrer mit verst. Zylinderschaft	HSS-E-PM	FU 500
<b>84802</b>	93	~5xD	DIN 338	TiN	Spiralbohrer kurz	HSS-E	FU 500 DZ
<b>84803</b>	40	~3xD	DIN 1897	TiN	Spiralbohrer extra kurz	HSS-E	V
<b>84804</b>	93	~5xD	DIN 338	blank	Spiralbohrer kurz	HSS-E	FU 500 DZ
<b>84805</b>	105	~3xD	Werksnorm	nanoFIRE	Spiralbohrer mit verst. Zylinderschaft	HSS-E-PM	FU 500

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<b>84806</b>	42	~3xD	DIN 1897	TiN	Spiralbohrer extra kurz	HSS-E	FU 500 DZ
<b>84807</b>	95	~5xD	DIN 338	TiN	Spiralbohrer kurz	HSS-E	S
<b>84808</b>	42	~3xD	DIN 1897	blank	Spiralbohrer extra kurz	HSS-E	FU 500 DZ
<b>84810</b>	332	~5xD	DIN 1899	TiN	Kleinstbohrer ohne Kühlkanäle	HSS-E-PM	N
<b>84811</b>	99	~5xD	DIN 338	TiN	Spiralbohrer kurz	HSS-E-PM	FN 500 DZ
<b>84812</b>	143	~10xD	DIN 340	TiN	Spiralbohrer lang	HSS-E	FU 500 DZ
<b>84814</b>	143	~10xD	DIN 340	blank	Spiralbohrer lang	HSS-E	FU 500 DZ
<b>84859</b>	180	~5xD	DIN 345	TiN	Spiralbohrer	HSS-E	N
<b>85010</b>	354		DIN 8374	dampfbehandelt	Mehrfasenstufenbohrer mit Zylinderschaft	HSS	N
<b>85110</b>	358		Werksnorm	dampfbehandelt	Mehrfasenstufenbohrer mit Zylinderschaft	HSS	N
<b>85210</b>	356		DIN 8376	dampfbehandelt	Mehrfasenstufenbohrer mit Zylinderschaft	HSS	N
<b>85216</b>	359		Werksnorm	dampfbehandelt	Mehrfasenstufenbohrer mit Zylinderschaft	HSS	N
<b>85218</b>	355		DIN 8374	dampfbehandelt	Mehrfasenstufenbohrer mit Zylinderschaft	HSS	N
<b>85310</b>	357		DIN 8378	dampfbehandelt	Mehrfasenstufenbohrer mit Zylinderschaft	HSS	N
<b>85510</b>	364		Werksnorm	dampfbehandelt	Mehrfasenstufenbohrer mit Morsekegel	HSS	N
<b>85610</b>	362		DIN 8377	dampfbehandelt	Mehrfasenstufenbohrer mit Morsekegel	HSS	N
<b>85616</b>	365		Werksnorm	dampfbehandelt	Mehrfasenstufenbohrer mit Morsekegel	HSS	N
<b>85619</b>	361		DIN 8375	dampfbehandelt	Mehrfasenstufenbohrer mit Morsekegel	HSS	N
<b>85710</b>	363		DIN 8379	dampfbehandelt	Mehrfasenstufenbohrer mit Morsekegel	HSS	N
<b>85910</b>	345		Werksnorm	dampfbehandelt	Stufenbohrer für Zentrierungen DIN 332	HSS	N
<b>85911</b>	345		Werksnorm	dampfbehandelt	Stufenbohrer für Zentrierungen DIN 332	HSS	N
<b>85912</b>	346		Werksnorm	dampfbehandelt	Stufenbohrer für Zentrierungen DIN 332	HSS	N
<b>85914</b>	347		Werksnorm	dampfbehandelt	Stufenbohrer für Zentrierungen DIN 332	HSS	N
<b>85916</b>	349		Werksnorm	blank	Kurzstufenbohrer mit Zylinderschaft	HSS	N
<b>85917</b>	350		Werksnorm	blank	Kurzstufenbohrer mit Zylinderschaft	HSS	N
<b>85918</b>	351		Werksnorm	blank	Kurzstufenbohrer mit Zylinderschaft	HSS	N
<b>85920</b>	352		Werksnorm	blank	Kurzstufenbohrer mit Zylinderschaft	HSS	N
<b>86010</b>	165		DIN 344	dampfbehandelt	Aufbohrer mit Zylinderschaft	HSS	N
<b>86110</b>	200		DIN 343	dampfbehandelt	Aufbohrer mit Morsekegel	HSS	N
<b>86111</b>	201		DIN 343	dampfbehandelt	Aufbohrer mit Morsekegel	HSS-E	N
<b>86400</b>	334	4xD	Werksnorm	AlTiN	Kleinstbohrer ohne Kühlkanäle	VHM	N
<b>86401</b>	336	7xD	Werksnorm	AlTiN	Kleinstbohrer ohne Kühlkanäle	VHM	N
<b>86402</b>	333		Werksnorm	TiAlN	Kleinstbohrer ohne Kühlkanäle	VHM	N
<b>86405</b>	337	5xD	Werksnorm	TiAlN	Kleinstbohrer mit Kühlkanälen	VHM	N
<b>86408</b>	338	8xD	Werksnorm	TiAlN	Kleinstbohrer mit Kühlkanälen	VHM	N
<b>86412</b>	339	15xD	Werksnorm	TiAlN Kopf	Kleinstbohrer mit Kühlkanälen	VHM	N
<b>86509</b>	257	15xD	Werksnorm	TiAlN	TS-Drills mit Innenkühlung	VHM	TS 100 T
<b>86511</b>	258	20xD	Werksnorm	TiAlN Kopf	TS-Drills mit Innenkühlung	VHM	TS 100 T
<b>86512</b>	259	25xD	Werksnorm	TiAlN Kopf	TS-Drills mit Innenkühlung	VHM	TS 100 T
<b>86513</b>	260	30xD	Werksnorm	TiAlN Kopf	TS-Drills mit Innenkühlung	VHM	TS 100 T
<b>86514</b>	261	40xD	Werksnorm	TiAlN Kopf	TS-Drills mit Innenkühlung	VHM	TS 100 T
<b>86602</b>	411		Werksnorm	TiN	Wechselplatten	HSS-E-PM	
<b>86605</b>	412		Werksnorm	TiN	Wechselplatten	HSS-E	
<b>86608</b>	413		Werksnorm	FIRE	Wechselplatten	HSS-E-PM	
<b>86609</b>	414		Werksnorm	AlTiN	Wechselplatten	HSS-E-PM	
<b>86611</b>	415		Werksnorm	AlTiN	Wechselplatten	HSS-E-PM	
<b>86612</b>	399	3xD	Werksnorm	vernickelt	Multiplex-Halter mit Zylinderschaft		
<b>86622</b>	400	5xD	Werksnorm	vernickelt	Multiplex-Halter mit Zylinderschaft		
<b>86624</b>	401	7xD	Werksnorm	vernickelt	Multiplex-Halter mit Zylinderschaft		
<b>86628</b>	402		Werksnorm	vernickelt	Multiplex-Halter mit Zylinderschaft		
<b>86630</b>	404		Werksnorm	vernickelt	Multiplex-Halter mit Morsekegel		
<b>86650</b>	405		Werksnorm	vernickelt	Multiplex-Halter mit Morsekegel		
<b>86670</b>	406		Werksnorm	brüniert	Multiplex-Halter mit Morsekegel		
<b>86678</b>	408		Werksnorm	vernickelt	Multiplex-Halter mit Morsekegel		
<b>86680</b>	407		Werksnorm	brüniert	Multiplex-Halter mit Morsekegel		
<b>86681</b>	432	1xD	Werksnorm	vernickelt	Multiplex HPC-Halter		
<b>86682</b>	433	1,5xD	Werksnorm	vernickelt	Multiplex HPC-Halter		HPC
<b>86683</b>	435	3xD	Werksnorm	vernickelt	Multiplex HPC-Halter		HPC
<b>86684</b>	437	5xD	Werksnorm	vernickelt	Multiplex HPC-Halter		HPC
<b>86685</b>	439	7xD	Werksnorm	vernickelt	Multiplex HPC-Halter		HPC
<b>86686</b>	441	10xD	Werksnorm	vernickelt	Multiplex HPC-Halter		HPC
<b>86690</b>	422		Werksnorm		Kühlmittelzuführinge		
<b>86691</b>	426		Werksnorm	brüniert	Kühlmittelzuführfutter für Multiplex		
<b>86692</b>	427		Werksnorm	brüniert	Kühlmittelzuführfutter für Multiplex		
<b>86693</b>	428		Werksnorm	brüniert	Kühlmittelzuführfutter für Multiplex		
<b>86694</b>	429		Werksnorm	brüniert	Kühlmittelzuführfutter für Multiplex		

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<b>86699</b>	430		Werksnorm	brüniert	Reduzierhülsen für Kühlmittelzuführfutter		
<b>86701</b>	417		Werksnorm	FIRE	Wechselplatten	VHM	
<b>86702</b>	418		Werksnorm	FIRE	Wechselplatten	VHM	
<b>86708</b>	419		Werksnorm	TiN	Wechselplatten	VHM	
<b>86709</b>	420		Werksnorm	TiN	Wechselplatten	VHM	
<b>86711</b>	421		Werksnorm	blank	Wechselplatten	VHM	
<b>86721</b>	443		Werksnorm	AlTiN nano	Multiplex HPC-Wechselplatten	VHM	HPC
<b>86722</b>	446		Werksnorm	nanoFIRE	Multiplex HPC-Wechselplatten	VHM	HPC
<b>86723</b>	449		Werksnorm	TiAlSiN	Multiplex HPC-Wechselplatten	VHM	HPC
<b>86724</b>	452		Werksnorm	blank	Multiplex HPC-Wechselplatten	VHM	HPC
<b>86725</b>	455		Werksnorm	AlTiN nano	Multiplex HPC-Wechselplatten	VHM	HPC
<b>86726</b>	459		Werksnorm	TiAlN	Multiplex HPC-Senkplatten	VHM	
<b>86727</b>	459		Werksnorm	blank	Multiplex HPC-Senkplatten	VHM	
<b>86728</b>	460		Werksnorm	TiN	Multiplex HPC-Senkplatten	VHM	
<b>86729</b>	458		Werksnorm	nanoFIRE	Multiplex HPC-Wechselplatten	VHM	
<b>86842</b>	425		Werksnorm		Torx-Schraubendreher		
<b>86843</b>	461		Werksnorm		Spannschrauben für Multiplex HPC-Halter 1,5-10xD		
<b>86844</b>	462		Werksnorm		Drehmomentschlüssel		
<b>86845</b>	463		Werksnorm		Torx-Einsätze		
<b>86846</b>	464		Werksnorm		Spannschrauben für Multiplex HPC-Senkhalter		
<b>87011</b>	329	~5xD	DIN 1899	blank	Kleinstbohrer ohne Kühlkanäle	HSS-E-PM	N
<b>87016</b>	331	~5xD	DIN 1899	blank	Kleinstbohrer ohne Kühlkanäle	HSS-E-PM	N
<b>88013</b>	112	~5xD	DIN 338	dampfbehandelt	Spiralbohrer-Sätze	HSS	N
<b>88014</b>	113	~5xD	DIN 338	blank	Spiralbohrer-Sätze	HSS-E	S
<b>88015</b>	112	~3xD	DIN 1897	MolyGlide	Spiralbohrer-Sätze	HSS-E	P2000
<b>88016</b>	113	~5xD	DIN 338	TiN Kopf	Spiralbohrer-Sätze	HSS	N
<b>88018</b>	114	~5xD	DIN 338	Bronze-Oxid	Spiralbohrer-Sätze	M42	N
<b>88021</b>	384		DIN 335	blank	Kegelsenkersätze 90°	HSS	
<b>88022</b>	385		DIN 335	TiAlN	Kegelsenkersätze 90°, spiralisiert	HSS-E	
<b>88026</b>	114	~5xD	DIN 338	dampfbehandelt	Spiralbohrer-Sätze	HSS-E	N
<b>88200</b>	382		DIN 335	blank	Kegelsenker 90°	HSS	
<b>88201</b>	383		DIN 335	TiAlN	Kegelsenker 90°, spiralisiert	HSS-E	
<b>88303</b>	111		Werksnorm		Spiralbohrer-Sätze		
<b>89235</b>	48	~3xD	DIN 6539	blank	Spiralbohrer extra kurz	VHM	N
<b>89237</b>	216	3xD	DIN 6539	TiN	TS-Drills ohne Innenkühlung	VHM	TS 100 U
<b>89239</b>	263	5xD	DIN 6539	blank	TS-Drills, 3-schneidig	VHM	TS 3 G
<b>89242</b>	117		Werksnorm	blank	NC-Anbohrer	VHM	N
<b>89243</b>	118		Werksnorm	blank	NC-Anbohrer	VHM	N
<b>89244</b>	100	~5xD	Werksnorm	blank	Spiralbohrer kurz	VHM	N
<b>89246</b>	52	~3xD	Werksnorm	blank	Spiralbohrer extra kurz	VHM	N
<b>89247</b>	262	5xD	DIN 6537L	blank	TS-Drills, 3-schneidig	VHM	TS 3 G
<b>89249</b>	117		Werksnorm	blank	NC-Anbohrer	VHM	N
<b>89252</b>	360			blank	Mehrfasenstufenbohrer mit Zylinderschaft	VHM	N
<b>89253</b>	50	~3xD	Werksnorm	nanoFIRE	Spiralbohrer extra kurz	VHM	N
<b>89254</b>	353		Werksnorm	blank	Kurzstufenbohrer mit Zylinderschaft	VHM	N
<b>89261</b>	102	~5xD	Werksnorm	nanoFIRE	Spiralbohrer kurz	VHM	N
<b>89264</b>	210	3xD	DIN 6537K	TiN	TS-Drills ohne Innenkühlung	VHM	TS 100 U
<b>89266</b>	222	3xD	DIN 6537K	TiN	TS-Drills mit Innenkühlung	VHM	TS 100 U
<b>89272</b>	231	5xD	DIN 6537L	TiN	TS-Drills mit Innenkühlung	VHM	TS 100 U
<b>89275</b>	220	5xD	Werksnorm	TiN	TS-Drills ohne Innenkühlung	VHM	TS 100 U
<b>89281</b>	335	~5xD	Werksnorm	blank	Kleinstbohrer ohne Kühlkanäle	VHM	N
<b>89286</b>	146	~10xD	Werksnorm	blank	Spiralbohrer lang	VHM	N
<b>89292</b>	229	4xD	Werksnorm	blank	TS-Drills mit Innenkühlung	VHM	TS 150 GG
<b>89293</b>	253	10xD	Werksnorm	blank	TS-Drills mit Innenkühlung	VHM	TS 150 GG
<b>89294</b>	245	7xD	Werksnorm	blank	TS-Drills mit Innenkühlung	VHM	TS 150 GG
<b>89295</b>	253	10xD	Werksnorm	blank	TS-Drills mit Innenkühlung	VHM	TS 150 GG
<b>89301</b>	163		DIN 8037	blank	Spiralbohrer mit HM-Schneiden	HM	N
<b>89302</b>	199		DIN 8041	blank	Spiralbohrer mit HM-Schneiden	HM	N
<b>89303</b>	164		DIN 8038	blank	Spiralbohrer mit HM-Schneiden	HM	N
<b>89306</b>	221	3xD	DIN 6538K	TiN	TS-Drills mit Innenkühlung	HM	TS 80 U
<b>89307</b>	230	5xD	DIN 6538M	TiN	TS-Drills mit Innenkühlung	HM	TS 80 U
<b>89308</b>	244	7xD	DIN 6538L	TiN	TS-Drills mit Innenkühlung	HM	TS 80 U
<b>89401</b>	216	3xD	DIN 6539	nanoFIRE	TS-Drills ohne Innenkühlung	VHM	TS 100 U
<b>89402</b>	212	3xD	DIN 6537K	nanoFIRE	TS-Drills ohne Innenkühlung	VHM	TS 100 U
<b>89408</b>	232	5xD	DIN 6537L	nanoFIRE	TS-Drills mit Innenkühlung	VHM	TS 100 U
<b>89410</b>	223	3xD	DIN 6537K	nanoFIRE	TS-Drills mit Innenkühlung	VHM	TS 100 U

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<b>89411</b>	232	5xD	DIN 6537L	nanoFIRE	TS-Drills mit Innenkühlung	VHM	TS 100 U
<b>89412</b>	246	7xD	Werksnorm	nanoFIRE	TS-Drills mit Innenkühlung	VHM	TS 100 U
<b>89413</b>	212	3xD	DIN 6537K	nanoFIRE	TS-Drills ohne Innenkühlung	VHM	TS 100 U
<b>89414</b>	218	5xD	DIN 6537L	nanoFIRE	TS-Drills ohne Innenkühlung	VHM	TS 100 U
<b>89415</b>	223	3xD	DIN 6537K	nanoFIRE	TS-Drills mit Innenkühlung	VHM	TS 100 U
<b>89416</b>	246	7xD	Werksnorm	nanoFIRE	TS-Drills mit Innenkühlung	VHM	TS 100 U
<b>89417</b>	218	5xD	DIN 6537L	nanoFIRE	TS-Drills ohne Innenkühlung	VHM	TS 100 U
<b>89418</b>	255	12xD	Werksnorm	nanoFIRE Kopf	TS-Drills mit Innenkühlung	VHM	TS 100 U
<b>89420</b>	234	5xD	DIN 6537L	FIRE	TS-Drills mit Innenkühlung	VHM	TS 100 R
<b>89421</b>	248	7xD	Werksnorm	FIRE	TS-Drills mit Innenkühlung	VHM	TS 100 R
<b>89422</b>	214	3xD	DIN 6537K	TiAlSiN	TS-Drills ohne Innenkühlung	VHM	TS 100 H
<b>89423</b>	225	3xD	DIN 6537K	TiAlSiN	TS-Drills mit Innenkühlung	VHM	TS 100 H
<b>89424</b>	225	3xD	DIN 6537K	TiAlSiN	TS-Drills mit Innenkühlung	VHM	TS 100 H
<b>89425</b>	236	5xD	DIN 6537L	TiAlSiN	TS-Drills mit Innenkühlung	VHM	TS 100 H
<b>89426</b>	236	5xD	DIN 6537L	TiAlSiN	TS-Drills mit Innenkühlung	VHM	TS 100 H
<b>89427</b>	250	7xD	Werksnorm	TiAlSiN	TS-Drills mit Innenkühlung	VHM	TS 100 H
<b>89450</b>	227	3xD	DIN 6537K	AlTiN nano	TS-Drills mit Innenkühlung	VHM	TS 100 INOX
<b>89451</b>	238	5xD	DIN 6537L	AlTiN nano	TS-Drills mit Innenkühlung	VHM	TS 100 INOX
<b>89460</b>	242	5xD	DIN 6537L	nanoFIRE	TS 100 HPC	VHM	TS 100 HPC
<b>89461</b>	251	7xD	Werksnorm	nanoFIRE	TS 100 HPC	VHM	TS 100 HPC
<b>89501</b>	277	80.000	Werksnorm	blank	Einlippenbohrer E 100	VHM	TLB E 100
<b>89502</b>	279	160.000	Werksnorm	blank	Einlippenbohrer E 100	VHM	TLB E 100
<b>89503</b>	276	45.000	Werksnorm	blank	Einlippenbohrer E 100	VHM	TLB E 100
<b>89504</b>	278	120.000	Werksnorm	blank	Einlippenbohrer E 100	VHM	TLB E 100
<b>89505</b>	280	20xD	Werksnorm	TiN	Einlippenbohrer E 80	HM	TLB E 80
<b>89506</b>	282	40xD	Werksnorm	TiN	Einlippenbohrer E 80	HM	TLB E 80
<b>89507</b>	283	80xD	Werksnorm	TiN	Einlippenbohrer E 80	HM	TLB E 80
<b>89508</b>	295	30xD	Werksnorm	blank	Zweilippenbohrer Z 80	HM	TLB Z 80
<b>89509</b>	281	30xD	Werksnorm	TiN	Einlippenbohrer E 80	HM	TLB E 80
<b>89510</b>	276	45.000	Werksnorm	AlTiN	Einlippenbohrer E 100	VHM	TLB E 100
<b>89511</b>	277	80.000	Werksnorm	AlTiN	Einlippenbohrer E 100	VHM	TLB E 100
<b>89512</b>	278	120.000	Werksnorm	AlTiN	Einlippenbohrer E 100	VHM	TLB E 100
<b>89513</b>	279	160.000	Werksnorm	AlTiN	Einlippenbohrer E 100	VHM	TLB E 100
<b>89514</b>	280	20xD	Werksnorm	TiCN	Einlippenbohrer E 80	HM	TLB E 80
<b>89515</b>	281	30xD	Werksnorm	TiCN	Einlippenbohrer E 80	HM	TLB E 80
<b>89516</b>	282	40xD	Werksnorm	TiCN	Einlippenbohrer E 80	HM	TLB E 80
<b>89517</b>	283	80xD	Werksnorm	TiCN	Einlippenbohrer E 80	HM	TLB E 80
<b>89518</b>	295	30xD	Werksnorm	blank	Zweilippenbohrer Z 80	HM	TLB Z 80
<b>89520</b>	271	25xD	Werksnorm	AlTiN nano	Einlippenbohrer E 100	VHM	TLB E 100
<b>89521</b>	273	50xD	Werksnorm	AlTiN nano	Einlippenbohrer E 100	VHM	TLB E 100
<b>89522</b>	275	75xD	Werksnorm	AlTiN nano	Einlippenbohrer E 100	VHM	TLB E 100
<b>89523</b>	271	25xD	Werksnorm	blank	Einlippenbohrer E 100	VHM	TLB E 100
<b>89524</b>	273	50xD	Werksnorm	blank	Einlippenbohrer E 100	VHM	TLB E 100
<b>89525</b>	275	75xD	Werksnorm	blank	Einlippenbohrer E 100	VHM	TLB E 100
<b>89530</b>	292	30xD	Werksnorm	TiN	Einlippenbohrer E 800 mit Wechselplatten	HM	TLB E 800
<b>89535</b>	293		Werksnorm	TiN	Schneidplatten für Einlippenbohrer E 800	VHM	
<b>89536</b>	294		Werksnorm	TiN	Führungsleisten für Einlippenbohrer E 800	VHM	
<b>89539</b>	284	GL 600	Werksnorm	TiN	Einlippenbohrer E 80 XXL	HM	TLB E 80
<b>89540</b>	285	GL 800	Werksnorm	TiN	Einlippenbohrer E 80 XXL	HM	TLB E 80
<b>89541</b>	287	GL1200	Werksnorm	TiN	Einlippenbohrer E 80 XXL	HM	TLB E 80
<b>89542</b>	289	GL1600	Werksnorm	TiN	Einlippenbohrer E 80 XXL	HM	TLB E 80
<b>89543</b>	291	GL2000	Werksnorm	TiN	Einlippenbohrer E 80 XXL	HM	TLB E 80
<b>89544</b>	286	GL1000	Werksnorm	TiN	Einlippenbohrer E 80 XXL	HM	TLB E 80
<b>89545</b>	288	GL1400	Werksnorm	TiN	Einlippenbohrer E 80 XXL	HM	TLB E 80
<b>89546</b>	290	GL1800	Werksnorm	TiN	Einlippenbohrer E 80 XXL	HM	TLB E 80
<b>89550</b>	227	3xD	DIN 6537K	AlTiN nano	TS-Drills mit Innenkühlung	VHM	TS 100 INOX
<b>89551</b>	238	5xD	DIN 6537L	AlTiN nano	TS-Drills mit Innenkühlung	VHM	TS 100 INOX
<b>89560</b>	240	5xD	DIN 6537L	blank	TS-Drills mit Innenkühlung	VHM	TS 100 ALU

# DIE HARTNER WERKZEUGAUSGABESYSTEME

Die Automaten und Schränke

TM 326



TM 426







TM 526



TM 626



TM 826

## Individuelle Lösungen zur effizienten Lagerung und Verwaltung von Werkzeugen.

Die vier Werkzeugausgabesysteme TM 326, TM 426, TM 526 und TM 626 bieten flexible Möglichkeiten für die maßgeschneiderte Werkzeuglagerung. Je nach Bedarf und Unternehmensgröße können Sie zwischen unterschiedlichen Automatisierungsgraden wählen. Individuelle Ausgabemöglichkeiten wie

Schubladen oder Spiralsysteme stehen zur Auswahl. Wir passen das Hartner Werkzeugausgabesystem ganz individuell an Ihre Wünsche und den Bedarf in Ihrem Betrieb an. So nutzen Sie die Möglichkeiten optimal. Das bestätigen auch zahlreiche zufriedene Kunden.

# DIE HARTNER TOOL MANAGEMENT SOFTWARE

## Eingebaute Intelligenz

Alle Hartner Werkzeugausgabesysteme werden von der anwenderfreundlichen TM-Software gesteuert. Sie erlaubt die einfache, schnelle und intuitive Bedienung über den integrierten Touchscreen.

Die Software bietet dem Kunden in allen Bereichen der Produktion Anwendungs- und individuelle Einstellmöglichkeiten.

Durch den modularen Aufbau können Prozesse in der Fertigung genau abgebildet und sämtliche Teilbereiche des Werkzeugkreislaufs von der Lagerung über die Bereitstellung bis zur Entsorgung transparent aufgezeigt werden.

Die Software dokumentiert alle relevanten Bewegungsdaten des Lagerbestands, löst Bestellvorschläge aus und ermöglicht Auswertungen nach unterschiedlichen Kriterien.

Dieses umfangreiche und detaillierte Reporting bietet Ihrem Unternehmen eine Vielzahl von Optimierungspotenzialen im Werkzeugkreislauf.

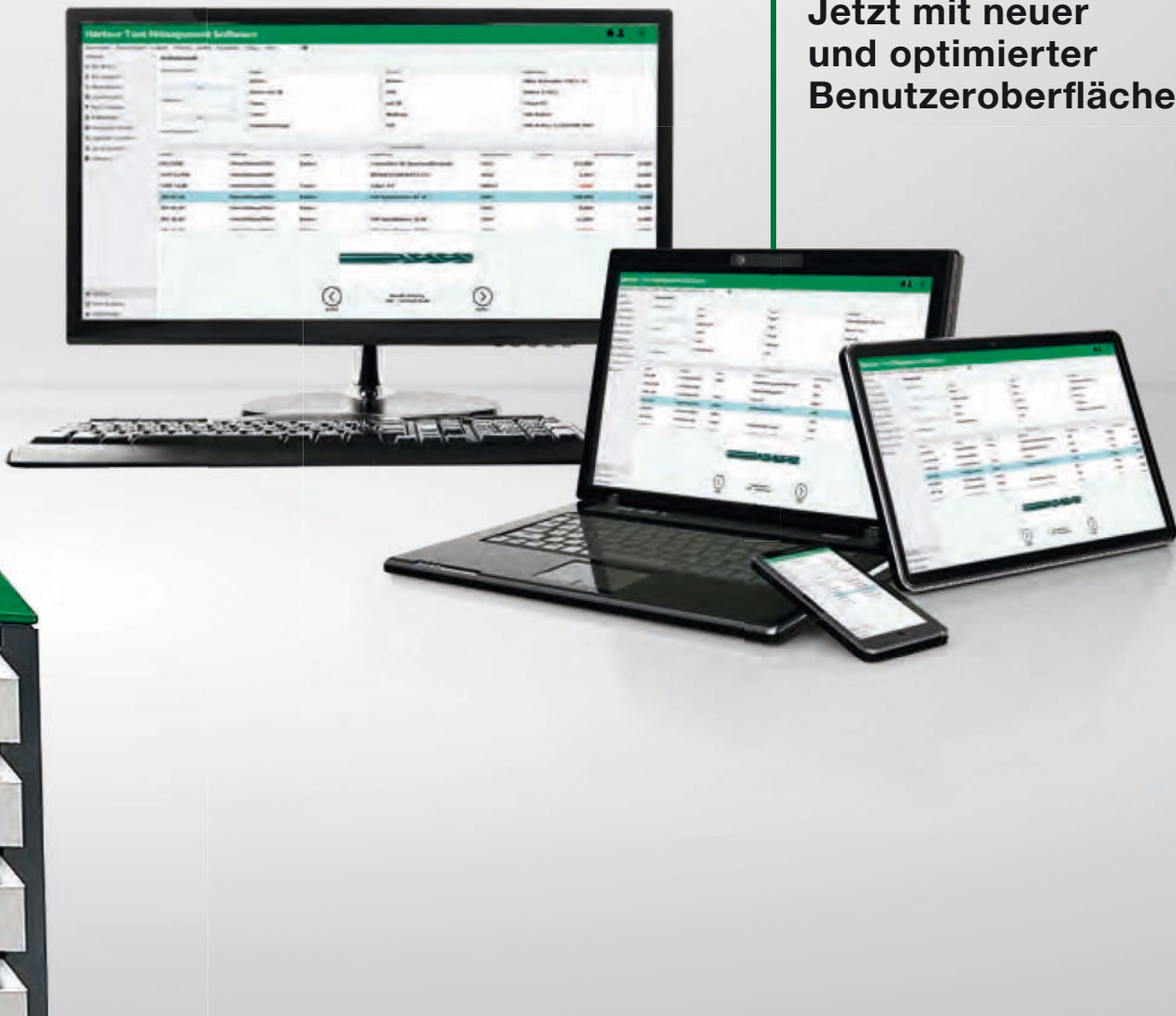
Schnittstellen ermöglichen weiterhin die Anbindung an unterschiedlichste Warenwirtschaftssysteme sowie die Online-Anbindung Ihrer Lieferanten durch automatisierte Bestellvorgänge.



# DIE HARTNER TOOL MANAGEMENT SOFTWARE

## Leistungen und Kundenvorteile

- ▼ einfache und intuitive Bedienoberfläche und Menüführung
- ▼ Erstellung eines persönlichen Dashboards
- ▼ Erstellung von Werkzeuglisten
- ▼ direkter Aufruf von CAD-Systemen und Grafikprogrammen zur Bearbeitung und Darstellung von Werkzeugzeichnungen
- ▼ umfangreiche Lagerverwaltungsfunktionen mit denen auch die Hartner TM-Werkzeugautomaten gesteuert werden
- ▼ Abbildung der Kundenorganisation zur eindeutigen Kostenzuordnung der Werkzeugentnahmen
- ▼ exakte Verbrauchsanalysen nach unterschiedlichsten Kriterien, z.B. Werkzeugverbrauch pro Bauteil, Maschine oder Fertigungsbereich
- ▼ individuelle Lösungen können nach Kundenwunsch programmiert werden
- ▼ Anbindung an alle gängigen ERP/PPS-Systeme, Werkzeugverwaltung und Paternoster-Liftsysteme über Programmierung entsprechender Schnittstellen
- ▼ mehrsprachige Software
- ▼ Erstellung von individuellen Kundenformularen



**Jetzt mit neuer  
und optimierter  
Benutzeroberfläche.**





# HARTNER















Precision Cutting Tools

Spiralbohrer  
mit Zylinderschaft

## SPIRALBOHRER MIT ZYLINDERSCHAFT







aus HSS, HSS-E, HSS-E-PM, Vollhartmetall  
blank und beschichtet



P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
<b>Spiralbohrer extra kurz</b>															
•		•	○			DIN 1897	N	HSS		rechts	zyl.	~3xD	0,500 - 39,500	<b>81110</b>	24
															
•		•	○			DIN 1897	N	HSS		links	zyl.	~3xD	0,500 - 36,500	<b>81115</b>	26
															
			•			DIN 1897	H	HSS		rechts	zyl.	~3xD	1,200 - 16,000	<b>81120</b>	28
															
			•			DIN 1897	W	HSS		rechts	zyl.	~3xD	1,500 - 16,000	<b>81130</b>	29
															
•	○	○	•			DIN 1897	FN	HSS		rechts	zyl.	~3xD	1,500 - 15,500	<b>81140</b>	30
															
•	○	○	•			DIN 1897	FN	HSS		links	zyl.	~3xD	1,000 - 12,500	<b>81145</b>	31
															
•		•	○			DIN 1897	N	HSS		rechts	zyl.	~3xD	1,000 - 25,000	<b>84400</b>	33
															
•		•	•			DIN 1897	N	HSS		rechts	zyl.	~3xD	1,000 - 25,000	<b>84501</b>	33
															
•	○	○	•	•	○	DIN 1897	N	M42		rechts	zyl.	~3xD	1,000 - 15,000	<b>81112</b>	35
															
•	•	•	○	•	○	DIN 1897	V	HSS-E		rechts	zyl.	~3xD	0,400 - 25,000	<b>81171</b>	37
															
○	•		○	○		DIN 1897	IS	HSS-E		rechts	zyl.	~3xD	1,000 - 12,000	<b>81173</b>	39
															
•	•	•	○	•	○	DIN 1897	V	HSS-E		rechts	zyl.	~3xD	0,500 - 15,000	<b>84503</b>	40
															
•	•	•	○	•	○	DIN 1897	V	HSS-E		rechts	zyl.	~3xD	0,500 - 15,000	<b>84803</b>	40
															
•	•	•	•			DIN 1897	FU 500 DZ	HSS-E		rechts	zyl.	~3xD	1,000 - 14,000	<b>84806</b>	42
															















P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Spiralbohrer extra kurz

	• • • • •	DIN 1897	FU 500 DZ	HSS-E	○	rechts	zyl.	~3xD	1,000 - 14,000	<b>84808</b>	42
	○ • ○ ○ •	DIN 1897	IS	HSS-E	Ⓢ	rechts	zyl.	~3xD	1,000 - 13,000	<b>81178</b>	44
	• ○ • ○ ○ ○	DIN 1897	FN 500	HSS-E-PM	Ⓢ	rechts	zyl.	~3xD	1,000 - 13,500	<b>84511</b>	46
	○ ○ ○ • ○ ○	DIN 6539	N	VHM	○	rechts	zyl.	~3xD	0,800 - 16,000	<b>89235</b>	48
	○ ○ ○ • ○ ○	Werksnorm	N	VHM	Ⓢ	rechts	zyl.	~3xD	1,000 - 16,000	<b>89253</b>	50
	○ ○ ○ ○ ○ ○	Werksnorm	N	VHM	○	rechts	zyl.	~3xD	0,500 - 6,100	<b>89246</b>	52

## Spiralbohrer kurz





















	• • • ○ •	DIN 338	N	HSS	○ <sub>z,36</sub> <sup>-0</sup>	rechts	zyl.	~5xD	0,200 - 20,000	<b>81010</b>	53
	• • • ○ •	DIN 338	N	HSS	○ <sub>z,60</sub> <sup>-0</sup>	links	zyl.	~5xD	0,250 - 17,000	<b>81015</b>	57
	• • • ○ •	DIN 338	N	HSS	○	rechts	zyl.	~5xD	3,000 - 13,000	<b>81017</b>	59
	• • • • •	DIN 338	H	HSS	○	rechts	zyl.	~5xD	0,300 - 20,000	<b>81020</b>	60
	• • • • •	DIN 338	H	HSS	○	links	zyl.	~5xD	0,500 - 16,000	<b>81025</b>	62
	• • • • •	DIN 338	W	HSS	○	rechts	zyl.	~5xD	0,250 - 16,500	<b>81030</b>	64
	• • • • •	DIN 338	W	HSS	○	links	zyl.	~5xD	0,500 - 15,000	<b>81035</b>	66

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
<b>Spiralbohrer kurz</b>															
•						DIN 338	FN	HSS		rechts	zyl.	~5xD	0,800 - 16,000	81040	67
•						DIN 338	FN	HSS		links	zyl.	~5xD	1,400 - 16,000	81045	69
•						DIN 338	N	HSS		rechts	zyl.	~5xD	0,400 - 19,500	84405	71
•			○			DIN 338	N	HSS		rechts	zyl.	~5xD	1,000 - 16,000	84406	73
•						DIN 338	FN	HSS		rechts	zyl.	~5xD	1,000 - 16,000	84415	75
•						DIN 338	FN	HSS		rechts	zyl.	~5xD	1,000 - 16,000	84502	75
•	○					DIN 338	N	M42		rechts	zyl.	~5xD	1,000 - 14,000	81012	77
•						DIN 338	N	M42		rechts	zyl.	~5xD	1,000 - 13,000	81018	79
•						DIN 338	N	M42		rechts	zyl.	~5xD	1,000 - 16,000	81019	81
•	○					DIN 338	N	HSS-E		rechts	zyl.	~5xD	0,200 - 20,000	81011	83
○						DIN 338	IS	HSS-E		rechts	zyl.	~5xD	1,000 - 13,000	81013	85
•	○					DIN 338	FN	HSS-E		rechts	zyl.	~5xD	1,000 - 13,000	81041	87
○						DIN 338	S	HSS-E		rechts	zyl.	~5xD	0,200 - 17,500	81061	89
•	○					DIN 338	FN	HSS-E		rechts	zyl.	~5xD	1,000 - 13,000	84800	91







P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Spiralbohrer kurz

	•	○	•	•	○	DIN 338	FN	HSS-E		rechts	zyl.	~5xD	1,000 - 13,000	84504	91
	•	•	•	•	○	DIN 338	FU 500 DZ	HSS-E		rechts	zyl.	~5xD	1,000 - 14,000	84804	93
	•	•	•	•	○	DIN 338	FU 500 DZ	HSS-E		rechts	zyl.	~5xD	1,000 - 14,000	84802	93
	○	•	•	•	○	DIN 338	S	HSS-E		rechts	zyl.	~5xD	0,500 - 13,000	84807	95
	○	•	•	•	○	DIN 338	S	HSS-E		rechts	zyl.	~5xD	0,500 - 13,000	84505	95
	○	•	○	○	○	DIN 338	IS	HSS-E		rechts	zyl.	~5xD	1,000 - 13,000	81078	97
	•	○	•	○	○	DIN 338	FN 500 DZ	HSS-E-PM		rechts	zyl.	~5xD	1,000 - 14,000	84811	99
	○	○	○	•	○	Werksnorm	N	VHM		rechts	zyl.	~5xD	1,000 - 12,000	89244	100
	○	○	○	•	○	Werksnorm	N	VHM		rechts	zyl.	~5xD	1,000 - 12,000	89261	102
	•	○	•	○	○	Werksnorm	HX 500	M42		rechts	zyl.	3xD	1,000 - 13,000	81000	104

## Spiralbohrer mit verst. Zylinderschaft

	•	•	•	•	○	Werksnorm	FU 500	HSS-E-PM		rechts	HA	~3xD	1,000 - 20,000	84805	105
	•	•	•	•	○	Werksnorm	FU 500	HSS-E-PM		rechts	HA	~5xD	2,000 - 20,000	84801	107

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## Spiralbohrer mit verst. Zylinderschaft



•	○	•	○	○	○	Werknorm	FN 500	<b>HSS-E-PM</b>	<b>F</b>	rechts	HA	~5xD	2,000 - 13,000	<b>84507</b>	109
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## Spiralbohrer-Sätze



•	○	•	○	○	○	Werknorm								<b>88303</b>	111
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•	○	•	○	○	○	DIN 1897	P2000	<b>HSS-E</b>	<b>M</b>	rechts	zyl.	~3xD		<b>88015</b>	112
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•	○	•	○	○	○	DIN 338	N	<b>HSS</b>	<b>T</b>	rechts	zyl.	~5xD		<b>88013</b>	112
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•	○	•	○	○	○	DIN 338	N	<b>HSS</b>	<b>T</b>	rechts	zyl.	~5xD		<b>88016</b>	113
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## Spiralbohrer-Sätze



○	●			●		DIN 338	S	HSS-E	○	rechts	zyl.	~5xD		<b>88014</b>	113
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●		●	○			DIN 338	N	HSS-E	●	rechts	zyl.	~5xD		<b>88026</b>	114
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●	●	●	●	●	○	DIN 338	N	M42	●	rechts	zyl.	~5xD		<b>88018</b>	114
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## NC-Anbohrer



●	○	●	●	○		Werksnorm	N	HSS	○	rechts	zyl.	3,000 - 25,000		<b>81191</b>	115
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●	○	●	●	○		Werksnorm	N	HSS	Ⓜ	rechts	zyl.	3,000 - 25,000		<b>84434</b>	115
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●	○	●	●	●		Werksnorm	N	HSS	○	rechts	zyl.	3,000 - 25,000		<b>81192</b>	116
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●	○	●	●	○		Werksnorm	N	HSS	Ⓜ	rechts	zyl.	3,000 - 25,000		<b>84435</b>	116
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○	○	○	○	○	○	Werksnorm	N	VHM	○	rechts	zyl.	4,000 - 20,000		<b>89242</b>	117
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## NC-Anbohrer



○	○	○	○	○	○	Werksnorm	N	VHM	○	rechts	HB	4,000 - 20,000		89249	117
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○	○	○	○	○	○	Werksnorm	N	VHM	○	rechts	HA	4,000 - 20,000		89243	118
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## Karosseriebohrer



●	○	●	●	●	○	Werksnorm	N	HSS	○ <sub>2,36</sub> <sup>-0</sup>	rechts	zyl.	2,000 - 10,000		81190	119
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## Kühlkanalbohrer



●	●	●	●	●	○	Werksnorm	FN	HSS-E	○	rechts	HE	~5xD	5,000 - 20,000	82761	120
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●	●	●	●	●	○	Werksnorm	FN	HSS-E	Ⓡ	rechts	HE	~5xD	5,000 - 20,000	84461	120
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●	○	●	●	○	○	Werksnorm	FN	HSS	○	rechts	zyl.	~10xD	3,000 - 13,000	82710	121
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## Bohrbuchsenbohrer



●	○	●	○	○	○	DIN 339	N	HSS	○ <sub>2,36</sub> <sup>-0</sup>	rechts	zyl.	~10xD	0,800 - 19,000	81210	122
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## Spiralbohrer lang



●	○	●	○	○	○	DIN 340	N	HSS	○ <sub>2,36</sub> <sup>-0</sup>	rechts	zyl.	~10xD	0,400 - 22,000	81310	124
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●	○	●	○	○	○	DIN 340	N	HSS	○ <sub>6,00</sub> <sup>-0</sup>	links	zyl.	~10xD	0,900 - 12,000	81315	126
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●	○	●	○	○	○	DIN 340	N	HSS	○	rechts	zyl.	~10xD	3,100 - 12,200	81317	127
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P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
<b>Spiralbohrer lang</b>															
						DIN 340	H	HSS	○	rechts	zyl.	~10xD	0,500 - 14,500	81320	128
						DIN 340	W	HSS	○	rechts	zyl.	~10xD	0,500 - 17,000	81330	129
						DIN 340	FN	HSS	⊖ <sup>+0</sup> <sub>2,36</sub>	rechts	zyl.	~10xD	0,900 - 14,000	81340	131
						DIN 340	FW	HSS	○	rechts	zyl.	~10xD	1,000 - 14,000	81350	133
						DIN 340	N	HSS	Ⓣ	rechts	zyl.	~10xD	0,500 - 16,000	84418	135
						DIN 340	FN	HSS	Ⓣ	rechts	zyl.	~10xD	1,000 - 14,000	84423	136
						DIN 340	FN	HSS	Ⓢ	rechts	zyl.	~10xD	1,000 - 14,000	84506	136
						DIN 340	N	HSS-E	⊖ <sup>+0</sup> <sub>2,36</sub>	rechts	zyl.	~10xD	0,500 - 12,500	81311	138
						DIN 340	FN	HSS-E	⊖ <sup>+0</sup> <sub>2,36</sub>	rechts	zyl.	~10xD	1,000 - 16,000	81341	139
						DIN 340	S	HSS-E	○	rechts	zyl.	~10xD	1,000 - 13,000	81361	141
						DIN 340	S	HSS-E	Ⓣ	rechts	zyl.	~10xD	1,000 - 13,000	81362	141
						DIN 340	FU 500 DZ	HSS-E	○	rechts	zyl.	~10xD	1,000 - 14,000	84814	143
						DIN 340	FU 500 DZ	HSS-E	Ⓣ	rechts	zyl.	~10xD	1,000 - 14,000	84812	143
						DIN 340	FN	HSS-E	Ⓢ	rechts	zyl.	~10xD	1,000 - 12,000	84508	145

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Spiralbohrer lang



○		○				Werksnorm	N	VHM	○	rechts	zyl.	~10xD	0,500 - 1,500	89286	146
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## Spiralbohrer überlang, Reihe 1



●		●	○			DIN 1869	N	HSS	○ <sup>-0</sup> / <sub>2,36</sub>	rechts	zyl.	~15xD	1,600 - 13,000	81410	147
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●		●	●			DIN 1869	FN	HSS	○ <sup>-0</sup> / <sub>2,36</sub>	rechts	zyl.	~15xD	2,000 - 13,000	81440	148
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○			●			DIN 1869	FW	HSS	○	rechts	zyl.	~15xD	2,000 - 9,500	81450	149
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●		●	●			DIN 1869	FN	HSS	Ⓣ	rechts	zyl.	~15xD	2,000 - 12,000	84425	150
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●	●	●	●	○		DIN 1869	FN	HSS-E	●	rechts	zyl.	~15xD	3,000 - 10,000	81441	151
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## Spiralbohrer überlang, Reihe 2



●		●	○			DIN 1869	N	HSS	○	rechts	zyl.	~20xD	3,000 - 12,000	81510	152
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●		●	●			DIN 1869	FN	HSS	○ <sup>-0</sup> / <sub>2,36</sub>	rechts	zyl.	~20xD	2,000 - 13,000	81540	153
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●		●	●	○		DIN 1869	FN	HSS	Ⓣ	rechts	zyl.	~20xD	3,000 - 8,500	84426	154
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●	●	●	●	○		DIN 1869	FN	HSS-E	●	rechts	zyl.	~20xD	3,000 - 10,000	81541	155
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## Spiralbohrer überlang, Reihe 3



●		●	○			DIN 1869	N	HSS	○	rechts	zyl.	~25xD	3,500 - 12,000	81610	156
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P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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### Spiralbohrer überlang, Reihe 3



•	•	•	•	•		DIN 1869	FN	HSS	☉	rechts	zyl.	~25xD	2,500 - 13,000	81640	157
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•	•	•	•	•		DIN 1869	FN	HSS-E	☉	rechts	zyl.	~25xD	2,500 - 13,000	81641	158
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### Spiralbohrer extra lang



•	•	•	•	•		Werknorm	FN	HSS	☉	rechts	zyl.	>25xD	6,000 - 12,000	81740	159
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•	•	•	•	•		Werknorm	FN	HSS	○	rechts	zyl.	>25xD	8,000 - 12,000	81750	160
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•	•	•	•	•		Werknorm	FN	HSS	○	rechts	zyl.	>25xD	10,000 - 12,000	81760	161
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### Stiftlochbohrer



•	○	•	○	•		DIN 1898	N	HSS	☉ <sub>2,36</sub>	rechts	zyl.		2,000 - 12,000	81810	162
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### Spiralbohrer mit HM-Schneiden



○	•	○	•	○		DIN 8037	N	HM	○	rechts	zyl.		2,600 - 20,000	89301	163
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○	•	○	•	○		DIN 8038	N	HM	○	rechts	zyl.		3,100 - 19,000	89303	164
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### Aufbohrer mit Zylinderschaft



•	○	•	○	•		DIN 344	N	HSS	☉	rechts	zyl.		3,800 - 15,000	86010	165
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## Spiralbohrer extra kurz

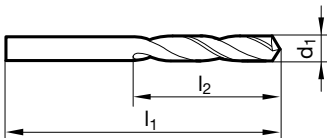
Artikel-Nr. 81110



P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • für Automaten/Revolverbänke • auch für Handbohrmaschinen geeignet  
 dünnwandige Materialien • Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen, Neusilber und Graphit



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,500		20,000	3,000	3,250		49,000	18,000
0,600		21,000	3,500	3,300		49,000	18,000
0,700		23,000	4,500	3,350		49,000	18,000
0,800		24,000	5,000	3,400		52,000	20,000
0,850		24,000	5,000	3,500		52,000	20,000
0,900		25,000	5,500	3,600		52,000	20,000
1,000		26,000	6,000	3,650		52,000	20,000
1,050		26,000	6,000	3,700		52,000	20,000
1,100		28,000	7,000	3,750		52,000	20,000
1,200		30,000	8,000	3,800		55,000	22,000
1,250		30,000	8,000	3,850		55,000	22,000
1,300		30,000	8,000	3,900		55,000	22,000
1,350		32,000	9,000	4,000		55,000	22,000
1,400		32,000	9,000	4,100		55,000	22,000
1,500		32,000	9,000	4,200		55,000	22,000
1,550		34,000	10,000	4,250		55,000	22,000
1,600		34,000	10,000	4,300		58,000	24,000
1,650		34,000	10,000	4,450		58,000	24,000
1,700		34,000	10,000	4,500		58,000	24,000
1,750		36,000	11,000	4,600		58,000	24,000
1,800		36,000	11,000	4,650		58,000	24,000
1,900		36,000	11,000	4,700		58,000	24,000
1,950		38,000	12,000	4,750		58,000	24,000
2,000		38,000	12,000	4,800		62,000	26,000
2,050		38,000	12,000	4,850		62,000	26,000
2,100		38,000	12,000	4,900		62,000	26,000
2,200		40,000	13,000	4,950		62,000	26,000
2,250		40,000	13,000	5,000		62,000	26,000
2,300		40,000	13,000	5,050		62,000	26,000
2,400		43,000	14,000	5,100		62,000	26,000
2,500		43,000	14,000	5,200		62,000	26,000
2,550		43,000	14,000	5,250		62,000	26,000
2,600		43,000	14,000	5,300		62,000	26,000
2,700		46,000	16,000	5,400		66,000	28,000
2,750		46,000	16,000	5,500		66,000	28,000
2,800		46,000	16,000	5,600		66,000	28,000
2,900		46,000	16,000	5,700		66,000	28,000
2,950		46,000	16,000	5,750		66,000	28,000
3,000		46,000	16,000	5,800		66,000	28,000
3,050		49,000	18,000	5,850		66,000	28,000
3,100		49,000	18,000	5,900		66,000	28,000
3,200		49,000	18,000	6,000		66,000	28,000





## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
6,100		70,000	31,000	12,000		102,000	51,000
6,150		70,000	31,000	12,050		102,000	51,000
6,200		70,000	31,000	12,200		102,000	51,000
6,250		70,000	31,000	12,300	31/64	102,000	51,000
6,300		70,000	31,000	12,500		102,000	51,000
6,350	1/4	70,000	31,000	12,600		102,000	51,000
6,500		70,000	31,000	12,700	1/2	102,000	51,000
6,600		70,000	31,000	12,750		102,000	51,000
6,700		70,000	31,000	12,900		102,000	51,000
6,750	17/64	74,000	34,000	13,000		102,000	51,000
6,800		74,000	34,000	13,100	33/64	102,000	51,000
6,900		74,000	34,000	13,200		102,000	51,000
7,000		74,000	34,000	13,500		107,000	54,000
7,100		74,000	34,000	13,600		107,000	54,000
7,400		74,000	34,000	13,750		107,000	54,000
7,500		74,000	34,000	14,000		107,000	54,000
7,600		79,000	37,000	14,200		111,000	56,000
7,700		79,000	37,000	14,250		111,000	56,000
7,750		79,000	37,000	14,300		111,000	56,000
7,800		79,000	37,000	14,500		111,000	56,000
7,900		79,000	37,000	14,750		111,000	56,000
8,000		79,000	37,000	15,000		111,000	56,000
8,100		79,000	37,000	15,100		115,000	58,000
8,200		79,000	37,000	15,250		115,000	58,000
8,250		79,000	37,000	15,500		115,000	58,000
8,300		79,000	37,000	15,750		115,000	58,000
8,350		79,000	37,000	16,000		115,000	58,000
8,400		79,000	37,000	16,250		119,000	60,000
8,500		79,000	37,000	16,270	41/64	119,000	60,000
8,600		84,000	40,000	16,500		119,000	60,000
8,700		84,000	40,000	17,000		119,000	60,000
8,750		84,000	40,000	17,500		123,000	62,000
8,800		84,000	40,000	18,000		123,000	62,000
8,900		84,000	40,000	18,200		127,000	64,000
9,000		84,000	40,000	18,500		127,000	64,000
9,100		84,000	40,000	18,750		127,000	64,000
9,200		84,000	40,000	19,000		127,000	64,000
9,250		84,000	40,000	19,100		131,000	66,000
9,300		84,000	40,000	19,500		131,000	66,000
9,500		84,000	40,000	20,000		131,000	66,000
9,600		89,000	43,000	20,500		136,000	68,000
9,700		89,000	43,000	21,000		136,000	68,000
9,750		89,000	43,000	21,500		141,000	70,000
9,800		89,000	43,000	22,000		141,000	70,000
9,900		89,000	43,000	22,500		146,000	72,000
10,000		89,000	43,000	23,000		146,000	72,000
10,050		89,000	43,000	23,500		146,000	72,000
10,100		89,000	43,000	24,000		151,000	75,000
10,200		89,000	43,000	24,500		151,000	75,000
10,250		89,000	43,000	25,000	63/64	151,000	75,000
10,300		89,000	43,000	26,000		156,000	78,000
10,400		89,000	43,000	26,500		156,000	78,000
10,500		89,000	43,000	27,000		162,000	81,000
10,600		89,000	43,000	27,500		162,000	81,000
10,700		95,000	47,000	28,000		162,000	81,000
10,750		95,000	47,000	28,750		168,000	84,000
10,800		95,000	47,000	29,000		168,000	84,000
10,900		95,000	47,000	30,000		168,000	84,000
11,000		95,000	47,000	31,000		174,000	87,000
11,100		95,000	47,000	32,000		180,000	90,000
11,200		95,000	47,000	39,500		200,000	100,000
11,400		95,000	47,000				
11,500		95,000	47,000				
11,700		95,000	47,000				
11,750		95,000	47,000				
11,800		95,000	47,000				



## Spiralbohrer extra kurz

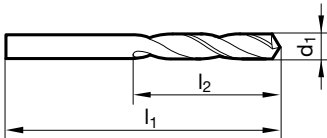
Artikel-Nr. 81115



P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \text{Ø } 14,200$  • Kegelmantelschliff • für Automaten/Revolverbänke  
 dünnwandige Materialien • Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen, Neusilber und Graphit



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
0,500		20,000	3,000	3,500		52,000	20,000
0,550		21,000	3,500	3,700		52,000	20,000
0,700		23,000	4,500	3,750		52,000	20,000
0,750		23,000	4,500	3,800		55,000	22,000
0,800		24,000	5,000	3,900		55,000	22,000
0,850		24,000	5,000	4,000		55,000	22,000
0,950		25,000	5,500	4,100		55,000	22,000
1,000		26,000	6,000	4,250		55,000	22,000
1,150		28,000	7,000	4,300		58,000	24,000
1,250		30,000	8,000	4,400		58,000	24,000
1,330		32,000	9,000	4,500		58,000	24,000
1,350		32,000	9,000	4,600		58,000	24,000
1,500		32,000	9,000	4,700		58,000	24,000
1,550		34,000	10,000	4,750		58,000	24,000
1,600		34,000	10,000	4,800		62,000	26,000
1,710		36,000	11,000	4,900		62,000	26,000
1,800		36,000	11,000	5,000		62,000	26,000
1,830		36,000	11,000	5,100		62,000	26,000
1,900		36,000	11,000	5,200		62,000	26,000
1,980	5/64	38,000	12,000	5,300		62,000	26,000
2,000		38,000	12,000	5,400		66,000	28,000
2,100		38,000	12,000	5,500		66,000	28,000
2,200		40,000	13,000	5,600		66,000	28,000
2,400		43,000	14,000	5,700		66,000	28,000
2,420		43,000	14,000	5,750		66,000	28,000
2,500		43,000	14,000	5,800		66,000	28,000
2,550		43,000	14,000	5,900		66,000	28,000
2,600		43,000	14,000	6,000		66,000	28,000
2,720		46,000	16,000	6,100		70,000	31,000
2,750		46,000	16,000	6,150		70,000	31,000
2,820		46,000	16,000	6,200		70,000	31,000
2,850		46,000	16,000	6,400		70,000	31,000
2,900		46,000	16,000	6,600		70,000	31,000
2,950		46,000	16,000	6,700		70,000	31,000
3,000		46,000	16,000	6,750	17/64	74,000	34,000
3,010		49,000	18,000	6,800		74,000	34,000
3,050		49,000	18,000	6,900		74,000	34,000
3,100		49,000	18,000	7,000		74,000	34,000
3,200		49,000	18,000	7,100		74,000	34,000
3,350		49,000	18,000	7,200		74,000	34,000
3,400		52,000	20,000	7,300		74,000	34,000
3,450		52,000	20,000	7,400		74,000	34,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
7,600		79,000	37,000	11,800		95,000	47,000
7,700		79,000	37,000	11,900		102,000	51,000
7,750		79,000	37,000	12,000		102,000	51,000
7,900		79,000	37,000	12,100		102,000	51,000
8,000		79,000	37,000	12,250		102,000	51,000
8,100		79,000	37,000	12,400		102,000	51,000
8,200		79,000	37,000	12,500		102,000	51,000
8,250		79,000	37,000	12,600		102,000	51,000
8,300		79,000	37,000	12,750		102,000	51,000
8,400		79,000	37,000	12,800		102,000	51,000
8,500		79,000	37,000	12,900		102,000	51,000
8,600		84,000	40,000	13,000		102,000	51,000
8,700		84,000	40,000	13,200		102,000	51,000
8,750		84,000	40,000	13,250		107,000	54,000
8,800		84,000	40,000	13,400		107,000	54,000
8,900		84,000	40,000	13,500		107,000	54,000
9,000		84,000	40,000	13,600		107,000	54,000
9,100		84,000	40,000	13,750		107,000	54,000
9,200		84,000	40,000	13,800		107,000	54,000
9,250		84,000	40,000	14,000		107,000	54,000
9,400		84,000	40,000	14,200		111,000	56,000
9,500		84,000	40,000	14,300		111,000	56,000
9,600		89,000	43,000	14,400		111,000	56,000
9,700		89,000	43,000	14,500		111,000	56,000
9,750		89,000	43,000	14,700		111,000	56,000
10,000		89,000	43,000	14,750		111,000	56,000
10,100		89,000	43,000	15,000		111,000	56,000
10,200		89,000	43,000	15,500		115,000	58,000
10,300		89,000	43,000	16,000		115,000	58,000
10,500		89,000	43,000	16,500		119,000	60,000
10,600		89,000	43,000	17,000		119,000	60,000
10,700		95,000	47,000	18,000		123,000	62,000
10,750		95,000	47,000	19,000		127,000	64,000
10,800		95,000	47,000	20,000		131,000	66,000
11,000		95,000	47,000	21,000		136,000	68,000
11,100		95,000	47,000	22,000		141,000	70,000
11,200		95,000	47,000	29,750		168,000	84,000
11,250		95,000	47,000	30,000		168,000	84,000
11,300		95,000	47,000	31,500		174,000	87,000
11,400		95,000	47,000	36,000		193,000	96,000
11,500		95,000	47,000	36,500		193,000	96,000
11,750		95,000	47,000				

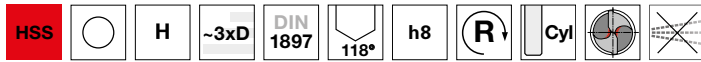


## Spiralbohrer extra kurz

Artikel-Nr. 81120

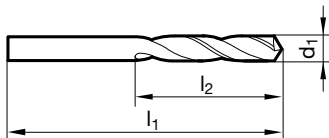


P	M	K	N	S	H
			•		



Ausspitzung  $\geq \varnothing 15,000$  • Kegelmantelschliff

harte und spröde Werkstoffe • Messing, Magnesium-Legierungen • Bronzen, Phosphorbronze • Schiefer, Glimmer, Pertinax

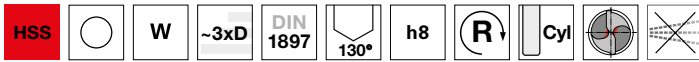
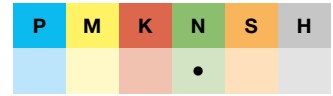


d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,200		30,000	8,000	5,000		62,000	26,000
1,400		32,000	9,000	5,100		62,000	26,000
1,500		32,000	9,000	5,200		62,000	26,000
1,600		34,000	10,000	5,300		62,000	26,000
1,700		34,000	10,000	5,400		66,000	28,000
1,900		36,000	11,000	5,500		66,000	28,000
2,000		38,000	12,000	5,600		66,000	28,000
2,350		40,000	13,000	5,700		66,000	28,000
2,380	3/32	43,000	14,000	5,800		66,000	28,000
2,400		43,000	14,000	6,000		66,000	28,000
2,500		43,000	14,000	6,100		70,000	31,000
2,600		43,000	14,000	6,200		70,000	31,000
2,700		46,000	16,000	6,500		70,000	31,000
2,800		46,000	16,000	7,000		74,000	34,000
2,900		46,000	16,000	7,500		74,000	34,000
2,950		46,000	16,000	8,000		79,000	37,000
3,000		46,000	16,000	8,500		79,000	37,000
3,100		49,000	18,000	8,600		84,000	40,000
3,200		49,000	18,000	8,700		84,000	40,000
3,250		49,000	18,000	9,000		84,000	40,000
3,300		49,000	18,000	10,000		89,000	43,000
3,400		52,000	20,000	10,200		89,000	43,000
3,500		52,000	20,000	10,500		89,000	43,000
3,600		52,000	20,000	12,000		102,000	51,000
3,800		55,000	22,000	13,000		102,000	51,000
3,900		55,000	22,000	14,000		107,000	54,000
4,000		55,000	22,000	15,000		111,000	56,000
4,100		55,000	22,000	16,000		115,000	58,000
4,200		55,000	22,000				
4,300		58,000	24,000				
4,400		58,000	24,000				
4,500		58,000	24,000				
4,600		58,000	24,000				
4,700		58,000	24,000				
4,800		62,000	26,000				
4,900		62,000	26,000				



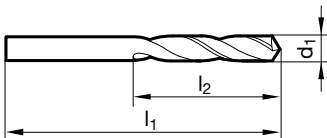
## Spiralbohrer extra kurz

Artikel-Nr. 81130



Ausspitzung  $\geq \varnothing 2,500$  • Kegelmantelschliff

weiche, langspanende Werkstoffe • Aluminium, Al-Legierungen (langspanend) • Zink, Hüttenkupfer, Silumin, Elektron • Kunststoffe (weich), Holz



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,500	32,000	9,000	5,200	62,000	26,000
2,000	38,000	12,000	5,300	62,000	26,000
2,200	40,000	13,000	5,400	66,000	28,000
2,300	40,000	13,000	5,700	66,000	28,000
2,500	43,000	14,000	5,800	66,000	28,000
2,600	43,000	14,000	6,000	66,000	28,000
2,800	46,000	16,000	6,400	70,000	31,000
2,900	46,000	16,000	6,500	70,000	31,000
3,000	46,000	16,000	6,800	74,000	34,000
3,200	49,000	18,000	7,000	74,000	34,000
3,300	49,000	18,000	7,500	74,000	34,000
3,400	52,000	20,000	7,800	79,000	37,000
3,500	52,000	20,000	8,000	79,000	37,000
3,600	52,000	20,000	8,500	79,000	37,000
3,800	55,000	22,000	9,000	84,000	40,000
3,900	55,000	22,000	10,000	89,000	43,000
4,000	55,000	22,000	10,500	89,000	43,000
4,100	55,000	22,000	11,000	95,000	47,000
4,200	55,000	22,000	12,000	102,000	51,000
4,300	58,000	24,000	13,000	102,000	51,000
4,500	58,000	24,000	15,000	111,000	56,000
4,900	62,000	26,000	16,000	115,000	58,000
5,000	62,000	26,000			
5,100	62,000	26,000			

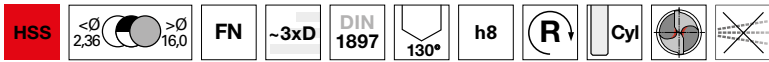


## Spiralbohrer extra kurz

Artikel-Nr. 81140

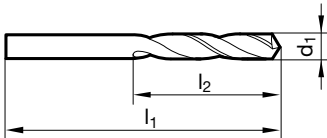


P	M	K	N	S	H
•	○	○	•		



Ausspitzung  $\geq \phi 1,500$  • Kegelmantelanschliff • für höherfeste Stähle

Automatenstähle • rost-/säurebest. Stähle • Einsatz-/Vergütungsstähle bis 800 N/mm<sup>2</sup> • kurz/mittellang spanende Al- und Cu-Legierungen



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
1,500		32,000	9,000	6,600		70,000	31,000
1,600		34,000	10,000	6,700		70,000	31,000
1,800		36,000	11,000	6,800		74,000	34,000
2,000		38,000	12,000	7,000		74,000	34,000
2,100		38,000	12,000	7,100		74,000	34,000
2,200		40,000	13,000	7,300		74,000	34,000
2,350		40,000	13,000	7,400		74,000	34,000
2,400		43,000	14,000	7,800		79,000	37,000
2,500		43,000	14,000	8,000		79,000	37,000
2,600		43,000	14,000	8,100		79,000	37,000
2,700		46,000	16,000	8,300		79,000	37,000
2,800		46,000	16,000	8,400		79,000	37,000
2,900		46,000	16,000	8,500		79,000	37,000
3,000		46,000	16,000	8,600		84,000	40,000
3,100		49,000	18,000	8,800		84,000	40,000
3,150		49,000	18,000	9,000		84,000	40,000
3,300		49,000	18,000	9,100		84,000	40,000
3,500		52,000	20,000	9,200		84,000	40,000
3,700		52,000	20,000	9,300		84,000	40,000
4,000		55,000	22,000	9,400		84,000	40,000
4,100		55,000	22,000	9,500		84,000	40,000
4,200		55,000	22,000	9,600		89,000	43,000
4,300		58,000	24,000	9,700		89,000	43,000
4,600		58,000	24,000	9,800		89,000	43,000
4,700		58,000	24,000	10,000		89,000	43,000
4,800		62,000	26,000	10,500		89,000	43,000
4,900		62,000	26,000	11,000		95,000	47,000
5,000		62,000	26,000	11,500		95,000	47,000
5,100		62,000	26,000	12,000		102,000	51,000
5,200		62,000	26,000	12,300	31/64	102,000	51,000
5,300		62,000	26,000	12,500		102,000	51,000
5,400		66,000	28,000	13,000		102,000	51,000
5,500		66,000	28,000	15,000		111,000	56,000
5,600		66,000	28,000	15,500		115,000	58,000
5,700		66,000	28,000				
5,800		66,000	28,000				
5,900		66,000	28,000				
6,000		66,000	28,000				
6,200		70,000	31,000				
6,300		70,000	31,000				
6,400		70,000	31,000				
6,500		70,000	31,000				



## Spiralbohrer extra kurz

Artikel-Nr. 81145

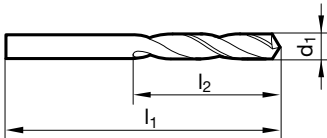


P	M	K	N	S	H
•	○	○	•		



Ausspitzung  $\geq \phi 1,000$  • Kegelmantelanschliff • für höherfeste Stähle

Automatenstähle • rost-/säurebest. Stähle • Einsatz-/Vergütungsstähle bis 800 N/mm<sup>2</sup> • kurz/mittellang spanende Al- und Cu-Legierungen



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		26,000	6,000	4,300		58,000	24,000
1,100		28,000	7,000	4,400		58,000	24,000
1,250		30,000	8,000	4,500		58,000	24,000
1,300		30,000	8,000	4,600		58,000	24,000
1,400		32,000	9,000	4,650		58,000	24,000
1,500		32,000	9,000	4,700		58,000	24,000
1,600		34,000	10,000	4,800		62,000	26,000
1,650		34,000	10,000	4,900		62,000	26,000
1,700		34,000	10,000	5,000		62,000	26,000
1,800		36,000	11,000	5,100		62,000	26,000
1,850		36,000	11,000	5,200		62,000	26,000
1,900		36,000	11,000	5,300		62,000	26,000
2,100		38,000	12,000	5,500		66,000	28,000
2,200		40,000	13,000	5,600		66,000	28,000
2,250		40,000	13,000	5,700		66,000	28,000
2,300		40,000	13,000	5,800		66,000	28,000
2,350		40,000	13,000	5,900		66,000	28,000
2,400		43,000	14,000	6,000		66,000	28,000
2,500		43,000	14,000	6,200		70,000	31,000
2,550		43,000	14,000	6,300		70,000	31,000
2,600		43,000	14,000	6,500		70,000	31,000
2,650		43,000	14,000	6,600		70,000	31,000
2,700		46,000	16,000	6,700		70,000	31,000
2,780	7/64	46,000	16,000	6,800		74,000	34,000
2,800		46,000	16,000	6,900		74,000	34,000
2,850		46,000	16,000	7,000		74,000	34,000
2,900		46,000	16,000	7,500		74,000	34,000
2,950		46,000	16,000	7,800		79,000	37,000
3,000		46,000	16,000	7,900		79,000	37,000
3,150		49,000	18,000	8,000		79,000	37,000
3,170	1/8	49,000	18,000	8,100		79,000	37,000
3,250		49,000	18,000	8,200		79,000	37,000
3,300		49,000	18,000	8,300		79,000	37,000
3,500		52,000	20,000	8,400		79,000	37,000
3,650		52,000	20,000	8,500		79,000	37,000
3,680		52,000	20,000	8,600		84,000	40,000
3,700		52,000	20,000	8,700		84,000	40,000
3,800		55,000	22,000	8,800		84,000	40,000
3,900		55,000	22,000	9,000		84,000	40,000
4,000		55,000	22,000	9,200		84,000	40,000
4,100		55,000	22,000	9,500		84,000	40,000
4,200		55,000	22,000	9,700		89,000	43,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
10,000		89,000	43,000				
10,500		89,000	43,000				
11,000		95,000	47,000				
11,500		95,000	47,000				
12,500		102,000	51,000				



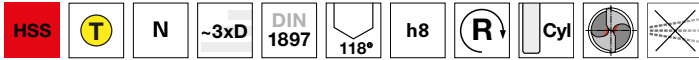


## Spiralbohrer extra kurz

### Artikel-Nr. 84400



P	M	K	N	S	H
•		•	○		

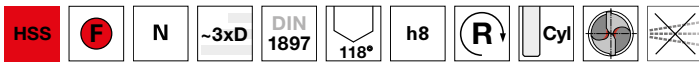


Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • für Automaten/Revolverbänke • auch für Handbohrmaschinen geeignet  
dünnwandige Materialien • Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen, Neusilber und Graphit

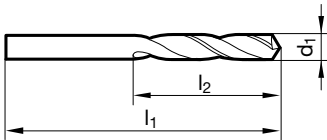
### Artikel-Nr. 84501



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • für Automaten/Revolverbänke • auch für Handbohrmaschinen geeignet  
dünnwandige Materialien • Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen, Neusilber und Graphit



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		26,000	6,000	3,700		52,000	20,000
1,100		28,000	7,000	3,800		55,000	22,000
1,200		30,000	8,000	3,900		55,000	22,000
1,300		30,000	8,000	4,000		55,000	22,000
1,350		32,000	9,000	4,100		55,000	22,000
1,400		32,000	9,000	4,200		55,000	22,000
1,450		32,000	9,000	4,300		58,000	24,000
1,500		32,000	9,000	4,400		58,000	24,000
1,600		34,000	10,000	4,500		58,000	24,000
1,700		34,000	10,000	4,600		58,000	24,000
1,800		36,000	11,000	4,700		58,000	24,000
1,900		36,000	11,000	4,800		62,000	26,000
2,000		38,000	12,000	4,900		62,000	26,000
2,100		38,000	12,000	5,000		62,000	26,000
2,200		40,000	13,000	5,100		62,000	26,000
2,300		40,000	13,000	5,200		62,000	26,000
2,400		43,000	14,000	5,300		62,000	26,000
2,500		43,000	14,000	5,400		66,000	28,000
2,600		43,000	14,000	5,500		66,000	28,000
2,700		46,000	16,000	5,600		66,000	28,000
2,800		46,000	16,000	5,700		66,000	28,000
2,900		46,000	16,000	5,800		66,000	28,000
3,000		46,000	16,000	5,900		66,000	28,000
3,100		49,000	18,000	6,000		66,000	28,000
3,200		49,000	18,000	6,100		70,000	31,000
3,300		49,000	18,000	6,200		70,000	31,000
3,400		52,000	20,000	6,300		70,000	31,000
3,450		52,000	20,000	6,400		70,000	31,000
3,500		52,000	20,000	6,500		70,000	31,000
3,600		52,000	20,000	6,600		70,000	31,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
6,700		70,000	31,000	11,000		95,000	47,000
6,800		74,000	34,000	11,200		95,000	47,000
6,900		74,000	34,000	11,300		95,000	47,000
7,000		74,000	34,000	11,400		95,000	47,000
7,100		74,000	34,000	11,500		95,000	47,000
7,200		74,000	34,000	11,700		95,000	47,000
7,300		74,000	34,000	11,800		95,000	47,000
7,400		74,000	34,000	11,900		102,000	51,000
7,500		74,000	34,000	12,000		102,000	51,000
7,600		79,000	37,000	12,100		102,000	51,000
7,700		79,000	37,000	12,200		102,000	51,000
7,800		79,000	37,000	12,300	31/64	102,000	51,000
7,900		79,000	37,000	12,500		102,000	51,000
8,000		79,000	37,000	12,700	1/2	102,000	51,000
8,100		79,000	37,000	12,800		102,000	51,000
8,200		79,000	37,000	13,000		102,000	51,000
8,300		79,000	37,000	13,200		102,000	51,000
8,400		79,000	37,000	13,500		107,000	54,000
8,500		79,000	37,000	13,800		107,000	54,000
8,600		84,000	40,000	14,000		107,000	54,000
8,700		84,000	40,000	14,200		111,000	56,000
8,800		84,000	40,000	14,800		111,000	56,000
8,900		84,000	40,000	15,000		111,000	56,000
9,000		84,000	40,000	15,300		115,000	58,000
9,100		84,000	40,000	15,500		115,000	58,000
9,200		84,000	40,000	16,000		115,000	58,000
9,300		84,000	40,000	17,000		119,000	60,000
9,400		84,000	40,000	17,500		123,000	62,000
9,500		84,000	40,000	18,000		123,000	62,000
9,600		89,000	43,000	18,500		127,000	64,000
9,700		89,000	43,000	19,500		131,000	66,000
9,800		89,000	43,000	20,000		131,000	66,000
9,900		89,000	43,000	25,000	63/64	151,000	75,000
10,000		89,000	43,000				
10,100		89,000	43,000				
10,200		89,000	43,000				
10,300		89,000	43,000				
10,400		89,000	43,000				
10,500		89,000	43,000				
10,600		89,000	43,000				
10,720	27/64	95,000	47,000				
10,800		95,000	47,000				

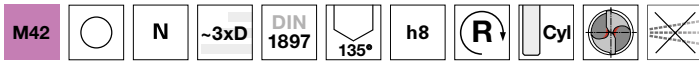


## Spiralbohrer extra kurz

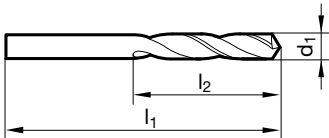
Artikel-Nr. 81112



P	M	K	N	S	H
•	○	○	•	•	○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • hoher Co- und Mo-Anteil • besonders hohe Verschleißfestigkeit  
 feste/hochfeste Legierung auf CrNi-Basis • Sonderlegierungen Hastelloy, Inconel, Nimonic • rost-/säure-/hitzebeständige Stähle  
 • verschleißfeste Bleche • Stähle/Bronzen bis 1400 N/mm<sup>2</sup>



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
1,000		26,000	6,000	4,800		62,000	26,000
1,100		28,000	7,000	4,900		62,000	26,000
1,200		30,000	8,000	5,000		62,000	26,000
1,300		30,000	8,000	5,100		62,000	26,000
1,400		32,000	9,000	5,200		62,000	26,000
1,500		32,000	9,000	5,300		62,000	26,000
1,600		34,000	10,000	5,400		66,000	28,000
1,700		34,000	10,000	5,500		66,000	28,000
1,800		36,000	11,000	5,560	7/32	66,000	28,000
1,900		36,000	11,000	5,600		66,000	28,000
2,000		38,000	12,000	5,800		66,000	28,000
2,100		38,000	12,000	6,000		66,000	28,000
2,200		40,000	13,000	6,100		70,000	31,000
2,300		40,000	13,000	6,200		70,000	31,000
2,380	3/32	43,000	14,000	6,300		70,000	31,000
2,400		43,000	14,000	6,350	1/4	70,000	31,000
2,500		43,000	14,000	6,400		70,000	31,000
2,600		43,000	14,000	6,500		70,000	31,000
2,700		46,000	16,000	6,600		70,000	31,000
2,780	7/64	46,000	16,000	6,800		74,000	34,000
2,800		46,000	16,000	6,900		74,000	34,000
2,900		46,000	16,000	7,000		74,000	34,000
3,000		46,000	16,000	7,100		74,000	34,000
3,100		49,000	18,000	7,200		74,000	34,000
3,170	1/8	49,000	18,000	7,300		74,000	34,000
3,200		49,000	18,000	7,400		74,000	34,000
3,300		49,000	18,000	7,500		74,000	34,000
3,400		52,000	20,000	7,540	19/64	79,000	37,000
3,500		52,000	20,000	7,600		79,000	37,000
3,600		52,000	20,000	7,700		79,000	37,000
3,700		52,000	20,000	7,800		79,000	37,000
3,800		55,000	22,000	7,900		79,000	37,000
3,900		55,000	22,000	8,000		79,000	37,000
3,970	5/32	55,000	22,000	8,100		79,000	37,000
4,000		55,000	22,000	8,200		79,000	37,000
4,100		55,000	22,000	8,300		79,000	37,000
4,200		55,000	22,000	8,500		79,000	37,000
4,300		58,000	24,000	8,600		84,000	40,000
4,400		58,000	24,000	8,700		84,000	40,000
4,500		58,000	24,000	9,000		84,000	40,000
4,600		58,000	24,000	9,200		84,000	40,000
4,700		58,000	24,000	9,300		84,000	40,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
9,500		84,000	40,000	13,500		107,000	54,000
9,700		89,000	43,000	14,000		107,000	54,000
9,800		89,000	43,000	14,500		111,000	56,000
9,900		89,000	43,000	15,000		111,000	56,000
10,000		89,000	43,000				
10,500		89,000	43,000				
11,000		95,000	47,000				
11,500		95,000	47,000				
12,000		102,000	51,000				
12,500		102,000	51,000				
12,700	1/2	102,000	51,000				
13,000		102,000	51,000				



## Spiralbohrer extra kurz

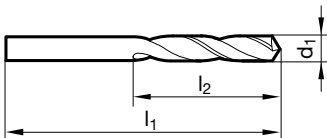
Artikel-Nr. 81171



P	M	K	N	S	H
•	•	•	○	•	○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
 rost-/säurebest. Stähle • Federstähle • austenitische Stähle • Sonderlegierungen Hastelloy, Inconel, Nimonic



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
0,400		19,000	2,500	2,500		43,000	14,000
0,500		20,000	3,000	2,550		43,000	14,000
0,600		21,000	3,500	2,600		43,000	14,000
0,650		22,000	4,000	2,650		43,000	14,000
0,750		23,000	4,500	2,700		46,000	16,000
0,800		24,000	5,000	2,800		46,000	16,000
0,860		25,000	5,500	2,900		46,000	16,000
0,870		25,000	5,500	3,000		46,000	16,000
0,900		25,000	5,500	3,050		49,000	18,000
0,950		25,000	5,500	3,100		49,000	18,000
1,000		26,000	6,000	3,200		49,000	18,000
1,030		26,000	6,000	3,250		49,000	18,000
1,100		28,000	7,000	3,300		49,000	18,000
1,150		28,000	7,000	3,400		52,000	20,000
1,200		30,000	8,000	3,500		52,000	20,000
1,250		30,000	8,000	3,550		52,000	20,000
1,300		30,000	8,000	3,600		52,000	20,000
1,350		32,000	9,000	3,700		52,000	20,000
1,400		32,000	9,000	3,750		52,000	20,000
1,450		32,000	9,000	3,800		55,000	22,000
1,500		32,000	9,000	3,900		55,000	22,000
1,550		34,000	10,000	4,000		55,000	22,000
1,600		34,000	10,000	4,100		55,000	22,000
1,650		34,000	10,000	4,200		55,000	22,000
1,700		34,000	10,000	4,250		55,000	22,000
1,750		36,000	11,000	4,300		58,000	24,000
1,800		36,000	11,000	4,500		58,000	24,000
1,850		36,000	11,000	4,600		58,000	24,000
1,900		36,000	11,000	4,650		58,000	24,000
1,950		38,000	12,000	4,800		62,000	26,000
1,970		38,000	12,000	4,900		62,000	26,000
1,980	5/64	38,000	12,000	5,000		62,000	26,000
2,000		38,000	12,000	5,050		62,000	26,000
2,030		38,000	12,000	5,100		62,000	26,000
2,050		38,000	12,000	5,200		62,000	26,000
2,100		38,000	12,000	5,300		62,000	26,000
2,200		40,000	13,000	5,400		66,000	28,000
2,250		40,000	13,000	5,500		66,000	28,000
2,300		40,000	13,000	5,550		66,000	28,000
2,400		43,000	14,000	5,600		66,000	28,000
2,450		43,000	14,000	5,700		66,000	28,000
2,470		43,000	14,000	5,800		66,000	28,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
5,900		66,000	28,000	10,600		89,000	43,000
5,950	15/64	66,000	28,000	10,800		95,000	47,000
6,000		66,000	28,000	10,900		95,000	47,000
6,100		70,000	31,000	11,000		95,000	47,000
6,200		70,000	31,000	11,100		95,000	47,000
6,250		70,000	31,000	11,200		95,000	47,000
6,300		70,000	31,000	11,500		95,000	47,000
6,400		70,000	31,000	11,750		95,000	47,000
6,500		70,000	31,000	11,800		95,000	47,000
6,600		70,000	31,000	12,000		102,000	51,000
6,700		70,000	31,000	12,200		102,000	51,000
6,750	17/64	74,000	34,000	12,250		102,000	51,000
6,800		74,000	34,000	12,300	31/64	102,000	51,000
6,900		74,000	34,000	12,400		102,000	51,000
7,000		74,000	34,000	12,500		102,000	51,000
7,100		74,000	34,000	12,600		102,000	51,000
7,200		74,000	34,000	12,800		102,000	51,000
7,300		74,000	34,000	12,900		102,000	51,000
7,400		74,000	34,000	13,000		102,000	51,000
7,500		74,000	34,000	13,300		107,000	54,000
7,600		79,000	37,000	13,500		107,000	54,000
7,700		79,000	37,000	13,750		107,000	54,000
7,800		79,000	37,000	13,800		107,000	54,000
7,900		79,000	37,000	14,000		107,000	54,000
8,000		79,000	37,000	14,500		111,000	56,000
8,100		79,000	37,000	15,000		111,000	56,000
8,200		79,000	37,000	15,500		115,000	58,000
8,250		79,000	37,000	15,750		115,000	58,000
8,300		79,000	37,000	16,000		115,000	58,000
8,400		79,000	37,000	16,500		119,000	60,000
8,500		79,000	37,000	17,000		119,000	60,000
8,800		84,000	40,000	17,500		123,000	62,000
8,900		84,000	40,000	18,500		127,000	64,000
9,000		84,000	40,000	19,000		127,000	64,000
9,100		84,000	40,000	19,500		131,000	66,000
9,200		84,000	40,000	20,000		131,000	66,000
9,400		84,000	40,000	20,500		136,000	68,000
9,500		84,000	40,000	21,000		136,000	68,000
9,600		89,000	43,000	22,000		141,000	70,000
9,750		89,000	43,000	22,200		141,000	70,000
9,800		89,000	43,000	23,000		146,000	72,000
9,900		89,000	43,000	25,000	63/64	151,000	75,000
10,000		89,000	43,000				
10,050		89,000	43,000				
10,100		89,000	43,000				
10,200		89,000	43,000				
10,400		89,000	43,000				
10,500		89,000	43,000				



## Spiralbohrer extra kurz

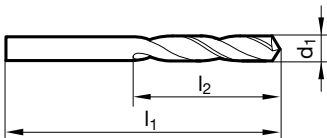
Artikel-Nr. 81173



P	M	K	N	S	H
○	●		○	○	



INOX-Drill • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
rost-/säure-/hitzebest. austenit. Stähle (V2A und V4A)



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	26,000	6,000	5,000	62,000	26,000
1,100	28,000	7,000	5,100	62,000	26,000
1,300	30,000	8,000	5,200	62,000	26,000
1,400	32,000	9,000	5,300	62,000	26,000
1,500	32,000	9,000	5,500	66,000	28,000
1,600	34,000	10,000	5,600	66,000	28,000
1,700	34,000	10,000	5,800	66,000	28,000
1,800	36,000	11,000	5,900	66,000	28,000
2,000	38,000	12,000	6,000	66,000	28,000
2,100	38,000	12,000	6,300	70,000	31,000
2,200	40,000	13,000	6,500	70,000	31,000
2,300	40,000	13,000	6,700	70,000	31,000
2,400	43,000	14,000	6,800	74,000	34,000
2,500	43,000	14,000	6,900	74,000	34,000
2,600	43,000	14,000	7,000	74,000	34,000
2,700	46,000	16,000	7,100	74,000	34,000
2,800	46,000	16,000	7,400	74,000	34,000
2,900	46,000	16,000	7,500	74,000	34,000
3,000	46,000	16,000	7,600	79,000	37,000
3,100	49,000	18,000	7,800	79,000	37,000
3,200	49,000	18,000	7,900	79,000	37,000
3,300	49,000	18,000	8,000	79,000	37,000
3,400	52,000	20,000	8,100	79,000	37,000
3,500	52,000	20,000	8,200	79,000	37,000
3,600	52,000	20,000	8,500	79,000	37,000
3,800	55,000	22,000	8,700	84,000	40,000
3,900	55,000	22,000	9,000	84,000	40,000
4,000	55,000	22,000	9,200	84,000	40,000
4,100	55,000	22,000	9,500	84,000	40,000
4,200	55,000	22,000	10,000	89,000	43,000
4,300	58,000	24,000	10,200	89,000	43,000
4,500	58,000	24,000	10,500	89,000	43,000
4,600	58,000	24,000	11,000	95,000	47,000
4,700	58,000	24,000	11,500	95,000	47,000
4,800	62,000	26,000	11,700	95,000	47,000
4,900	62,000	26,000	12,000	102,000	51,000



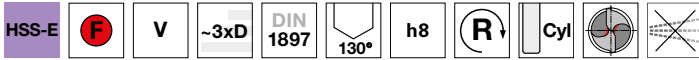
# HARTNER

## Spiralbohrer extra kurz

### Artikel-Nr. 84503



P	M	K	N	S	H
•	•	•	○	•	○

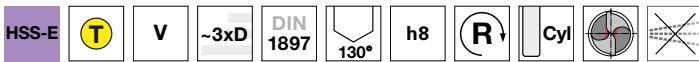


Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
rost-/säurebest. Stähle • Federstähle • austenitische Stähle • Sonderlegierungen Hastelloy, Inconel, Nimonic

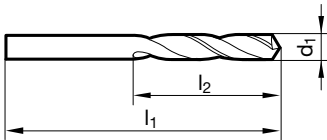
### Artikel-Nr. 84803



P	M	K	N	S	H
•	•	•	○	•	○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
rost-/säurebest. Stähle • Federstähle • austenitische Stähle • Sonderlegierungen Hastelloy, Inconel, Nimonic



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
0,500		20,000	3,000	3,050		49,000	18,000
0,700		23,000	4,500	3,100		49,000	18,000
0,900		25,000	5,500	3,200		49,000	18,000
1,000		26,000	6,000	3,250		49,000	18,000
1,100		28,000	7,000	3,300		49,000	18,000
1,200		30,000	8,000	3,350		49,000	18,000
1,300		30,000	8,000	3,400		52,000	20,000
1,400		32,000	9,000	3,450		52,000	20,000
1,500		32,000	9,000	3,500		52,000	20,000
1,600		34,000	10,000	3,600		52,000	20,000
1,700		34,000	10,000	3,700		52,000	20,000
1,800		36,000	11,000	3,800		55,000	22,000
1,850		36,000	11,000	3,900		55,000	22,000
1,900		36,000	11,000	4,000		55,000	22,000
2,000		38,000	12,000	4,100		55,000	22,000
2,050		38,000	12,000	4,200		55,000	22,000
2,100		38,000	12,000	4,300		58,000	24,000
2,200		40,000	13,000	4,400		58,000	24,000
2,300		40,000	13,000	4,500		58,000	24,000
2,350		40,000	13,000	4,600		58,000	24,000
2,400		43,000	14,000	4,700		58,000	24,000
2,450		43,000	14,000	4,800		62,000	26,000
2,500		43,000	14,000	4,900		62,000	26,000
2,550		43,000	14,000	5,000		62,000	26,000
2,600		43,000	14,000	5,100		62,000	26,000
2,700		46,000	16,000	5,200		62,000	26,000
2,800		46,000	16,000	5,300		62,000	26,000
2,900		46,000	16,000	5,400		66,000	28,000
2,950		46,000	16,000	5,500		66,000	28,000
3,000		46,000	16,000	5,600		66,000	28,000





## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
5,700		66,000	28,000	8,600		84,000	40,000
5,800		66,000	28,000	8,700		84,000	40,000
5,900		66,000	28,000	8,800		84,000	40,000
6,000		66,000	28,000	9,000		84,000	40,000
6,050		70,000	31,000	9,100		84,000	40,000
6,100		70,000	31,000	9,200		84,000	40,000
6,200		70,000	31,000	9,300		84,000	40,000
6,300		70,000	31,000	9,500		84,000	40,000
6,350	1/4	70,000	31,000	9,600		89,000	43,000
6,400		70,000	31,000	9,700		89,000	43,000
6,500		70,000	31,000	9,800		89,000	43,000
6,600		70,000	31,000	9,900		89,000	43,000
6,700		70,000	31,000	10,000		89,000	43,000
6,800		74,000	34,000	10,200		89,000	43,000
6,900		74,000	34,000	10,500		89,000	43,000
7,000		74,000	34,000	11,000		95,000	47,000
7,100		74,000	34,000	11,500		95,000	47,000
7,200		74,000	34,000	12,000		102,000	51,000
7,300		74,000	34,000	12,500		102,000	51,000
7,400		74,000	34,000	13,000		102,000	51,000
7,500		74,000	34,000	14,000		107,000	54,000
7,700		79,000	37,000	14,500		111,000	56,000
7,800		79,000	37,000	15,000		111,000	56,000
7,900		79,000	37,000				
8,000		79,000	37,000				
8,100		79,000	37,000				
8,200		79,000	37,000				
8,300		79,000	37,000				
8,400		79,000	37,000				
8,500		79,000	37,000				

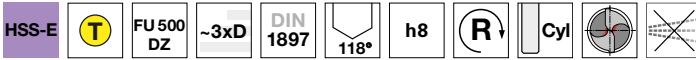


## Spiralbohrer extra kurz

### Artikel-Nr. 84806



P	M	K	N	S	H
•	•	•	•		



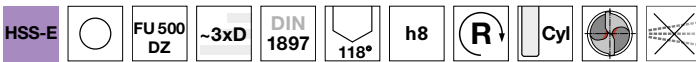
Ausspitzung  $\geq \varnothing 1,000$  • Flächenanschliff • Co-legierter HSS-Stahl • geringe Vorschubkraft notwendig • geringes Drehmoment notwendig • universell einsetzbar

Stähle (legiert/unleg.) bis 800 N/mm<sup>2</sup> • Kalt-/Warmarbeitsstähle • Wälzlagerstähle • NE-Metalle • Gusswerkstoffe • rostfreie Stähle • Kunststoffe

### Artikel-Nr. 84808

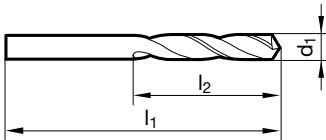


P	M	K	N	S	H
•	•	•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Flächenanschliff • Co-legierter HSS-Stahl • geringe Vorschubkraft notwendig • geringes Drehmoment notwendig • universell einsetzbar

Stähle (legiert/unleg.) bis 800 N/mm<sup>2</sup> • Kalt-/Warmarbeitsstähle • Wälzlagerstähle • NE-Metalle • Gusswerkstoffe • rostfreie Stähle • Kunststoffe



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		26,000	6,000	3,600		52,000	20,000
1,100		28,000	7,000	3,700		52,000	20,000
1,200		30,000	8,000	3,800		55,000	22,000
1,300		30,000	8,000	3,900		55,000	22,000
1,400		32,000	9,000	3,970	5/32	55,000	22,000
1,500		32,000	9,000	4,000		55,000	22,000
1,600		34,000	10,000	4,100		55,000	22,000
1,700		34,000	10,000	4,200		55,000	22,000
1,800		36,000	11,000	4,300		58,000	24,000
1,900		36,000	11,000	4,370	11/64	58,000	24,000
2,000		38,000	12,000	4,400		58,000	24,000
2,100		38,000	12,000	4,500		58,000	24,000
2,200		40,000	13,000	4,600		58,000	24,000
2,300		40,000	13,000	4,700		58,000	24,000
2,380	3/32	43,000	14,000	4,760	3/16	62,000	26,000
2,400		43,000	14,000	4,800		62,000	26,000
2,500		43,000	14,000	4,900		62,000	26,000
2,600		43,000	14,000	5,000		62,000	26,000
2,700		46,000	16,000	5,100		62,000	26,000
2,780	7/64	46,000	16,000	5,160	13/64	62,000	26,000
2,800		46,000	16,000	5,200		62,000	26,000
2,900		46,000	16,000	5,300		62,000	26,000
3,000		46,000	16,000	5,400		66,000	28,000
3,100		49,000	18,000	5,500		66,000	28,000
3,170	1/8	49,000	18,000	5,560	7/32	66,000	28,000
3,200		49,000	18,000	5,600		66,000	28,000
3,300		49,000	18,000	5,700		66,000	28,000
3,400		52,000	20,000	5,800		66,000	28,000
3,500		52,000	20,000	5,900		66,000	28,000
3,570	9/64	52,000	20,000	5,950	15/64	66,000	28,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
6,000		66,000	28,000	8,700		84,000	40,000
6,100		70,000	31,000	8,730	11/32	84,000	40,000
6,200		70,000	31,000	8,800		84,000	40,000
6,300		70,000	31,000	8,900		84,000	40,000
6,350	1/4	70,000	31,000	9,000		84,000	40,000
6,400		70,000	31,000	9,100		84,000	40,000
6,500		70,000	31,000	9,200		84,000	40,000
6,600		70,000	31,000	9,300		84,000	40,000
6,700		70,000	31,000	9,400		84,000	40,000
6,800		74,000	34,000	9,500		89,000	40,000
6,900		74,000	34,000	9,600		89,000	43,000
7,000		74,000	34,000	9,700		89,000	43,000
7,100		74,000	34,000	9,800		89,000	43,000
7,140	9/32	74,000	34,000	9,900		89,000	43,000
7,200		74,000	34,000	10,000		89,000	43,000
7,300		74,000	34,000	10,100		89,000	43,000
7,400		74,000	34,000	10,200		89,000	43,000
7,500		74,000	34,000	10,300		89,000	43,000
7,600		79,000	37,000	10,400		89,000	43,000
7,700		79,000	37,000	10,500		89,000	43,000
7,800		79,000	37,000	11,000		95,000	47,000
7,900		79,000	37,000	11,110	7/16	95,000	47,000
7,940	5/16	79,000	37,000	11,500		95,000	47,000
8,000		79,000	37,000	12,000		102,000	51,000
8,100		79,000	37,000	12,500		102,000	51,000
8,200		79,000	37,000	13,000		102,000	51,000
8,300		79,000	37,000	13,500		107,000	54,000
8,400		79,000	37,000	14,000		107,000	54,000
8,500		79,000	37,000				
8,600		84,000	40,000				

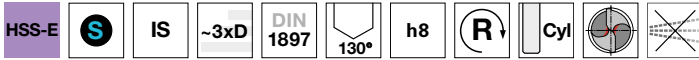


## Spiralbohrer extra kurz

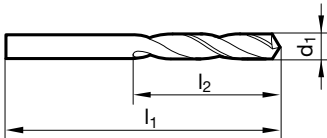
Artikel-Nr. 81178



P	M	K	N	S	H
○	●	○	○	●	



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff mit optimierter Kreuzausspitzung • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
rost-/säure-/hitzebest. austenit. Stähle (V2A und V4A) • Sonderlegierungen



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
1,000		26,000	6,000	5,100		62,000	26,000
1,100		28,000	7,000	5,200		62,000	26,000
1,200		30,000	8,000	5,300		62,000	26,000
1,300		30,000	8,000	5,400		66,000	28,000
1,400		32,000	9,000	5,500		66,000	28,000
1,500		32,000	9,000	5,550		66,000	28,000
1,600		34,000	10,000	5,600		66,000	28,000
1,700		34,000	10,000	5,700		66,000	28,000
1,800		36,000	11,000	5,800		66,000	28,000
1,900		36,000	11,000	5,900		66,000	28,000
2,000		38,000	12,000	6,000		66,000	28,000
2,100		38,000	12,000	6,100		70,000	31,000
2,200		40,000	13,000	6,200		70,000	31,000
2,300		40,000	13,000	6,300		70,000	31,000
2,400		43,000	14,000	6,400		70,000	31,000
2,500		43,000	14,000	6,500		70,000	31,000
2,600		43,000	14,000	6,600		70,000	31,000
2,700		46,000	16,000	6,700		70,000	31,000
2,800		46,000	16,000	6,800		74,000	34,000
2,900		46,000	16,000	6,900		74,000	34,000
3,000		46,000	16,000	7,000		74,000	34,000
3,100		49,000	18,000	7,100		74,000	34,000
3,200		49,000	18,000	7,200		74,000	34,000
3,300		49,000	18,000	7,300		74,000	34,000
3,400		52,000	20,000	7,400		74,000	34,000
3,500		52,000	20,000	7,450		74,000	34,000
3,600		52,000	20,000	7,500		74,000	34,000
3,700		52,000	20,000	7,600		79,000	37,000
3,800		55,000	22,000	7,700		79,000	37,000
3,900		55,000	22,000	7,800		79,000	37,000
4,000		55,000	22,000	7,900		79,000	37,000
4,100		55,000	22,000	8,000		79,000	37,000
4,200		55,000	22,000	8,100		79,000	37,000
4,300		58,000	24,000	8,200		79,000	37,000
4,400		58,000	24,000	8,300		79,000	37,000
4,500		58,000	24,000	8,400		79,000	37,000
4,600		58,000	24,000	8,500		79,000	37,000
4,650		58,000	24,000	8,600		84,000	40,000
4,700		58,000	24,000	8,700		84,000	40,000
4,800		62,000	26,000	8,800		84,000	40,000
4,900		62,000	26,000	8,900		84,000	40,000
5,000		62,000	26,000	9,000		84,000	40,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
9,100		84,000	40,000	10,500		89,000	43,000
9,200		84,000	40,000	11,000		95,000	47,000
9,250		84,000	40,000	11,200		95,000	47,000
9,300		84,000	40,000	11,500		95,000	47,000
9,400		84,000	40,000	11,800		95,000	47,000
9,500		84,000	40,000	12,000		102,000	51,000
9,600		89,000	43,000	12,500		102,000	51,000
9,700		89,000	43,000	13,000		102,000	51,000
9,800		89,000	43,000				
9,900		89,000	43,000				
10,000		89,000	43,000				
10,200		89,000	43,000				

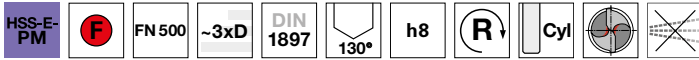


## Spiralbohrer extra kurz

Artikel-Nr. 84511

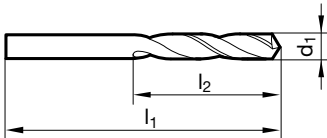


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • PM-Co-legierter HSS-Stahl • besonders hohe Stabilität • besonders hohe Verschleißfestigkeit

höherfeste Materialien, hochlegierte Stähle • Vergütungs- und Einsatzstähle • Gusseisen, Messing, Bronzen



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		26,000	6,000	5,560	7/32	66,000	28,000
1,200		30,000	8,000	5,700		66,000	28,000
1,500		32,000	9,000	5,800		66,000	28,000
2,000		38,000	12,000	5,900		66,000	28,000
2,200		40,000	13,000	6,000		66,000	28,000
2,300		40,000	13,000	6,200		70,000	31,000
2,400		43,000	14,000	6,300		70,000	31,000
2,500		43,000	14,000	6,350	1/4	70,000	31,000
2,600		43,000	14,000	6,400		70,000	31,000
2,700		46,000	16,000	6,500		70,000	31,000
2,780	7/64	46,000	16,000	6,600		70,000	31,000
3,000		46,000	16,000	6,700		70,000	31,000
3,100		49,000	18,000	6,750	17/64	74,000	34,000
3,170	1/8	49,000	18,000	6,800		74,000	34,000
3,200		49,000	18,000	6,900		74,000	34,000
3,260		49,000	18,000	7,100		74,000	34,000
3,300		49,000	18,000	7,140	9/32	74,000	34,000
3,500		52,000	20,000	7,200		74,000	34,000
3,570	9/64	52,000	20,000	7,300		74,000	34,000
3,600		52,000	20,000	7,370		74,000	34,000
3,700		52,000	20,000	7,400		74,000	34,000
3,800		55,000	22,000	7,500		74,000	34,000
3,900		55,000	22,000	7,540	19/64	79,000	37,000
4,000		55,000	22,000	7,600		79,000	37,000
4,090		55,000	22,000	7,700		79,000	37,000
4,100		55,000	22,000	7,900		79,000	37,000
4,200		55,000	22,000	7,940	5/16	79,000	37,000
4,370	11/64	58,000	24,000	8,000		79,000	37,000
4,400		58,000	24,000	8,100		79,000	37,000
4,500		58,000	24,000	8,200		79,000	37,000
4,650		58,000	24,000	8,300		79,000	37,000
4,700		58,000	24,000	8,500		79,000	37,000
4,760	3/16	62,000	26,000	8,600		84,000	40,000
4,800		62,000	26,000	8,700		84,000	40,000
4,980		62,000	26,000	8,730	11/32	84,000	40,000
5,000		62,000	26,000	8,800		84,000	40,000
5,100		62,000	26,000	9,100		84,000	40,000
5,160	13/64	62,000	26,000	9,130	23/64	84,000	40,000
5,300		62,000	26,000	9,200		84,000	40,000
5,400		66,000	28,000	9,300		84,000	40,000
5,410		66,000	28,000	9,350		84,000	40,000
5,500		66,000	28,000	9,500		84,000	40,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
9,520	3/8	89,000	43,000	11,510	29/64	95,000	47,000
9,600		89,000	43,000	11,910	15/32	102,000	51,000
9,800		89,000	43,000	12,000		102,000	51,000
9,900		89,000	43,000	12,500		102,000	51,000
9,920	25/64	89,000	43,000	12,700	1/2	102,000	51,000
10,000		89,000	43,000	13,000		102,000	51,000
10,200		89,000	43,000	13,500		107,000	54,000
10,320	13/32	89,000	43,000				
10,500		89,000	43,000				
10,720	27/64	95,000	47,000				
11,000		95,000	47,000				
11,110	7/16	95,000	47,000				

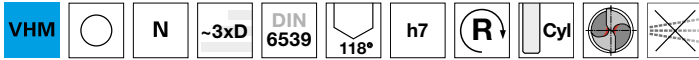


## Spiralbohrer extra kurz

Artikel-Nr. 89235

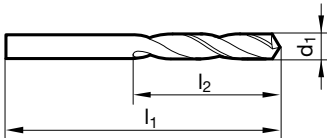


P	M	K	N	S	H
○	○	○	●	○	



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Grauguss • Bronzen, Messing • Aluminium und Al-Legierungen  
• Magnesium und Mg-Legierungen • Kunststoffe und faserverstärkte Kunststoffe



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
0,800		24,000	5,000	4,200		55,000	22,000
0,900		25,000	5,500	4,300		58,000	24,000
1,000		26,000	6,000	4,370	11/64	58,000	24,000
1,100		28,000	7,000	4,400		58,000	24,000
1,200		30,000	8,000	4,500		58,000	24,000
1,300		30,000	8,000	4,600		58,000	24,000
1,400		32,000	9,000	4,700		58,000	24,000
1,500		32,000	9,000	4,760	3/16	62,000	26,000
1,600		34,000	10,000	4,800		62,000	26,000
1,700		34,000	10,000	4,850		62,000	26,000
1,800		36,000	11,000	4,900		62,000	26,000
1,900		36,000	11,000	5,000		62,000	26,000
1,980	5/64	38,000	12,000	5,100		62,000	26,000
2,000		38,000	12,000	5,200		62,000	26,000
2,100		38,000	12,000	5,300		62,000	26,000
2,200		40,000	13,000	5,400		66,000	28,000
2,300		40,000	13,000	5,500		66,000	28,000
2,380	3/32	43,000	14,000	5,560	7/32	66,000	28,000
2,400		43,000	14,000	5,600		66,000	28,000
2,500		43,000	14,000	5,700		66,000	28,000
2,600		43,000	14,000	5,800		66,000	28,000
2,700		46,000	16,000	5,900		66,000	28,000
2,780	7/64	46,000	16,000	6,000		66,000	28,000
2,800		46,000	16,000	6,100		70,000	31,000
2,900		46,000	16,000	6,200		70,000	31,000
3,000		46,000	16,000	6,300		70,000	31,000
3,050		49,000	18,000	6,350	1/4	70,000	31,000
3,100		49,000	18,000	6,400		70,000	31,000
3,170	1/8	49,000	18,000	6,500		70,000	31,000
3,200		49,000	18,000	6,600		70,000	31,000
3,300		49,000	18,000	6,700		70,000	31,000
3,400		52,000	20,000	6,800		74,000	34,000
3,500		52,000	20,000	6,900		74,000	34,000
3,570	9/64	52,000	20,000	7,000		74,000	34,000
3,600		52,000	20,000	7,100		74,000	34,000
3,700		52,000	20,000	7,140	9/32	74,000	34,000
3,800		55,000	22,000	7,200		74,000	34,000
3,900		55,000	22,000	7,300		74,000	34,000
3,970	5/32	55,000	22,000	7,400		74,000	34,000
4,000		55,000	22,000	7,500		74,000	34,000
4,040		55,000	22,000	7,600		79,000	37,000
4,100		55,000	22,000	7,700		79,000	37,000





## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
7,800		79,000	37,000	10,200		89,000	43,000
7,900		79,000	37,000	10,300		89,000	43,000
7,940	5/16	79,000	37,000	10,500		89,000	43,000
8,000		79,000	37,000	10,800		95,000	47,000
8,100		79,000	37,000	11,000		95,000	47,000
8,200		79,000	37,000	11,110	7/16	95,000	47,000
8,300		79,000	37,000	11,400		95,000	47,000
8,400		79,000	37,000	11,500		95,000	47,000
8,500		79,000	37,000	12,000		102,000	51,000
8,600		84,000	40,000	12,300	31/64	102,000	51,000
8,700		84,000	40,000	12,400		102,000	51,000
8,730	11/32	84,000	40,000	13,000		102,000	51,000
8,800		84,000	40,000	13,200		102,000	51,000
8,900		84,000	40,000	14,000		107,000	54,000
9,000		84,000	40,000	15,000		111,000	56,000
9,100		84,000	40,000	16,000		115,000	58,000
9,300		84,000	40,000				
9,400		84,000	40,000				
9,500		84,000	40,000				
9,600		89,000	43,000				
9,700		89,000	43,000				
9,800		89,000	43,000				
9,900		89,000	43,000				
10,000		89,000	43,000				

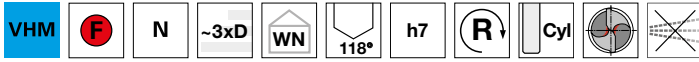


## Spiralbohrer extra kurz

Artikel-Nr. 89253

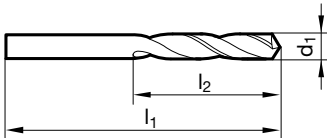


P	M	K	N	S	H
○	○	○	●	○	



Ausspitzung  $\geq \varnothing 2,060$  • Flächenanschliff • Hauptschneidenform gerade

Al-Werkstoffe mit hohem Si-Gehalt • Automatenstähle, Vergütungsstähle • Bau- und Einsatzstähle • Gusswerkstoffe • Kunststoffe und faserverstärkte Kunststoffe • Magnesium und Mg-Legierungen • Messing



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
1,000		26,000	6,000	3,800		55,000	22,000
1,100		28,000	7,000	3,900		55,000	22,000
1,190	3/64	30,000	8,000	3,970	5/32	55,000	22,000
1,200		30,000	8,000	4,000		55,000	22,000
1,300		30,000	8,000	4,040		55,000	22,000
1,400		32,000	9,000	4,100		55,000	22,000
1,500		32,000	9,000	4,200		55,000	22,000
1,590	1/16	34,000	10,000	4,300		58,000	24,000
1,600		34,000	10,000	4,370	11/64	58,000	24,000
1,700		34,000	10,000	4,400		58,000	24,000
1,800		36,000	11,000	4,500		58,000	24,000
1,850		36,000	11,000	4,570		58,000	24,000
1,900		36,000	11,000	4,600		58,000	24,000
1,980	5/64	38,000	12,000	4,700		58,000	24,000
2,000		38,000	12,000	4,760	3/16	62,000	26,000
2,060		38,000	12,000	4,800		62,000	26,000
2,100		38,000	12,000	4,900		62,000	26,000
2,200		40,000	13,000	4,980		62,000	26,000
2,250		40,000	13,000	5,000		62,000	26,000
2,300		40,000	13,000	5,060		62,000	26,000
2,380	3/32	43,000	14,000	5,100		62,000	26,000
2,400		43,000	14,000	5,160	13/64	62,000	26,000
2,500		43,000	14,000	5,200		62,000	26,000
2,530		43,000	14,000	5,300		62,000	26,000
2,600		43,000	14,000	5,400		66,000	28,000
2,700		46,000	16,000	5,500		66,000	28,000
2,780	7/64	46,000	16,000	5,560	7/32	66,000	28,000
2,800		46,000	16,000	5,600		66,000	28,000
2,900		46,000	16,000	5,700		66,000	28,000
2,950		46,000	16,000	5,800		66,000	28,000
3,000		46,000	16,000	5,900		66,000	28,000
3,050		49,000	18,000	5,950	15/64	66,000	28,000
3,100		49,000	18,000	6,000		66,000	28,000
3,170	1/8	49,000	18,000	6,040		70,000	31,000
3,200		49,000	18,000	6,100		70,000	31,000
3,300		49,000	18,000	6,150		70,000	31,000
3,400		52,000	20,000	6,200		70,000	31,000
3,450		52,000	20,000	6,250		70,000	31,000
3,500		52,000	20,000	6,300		70,000	31,000
3,570	9/64	52,000	20,000	6,350	1/4	70,000	31,000
3,600		52,000	20,000	6,400		70,000	31,000
3,700		52,000	20,000	6,500		70,000	31,000



## Spiralbohrer extra kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
6,600		70,000	31,000	9,000		84,000	40,000
6,700		70,000	31,000	9,130	23/64	84,000	40,000
6,800		74,000	34,000	9,300		84,000	40,000
6,900		74,000	34,000	9,500		84,000	40,000
7,000		74,000	34,000	9,520	3/8	89,000	43,000
7,030		74,000	34,000	9,600		89,000	43,000
7,100		74,000	34,000	9,700		89,000	43,000
7,140	9/32	74,000	34,000	9,800		89,000	43,000
7,200		74,000	34,000	9,920	25/64	89,000	43,000
7,300		74,000	34,000	10,000		89,000	43,000
7,400		74,000	34,000	10,080		89,000	43,000
7,500		74,000	34,000	10,200		89,000	43,000
7,540	19/64	79,000	37,000	10,320	13/32	89,000	43,000
7,600		79,000	37,000	10,500		89,000	43,000
7,800		79,000	37,000	10,720	27/64	95,000	47,000
7,900		79,000	37,000	11,000		95,000	47,000
7,940	5/16	79,000	37,000	11,110	7/16	95,000	47,000
8,000		79,000	37,000	11,500		95,000	47,000
8,030		79,000	37,000	11,510	29/64	95,000	47,000
8,100		79,000	37,000	11,910	15/32	102,000	51,000
8,200		79,000	37,000	12,000		102,000	51,000
8,300		79,000	37,000	12,300	31/64	102,000	51,000
8,330	21/64	79,000	37,000	12,700	1/2	102,000	51,000
8,400		79,000	37,000	13,000		102,000	51,000
8,500		79,000	37,000	13,500		107,000	54,000
8,600		84,000	40,000	14,000		107,000	54,000
8,700		84,000	40,000	14,290	9/16	111,000	56,000
8,730	11/32	84,000	40,000	14,500		111,000	56,000
8,800		84,000	40,000	15,000		111,000	56,000
8,900		84,000	40,000	16,000		115,000	58,000



## Spiralbohrer extra kurz

Artikel-Nr. 89246

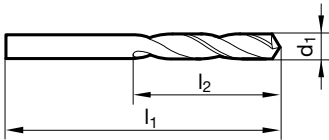


<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
○	○	○	○	○	○



Flächenanschliff • Hauptschneidenform gerade

glasfaserverstärkte Kunststoffe • Duroplaste mit Schmirgelwirkung auf Schneiden und Fasen



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
0,500	30,000	6,500	4,000	50,000	22,000
0,900	30,000	9,500	4,100	50,000	25,000
1,000	30,000	11,000	4,200	50,000	25,000
1,200	30,000	13,000	4,600	50,000	25,000
1,400	30,000	13,000	4,700	50,000	25,000
2,000	40,000	17,500	5,000	50,000	25,000
2,500	40,000	17,500	5,200	50,000	25,000
3,000	45,000	20,000	5,300	50,000	25,000
3,100	50,000	22,000	5,600	50,000	25,000
3,200	50,000	22,000	5,800	50,000	25,000
3,400	50,000	22,000	5,900	50,000	25,000
3,600	50,000	22,000	6,100	65,000	30,000

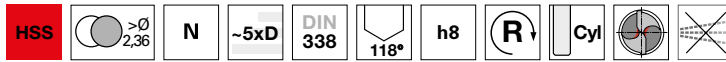


## Spiralbohrer kurz

Artikel-Nr. 81010

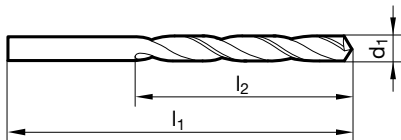


P	M	K	N	S	H
•		•	○		



Ausspitzung ≥ Ø 1,000 • Kegelmantelschliff

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen und Graphit



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,200		19,000	2,500	0,650		26,000	8,000
0,220		19,000	2,500	0,670		26,000	8,000
0,230		19,000	2,500	0,690		28,000	9,000
0,240		19,000	2,500	0,700		28,000	9,000
0,250		19,000	3,000	0,710		28,000	9,000
0,260		19,000	3,000	0,720		28,000	9,000
0,270		19,000	3,000	0,730		28,000	9,000
0,280		19,000	3,000	0,740		28,000	9,000
0,290		19,000	3,000	0,750		28,000	9,000
0,300		19,000	3,000	0,760		30,000	10,000
0,310		19,000	4,000	0,770		30,000	10,000
0,320		19,000	4,000	0,780		30,000	10,000
0,330		19,000	4,000	0,790	1/32	30,000	10,000
0,350		19,000	4,000	0,800		30,000	10,000
0,370		19,000	4,000	0,810		30,000	10,000
0,380		19,000	4,000	0,820		30,000	10,000
0,390		20,000	5,000	0,830		30,000	10,000
0,400		20,000	5,000	0,850		30,000	10,000
0,410		20,000	5,000	0,860		32,000	11,000
0,420		20,000	5,000	0,870		32,000	11,000
0,430		20,000	5,000	0,880		32,000	11,000
0,440		20,000	5,000	0,890		32,000	11,000
0,450		20,000	5,000	0,900		32,000	11,000
0,460		20,000	5,000	0,910		32,000	11,000
0,470		20,000	5,000	0,940		32,000	11,000
0,480		20,000	5,000	0,950		32,000	11,000
0,490		22,000	6,000	0,960		34,000	12,000
0,500		22,000	6,000	0,970		34,000	12,000
0,510		22,000	6,000	0,980		34,000	12,000
0,520		22,000	6,000	0,990		34,000	12,000
0,530		22,000	6,000	1,000		34,000	12,000
0,540		24,000	7,000	1,010		34,000	12,000
0,550		24,000	7,000	1,020		34,000	12,000
0,560		24,000	7,000	1,030		34,000	12,000
0,570		24,000	7,000	1,040		34,000	12,000
0,580		24,000	7,000	1,050		34,000	12,000
0,590		24,000	7,000	1,070		36,000	14,000
0,600		24,000	7,000	1,100		36,000	14,000
0,610		26,000	8,000	1,110		36,000	14,000
0,620		26,000	8,000	1,120		36,000	14,000
0,630		26,000	8,000	1,130		36,000	14,000
0,640		26,000	8,000	1,150		36,000	14,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
1,160		36,000	14,000	2,440		57,000	30,000
1,180		36,000	14,000	2,450		57,000	30,000
1,190	3/64	38,000	16,000	2,460		57,000	30,000
1,200		38,000	16,000	2,500		57,000	30,000
1,210		38,000	16,000	2,510		57,000	30,000
1,220		38,000	16,000	2,520		57,000	30,000
1,250		38,000	16,000	2,530		57,000	30,000
1,260		38,000	16,000	2,550		57,000	30,000
1,270		38,000	16,000	2,570		57,000	30,000
1,300		38,000	16,000	2,600		57,000	30,000
1,310		38,000	16,000	2,640		57,000	30,000
1,350		40,000	18,000	2,650		57,000	30,000
1,360		40,000	18,000	2,700		61,000	33,000
1,400		40,000	18,000	2,750		61,000	33,000
1,410		40,000	18,000	2,780	7/64	61,000	33,000
1,420		40,000	18,000	2,800		61,000	33,000
1,430		40,000	18,000	2,850		61,000	33,000
1,440		40,000	18,000	2,880		61,000	33,000
1,450		40,000	18,000	2,900		61,000	33,000
1,460		40,000	18,000	2,940		61,000	33,000
1,480		40,000	18,000	2,950		61,000	33,000
1,490		40,000	18,000	2,970		61,000	33,000
1,500		40,000	18,000	3,000		61,000	33,000
1,520		43,000	20,000	3,010		65,000	36,000
1,550		43,000	20,000	3,020		65,000	36,000
1,560		43,000	20,000	3,050		65,000	36,000
1,580		43,000	20,000	3,070		65,000	36,000
1,590	1/16	43,000	20,000	3,100		65,000	36,000
1,600		43,000	20,000	3,150		65,000	36,000
1,620		43,000	20,000	3,160		65,000	36,000
1,650		43,000	20,000	3,170	1/8	65,000	36,000
1,700		43,000	20,000	3,200		65,000	36,000
1,720		46,000	22,000	3,250		65,000	36,000
1,730		46,000	22,000	3,260		65,000	36,000
1,740		46,000	22,000	3,300		65,000	36,000
1,750		46,000	22,000	3,350		65,000	36,000
1,760		46,000	22,000	3,400		70,000	39,000
1,800		46,000	22,000	3,450		70,000	39,000
1,820		46,000	22,000	3,500		70,000	39,000
1,830		46,000	22,000	3,550		70,000	39,000
1,840		46,000	22,000	3,600		70,000	39,000
1,850		46,000	22,000	3,650		70,000	39,000
1,890		46,000	22,000	3,670		70,000	39,000
1,900		46,000	22,000	3,680		70,000	39,000
1,910		49,000	24,000	3,700		70,000	39,000
1,920		49,000	24,000	3,750		70,000	39,000
1,930		49,000	24,000	3,800		75,000	43,000
1,950		49,000	24,000	3,850		75,000	43,000
1,980	5/64	49,000	24,000	3,900		75,000	43,000
1,990		49,000	24,000	3,930		75,000	43,000
2,000		49,000	24,000	3,950		75,000	43,000
2,010		49,000	24,000	3,970	5/32	75,000	43,000
2,020		49,000	24,000	3,990		75,000	43,000
2,030		49,000	24,000	4,000		75,000	43,000
2,040		49,000	24,000	4,030		75,000	43,000
2,050		49,000	24,000	4,040		75,000	43,000
2,100		49,000	24,000	4,050		75,000	43,000
2,110		49,000	24,000	4,060		75,000	43,000
2,120		49,000	24,000	4,100		75,000	43,000
2,150		53,000	27,000	4,150		75,000	43,000
2,170		53,000	27,000	4,200		75,000	43,000
2,200		53,000	27,000	4,220		75,000	43,000
2,220		53,000	27,000	4,250		75,000	43,000
2,250		53,000	27,000	4,300		80,000	47,000
2,270		53,000	27,000	4,320		80,000	47,000
2,300		53,000	27,000	4,350		80,000	47,000
2,330		53,000	27,000	4,370	11/64	80,000	47,000
2,350		53,000	27,000	4,390		80,000	47,000
2,360		53,000	27,000	4,400		80,000	47,000
2,370		57,000	30,000	4,450		80,000	47,000
2,380	3/32	57,000	30,000	4,500		80,000	47,000
2,400		57,000	30,000	4,530		80,000	47,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
4,550		80,000	47,000	7,250		109,000	69,000
4,570		80,000	47,000	7,300		109,000	69,000
4,600		80,000	47,000	7,350		109,000	69,000
4,650		80,000	47,000	7,400		109,000	69,000
4,700		80,000	47,000	7,450		109,000	69,000
4,750		80,000	47,000	7,500		109,000	69,000
4,760	3/16	86,000	52,000	7,540	19/64	117,000	75,000
4,780		86,000	52,000	7,600		117,000	75,000
4,800		86,000	52,000	7,700		117,000	75,000
4,830		86,000	52,000	7,750		117,000	75,000
4,850		86,000	52,000	7,800		117,000	75,000
4,900		86,000	52,000	7,850		117,000	75,000
4,920		86,000	52,000	7,900		117,000	75,000
4,950		86,000	52,000	7,940	5/16	117,000	75,000
5,000		86,000	52,000	7,950		117,000	75,000
5,050		86,000	52,000	8,000		117,000	75,000
5,060		86,000	52,000	8,050		117,000	75,000
5,100		86,000	52,000	8,100		117,000	75,000
5,110		86,000	52,000	8,200		117,000	75,000
5,150		86,000	52,000	8,250		117,000	75,000
5,160	13/64	86,000	52,000	8,300		117,000	75,000
5,200		86,000	52,000	8,330	21/64	117,000	75,000
5,250		86,000	52,000	8,400		117,000	75,000
5,300		86,000	52,000	8,450		117,000	75,000
5,310		93,000	57,000	8,500		117,000	75,000
5,350		93,000	57,000	8,550		125,000	81,000
5,400		93,000	57,000	8,600		125,000	81,000
5,410		93,000	57,000	8,700		125,000	81,000
5,450		93,000	57,000	8,730	11/32	125,000	81,000
5,500		93,000	57,000	8,750		125,000	81,000
5,530		93,000	57,000	8,800		125,000	81,000
5,550		93,000	57,000	8,850		125,000	81,000
5,560	7/32	93,000	57,000	8,900		125,000	81,000
5,600		93,000	57,000	9,000		125,000	81,000
5,610		93,000	57,000	9,100		125,000	81,000
5,620		93,000	57,000	9,130	23/64	125,000	81,000
5,650		93,000	57,000	9,150		125,000	81,000
5,700		93,000	57,000	9,200		125,000	81,000
5,750		93,000	57,000	9,250		125,000	81,000
5,790		93,000	57,000	9,300		125,000	81,000
5,800		93,000	57,000	9,350		125,000	81,000
5,850		93,000	57,000	9,400		125,000	81,000
5,900		93,000	57,000	9,500		125,000	81,000
5,950	15/64	93,000	57,000	9,520	3/8	133,000	87,000
5,970		93,000	57,000	9,550		133,000	87,000
6,000		93,000	57,000	9,600		133,000	87,000
6,030		101,000	63,000	9,650		133,000	87,000
6,040		101,000	63,000	9,700		133,000	87,000
6,050		101,000	63,000	9,750		133,000	87,000
6,100		101,000	63,000	9,800		133,000	87,000
6,150		101,000	63,000	9,900		133,000	87,000
6,200		101,000	63,000	9,920	25/64	133,000	87,000
6,250		101,000	63,000	9,950		133,000	87,000
6,300		101,000	63,000	10,000		133,000	87,000
6,350	1/4	101,000	63,000	10,050		133,000	87,000
6,400		101,000	63,000	10,080		133,000	87,000
6,450		101,000	63,000	10,100		133,000	87,000
6,500		101,000	63,000	10,200		133,000	87,000
6,550		101,000	63,000	10,250		133,000	87,000
6,600		101,000	63,000	10,300		133,000	87,000
6,650		101,000	63,000	10,320	13/32	133,000	87,000
6,700		101,000	63,000	10,400		133,000	87,000
6,750	17/64	109,000	69,000	10,500		133,000	87,000
6,800		109,000	69,000	10,600		133,000	87,000
6,850		109,000	69,000	10,700		142,000	94,000
6,900		109,000	69,000	10,720	27/64	142,000	94,000
6,950		109,000	69,000	10,750		142,000	94,000
7,000		109,000	69,000	10,800		142,000	94,000
7,050		109,000	69,000	10,900		142,000	94,000
7,100		109,000	69,000	11,000		142,000	94,000
7,140	9/32	109,000	69,000	11,100		142,000	94,000
7,200		109,000	69,000	11,110	7/16	142,000	94,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
11,200		142,000	94,000	14,250		169,000	114,000
11,250		142,000	94,000	14,300		169,000	114,000
11,300		142,000	94,000	14,400		169,000	114,000
11,400		142,000	94,000	14,500		169,000	114,000
11,500		142,000	94,000	14,600		169,000	114,000
11,510	29/64	142,000	94,000	14,700		169,000	114,000
11,600		142,000	94,000	14,750		169,000	114,000
11,700		142,000	94,000	14,800		169,000	114,000
11,750		142,000	94,000	14,900		169,000	114,000
11,800		142,000	94,000	15,000		169,000	114,000
11,900		151,000	101,000	15,080	19/32	178,000	120,000
11,910	15/32	151,000	101,000	15,100		178,000	120,000
12,000		151,000	101,000	15,250		178,000	120,000
12,050		151,000	101,000	15,400		178,000	120,000
12,100		151,000	101,000	15,500		178,000	120,000
12,200		151,000	101,000	15,700		178,000	120,000
12,250		151,000	101,000	15,750		178,000	120,000
12,300	31/64	151,000	101,000	15,800		178,000	120,000
12,400		151,000	101,000	15,870	5/8	178,000	120,000
12,500		151,000	101,000	16,000		178,000	120,000
12,600		151,000	101,000	16,100		184,000	125,000
12,700	1/2	151,000	101,000	16,200		184,000	125,000
12,750		151,000	101,000	16,250		184,000	125,000
12,800		151,000	101,000	16,270	41/64	184,000	125,000
12,850		151,000	101,000	16,500		184,000	125,000
12,900		151,000	101,000	16,600		184,000	125,000
13,000		151,000	101,000	16,700		184,000	125,000
13,100	33/64	151,000	101,000	17,000		184,000	125,000
13,200		151,000	101,000	17,250		191,000	130,000
13,250		160,000	108,000	17,500		191,000	130,000
13,300		160,000	108,000	17,750		191,000	130,000
13,400		160,000	108,000	17,800		191,000	130,000
13,490	17/32	160,000	108,000	18,000		191,000	130,000
13,500		160,000	108,000	18,500		198,000	135,000
13,600		160,000	108,000	18,750		198,000	135,000
13,700		160,000	108,000	19,000		198,000	135,000
13,750		160,000	108,000	19,250		205,000	140,000
13,800		160,000	108,000	19,500		205,000	140,000
13,900		160,000	108,000	20,000		205,000	140,000
14,000		160,000	108,000				
14,100		169,000	114,000				
14,200		169,000	114,000				





## Spiralbohrer kurz

Artikel-Nr. 81015

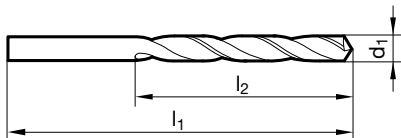


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 15,000$  • Kegelmantelanschliff

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen und Graphit



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
0,250		19,000	3,000	3,150		65,000	36,000
0,300		19,000	3,000	3,200		65,000	36,000
0,370		19,000	4,000	3,250		65,000	36,000
0,400		20,000	5,000	3,300		65,000	36,000
0,500		22,000	6,000	3,350		65,000	36,000
0,650		26,000	8,000	3,400		70,000	39,000
0,700		28,000	9,000	3,450		70,000	39,000
0,800		30,000	10,000	3,500		70,000	39,000
0,900		32,000	11,000	3,550		70,000	39,000
0,950		32,000	11,000	3,600		70,000	39,000
1,000		34,000	12,000	3,650		70,000	39,000
1,050		34,000	12,000	3,700		70,000	39,000
1,100		36,000	14,000	3,750		70,000	39,000
1,150		36,000	14,000	3,800		75,000	43,000
1,170		36,000	14,000	3,850		75,000	43,000
1,200		38,000	16,000	3,900		75,000	43,000
1,250		38,000	16,000	3,950		75,000	43,000
1,300		38,000	16,000	4,000		75,000	43,000
1,350		40,000	18,000	4,100		75,000	43,000
1,400		40,000	18,000	4,150		75,000	43,000
1,450		40,000	18,000	4,200		75,000	43,000
1,500		40,000	18,000	4,250		75,000	43,000
1,550		43,000	20,000	4,350		80,000	47,000
1,560		43,000	20,000	4,400		80,000	47,000
1,600		43,000	20,000	4,450		80,000	47,000
1,700		43,000	20,000	4,500		80,000	47,000
1,800		46,000	22,000	4,550		80,000	47,000
2,000		49,000	24,000	4,600		80,000	47,000
2,050		49,000	24,000	4,650		80,000	47,000
2,100		49,000	24,000	4,700		80,000	47,000
2,200		53,000	27,000	4,750		80,000	47,000
2,250		53,000	27,000	4,850		86,000	52,000
2,400		57,000	30,000	4,900		86,000	52,000
2,500		57,000	30,000	5,000		86,000	52,000
2,550		57,000	30,000	5,200		86,000	52,000
2,600		57,000	30,000	5,300		86,000	52,000
2,700		61,000	33,000	5,400		93,000	57,000
2,750		61,000	33,000	5,500		93,000	57,000
2,800		61,000	33,000	5,600		93,000	57,000
3,000		61,000	33,000	5,700		93,000	57,000
3,050		65,000	36,000	5,750		93,000	57,000
3,100		65,000	36,000	5,800		93,000	57,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
5,900		93,000	57,000	9,500		125,000	81,000
6,000		93,000	57,000	9,600		133,000	87,000
6,100		101,000	63,000	9,700		133,000	87,000
6,200		101,000	63,000	9,750		133,000	87,000
6,250		101,000	63,000	9,800		133,000	87,000
6,300		101,000	63,000	9,900		133,000	87,000
6,400		101,000	63,000	10,000		133,000	87,000
6,500		101,000	63,000	10,100		133,000	87,000
6,600		101,000	63,000	10,200		133,000	87,000
6,650		101,000	63,000	10,300		133,000	87,000
6,750	17/64	109,000	69,000	10,400		133,000	87,000
6,800		109,000	69,000	10,500		133,000	87,000
6,900		109,000	69,000	10,600		133,000	87,000
7,000		109,000	69,000	10,750		142,000	94,000
7,100		109,000	69,000	10,800		142,000	94,000
7,200		109,000	69,000	10,900		142,000	94,000
7,250		109,000	69,000	11,000		142,000	94,000
7,300		109,000	69,000	11,100		142,000	94,000
7,400		109,000	69,000	11,250		142,000	94,000
7,500		109,000	69,000	11,500		142,000	94,000
7,600		117,000	75,000	11,600		142,000	94,000
7,700		117,000	75,000	11,750		142,000	94,000
7,800		117,000	75,000	11,800		142,000	94,000
8,000		117,000	75,000	12,000		151,000	101,000
8,100		117,000	75,000	12,100		151,000	101,000
8,250		117,000	75,000	12,200		151,000	101,000
8,300		117,000	75,000	12,250		151,000	101,000
8,400		117,000	75,000	12,500		151,000	101,000
8,500		117,000	75,000	12,750		151,000	101,000
8,600		125,000	81,000	13,000		151,000	101,000
8,800		125,000	81,000	13,500		160,000	108,000
8,900		125,000	81,000	14,000		160,000	108,000
9,000		125,000	81,000	14,500		169,000	114,000
9,100		125,000	81,000	15,000		169,000	114,000
9,300		125,000	81,000	15,500		178,000	120,000
9,400		125,000	81,000	17,000		184,000	125,000

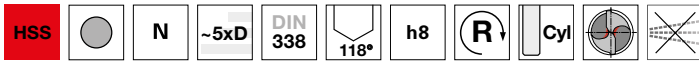


## Spiralbohrer kurz

Artikel-Nr. 81017

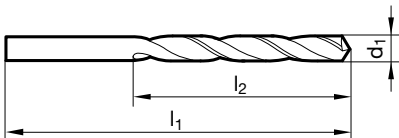


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelanschliff • mit Mitnehmer nach DIN 1809

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen und Graphit

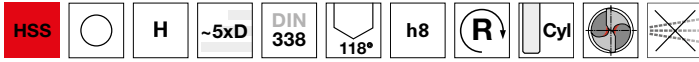


d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
3,000		61,000	33,000	7,600		117,000	75,000
3,100		65,000	36,000	7,700		117,000	75,000
3,200		65,000	36,000	7,750		117,000	75,000
3,300		65,000	36,000	7,800		117,000	75,000
3,400		70,000	39,000	7,900		117,000	75,000
3,500		70,000	39,000	8,000		117,000	75,000
3,600		70,000	39,000	8,500		117,000	75,000
3,700		70,000	39,000	8,700		125,000	81,000
3,800		75,000	43,000	8,800		125,000	81,000
4,000		75,000	43,000	8,900		125,000	81,000
4,200		75,000	43,000	9,000		125,000	81,000
4,500		80,000	47,000	9,100		125,000	81,000
4,600		80,000	47,000	9,500		125,000	81,000
5,000		86,000	52,000	9,800		133,000	87,000
5,100		86,000	52,000	10,000		133,000	87,000
5,200		86,000	52,000	10,200		133,000	87,000
5,500		93,000	57,000	10,500		133,000	87,000
5,600		93,000	57,000	11,000		142,000	94,000
5,750		93,000	57,000	11,500		142,000	94,000
5,800		93,000	57,000	12,000		151,000	101,000
6,000		93,000	57,000	13,000		151,000	101,000
6,100		101,000	63,000				
6,200		101,000	63,000				
6,300		101,000	63,000				
6,400		101,000	63,000				
6,500		101,000	63,000				
6,800		109,000	69,000				
7,000		109,000	69,000				
7,200		109,000	69,000				
7,500		109,000	69,000				



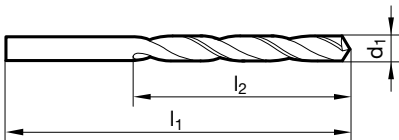
## Spiralbohrer kurz

Artikel-Nr. 81020



Ausspitzung  $\geq \varnothing 14,500$  • Kegelmantelanschliff

harte und spröde Werkstoffe • Messing, Magnesium-Legierungen • Bronzen, Phosphorbronze • Schiefer, Glimmer, Pertinax



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
0,300		19,000	3,000	2,100		49,000	24,000
0,320		19,000	4,000	2,200		53,000	27,000
0,400		20,000	5,000	2,250		53,000	27,000
0,450		20,000	5,000	2,300		53,000	27,000
0,480		20,000	5,000	2,400		57,000	30,000
0,500		22,000	6,000	2,450		57,000	30,000
0,510		22,000	6,000	2,500		57,000	30,000
0,560		24,000	7,000	2,550		57,000	30,000
0,600		24,000	7,000	2,600		57,000	30,000
0,650		26,000	8,000	2,630		57,000	30,000
0,700		28,000	9,000	2,700		61,000	33,000
0,750		28,000	9,000	2,780	7/64	61,000	33,000
0,800		30,000	10,000	2,800		61,000	33,000
0,810		30,000	10,000	2,900		61,000	33,000
0,840		30,000	10,000	2,950		61,000	33,000
0,900		32,000	11,000	3,000		61,000	33,000
0,910		32,000	11,000	3,020		65,000	36,000
0,950		32,000	11,000	3,050		65,000	36,000
1,000		34,000	12,000	3,100		65,000	36,000
1,050		34,000	12,000	3,150		65,000	36,000
1,100		36,000	14,000	3,200		65,000	36,000
1,150		36,000	14,000	3,250		65,000	36,000
1,200		38,000	16,000	3,300		65,000	36,000
1,250		38,000	16,000	3,350		65,000	36,000
1,280		38,000	16,000	3,400		70,000	39,000
1,300		38,000	16,000	3,500		70,000	39,000
1,310		38,000	16,000	3,550		70,000	39,000
1,400		40,000	18,000	3,600		70,000	39,000
1,420		40,000	18,000	3,650		70,000	39,000
1,450		40,000	18,000	3,700		70,000	39,000
1,500		40,000	18,000	3,750		70,000	39,000
1,510		43,000	20,000	3,800		75,000	43,000
1,550		43,000	20,000	3,850		75,000	43,000
1,600		43,000	20,000	3,900		75,000	43,000
1,650		43,000	20,000	4,000		75,000	43,000
1,700		43,000	20,000	4,050		75,000	43,000
1,800		46,000	22,000	4,100		75,000	43,000
1,850		46,000	22,000	4,200		75,000	43,000
1,900		46,000	22,000	4,250		75,000	43,000
1,950		49,000	24,000	4,300		80,000	47,000
2,000		49,000	24,000	4,400		80,000	47,000
2,050		49,000	24,000	4,500		80,000	47,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
4,600		80,000	47,000	8,400		117,000	75,000
4,700		80,000	47,000	8,500		117,000	75,000
4,750		80,000	47,000	8,600		125,000	81,000
4,800		86,000	52,000	8,700		125,000	81,000
4,900		86,000	52,000	8,800		125,000	81,000
5,000		86,000	52,000	8,900		125,000	81,000
5,100		86,000	52,000	9,000		125,000	81,000
5,200		86,000	52,000	9,100		125,000	81,000
5,300		86,000	52,000	9,200		125,000	81,000
5,400		93,000	57,000	9,250		125,000	81,000
5,500		93,000	57,000	9,300		125,000	81,000
5,600		93,000	57,000	9,400		125,000	81,000
5,700		93,000	57,000	9,500		125,000	81,000
5,750		93,000	57,000	9,600		133,000	87,000
5,800		93,000	57,000	9,700		133,000	87,000
5,900		93,000	57,000	9,750		133,000	87,000
6,000		93,000	57,000	9,800		133,000	87,000
6,100		101,000	63,000	9,900		133,000	87,000
6,200		101,000	63,000	10,000		133,000	87,000
6,250		101,000	63,000	10,100		133,000	87,000
6,300		101,000	63,000	10,200		133,000	87,000
6,400		101,000	63,000	10,500		133,000	87,000
6,500		101,000	63,000	10,600		133,000	87,000
6,600		101,000	63,000	10,800		142,000	94,000
6,700		101,000	63,000	11,000		142,000	94,000
6,800		109,000	69,000	11,200		142,000	94,000
6,900		109,000	69,000	11,500		142,000	94,000
7,000		109,000	69,000	12,000		151,000	101,000
7,050		109,000	69,000	12,100		151,000	101,000
7,100		109,000	69,000	12,500		151,000	101,000
7,200		109,000	69,000	12,700	1/2	151,000	101,000
7,250		109,000	69,000	13,000		151,000	101,000
7,300		109,000	69,000	13,800		160,000	108,000
7,500		109,000	69,000	14,000		160,000	108,000
7,600		117,000	75,000	14,500		169,000	114,000
7,700		117,000	75,000	15,000		169,000	114,000
7,750		117,000	75,000	15,100		178,000	120,000
7,800		117,000	75,000	15,500		178,000	120,000
7,900		117,000	75,000	16,000		178,000	120,000
8,000		117,000	75,000	18,000		191,000	130,000
8,100		117,000	75,000	19,000		198,000	135,000
8,200		117,000	75,000	20,000		205,000	140,000



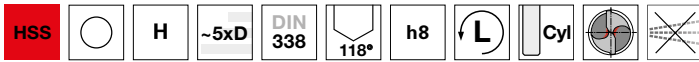
# HARTNER

## Spiralbohrer kurz

Artikel-Nr. 81025

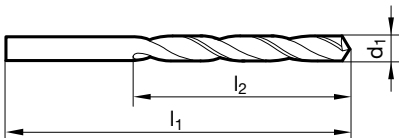


P	M	K	N	S	H
			•		



Ausspitzung  $\geq \varnothing 14,500$  • Kegelmantelschliff

harte und spröde Werkstoffe • Messing, Magnesium-Legierungen • Bronzen, Phosphorbronze • Schiefer, Glimmer, Pertinax



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,500		22,000	6,000	2,900		61,000	33,000
0,580		24,000	7,000	2,950		61,000	33,000
0,670		26,000	8,000	3,000		61,000	33,000
0,690		28,000	9,000	3,100		65,000	36,000
0,700		28,000	9,000	3,150		65,000	36,000
0,750		28,000	9,000	3,200		65,000	36,000
0,800		30,000	10,000	3,250		65,000	36,000
0,900		32,000	11,000	3,300		65,000	36,000
0,950		32,000	11,000	3,400		70,000	39,000
1,000		34,000	12,000	3,500		70,000	39,000
1,050		34,000	12,000	3,700		70,000	39,000
1,100		36,000	14,000	3,750		70,000	39,000
1,150		36,000	14,000	3,800		75,000	43,000
1,160		36,000	14,000	3,850		75,000	43,000
1,180		36,000	14,000	3,900		75,000	43,000
1,200		38,000	16,000	4,000		75,000	43,000
1,240		38,000	16,000	4,100		75,000	43,000
1,290		38,000	16,000	4,300		80,000	47,000
1,400		40,000	18,000	4,400		80,000	47,000
1,460		40,000	18,000	4,500		80,000	47,000
1,470		40,000	18,000	4,600		80,000	47,000
1,480		40,000	18,000	4,700		80,000	47,000
1,500		40,000	18,000	4,750		80,000	47,000
1,600		43,000	20,000	4,800		86,000	52,000
1,660		43,000	20,000	4,950		86,000	52,000
1,710		46,000	22,000	5,000		86,000	52,000
1,730		46,000	22,000	5,200		86,000	52,000
1,800		46,000	22,000	5,300		86,000	52,000
1,900		46,000	22,000	5,400		93,000	57,000
1,920		49,000	24,000	5,500		93,000	57,000
1,950		49,000	24,000	5,600		93,000	57,000
2,000		49,000	24,000	5,750		93,000	57,000
2,050		49,000	24,000	5,800		93,000	57,000
2,100		49,000	24,000	5,900		93,000	57,000
2,250		53,000	27,000	6,000		93,000	57,000
2,350		53,000	27,000	6,100		101,000	63,000
2,400		57,000	30,000	6,250		101,000	63,000
2,430		57,000	30,000	6,400		101,000	63,000
2,500		57,000	30,000	6,500		101,000	63,000
2,700		61,000	33,000	6,600		101,000	63,000
2,750		61,000	33,000	6,800		109,000	69,000
2,800		61,000	33,000	6,900		109,000	69,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
7,000		109,000	69,000	9,800		133,000	87,000
7,100		109,000	69,000	10,000		133,000	87,000
7,200		109,000	69,000	11,000		142,000	94,000
7,300		109,000	69,000	11,500		142,000	94,000
7,500		109,000	69,000	12,000		151,000	101,000
7,700		117,000	75,000	13,000		151,000	101,000
7,750		117,000	75,000	13,500		160,000	108,000
7,800		117,000	75,000	14,000		160,000	108,000
8,000		117,000	75,000	14,500		169,000	114,000
8,100		117,000	75,000	15,500		178,000	120,000
8,500		117,000	75,000	16,000		178,000	120,000
8,600		125,000	81,000				
8,700		125,000	81,000				
8,900		125,000	81,000				
9,000		125,000	81,000				
9,200		125,000	81,000				
9,400		125,000	81,000				
9,500		125,000	81,000				

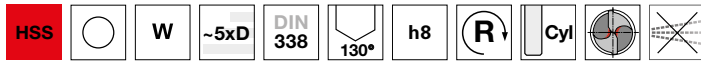


## Spiralbohrer kurz

Artikel-Nr. 81030

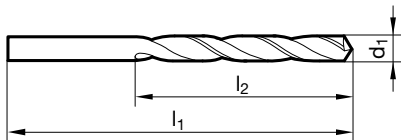


P	M	K	N	S	H
			•		



Ausspitzung  $\geq \varnothing 14,500$  • Kegelmantelschliff

weiche, langspanende Werkstoffe • Aluminium, Al-Legierungen (langspanend) • Zink, Hüttenkupfer, Silumin, Elektron • Kunststoffe (weich) • Holz



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,250		19,000	3,000	2,450		57,000	30,000
0,300		19,000	3,000	2,500		57,000	30,000
0,400		20,000	5,000	2,550		57,000	30,000
0,500		22,000	6,000	2,600		57,000	30,000
0,550		24,000	7,000	2,700		61,000	33,000
0,600		24,000	7,000	2,750		61,000	33,000
0,700		28,000	9,000	2,800		61,000	33,000
0,800		30,000	10,000	2,850		61,000	33,000
0,850		30,000	10,000	2,900		61,000	33,000
0,900		32,000	11,000	2,950		61,000	33,000
0,950		32,000	11,000	3,000		61,000	33,000
0,970		34,000	12,000	3,050		65,000	36,000
1,000		34,000	12,000	3,100		65,000	36,000
1,050		34,000	12,000	3,150		65,000	36,000
1,070		36,000	14,000	3,200		65,000	36,000
1,100		36,000	14,000	3,250		65,000	36,000
1,150		36,000	14,000	3,300		65,000	36,000
1,200		38,000	16,000	3,400		70,000	39,000
1,240		38,000	16,000	3,450		70,000	39,000
1,250		38,000	16,000	3,500		70,000	39,000
1,280		38,000	16,000	3,600		70,000	39,000
1,300		38,000	16,000	3,650		70,000	39,000
1,400		40,000	18,000	3,700		70,000	39,000
1,450		40,000	18,000	3,750		70,000	39,000
1,500		40,000	18,000	3,800		75,000	43,000
1,530		43,000	20,000	3,850		75,000	43,000
1,550		43,000	20,000	3,900		75,000	43,000
1,600		43,000	20,000	3,950		75,000	43,000
1,650		43,000	20,000	4,000		75,000	43,000
1,700		43,000	20,000	4,040		75,000	43,000
1,750		46,000	22,000	4,100		75,000	43,000
1,800		46,000	22,000	4,150		75,000	43,000
1,900		46,000	22,000	4,200		75,000	43,000
1,950		49,000	24,000	4,250		75,000	43,000
2,000		49,000	24,000	4,300		80,000	47,000
2,050		49,000	24,000	4,400		80,000	47,000
2,100		49,000	24,000	4,500		80,000	47,000
2,150		53,000	27,000	4,600		80,000	47,000
2,200		53,000	27,000	4,700		80,000	47,000
2,250		53,000	27,000	4,750		80,000	47,000
2,300		53,000	27,000	4,800		86,000	52,000
2,400		57,000	30,000	4,850		86,000	52,000





## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
4,900		86,000	52,000	9,100		125,000	81,000
4,950		86,000	52,000	9,200		125,000	81,000
5,000		86,000	52,000	9,250		125,000	81,000
5,050		86,000	52,000	9,300		125,000	81,000
5,100		86,000	52,000	9,500		125,000	81,000
5,200		86,000	52,000	9,600		133,000	87,000
5,250		86,000	52,000	9,700		133,000	87,000
5,300		86,000	52,000	9,800		133,000	87,000
5,400		93,000	57,000	9,900		133,000	87,000
5,500		93,000	57,000	10,000		133,000	87,000
5,550		93,000	57,000	10,100		133,000	87,000
5,600		93,000	57,000	10,200		133,000	87,000
5,700		93,000	57,000	10,250		133,000	87,000
5,750		93,000	57,000	10,300		133,000	87,000
5,800		93,000	57,000	10,400		133,000	87,000
5,900		93,000	57,000	10,500		133,000	87,000
5,950	15/64	93,000	57,000	10,600		133,000	87,000
6,000		93,000	57,000	10,800		142,000	94,000
6,100		101,000	63,000	10,900		142,000	94,000
6,150		101,000	63,000	10,950		142,000	94,000
6,200		101,000	63,000	11,000		142,000	94,000
6,250		101,000	63,000	11,100		142,000	94,000
6,300		101,000	63,000	11,200		142,000	94,000
6,350	1/4	101,000	63,000	11,500		142,000	94,000
6,400		101,000	63,000	11,600		142,000	94,000
6,500		101,000	63,000	11,700		142,000	94,000
6,600		101,000	63,000	11,800		142,000	94,000
6,700		101,000	63,000	12,000		151,000	101,000
6,750	17/64	109,000	69,000	12,100		151,000	101,000
6,800		109,000	69,000	12,200		151,000	101,000
6,900		109,000	69,000	12,500		151,000	101,000
7,000		109,000	69,000	12,600		151,000	101,000
7,100		109,000	69,000	12,700	1/2	151,000	101,000
7,200		109,000	69,000	13,000		151,000	101,000
7,250		109,000	69,000	13,200		151,000	101,000
7,300		109,000	69,000	13,500		160,000	108,000
7,400		109,000	69,000	14,000		160,000	108,000
7,500		109,000	69,000	14,400		169,000	114,000
7,600		117,000	75,000	14,500		169,000	114,000
7,700		117,000	75,000	15,000		169,000	114,000
7,750		117,000	75,000	15,500		178,000	120,000
7,800		117,000	75,000	16,000		178,000	120,000
7,900		117,000	75,000	16,500		184,000	125,000
8,000		117,000	75,000				
8,100		117,000	75,000				
8,300		117,000	75,000				
8,400		117,000	75,000				
8,500		117,000	75,000				
8,600		125,000	81,000				
8,700		125,000	81,000				
8,750		125,000	81,000				
8,800		125,000	81,000				
8,900		125,000	81,000				
9,000		125,000	81,000				

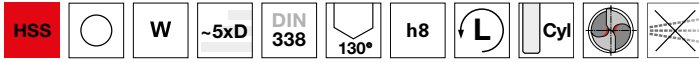


## Spiralbohrer kurz

Artikel-Nr. 81035

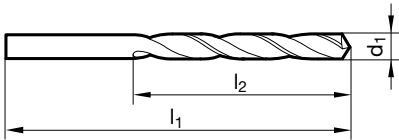


P	M	K	N	S	H
			•		



Ausspitzung  $\geq \varnothing 15,000$  • Kegelmantelschliff

weiche, langspanende Werkstoffe • Aluminium, Al-Legierungen (langspanend) • Zink, Hüttenkupfer, Silumin, Elektron • Kunststoffe (weich) • Holz



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,500		22,000	6,000	4,900		86,000	52,000
0,600		24,000	7,000	5,100		86,000	52,000
0,750		28,000	9,000	5,250		86,000	52,000
1,000		34,000	12,000	5,400		93,000	57,000
1,050		34,000	12,000	5,500		93,000	57,000
1,100		36,000	14,000	5,600		93,000	57,000
1,200		38,000	16,000	5,800		93,000	57,000
1,550		43,000	20,000	6,000		93,000	57,000
1,750		46,000	22,000	6,200		101,000	63,000
1,800		46,000	22,000	6,300		101,000	63,000
1,850		46,000	22,000	6,400		101,000	63,000
1,900		46,000	22,000	6,800		109,000	69,000
2,000		49,000	24,000	6,900		109,000	69,000
2,250		53,000	27,000	7,000		109,000	69,000
2,300		53,000	27,000	7,400		109,000	69,000
2,350		53,000	27,000	7,500		109,000	69,000
2,400		57,000	30,000	7,600		117,000	75,000
2,500		57,000	30,000	7,700		117,000	75,000
2,600		57,000	30,000	7,900		117,000	75,000
2,650		57,000	30,000	9,100		125,000	81,000
2,700		61,000	33,000	9,300		125,000	81,000
2,900		61,000	33,000	9,400		125,000	81,000
3,000		61,000	33,000	9,500		125,000	81,000
3,100		65,000	36,000	10,500		133,000	87,000
3,200		65,000	36,000	11,500		142,000	94,000
3,500		70,000	39,000	12,500		151,000	101,000
3,700		70,000	39,000	13,000		151,000	101,000
3,800		75,000	43,000	13,500		160,000	108,000
3,850		75,000	43,000	14,000		160,000	108,000
3,900		75,000	43,000	15,000		169,000	114,000
3,950		75,000	43,000				
4,100		75,000	43,000				
4,200		75,000	43,000				
4,500		80,000	47,000				
4,600		80,000	47,000				
4,700		80,000	47,000				



## Spiralbohrer kurz

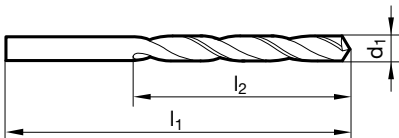
Artikel-Nr. 81040



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \text{Ø } 1,000$  • Kegelmantelanschliff • weite Spannuten • besonders für Bohrtiefen über 3xD  
 Grauguss • Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,800		30,000	10,000	3,550		70,000	39,000
1,000		34,000	12,000	3,600		70,000	39,000
1,100		36,000	14,000	3,700		70,000	39,000
1,200		38,000	16,000	3,800		75,000	43,000
1,300		38,000	16,000	3,900		75,000	43,000
1,350		40,000	18,000	3,950		75,000	43,000
1,400		40,000	18,000	4,000		75,000	43,000
1,450		40,000	18,000	4,050		75,000	43,000
1,500		40,000	18,000	4,100		75,000	43,000
1,550		43,000	20,000	4,200		75,000	43,000
1,570		43,000	20,000	4,250		75,000	43,000
1,600		43,000	20,000	4,400		80,000	47,000
1,650		43,000	20,000	4,500		80,000	47,000
1,700		43,000	20,000	4,600		80,000	47,000
1,800		46,000	22,000	4,700		80,000	47,000
1,850		46,000	22,000	4,800		86,000	52,000
1,900		46,000	22,000	4,900		86,000	52,000
1,950		49,000	24,000	4,950		86,000	52,000
2,000		49,000	24,000	5,000		86,000	52,000
2,050		49,000	24,000	5,030		86,000	52,000
2,100		49,000	24,000	5,100		86,000	52,000
2,150		53,000	27,000	5,200		86,000	52,000
2,200		53,000	27,000	5,300		86,000	52,000
2,300		53,000	27,000	5,400		93,000	57,000
2,350		53,000	27,000	5,500		93,000	57,000
2,500		57,000	30,000	5,600		93,000	57,000
2,550		57,000	30,000	5,700		93,000	57,000
2,600		57,000	30,000	5,800		93,000	57,000
2,700		61,000	33,000	5,900		93,000	57,000
2,800		61,000	33,000	5,950	15/64	93,000	57,000
2,850		61,000	33,000	6,000		93,000	57,000
2,900		61,000	33,000	6,100		101,000	63,000
3,000		61,000	33,000	6,300		101,000	63,000
3,050		65,000	36,000	6,400		101,000	63,000
3,100		65,000	36,000	6,450		101,000	63,000
3,150		65,000	36,000	6,500		101,000	63,000
3,200		65,000	36,000	6,600		101,000	63,000
3,250		65,000	36,000	6,800		109,000	69,000
3,300		65,000	36,000	6,900		109,000	69,000
3,350		65,000	36,000	7,000		109,000	69,000
3,400		70,000	39,000	7,100		109,000	69,000
3,500		70,000	39,000	7,300		109,000	69,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
7,400		109,000	69,000	10,300		133,000	87,000
7,500		109,000	69,000	10,400		133,000	87,000
7,600		117,000	75,000	10,500		133,000	87,000
7,750		117,000	75,000	10,800		142,000	94,000
7,800		117,000	75,000	10,900		142,000	94,000
7,900		117,000	75,000	11,000		142,000	94,000
8,000		117,000	75,000	11,100		142,000	94,000
8,100		117,000	75,000	11,400		142,000	94,000
8,250		117,000	75,000	11,600		142,000	94,000
8,300		117,000	75,000	12,000		151,000	101,000
8,500		117,000	75,000	12,200		151,000	101,000
8,800		125,000	81,000	12,400		151,000	101,000
8,900		125,000	81,000	12,500		151,000	101,000
9,000		125,000	81,000	13,000		151,000	101,000
9,100		125,000	81,000	14,000		160,000	108,000
9,200		125,000	81,000	14,500		169,000	114,000
9,400		125,000	81,000	15,000		169,000	114,000
9,500		125,000	81,000	15,400		178,000	120,000
9,600		133,000	87,000	15,500		178,000	120,000
9,700		133,000	87,000	16,000		178,000	120,000
9,800		133,000	87,000				
9,900		133,000	87,000				
10,000		133,000	87,000				
10,200		133,000	87,000				



## Spiralbohrer kurz

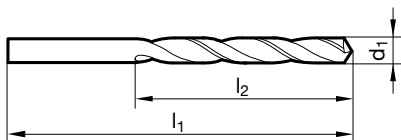
Artikel-Nr. 81045



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 1,400$  • Kegelmantelanschliff • weite Spannuten • besonders für Bohrtiefen über 3xD  
 Grauguss • Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,400		40,000	18,000	5,300		86,000	52,000
1,500		40,000	18,000	5,400		93,000	57,000
1,600		43,000	20,000	5,500		93,000	57,000
1,700		43,000	20,000	5,600		93,000	57,000
1,800		46,000	22,000	5,700		93,000	57,000
1,900		46,000	22,000	5,800		93,000	57,000
2,000		49,000	24,000	5,900		93,000	57,000
2,100		49,000	24,000	6,000		93,000	57,000
2,200		53,000	27,000	6,100		101,000	63,000
2,300		53,000	27,000	6,200		101,000	63,000
2,400		57,000	30,000	6,300		101,000	63,000
2,500		57,000	30,000	6,600		101,000	63,000
2,550		57,000	30,000	6,700		101,000	63,000
2,700		61,000	33,000	6,800		109,000	69,000
2,750		61,000	33,000	6,900		109,000	69,000
2,780	7/64	61,000	33,000	7,000		109,000	69,000
2,800		61,000	33,000	7,100		109,000	69,000
2,900		61,000	33,000	7,200		109,000	69,000
3,000		61,000	33,000	7,300		109,000	69,000
3,100		65,000	36,000	7,400		109,000	69,000
3,150		65,000	36,000	7,500		109,000	69,000
3,170	1/8	65,000	36,000	7,700		117,000	75,000
3,200		65,000	36,000	7,800		117,000	75,000
3,250		65,000	36,000	7,900		117,000	75,000
3,300		65,000	36,000	8,000		117,000	75,000
3,400		70,000	39,000	8,400		117,000	75,000
3,500		70,000	39,000	8,500		117,000	75,000
3,650		70,000	39,000	8,600		125,000	81,000
3,700		70,000	39,000	8,700		125,000	81,000
3,800		75,000	43,000	8,800		125,000	81,000
3,900		75,000	43,000	8,900		125,000	81,000
4,000		75,000	43,000	9,000		125,000	81,000
4,100		75,000	43,000	9,200		125,000	81,000
4,200		75,000	43,000	9,300		125,000	81,000
4,300		80,000	47,000	9,500		125,000	81,000
4,400		80,000	47,000	9,600		133,000	87,000
4,500		80,000	47,000	9,700		133,000	87,000
4,600		80,000	47,000	9,900		133,000	87,000
4,800		86,000	52,000	10,000		133,000	87,000
4,900		86,000	52,000	10,100		133,000	87,000
5,000		86,000	52,000	10,300		133,000	87,000
5,200		86,000	52,000	10,400		133,000	87,000



HARTNER

### Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
10,500		133,000	87,000	15,500		178,000	120,000
10,800		142,000	94,000	16,000		178,000	120,000
11,000		142,000	94,000				
11,300		142,000	94,000				
11,500		142,000	94,000				
11,700		142,000	94,000				
11,900		151,000	101,000				
13,000		151,000	101,000				
13,500		160,000	108,000				
14,000		160,000	108,000				
14,500		169,000	114,000				
15,000		169,000	114,000				

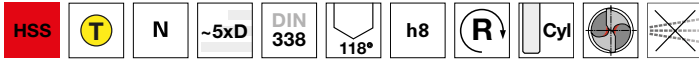


## Spiralbohrer kurz

Artikel-Nr. 84405

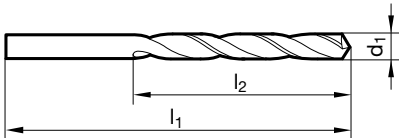


P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen und Graphit



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,400		20,000	5,000	2,750		61,000	33,000
0,500		22,000	6,000	2,800		61,000	33,000
0,600		24,000	7,000	2,850		61,000	33,000
0,610		26,000	8,000	2,900		61,000	33,000
0,700		28,000	9,000	2,950		61,000	33,000
0,800		30,000	10,000	3,000		61,000	33,000
0,820		30,000	10,000	3,050		65,000	36,000
0,900		32,000	11,000	3,100		65,000	36,000
1,000		34,000	12,000	3,150		65,000	36,000
1,020		34,000	12,000	3,200		65,000	36,000
1,100		36,000	14,000	3,250		65,000	36,000
1,150		36,000	14,000	3,300		65,000	36,000
1,200		38,000	16,000	3,400		70,000	39,000
1,250		38,000	16,000	3,450		70,000	39,000
1,300		38,000	16,000	3,500		70,000	39,000
1,350		40,000	18,000	3,600		70,000	39,000
1,400		40,000	18,000	3,650		70,000	39,000
1,450		40,000	18,000	3,700		70,000	39,000
1,500		40,000	18,000	3,750		70,000	39,000
1,550		43,000	20,000	3,800		75,000	43,000
1,600		43,000	20,000	3,900		75,000	43,000
1,650		43,000	20,000	3,950		75,000	43,000
1,700		43,000	20,000	4,000		75,000	43,000
1,750		46,000	22,000	4,100		75,000	43,000
1,800		46,000	22,000	4,150		75,000	43,000
1,820		46,000	22,000	4,200		75,000	43,000
1,900		46,000	22,000	4,250		75,000	43,000
2,000		49,000	24,000	4,300		80,000	47,000
2,050		49,000	24,000	4,400		80,000	47,000
2,100		49,000	24,000	4,500		80,000	47,000
2,150		53,000	27,000	4,600		80,000	47,000
2,200		53,000	27,000	4,700		80,000	47,000
2,300		53,000	27,000	4,800		86,000	52,000
2,400		57,000	30,000	4,900		86,000	52,000
2,450		57,000	30,000	5,000		86,000	52,000
2,500		57,000	30,000	5,100		86,000	52,000
2,520		57,000	30,000	5,150		86,000	52,000
2,530		57,000	30,000	5,200		86,000	52,000
2,550		57,000	30,000	5,250		86,000	52,000
2,600		57,000	30,000	5,300		86,000	52,000
2,650		57,000	30,000	5,400		93,000	57,000
2,700		61,000	33,000	5,500		93,000	57,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
5,600		93,000	57,000	9,900		133,000	87,000
5,700		93,000	57,000	10,000		133,000	87,000
5,800		93,000	57,000	10,100		133,000	87,000
5,900		93,000	57,000	10,200		133,000	87,000
6,000		93,000	57,000	10,250		133,000	87,000
6,040		101,000	63,000	10,300		133,000	87,000
6,100		101,000	63,000	10,500		133,000	87,000
6,200		101,000	63,000	10,600		133,000	87,000
6,300		101,000	63,000	10,700		142,000	94,000
6,350	1/4	101,000	63,000	10,750		142,000	94,000
6,400		101,000	63,000	10,800		142,000	94,000
6,500		101,000	63,000	11,000		142,000	94,000
6,550		101,000	63,000	11,200		142,000	94,000
6,600		101,000	63,000	11,250		142,000	94,000
6,700		101,000	63,000	11,300		142,000	94,000
6,750	17/64	109,000	69,000	11,500		142,000	94,000
6,800		109,000	69,000	11,600		142,000	94,000
6,900		109,000	69,000	11,700		142,000	94,000
7,000		109,000	69,000	11,750		142,000	94,000
7,100		109,000	69,000	11,800		142,000	94,000
7,200		109,000	69,000	12,000		151,000	101,000
7,300		109,000	69,000	12,200		151,000	101,000
7,400		109,000	69,000	12,500		151,000	101,000
7,500		109,000	69,000	12,700	1/2	151,000	101,000
7,600		117,000	75,000	12,800		151,000	101,000
7,700		117,000	75,000	12,900		151,000	101,000
7,750		117,000	75,000	13,000		151,000	101,000
7,800		117,000	75,000	13,100	33/64	151,000	101,000
7,900		117,000	75,000	13,250		160,000	108,000
8,000		117,000	75,000	13,500		160,000	108,000
8,100		117,000	75,000	14,000		160,000	108,000
8,200		117,000	75,000	14,200		169,000	114,000
8,300		117,000	75,000	14,250		169,000	114,000
8,400		117,000	75,000	14,500		169,000	114,000
8,500		117,000	75,000	14,750		169,000	114,000
8,600		125,000	81,000	15,000		169,000	114,000
8,700		125,000	81,000	15,250		178,000	120,000
8,750		125,000	81,000	15,500		178,000	120,000
8,900		125,000	81,000	15,800		178,000	120,000
9,000		125,000	81,000	16,000		178,000	120,000
9,100		125,000	81,000	16,500		184,000	125,000
9,200		125,000	81,000	17,000		184,000	125,000
9,300		125,000	81,000	17,500		191,000	130,000
9,400		125,000	81,000	18,000		191,000	130,000
9,500		125,000	81,000	18,500		198,000	135,000
9,600		133,000	87,000	19,000		198,000	135,000
9,700		133,000	87,000	19,500		205,000	140,000
9,800		133,000	87,000				



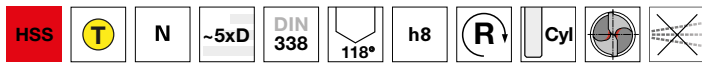


## Spiralbohrer kurz

Artikel-Nr. 84406

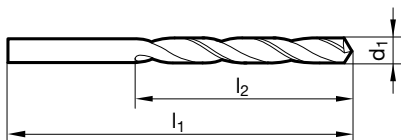


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \text{Ø } 1,000$  • Kegelmantelanschliff • Kopfbeschichtung

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen und Graphit



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
1,000		34,000	12,000	4,300		80,000	47,000
1,100		36,000	14,000	4,370	11/64	80,000	47,000
1,190	3/64	38,000	16,000	4,400		80,000	47,000
1,200		38,000	16,000	4,500		80,000	47,000
1,300		38,000	16,000	4,600		80,000	47,000
1,400		40,000	18,000	4,700		80,000	47,000
1,500		40,000	18,000	4,760	3/16	86,000	52,000
1,590	1/16	43,000	20,000	4,800		86,000	52,000
1,600		43,000	20,000	4,900		86,000	52,000
1,700		43,000	20,000	5,000		86,000	52,000
1,800		46,000	22,000	5,100		86,000	52,000
1,900		46,000	22,000	5,160	13/64	86,000	52,000
1,980	5/64	49,000	24,000	5,200		86,000	52,000
2,000		49,000	24,000	5,300		86,000	52,000
2,100		49,000	24,000	5,400		93,000	57,000
2,200		53,000	27,000	5,500		93,000	57,000
2,300		53,000	27,000	5,560	7/32	93,000	57,000
2,380	3/32	57,000	30,000	5,600		93,000	57,000
2,400		57,000	30,000	5,700		93,000	57,000
2,440		57,000	30,000	5,800		93,000	57,000
2,500		57,000	30,000	5,900		93,000	57,000
2,600		57,000	30,000	5,950	15/64	93,000	57,000
2,700		61,000	33,000	6,000		93,000	57,000
2,780	7/64	61,000	33,000	6,100		101,000	63,000
2,800		61,000	33,000	6,200		101,000	63,000
2,900		61,000	33,000	6,300		101,000	63,000
3,000		61,000	33,000	6,350	1/4	101,000	63,000
3,100		65,000	36,000	6,400		101,000	63,000
3,170	1/8	65,000	36,000	6,500		101,000	63,000
3,200		65,000	36,000	6,600		101,000	63,000
3,300		65,000	36,000	6,700		101,000	63,000
3,400		70,000	39,000	6,750	17/64	109,000	69,000
3,500		70,000	39,000	6,800		109,000	69,000
3,570	9/64	70,000	39,000	6,900		109,000	69,000
3,600		70,000	39,000	7,000		109,000	69,000
3,700		70,000	39,000	7,100		109,000	69,000
3,800		75,000	43,000	7,140	9/32	109,000	69,000
3,900		75,000	43,000	7,200		109,000	69,000
3,970	5/32	75,000	43,000	7,300		109,000	69,000
4,000		75,000	43,000	7,400		109,000	69,000
4,100		75,000	43,000	7,500		109,000	69,000
4,200		75,000	43,000	7,540	19/64	117,000	75,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
7,600		117,000	75,000	11,500		142,000	94,000
7,700		117,000	75,000	11,510	29/64	142,000	94,000
7,800		117,000	75,000	11,600		142,000	94,000
7,900		117,000	75,000	11,700		142,000	94,000
7,940	5/16	117,000	75,000	11,800		142,000	94,000
8,000		117,000	75,000	11,900		151,000	101,000
8,100		117,000	75,000	11,910	15/32	151,000	101,000
8,200		117,000	75,000	12,000		151,000	101,000
8,300		117,000	75,000	12,100		151,000	101,000
8,330	21/64	117,000	75,000	12,200		151,000	101,000
8,400		117,000	75,000	12,300	31/64	151,000	101,000
8,500		117,000	75,000	12,400		151,000	101,000
8,600		125,000	81,000	12,500		151,000	101,000
8,700		125,000	81,000	12,600		151,000	101,000
8,730	11/32	125,000	81,000	12,700	1/2	151,000	101,000
8,800		125,000	81,000	12,800		151,000	101,000
8,900		125,000	81,000	12,900		151,000	101,000
9,000		125,000	81,000	13,000		151,000	101,000
9,100		125,000	81,000	13,100	33/64	151,000	101,000
9,130	23/64	125,000	81,000	13,200		151,000	101,000
9,200		125,000	81,000	13,250		160,000	108,000
9,300		125,000	81,000	13,300		160,000	108,000
9,400		125,000	81,000	13,400		160,000	108,000
9,500		125,000	81,000	13,490	17/32	160,000	108,000
9,520	3/8	133,000	87,000	13,500		160,000	108,000
9,600		133,000	87,000	13,600		160,000	108,000
9,700		133,000	87,000	13,700		160,000	108,000
9,800		133,000	87,000	13,750		160,000	108,000
9,900		133,000	87,000	13,800		160,000	108,000
9,920	25/64	133,000	87,000	13,890	35/64	160,000	108,000
10,000		133,000	87,000	13,900		160,000	108,000
10,100		133,000	87,000	14,000		160,000	108,000
10,200		133,000	87,000	14,250		169,000	114,000
10,300		133,000	87,000	14,290	9/16	169,000	114,000
10,320	13/32	133,000	87,000	14,500		169,000	114,000
10,400		133,000	87,000	14,680	37/64	169,000	114,000
10,500		133,000	87,000	14,750		169,000	114,000
10,600		133,000	87,000	15,000		169,000	114,000
10,700		142,000	94,000	15,080	19/32	178,000	120,000
10,720	27/64	142,000	94,000	15,250		178,000	120,000
10,800		142,000	94,000	15,480	39/64	178,000	120,000
10,900		142,000	94,000	15,500		178,000	120,000
11,000		142,000	94,000	15,750		178,000	120,000
11,100		142,000	94,000	16,000		178,000	120,000
11,110	7/16	142,000	94,000				
11,200		142,000	94,000				
11,300		142,000	94,000				
11,400		142,000	94,000				

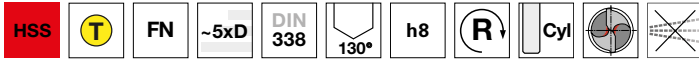


## Spiralbohrer kurz

### Artikel-Nr. 84415



P	M	K	N	S	H
•		•	•		

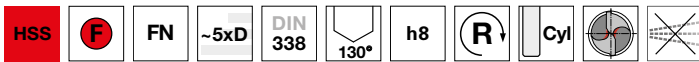


Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • weite Spannuten • besonders für Bohrtiefen über 3xD  
 Grauguss • Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.

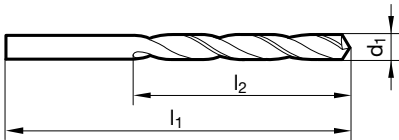
### Artikel-Nr. 84502



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • weite Spannuten • besonders für Bohrtiefen über 3xD  
 Grauguss • Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		34,000	12,000	3,900		75,000	43,000
1,100		36,000	14,000	4,000		75,000	43,000
1,200		38,000	16,000	4,100		75,000	43,000
1,300		38,000	16,000	4,200		75,000	43,000
1,400		40,000	18,000	4,300		80,000	47,000
1,500		40,000	18,000	4,400		80,000	47,000
1,600		43,000	20,000	4,500		80,000	47,000
1,700		43,000	20,000	4,600		80,000	47,000
1,800		46,000	22,000	4,700		80,000	47,000
1,900		46,000	22,000	4,800		86,000	52,000
2,000		49,000	24,000	4,900		86,000	52,000
2,100		49,000	24,000	5,000		86,000	52,000
2,200		53,000	27,000	5,100		86,000	52,000
2,300		53,000	27,000	5,200		86,000	52,000
2,400		57,000	30,000	5,300		86,000	52,000
2,500		57,000	30,000	5,400		93,000	57,000
2,600		57,000	30,000	5,500		93,000	57,000
2,700		61,000	33,000	5,600		93,000	57,000
2,800		61,000	33,000	5,700		93,000	57,000
2,900		61,000	33,000	5,800		93,000	57,000
3,000		61,000	33,000	5,900		93,000	57,000
3,100		65,000	36,000	6,000		93,000	57,000
3,170	1/8	65,000	36,000	6,200		101,000	63,000
3,200		65,000	36,000	6,300		101,000	63,000
3,300		65,000	36,000	6,400		101,000	63,000
3,400		70,000	39,000	6,500		101,000	63,000
3,500		70,000	39,000	6,600		101,000	63,000
3,600		70,000	39,000	6,700		101,000	63,000
3,700		70,000	39,000	6,800		109,000	69,000
3,800		75,000	43,000	6,900		109,000	69,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
7,000		109,000	69,000	10,000		133,000	87,000
7,100		109,000	69,000	10,100		133,000	87,000
7,200		109,000	69,000	10,200		133,000	87,000
7,300		109,000	69,000	10,300		133,000	87,000
7,400		109,000	69,000	10,500		133,000	87,000
7,500		109,000	69,000	10,700		142,000	94,000
7,600		117,000	75,000	11,000		142,000	94,000
7,700		117,000	75,000	11,400		142,000	94,000
7,800		117,000	75,000	11,500		142,000	94,000
7,900		117,000	75,000	11,600		142,000	94,000
8,000		117,000	75,000	11,700		142,000	94,000
8,100		117,000	75,000	11,800		142,000	94,000
8,200		117,000	75,000	12,000		151,000	101,000
8,300		117,000	75,000	12,100		151,000	101,000
8,400		117,000	75,000	12,200		151,000	101,000
8,500		117,000	75,000	12,300	31/64	151,000	101,000
8,600		125,000	81,000	12,500		151,000	101,000
8,700		125,000	81,000	12,700	1/2	151,000	101,000
8,800		125,000	81,000	12,800		151,000	101,000
8,900		125,000	81,000	13,000		151,000	101,000
9,000		125,000	81,000	13,500		160,000	108,000
9,100		125,000	81,000	14,000		160,000	108,000
9,200		125,000	81,000	15,000		169,000	114,000
9,300		125,000	81,000	16,000		178,000	120,000
9,400		125,000	81,000				
9,500		125,000	81,000				
9,600		133,000	87,000				
9,700		133,000	87,000				
9,800		133,000	87,000				
9,900		133,000	87,000				

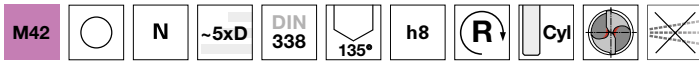


## Spiralbohrer kurz

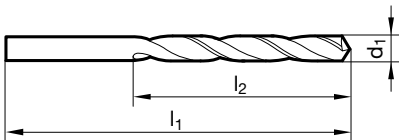
Artikel-Nr. 81012



P	M	K	N	S	H
●	○	○	●	○	○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff mit Kreuzausspitzung nach NAS 907 • hoher Co- und Mo-Anteil • besonders hohe Verschleißfestigkeit



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	34,000	12,000	5,200	86,000	52,000
1,100	36,000	14,000	5,300	86,000	52,000
1,200	38,000	16,000	5,400	93,000	57,000
1,300	38,000	16,000	5,500	93,000	57,000
1,400	40,000	18,000	5,600	93,000	57,000
1,500	40,000	18,000	5,700	93,000	57,000
1,600	43,000	20,000	5,800	93,000	57,000
1,700	43,000	20,000	5,900	93,000	57,000
1,800	46,000	22,000	6,000	93,000	57,000
1,900	46,000	22,000	6,100	101,000	63,000
2,000	49,000	24,000	6,200	101,000	63,000
2,100	49,000	24,000	6,300	101,000	63,000
2,200	53,000	27,000	6,400	101,000	63,000
2,300	53,000	27,000	6,500	101,000	63,000
2,400	57,000	30,000	6,600	101,000	63,000
2,500	57,000	30,000	6,700	101,000	63,000
2,600	57,000	30,000	6,800	109,000	69,000
2,700	61,000	33,000	6,900	109,000	69,000
2,800	61,000	33,000	7,000	109,000	69,000
2,900	61,000	33,000	7,100	109,000	69,000
3,000	61,000	33,000	7,200	109,000	69,000
3,100	65,000	36,000	7,300	109,000	69,000
3,200	65,000	36,000	7,400	109,000	69,000
3,300	65,000	36,000	7,500	109,000	69,000
3,400	70,000	39,000	7,600	117,000	75,000
3,500	70,000	39,000	7,700	117,000	75,000
3,600	70,000	39,000	7,800	117,000	75,000
3,700	70,000	39,000	7,900	117,000	75,000
3,800	75,000	43,000	8,000	117,000	75,000
3,900	75,000	43,000	8,100	117,000	75,000
4,000	75,000	43,000	8,200	117,000	75,000
4,100	75,000	43,000	8,300	117,000	75,000
4,200	75,000	43,000	8,400	117,000	75,000
4,300	80,000	47,000	8,500	117,000	75,000
4,400	80,000	47,000	8,600	125,000	81,000
4,500	80,000	47,000	8,700	125,000	81,000
4,600	80,000	47,000	8,800	125,000	81,000
4,700	80,000	47,000	8,900	125,000	81,000
4,800	86,000	52,000	9,000	125,000	81,000
4,900	86,000	52,000	9,100	125,000	81,000
5,000	86,000	52,000	9,200	125,000	81,000
5,100	86,000	52,000	9,300	125,000	81,000



## Spiralbohrer kurz

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
9,400	125,000	81,000	12,500	151,000	101,000
9,500	125,000	81,000	13,000	151,000	101,000
9,600	133,000	87,000	14,000	160,000	108,000
9,700	133,000	87,000			
9,800	133,000	87,000			
9,900	133,000	87,000			
10,000	133,000	87,000			
10,200	133,000	87,000			
10,500	133,000	87,000			
11,000	142,000	94,000			
11,500	142,000	94,000			
12,000	151,000	101,000			

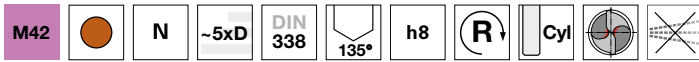


## Spiralbohrer kurz

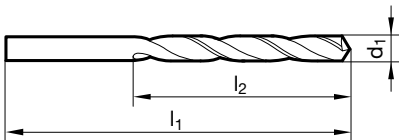
Artikel-Nr. 81018



P	M	K	N	S	H
•	•	•	•	•	○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff mit Kreuzausspitzung nach NAS 907 • hoher Co- und Mo-Anteil • besonders hohe Verschleißfestigkeit • stark reduzierter ansteigender Kern



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
1,000		34,000	12,000	4,400		80,000	47,000
1,100		36,000	14,000	4,500		80,000	47,000
1,200		38,000	16,000	4,600		80,000	47,000
1,300		38,000	16,000	4,700		80,000	47,000
1,400		40,000	18,000	4,760	3/16	86,000	52,000
1,500		40,000	18,000	4,800		86,000	52,000
1,590	1/16	43,000	20,000	4,900		86,000	52,000
1,600		43,000	20,000	5,000		86,000	52,000
1,700		43,000	20,000	5,100		86,000	52,000
1,800		46,000	22,000	5,160	13/64	86,000	52,000
1,900		46,000	22,000	5,200		86,000	52,000
1,980	5/64	49,000	24,000	5,300		86,000	52,000
2,000		49,000	24,000	5,400		93,000	57,000
2,100		49,000	24,000	5,500		93,000	57,000
2,200		53,000	27,000	5,560	7/32	93,000	57,000
2,300		53,000	27,000	5,600		93,000	57,000
2,380	3/32	57,000	30,000	5,700		93,000	57,000
2,400		57,000	30,000	5,800		93,000	57,000
2,500		57,000	30,000	5,900		93,000	57,000
2,600		57,000	30,000	5,950	15/64	93,000	57,000
2,700		61,000	33,000	6,000		93,000	57,000
2,780	7/64	61,000	33,000	6,100		101,000	63,000
2,800		61,000	33,000	6,200		101,000	63,000
2,900		61,000	33,000	6,300		101,000	63,000
3,000		61,000	33,000	6,350	1/4	101,000	63,000
3,100		65,000	36,000	6,400		101,000	63,000
3,170	1/8	65,000	36,000	6,500		101,000	63,000
3,200		65,000	36,000	6,600		101,000	63,000
3,250		65,000	36,000	6,700		101,000	63,000
3,300		65,000	36,000	6,800		109,000	69,000
3,400		70,000	39,000	6,900		109,000	69,000
3,500		70,000	39,000	7,000		109,000	69,000
3,570	9/64	70,000	39,000	7,100		109,000	69,000
3,600		70,000	39,000	7,140	9/32	109,000	69,000
3,700		70,000	39,000	7,200		109,000	69,000
3,800		75,000	43,000	7,300		109,000	69,000
3,900		75,000	43,000	7,400		109,000	69,000
3,970	5/32	75,000	43,000	7,500		109,000	69,000
4,000		75,000	43,000	7,540	19/64	117,000	75,000
4,100		75,000	43,000	7,600		117,000	75,000
4,200		75,000	43,000	7,700		117,000	75,000
4,300		80,000	47,000	7,800		117,000	75,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
7,900		117,000	75,000	9,900		133,000	87,000
7,940	5/16	117,000	75,000	9,920	25/64	133,000	87,000
8,000		117,000	75,000	10,000		133,000	87,000
8,100		117,000	75,000	10,100		133,000	87,000
8,200		117,000	75,000	10,200		133,000	87,000
8,300		117,000	75,000	10,300		133,000	87,000
8,330	21/64	117,000	75,000	10,320	13/32	133,000	87,000
8,400		117,000	75,000	10,500		133,000	87,000
8,500		117,000	75,000	10,720	27/64	142,000	94,000
8,600		125,000	81,000	10,800		142,000	94,000
8,700		125,000	81,000	11,000		142,000	94,000
8,730	11/32	125,000	81,000	11,110	7/16	142,000	94,000
8,800		125,000	81,000	11,500		142,000	94,000
8,900		125,000	81,000	11,510	29/64	142,000	94,000
9,000		125,000	81,000	11,910	15/32	151,000	101,000
9,100		125,000	81,000	12,000		151,000	101,000
9,130	23/64	125,000	81,000	12,200		151,000	101,000
9,200		125,000	81,000	12,300	31/64	151,000	101,000
9,300		125,000	81,000	12,500		151,000	101,000
9,500		125,000	81,000	12,700	1/2	151,000	101,000
9,520	3/8	133,000	87,000	12,800		151,000	101,000
9,600		133,000	87,000	13,000		151,000	101,000
9,700		133,000	87,000				
9,800		133,000	87,000				



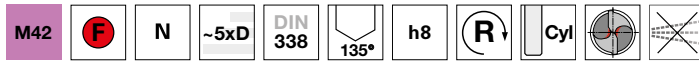


## Spiralbohrer kurz

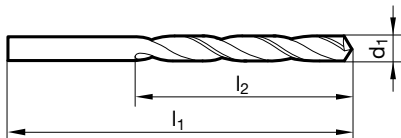
Artikel-Nr. 81019



P	M	K	N	S	H
•	•	•	○	•	○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff mit Kreuzausspitzung nach NAS 907 • hoher Co- und Mo-Anteil • besonders hohe Verschleißfestigkeit



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		34,000	12,000	4,760	3/16	86,000	52,000
1,100		36,000	14,000	4,800		86,000	52,000
1,200		38,000	16,000	4,900		86,000	52,000
1,300		38,000	16,000	5,000		86,000	52,000
1,400		40,000	18,000	5,100		86,000	52,000
1,500		40,000	18,000	5,160	13/64	86,000	52,000
1,590	1/16	43,000	20,000	5,200		86,000	52,000
1,600		43,000	20,000	5,300		86,000	52,000
1,700		43,000	20,000	5,400		93,000	57,000
1,800		46,000	22,000	5,500		93,000	57,000
1,900		46,000	22,000	5,600		93,000	57,000
2,000		49,000	24,000	5,700		93,000	57,000
2,100		49,000	24,000	5,800		93,000	57,000
2,200		53,000	27,000	5,900		93,000	57,000
2,300		53,000	27,000	5,950	15/64	93,000	57,000
2,380	3/32	57,000	30,000	6,000		93,000	57,000
2,400		57,000	30,000	6,100		101,000	63,000
2,500		57,000	30,000	6,200		101,000	63,000
2,600		57,000	30,000	6,300		101,000	63,000
2,700		61,000	33,000	6,350	1/4	101,000	63,000
2,800		61,000	33,000	6,400		101,000	63,000
2,900		61,000	33,000	6,500		101,000	63,000
3,000		61,000	33,000	6,600		101,000	63,000
3,100		65,000	36,000	6,700		101,000	63,000
3,170	1/8	65,000	36,000	6,750	17/64	109,000	69,000
3,200		65,000	36,000	6,800		109,000	69,000
3,300		65,000	36,000	6,900		109,000	69,000
3,400		70,000	39,000	7,000		109,000	69,000
3,500		70,000	39,000	7,100		109,000	69,000
3,600		70,000	39,000	7,200		109,000	69,000
3,700		70,000	39,000	7,300		109,000	69,000
3,800		75,000	43,000	7,400		109,000	69,000
3,900		75,000	43,000	7,500		109,000	69,000
3,970	5/32	75,000	43,000	7,600		117,000	75,000
4,000		75,000	43,000	7,700		117,000	75,000
4,100		75,000	43,000	7,800		117,000	75,000
4,200		75,000	43,000	7,900		117,000	75,000
4,300		80,000	47,000	8,000		117,000	75,000
4,400		80,000	47,000	8,100		117,000	75,000
4,500		80,000	47,000	8,200		117,000	75,000
4,600		80,000	47,000	8,300		117,000	75,000
4,700		80,000	47,000	8,400		117,000	75,000



HARTNER

### Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
8,500		117,000	75,000	10,100		133,000	87,000
8,600		125,000	81,000	10,200		133,000	87,000
8,700		125,000	81,000	10,500		133,000	87,000
8,730	11/32	125,000	81,000	10,800		142,000	94,000
8,800		125,000	81,000	11,000		142,000	94,000
8,900		125,000	81,000	11,200		142,000	94,000
9,000		125,000	81,000	11,500		142,000	94,000
9,100		125,000	81,000	11,800		142,000	94,000
9,200		125,000	81,000	11,910	15/32	151,000	101,000
9,300		125,000	81,000	12,000		151,000	101,000
9,400		125,000	81,000	12,200		151,000	101,000
9,500		125,000	81,000	12,500		151,000	101,000
9,600		133,000	87,000	13,000		151,000	101,000
9,700		133,000	87,000	14,000		160,000	108,000
9,800		133,000	87,000	15,000		169,000	114,000
9,900		133,000	87,000	16,000		178,000	120,000
9,920	25/64	133,000	87,000				
10,000		133,000	87,000				

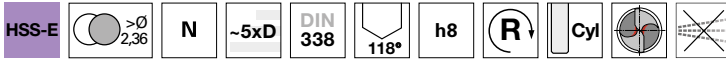


## Spiralbohrer kurz

Artikel-Nr. 81011

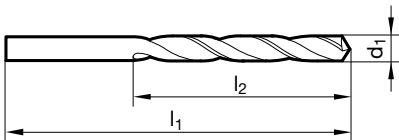


P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

Stahl und Stahlguss (legiert und unleg.) • Gusswerkstoffe über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle  
• hochlegierte Stähle • Vergütungs- und Einsatzstähle



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,200		19,000	2,500	1,900		46,000	22,000
0,250		19,000	3,000	1,950		49,000	24,000
0,300		19,000	3,000	2,000		49,000	24,000
0,350		19,000	4,000	2,030		49,000	24,000
0,400		20,000	5,000	2,050		49,000	24,000
0,430		20,000	5,000	2,100		49,000	24,000
0,450		20,000	5,000	2,150		53,000	27,000
0,500		22,000	6,000	2,200		53,000	27,000
0,550		24,000	7,000	2,250		53,000	27,000
0,600		24,000	7,000	2,300		53,000	27,000
0,650		26,000	8,000	2,400		57,000	30,000
0,680		28,000	9,000	2,450		57,000	30,000
0,700		28,000	9,000	2,500		57,000	30,000
0,750		28,000	9,000	2,550		57,000	30,000
0,800		30,000	10,000	2,600		57,000	30,000
0,860		32,000	11,000	2,650		57,000	30,000
0,870		32,000	11,000	2,700		61,000	33,000
0,900		32,000	11,000	2,750		61,000	33,000
0,950		32,000	11,000	2,800		61,000	33,000
0,980		34,000	12,000	2,850		61,000	33,000
1,000		34,000	12,000	2,900		61,000	33,000
1,050		34,000	12,000	2,950		61,000	33,000
1,100		36,000	14,000	3,000		61,000	33,000
1,150		36,000	14,000	3,050		65,000	36,000
1,170		36,000	14,000	3,100		65,000	36,000
1,200		38,000	16,000	3,150		65,000	36,000
1,230		38,000	16,000	3,200		65,000	36,000
1,250		38,000	16,000	3,250		65,000	36,000
1,300		38,000	16,000	3,300		65,000	36,000
1,350		40,000	18,000	3,400		70,000	39,000
1,370		40,000	18,000	3,500		70,000	39,000
1,400		40,000	18,000	3,600		70,000	39,000
1,450		40,000	18,000	3,700		70,000	39,000
1,500		40,000	18,000	3,750		70,000	39,000
1,550		43,000	20,000	3,800		75,000	43,000
1,600		43,000	20,000	3,900		75,000	43,000
1,650		43,000	20,000	4,000		75,000	43,000
1,700		43,000	20,000	4,100		75,000	43,000
1,750		46,000	22,000	4,200		75,000	43,000
1,800		46,000	22,000	4,250		75,000	43,000
1,820		46,000	22,000	4,300		80,000	47,000
1,860		46,000	22,000	4,400		80,000	47,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
4,500		80,000	47,000	9,400		125,000	81,000
4,550		80,000	47,000	9,500		125,000	81,000
4,600		80,000	47,000	9,520	3/8	133,000	87,000
4,650		80,000	47,000	9,600		133,000	87,000
4,700		80,000	47,000	9,700		133,000	87,000
4,800		86,000	52,000	9,800		133,000	87,000
4,900		86,000	52,000	9,900		133,000	87,000
5,000		86,000	52,000	10,000		133,000	87,000
5,020		86,000	52,000	10,050		133,000	87,000
5,050		86,000	52,000	10,200		133,000	87,000
5,100		86,000	52,000	10,250		133,000	87,000
5,150		86,000	52,000	10,300		133,000	87,000
5,200		86,000	52,000	10,400		133,000	87,000
5,250		86,000	52,000	10,500		133,000	87,000
5,300		86,000	52,000	10,600		133,000	87,000
5,400		93,000	57,000	10,720	27/64	142,000	94,000
5,500		93,000	57,000	10,800		142,000	94,000
5,600		93,000	57,000	10,900		142,000	94,000
5,700		93,000	57,000	11,000		142,000	94,000
5,750		93,000	57,000	11,100		142,000	94,000
5,800		93,000	57,000	11,200		142,000	94,000
5,900		93,000	57,000	11,300		142,000	94,000
6,000		93,000	57,000	11,500		142,000	94,000
6,050		101,000	63,000	11,700		142,000	94,000
6,100		101,000	63,000	11,750		142,000	94,000
6,150		101,000	63,000	11,800		142,000	94,000
6,200		101,000	63,000	12,000		151,000	101,000
6,300		101,000	63,000	12,200		151,000	101,000
6,350	1/4	101,000	63,000	12,250		151,000	101,000
6,400		101,000	63,000	12,400		151,000	101,000
6,500		101,000	63,000	12,500		151,000	101,000
6,600		101,000	63,000	12,600		151,000	101,000
6,750	17/64	109,000	69,000	12,700	1/2	151,000	101,000
6,800		109,000	69,000	12,800		151,000	101,000
7,000		109,000	69,000	12,900		151,000	101,000
7,100		109,000	69,000	13,000		151,000	101,000
7,140	9/32	109,000	69,000	13,200		151,000	101,000
7,200		109,000	69,000	13,300		160,000	108,000
7,300		109,000	69,000	13,400		160,000	108,000
7,400		109,000	69,000	13,500		160,000	108,000
7,500		109,000	69,000	13,600		160,000	108,000
7,600		117,000	75,000	13,700		160,000	108,000
7,700		117,000	75,000	13,800		160,000	108,000
7,900		117,000	75,000	14,000		160,000	108,000
8,000		117,000	75,000	14,200		169,000	114,000
8,100		117,000	75,000	14,400		169,000	114,000
8,200		117,000	75,000	14,500		169,000	114,000
8,300		117,000	75,000	15,000		169,000	114,000
8,500		117,000	75,000	15,250		178,000	120,000
8,600		125,000	81,000	15,500		178,000	120,000
8,700		125,000	81,000	15,870	5/8	178,000	120,000
8,730	11/32	125,000	81,000	16,000		178,000	120,000
8,750		125,000	81,000	16,500		184,000	125,000
8,800		125,000	81,000	17,000		184,000	125,000
8,900		125,000	81,000	17,500		191,000	130,000
9,000		125,000	81,000	19,000		198,000	135,000
9,100		125,000	81,000	20,000		205,000	140,000
9,200		125,000	81,000				
9,250		125,000	81,000				
9,300		125,000	81,000				

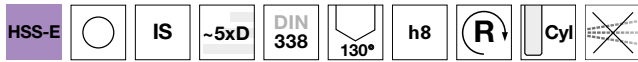


## Spiralbohrer kurz

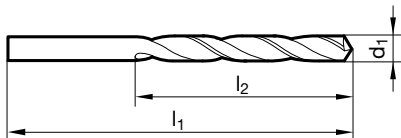
Artikel-Nr. 81013



P	M	K	N	S	H
○	●		○	○	



INOX-Drill • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
rost-/säure-/hitzebest. austenit. Stähle (V2A und V4A)



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		34,000	12,000	5,100		86,000	52,000
1,100		36,000	14,000	5,200		86,000	52,000
1,200		38,000	16,000	5,300		86,000	52,000
1,300		38,000	16,000	5,400		93,000	57,000
1,400		40,000	18,000	5,500		93,000	57,000
1,500		40,000	18,000	5,600		93,000	57,000
1,600		43,000	20,000	5,700		93,000	57,000
1,700		43,000	20,000	5,800		93,000	57,000
1,800		46,000	22,000	5,900		93,000	57,000
1,900		46,000	22,000	6,000		93,000	57,000
2,000		49,000	24,000	6,100		101,000	63,000
2,100		49,000	24,000	6,200		101,000	63,000
2,200		53,000	27,000	6,300		101,000	63,000
2,300		53,000	27,000	6,400		101,000	63,000
2,400		57,000	30,000	6,500		101,000	63,000
2,500		57,000	30,000	6,600		101,000	63,000
2,600		57,000	30,000	6,700		101,000	63,000
2,700		61,000	33,000	6,800		109,000	69,000
2,800		61,000	33,000	6,900		109,000	69,000
2,900		61,000	33,000	7,000		109,000	69,000
3,000		61,000	33,000	7,100		109,000	69,000
3,100		65,000	36,000	7,200		109,000	69,000
3,200		65,000	36,000	7,300		109,000	69,000
3,300		65,000	36,000	7,400		109,000	69,000
3,400		70,000	39,000	7,500		109,000	69,000
3,500		70,000	39,000	7,600		117,000	75,000
3,570	9/64	70,000	39,000	7,700		117,000	75,000
3,600		70,000	39,000	7,800		117,000	75,000
3,700		70,000	39,000	7,900		117,000	75,000
3,800		75,000	43,000	8,000		117,000	75,000
3,900		75,000	43,000	8,100		117,000	75,000
4,000		75,000	43,000	8,200		117,000	75,000
4,100		75,000	43,000	8,300		117,000	75,000
4,200		75,000	43,000	8,400		117,000	75,000
4,300		80,000	47,000	8,500		117,000	75,000
4,400		80,000	47,000	8,600		125,000	81,000
4,500		80,000	47,000	8,700		125,000	81,000
4,600		80,000	47,000	8,800		125,000	81,000
4,700		80,000	47,000	8,900		125,000	81,000
4,800		86,000	52,000	9,000		125,000	81,000
4,900		86,000	52,000	9,100		125,000	81,000
5,000		86,000	52,000	9,200		125,000	81,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
9,300		125,000	81,000	11,100		142,000	94,000
9,400		125,000	81,000	11,400		142,000	94,000
9,500		125,000	81,000	11,500		142,000	94,000
9,600		133,000	87,000	11,600		142,000	94,000
9,700		133,000	87,000	11,800		142,000	94,000
9,800		133,000	87,000	12,000		151,000	101,000
9,900		133,000	87,000	12,500		151,000	101,000
10,000		133,000	87,000	13,000		151,000	101,000
10,100		133,000	87,000				
10,200		133,000	87,000				
10,300		133,000	87,000				
10,400		133,000	87,000				
10,500		133,000	87,000				
10,600		133,000	87,000				
10,700		142,000	94,000				
10,800		142,000	94,000				
10,900		142,000	94,000				
11,000		142,000	94,000				



## Spiralbohrer kurz

Artikel-Nr. 81041

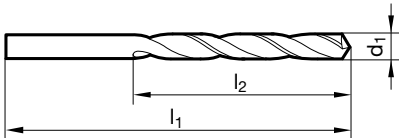


P	M	K	N	S	H
•	○	•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit • weite Spannuten • besonders für Bohrtiefen über  $3 \times D$

Grauguss und Stähle über  $800 \text{ N/mm}^2$  • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle • Vergütungs- und Einsatzstähle



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		34,000	12,000	3,900		75,000	43,000
1,100		36,000	14,000	4,000		75,000	43,000
1,200		38,000	16,000	4,050		75,000	43,000
1,250		38,000	16,000	4,100		75,000	43,000
1,300		38,000	16,000	4,200		75,000	43,000
1,400		40,000	18,000	4,300		80,000	47,000
1,500		40,000	18,000	4,400		80,000	47,000
1,550		43,000	20,000	4,500		80,000	47,000
1,600		43,000	20,000	4,600		80,000	47,000
1,650		43,000	20,000	4,700		80,000	47,000
1,700		43,000	20,000	4,900		86,000	52,000
1,800		46,000	22,000	5,000		86,000	52,000
1,850		46,000	22,000	5,100		86,000	52,000
1,900		46,000	22,000	5,200		86,000	52,000
2,000		49,000	24,000	5,300		86,000	52,000
2,050		49,000	24,000	5,400		93,000	57,000
2,100		49,000	24,000	5,500		93,000	57,000
2,200		53,000	27,000	5,600		93,000	57,000
2,300		53,000	27,000	5,700		93,000	57,000
2,350		53,000	27,000	5,800		93,000	57,000
2,400		57,000	30,000	5,900		93,000	57,000
2,450		57,000	30,000	6,000		93,000	57,000
2,500		57,000	30,000	6,100		101,000	63,000
2,550		57,000	30,000	6,200		101,000	63,000
2,600		57,000	30,000	6,300		101,000	63,000
2,650		57,000	30,000	6,400		101,000	63,000
2,700		61,000	33,000	6,500		101,000	63,000
2,750		61,000	33,000	6,600		101,000	63,000
2,780	7/64	61,000	33,000	6,700		101,000	63,000
2,800		61,000	33,000	6,750	17/64	109,000	69,000
2,900		61,000	33,000	6,800		109,000	69,000
3,000		61,000	33,000	6,900		109,000	69,000
3,050		65,000	36,000	7,000		109,000	69,000
3,100		65,000	36,000	7,100		109,000	69,000
3,200		65,000	36,000	7,200		109,000	69,000
3,250		65,000	36,000	7,300		109,000	69,000
3,300		65,000	36,000	7,500		109,000	69,000
3,400		70,000	39,000	7,600		117,000	75,000
3,450		70,000	39,000	7,700		117,000	75,000
3,500		70,000	39,000	7,800		117,000	75,000
3,700		70,000	39,000	7,900		117,000	75,000
3,800		75,000	43,000	8,000		117,000	75,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
8,100		117,000	75,000	10,200		133,000	87,000
8,200		117,000	75,000	10,300		133,000	87,000
8,300		117,000	75,000	10,500		133,000	87,000
8,400		117,000	75,000	10,700		142,000	94,000
8,500		117,000	75,000	10,800		142,000	94,000
8,600		125,000	81,000	11,000		142,000	94,000
8,700		125,000	81,000	11,100		142,000	94,000
8,800		125,000	81,000	11,200		142,000	94,000
8,900		125,000	81,000	11,600		142,000	94,000
9,000		125,000	81,000	11,700		142,000	94,000
9,100		125,000	81,000	11,800		142,000	94,000
9,200		125,000	81,000	12,000		151,000	101,000
9,300		125,000	81,000	12,500		151,000	101,000
9,500		125,000	81,000	12,700	1/2	151,000	101,000
9,700		133,000	87,000	13,000		151,000	101,000
9,800		133,000	87,000				
9,900		133,000	87,000				
10,000		133,000	87,000				



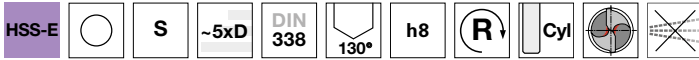


## Spiralbohrer kurz

Artikel-Nr. 81061

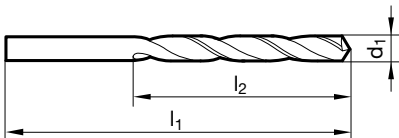


P	M	K	N	S	H
○	●			●	



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

Titan und Titanlegierungen • rost-/säure-/hitzebest. austen. Stähle • hochfeste/kurzspan. Stähle ab 900 N/mm<sup>2</sup> • Sonderlegierungen  
Hastelloy, Inconel, Nimonic



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
0,200		19,000	2,500	1,820		46,000	22,000
0,300		19,000	3,000	1,850		46,000	22,000
0,400		20,000	5,000	1,900		46,000	22,000
0,500		22,000	6,000	1,950		49,000	24,000
0,550		24,000	7,000	1,990		49,000	24,000
0,580		24,000	7,000	2,000		49,000	24,000
0,600		24,000	7,000	2,030		49,000	24,000
0,650		26,000	8,000	2,050		49,000	24,000
0,700		28,000	9,000	2,080		49,000	24,000
0,750		28,000	9,000	2,100		49,000	24,000
0,800		30,000	10,000	2,200		53,000	27,000
0,820		30,000	10,000	2,250		53,000	27,000
0,840		30,000	10,000	2,300		53,000	27,000
0,850		30,000	10,000	2,350		53,000	27,000
0,900		32,000	11,000	2,380	3/32	57,000	30,000
0,950		32,000	11,000	2,400		57,000	30,000
1,000		34,000	12,000	2,450		57,000	30,000
1,040		34,000	12,000	2,500		57,000	30,000
1,050		34,000	12,000	2,550		57,000	30,000
1,100		36,000	14,000	2,600		57,000	30,000
1,150		36,000	14,000	2,700		61,000	33,000
1,180		36,000	14,000	2,750		61,000	33,000
1,190	3/64	38,000	16,000	2,800		61,000	33,000
1,200		38,000	16,000	2,850		61,000	33,000
1,210		38,000	16,000	2,900		61,000	33,000
1,250		38,000	16,000	2,950		61,000	33,000
1,300		38,000	16,000	3,000		61,000	33,000
1,350		40,000	18,000	3,050		65,000	36,000
1,400		40,000	18,000	3,100		65,000	36,000
1,450		40,000	18,000	3,200		65,000	36,000
1,500		40,000	18,000	3,250		65,000	36,000
1,510		43,000	20,000	3,300		65,000	36,000
1,520		43,000	20,000	3,350		65,000	36,000
1,530		43,000	20,000	3,400		70,000	39,000
1,550		43,000	20,000	3,450		70,000	39,000
1,600		43,000	20,000	3,500		70,000	39,000
1,630		43,000	20,000	3,600		70,000	39,000
1,650		43,000	20,000	3,650		70,000	39,000
1,700		43,000	20,000	3,700		70,000	39,000
1,730		46,000	22,000	3,800		75,000	43,000
1,750		46,000	22,000	3,900		75,000	43,000
1,800		46,000	22,000	4,000		75,000	43,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
4,050		75,000	43,000	9,000		125,000	81,000
4,100		75,000	43,000	9,100		125,000	81,000
4,200		75,000	43,000	9,200		125,000	81,000
4,250		75,000	43,000	9,300		125,000	81,000
4,300		80,000	47,000	9,400		125,000	81,000
4,400		80,000	47,000	9,500		125,000	81,000
4,500		80,000	47,000	9,600		133,000	87,000
4,600		80,000	47,000	9,700		133,000	87,000
4,700		80,000	47,000	9,800		133,000	87,000
4,750		80,000	47,000	9,900		133,000	87,000
4,800		86,000	52,000	10,000		133,000	87,000
4,850		86,000	52,000	10,100		133,000	87,000
4,900		86,000	52,000	10,200		133,000	87,000
5,000		86,000	52,000	10,300		133,000	87,000
5,100		86,000	52,000	10,400		133,000	87,000
5,200		86,000	52,000	10,500		133,000	87,000
5,300		86,000	52,000	10,600		133,000	87,000
5,400		93,000	57,000	10,700		142,000	94,000
5,500		93,000	57,000	10,750		142,000	94,000
5,600		93,000	57,000	10,800		142,000	94,000
5,700		93,000	57,000	10,900		142,000	94,000
5,800		93,000	57,000	11,000		142,000	94,000
5,900		93,000	57,000	11,100		142,000	94,000
6,000		93,000	57,000	11,200		142,000	94,000
6,100		101,000	63,000	11,300		142,000	94,000
6,200		101,000	63,000	11,500		142,000	94,000
6,300		101,000	63,000	11,700		142,000	94,000
6,400		101,000	63,000	11,800		142,000	94,000
6,500		101,000	63,000	12,000		151,000	101,000
6,600		101,000	63,000	12,100		151,000	101,000
6,700		101,000	63,000	12,200		151,000	101,000
6,750	17/64	109,000	69,000	12,300	31/64	151,000	101,000
6,800		109,000	69,000	12,400		151,000	101,000
6,900		109,000	69,000	12,500		151,000	101,000
7,000		109,000	69,000	12,700	1/2	151,000	101,000
7,100		109,000	69,000	13,000		151,000	101,000
7,200		109,000	69,000	13,500		160,000	108,000
7,300		109,000	69,000	14,000		160,000	108,000
7,400		109,000	69,000	14,500		169,000	114,000
7,500		109,000	69,000	15,000		169,000	114,000
7,600		117,000	75,000	15,500		178,000	120,000
7,700		117,000	75,000	16,000		178,000	120,000
7,800		117,000	75,000	16,500		184,000	125,000
7,900		117,000	75,000	17,000		184,000	125,000
8,000		117,000	75,000	17,500		191,000	130,000
8,100		117,000	75,000				
8,200		117,000	75,000				
8,300		117,000	75,000				
8,400		117,000	75,000				
8,500		117,000	75,000				
8,600		125,000	81,000				
8,700		125,000	81,000				
8,800		125,000	81,000				
8,900		125,000	81,000				

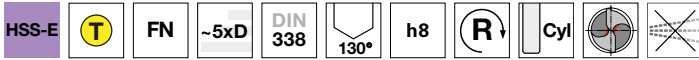


## Spiralbohrer kurz

### Artikel-Nr. 84800



P	M	K	N	S	H
●	○	●	○		



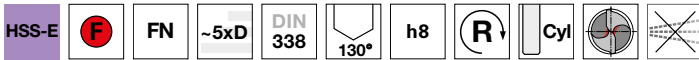
Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit • weite Spannuten • besonders für Bohrtiefen über  $3xD$

Grauguss und Stähle über  $800 \text{ N/mm}^2$  • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle • Vergütungs- und Einsatzstähle

### Artikel-Nr. 84504

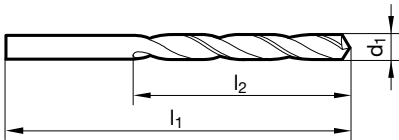


P	M	K	N	S	H
●	○	●	●		○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • weite Spannuten • höhere Verschleißfestigkeit • besonders für Bohrtiefen über  $3xD$

Grauguss und Stähle über  $800 \text{ N/mm}^2$  • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle • Vergütungs- und Einsatzstähle



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
1,000		34,000	12,000	3,400		70,000	39,000
1,100		36,000	14,000	3,500		70,000	39,000
1,200		38,000	16,000	3,600		70,000	39,000
1,300		38,000	16,000	3,700		70,000	39,000
1,400		40,000	18,000	3,800		75,000	43,000
1,450		40,000	18,000	3,900		75,000	43,000
1,500		40,000	18,000	4,000		75,000	43,000
1,600		43,000	20,000	4,100		75,000	43,000
1,700		43,000	20,000	4,200		75,000	43,000
1,800		46,000	22,000	4,300		80,000	47,000
1,900		46,000	22,000	4,400		80,000	47,000
1,930		49,000	24,000	4,500		80,000	47,000
2,000		49,000	24,000	4,600		80,000	47,000
2,100		49,000	24,000	4,700		80,000	47,000
2,200		53,000	27,000	4,800		86,000	52,000
2,250		53,000	27,000	4,900		86,000	52,000
2,300		53,000	27,000	5,000		86,000	52,000
2,400		57,000	30,000	5,100		86,000	52,000
2,450		57,000	30,000	5,200		86,000	52,000
2,500		57,000	30,000	5,300		86,000	52,000
2,550		57,000	30,000	5,400		93,000	57,000
2,600		57,000	30,000	5,500		93,000	57,000
2,700		61,000	33,000	5,560	7/32	93,000	57,000
2,800		61,000	33,000	5,600		93,000	57,000
2,900		61,000	33,000	5,700		93,000	57,000
3,000		61,000	33,000	5,800		93,000	57,000
3,100		65,000	36,000	6,000		93,000	57,000
3,200		65,000	36,000	6,100		101,000	63,000
3,250		65,000	36,000	6,200		101,000	63,000
3,300		65,000	36,000	6,300		101,000	63,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
6,400		101,000	63,000	9,100		125,000	81,000
6,500		101,000	63,000	9,200		125,000	81,000
6,600		101,000	63,000	9,300		125,000	81,000
6,700		101,000	63,000	9,500		125,000	81,000
6,800		109,000	69,000	9,700		133,000	87,000
6,900		109,000	69,000	9,800		133,000	87,000
7,000		109,000	69,000	9,900		133,000	87,000
7,100		109,000	69,000	10,000		133,000	87,000
7,200		109,000	69,000	10,100		133,000	87,000
7,400		109,000	69,000	10,200		133,000	87,000
7,500		109,000	69,000	10,300		133,000	87,000
7,700		117,000	75,000	10,500		133,000	87,000
7,800		117,000	75,000	10,700		142,000	94,000
7,900		117,000	75,000	10,800		142,000	94,000
8,000		117,000	75,000	11,000		142,000	94,000
8,100		117,000	75,000	11,500		142,000	94,000
8,200		117,000	75,000	11,700		142,000	94,000
8,400		117,000	75,000	12,000		151,000	101,000
8,500		117,000	75,000	12,500		151,000	101,000
8,600		125,000	81,000	13,000		151,000	101,000
8,700		125,000	81,000				
8,800		125,000	81,000				
8,900		125,000	81,000				
9,000		125,000	81,000				

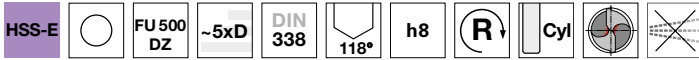


## Spiralbohrer kurz

### Artikel-Nr. 84804



P	M	K	N	S	H
•	•	•	•		



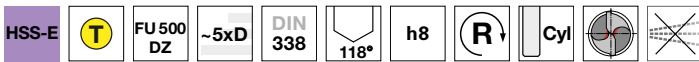
Ausspitzung  $\geq \varnothing 1,000$  • Flächenanschliff • Co-legierter HSS-Stahl • geringe Vorschubkraft notwendig • geringes Drehmoment notwendig • universell einsetzbar

Stähle (legiert/unleg.) bis 800 N/mm<sup>2</sup> • Kalt-/Warmarbeitsstähle • Wälzlagerstähle • NE-Metalle • Gusswerkstoffe • rostfreie Stähle • Kunststoffe

### Artikel-Nr. 84802

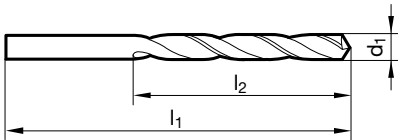


P	M	K	N	S	H
•	•	•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Flächenanschliff • Co-legierter HSS-Stahl • geringe Vorschubkraft notwendig • geringes Drehmoment notwendig • höhere Verschleißfestigkeit • universell einsetzbar

Stähle (legiert/unleg.) bis 800 N/mm<sup>2</sup> • Kalt-/Warmarbeitsstähle • Wälzlagerstähle • NE-Metalle • Gusswerkstoffe • rostfreie Stähle • Kunststoffe



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		34,000	12,000	3,600		70,000	39,000
1,100		36,000	14,000	3,700		70,000	39,000
1,200		38,000	16,000	3,800		75,000	43,000
1,300		38,000	16,000	3,900		75,000	43,000
1,400		40,000	18,000	3,970	5/32	75,000	43,000
1,500		40,000	18,000	4,000		75,000	43,000
1,600		43,000	20,000	4,100		75,000	43,000
1,700		43,000	20,000	4,200		75,000	43,000
1,800		46,000	22,000	4,300		80,000	47,000
1,900		46,000	22,000	4,370	11/64	80,000	47,000
2,000		49,000	24,000	4,400		80,000	47,000
2,100		49,000	24,000	4,500		80,000	47,000
2,200		53,000	27,000	4,600		80,000	47,000
2,300		53,000	27,000	4,650		80,000	47,000
2,380	3/32	57,000	30,000	4,700		80,000	47,000
2,400		57,000	30,000	4,760	3/16	86,000	52,000
2,500		57,000	30,000	4,800		86,000	52,000
2,600		57,000	30,000	4,900		86,000	52,000
2,700		61,000	33,000	5,000		86,000	52,000
2,780	7/64	61,000	33,000	5,100		86,000	52,000
2,800		61,000	33,000	5,160	13/64	86,000	52,000
2,900		61,000	33,000	5,200		86,000	52,000
3,000		61,000	33,000	5,300		86,000	52,000
3,100		65,000	36,000	5,400		93,000	57,000
3,170	1/8	65,000	36,000	5,500		93,000	57,000
3,200		65,000	36,000	5,550		93,000	57,000
3,300		65,000	36,000	5,560	7/32	93,000	57,000
3,400		70,000	39,000	5,600		93,000	57,000
3,500		70,000	39,000	5,700		93,000	57,000
3,570	9/64	70,000	39,000	5,800		93,000	57,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
5,900		93,000	57,000	8,500		117,000	75,000
5,950	15/64	93,000	57,000	8,600		125,000	81,000
6,000		93,000	57,000	8,700		125,000	81,000
6,100		101,000	63,000	8,730	11/32	125,000	81,000
6,200		101,000	63,000	8,800		125,000	81,000
6,300		101,000	63,000	8,900		125,000	81,000
6,350	1/4	101,000	63,000	9,000		125,000	81,000
6,400		101,000	63,000	9,100		125,000	81,000
6,500		101,000	63,000	9,200		125,000	81,000
6,600		101,000	63,000	9,300		125,000	81,000
6,700		101,000	63,000	9,400		125,000	81,000
6,800		109,000	69,000	9,500		125,000	81,000
6,900		109,000	69,000	9,600		133,000	87,000
7,000		109,000	69,000	9,700		133,000	87,000
7,100		109,000	69,000	9,800		133,000	87,000
7,140	9/32	109,000	69,000	9,900		133,000	87,000
7,200		109,000	69,000	10,000		133,000	87,000
7,300		109,000	69,000	10,100		133,000	87,000
7,400		109,000	69,000	10,200		133,000	87,000
7,500		109,000	69,000	10,300		133,000	87,000
7,600		117,000	75,000	10,500		133,000	87,000
7,700		117,000	75,000	11,000		142,000	94,000
7,800		117,000	75,000	11,110	7/16	142,000	94,000
7,900		117,000	75,000	11,200		142,000	94,000
7,940	5/16	117,000	75,000	11,500		142,000	94,000
8,000		117,000	75,000	12,000		151,000	101,000
8,100		117,000	75,000	12,500		151,000	101,000
8,200		117,000	75,000	13,000		151,000	101,000
8,300		117,000	75,000	13,500		160,000	108,000
8,400		117,000	75,000	14,000		160,000	108,000

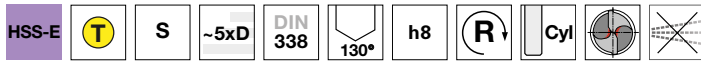


## Spiralbohrer kurz

### Artikel-Nr. 84807



P	M	K	N	S	H
○	●			●	



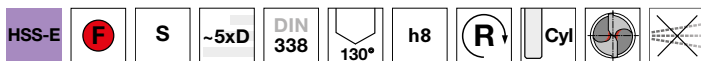
Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

Titan und Titanlegierungen • rost-/säure-/hitzebest. austen. Stähle • hochfeste/kurzspan. Stähle ab 900 N/mm<sup>2</sup> • Sonderlegierungen  
Hastelloy, Inconel, Nimonic

### Artikel-Nr. 84505

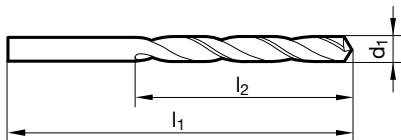


P	M	K	N	S	H
○	●			●	



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

Titan und Titanlegierungen • rost-/säure-/hitzebest. austen. Stähle • hochfeste/kurzspan. Stähle ab 900 N/mm<sup>2</sup> • Sonderlegierungen  
Hastelloy, Inconel, Nimonic



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,500		22,000	6,000	2,500		57,000	30,000
0,600		24,000	7,000	2,550		57,000	30,000
0,650		26,000	8,000	2,600		57,000	30,000
0,700		28,000	9,000	2,700		61,000	33,000
0,750		28,000	9,000	2,800		61,000	33,000
0,800		30,000	10,000	2,900		61,000	33,000
0,850		30,000	10,000	3,000		61,000	33,000
0,900		32,000	11,000	3,100		65,000	36,000
0,950		32,000	11,000	3,200		65,000	36,000
1,000		34,000	12,000	3,300		65,000	36,000
1,050		34,000	12,000	3,350		65,000	36,000
1,100		36,000	14,000	3,400		70,000	39,000
1,200		38,000	16,000	3,500		70,000	39,000
1,250		38,000	16,000	3,600		70,000	39,000
1,300		38,000	16,000	3,700		70,000	39,000
1,350		40,000	18,000	3,800		75,000	43,000
1,400		40,000	18,000	3,900		75,000	43,000
1,500		40,000	18,000	4,000		75,000	43,000
1,550		43,000	20,000	4,100		75,000	43,000
1,600		43,000	20,000	4,200		75,000	43,000
1,700		43,000	20,000	4,300		80,000	47,000
1,800		46,000	22,000	4,400		80,000	47,000
1,850		46,000	22,000	4,500		80,000	47,000
1,900		46,000	22,000	4,600		80,000	47,000
2,000		49,000	24,000	4,700		80,000	47,000
2,050		49,000	24,000	4,800		86,000	52,000
2,100		49,000	24,000	4,900		86,000	52,000
2,200		53,000	27,000	5,000		86,000	52,000
2,300		53,000	27,000	5,050		86,000	52,000
2,400		57,000	30,000	5,100		86,000	52,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
5,200		86,000	52,000	8,800		125,000	81,000
5,300		86,000	52,000	8,900		125,000	81,000
5,400		93,000	57,000	9,000		125,000	81,000
5,500		93,000	57,000	9,100		125,000	81,000
5,600		93,000	57,000	9,200		125,000	81,000
5,700		93,000	57,000	9,300		125,000	81,000
5,800		93,000	57,000	9,400		125,000	81,000
5,900		93,000	57,000	9,500		125,000	81,000
6,000		93,000	57,000	9,600		133,000	87,000
6,100		101,000	63,000	9,700		133,000	87,000
6,200		101,000	63,000	9,800		133,000	87,000
6,300		101,000	63,000	9,900		133,000	87,000
6,400		101,000	63,000	10,000		133,000	87,000
6,500		101,000	63,000	10,100		133,000	87,000
6,600		101,000	63,000	10,200		133,000	87,000
6,700		101,000	63,000	10,300		133,000	87,000
6,800		109,000	69,000	10,500		133,000	87,000
6,900		109,000	69,000	10,800		142,000	94,000
7,000		109,000	69,000	11,000		142,000	94,000
7,100		109,000	69,000	11,500		142,000	94,000
7,200		109,000	69,000	12,000		151,000	101,000
7,300		109,000	69,000	12,300	31/64	151,000	101,000
7,400		109,000	69,000	12,500		151,000	101,000
7,500		109,000	69,000	12,700	1/2	151,000	101,000
7,600		117,000	75,000	13,000		151,000	101,000
7,700		117,000	75,000				
7,800		117,000	75,000				
7,900		117,000	75,000				
8,000		117,000	75,000				
8,100		117,000	75,000				
8,200		117,000	75,000				
8,300		117,000	75,000				
8,400		117,000	75,000				
8,500		117,000	75,000				
8,600		125,000	81,000				
8,700		125,000	81,000				



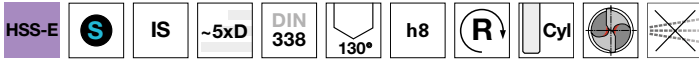


## Spiralbohrer kurz

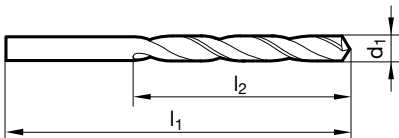
Artikel-Nr. 81078



P	M	K	N	S	H
○	●	○	○	○	



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff mit optimierter Kreuzausspitzung • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
rost-/säure-/hitzebest. austenit. Stähle (V2A und V4A) • Sonderlegierungen



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
1,000		34,000	12,000	5,200		86,000	52,000
1,100		36,000	14,000	5,300		86,000	52,000
1,200		38,000	16,000	5,400		93,000	57,000
1,300		38,000	16,000	5,500		93,000	57,000
1,400		40,000	18,000	5,600		93,000	57,000
1,500		40,000	18,000	5,700		93,000	57,000
1,600		43,000	20,000	5,800		93,000	57,000
1,700		43,000	20,000	5,900		93,000	57,000
1,800		46,000	22,000	6,000		93,000	57,000
1,900		46,000	22,000	6,100		101,000	63,000
2,000		49,000	24,000	6,200		101,000	63,000
2,100		49,000	24,000	6,300		101,000	63,000
2,200		53,000	27,000	6,400		101,000	63,000
2,300		53,000	27,000	6,500		101,000	63,000
2,400		57,000	30,000	6,600		101,000	63,000
2,500		57,000	30,000	6,700		101,000	63,000
2,600		57,000	30,000	6,800		109,000	69,000
2,700		61,000	33,000	6,900		109,000	69,000
2,800		61,000	33,000	7,000		109,000	69,000
2,900		61,000	33,000	7,100		109,000	69,000
3,000		61,000	33,000	7,200		109,000	69,000
3,100		65,000	36,000	7,300		109,000	69,000
3,200		65,000	36,000	7,400		109,000	69,000
3,300		65,000	36,000	7,500		109,000	69,000
3,400		70,000	39,000	7,600		117,000	75,000
3,500		70,000	39,000	7,700		117,000	75,000
3,600		70,000	39,000	7,800		117,000	75,000
3,700		70,000	39,000	7,900		117,000	75,000
3,800		75,000	43,000	8,000		117,000	75,000
3,900		75,000	43,000	8,100		117,000	75,000
4,000		75,000	43,000	8,200		117,000	75,000
4,100		75,000	43,000	8,300		117,000	75,000
4,200		75,000	43,000	8,400		117,000	75,000
4,300		80,000	47,000	8,500		117,000	75,000
4,400		80,000	47,000	8,600		125,000	81,000
4,500		80,000	47,000	8,700		125,000	81,000
4,600		80,000	47,000	8,800		125,000	81,000
4,700		80,000	47,000	8,900		125,000	81,000
4,800		86,000	52,000	9,000		125,000	81,000
4,900		86,000	52,000	9,100		125,000	81,000
5,000		86,000	52,000	9,200		125,000	81,000
5,100		86,000	52,000	9,300		125,000	81,000



HARTNER

### Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
9,400		125,000	81,000	11,800		142,000	94,000
9,500		125,000	81,000	12,000		151,000	101,000
9,600		133,000	87,000	12,500		151,000	101,000
9,700		133,000	87,000	13,000		151,000	101,000
9,800		133,000	87,000				
9,900		133,000	87,000				
10,000		133,000	87,000				
10,200		133,000	87,000				
10,500		133,000	87,000				
11,000		142,000	94,000				
11,200		142,000	94,000				
11,500		142,000	94,000				

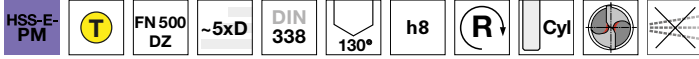


## Spiralbohrer kurz

Artikel-Nr. 84811

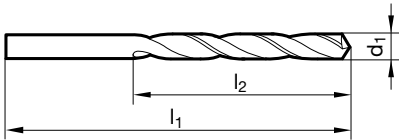


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • PM-Co-legierter HSS-Stahl • besonders hohe Stabilität • besonders hohe Verschleißfestigkeit

hochlegierte Stähle • Vergütungs- und Einsatzstähle • Gusseisen, Messing, Bronzen



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		34,000	12,000	6,300		101,000	63,000
1,200		38,000	16,000	6,350	1/4	101,000	63,000
1,300		38,000	16,000	6,700		101,000	63,000
1,400		40,000	18,000	6,800		109,000	69,000
1,500		40,000	18,000	7,000		109,000	69,000
1,600		43,000	20,000	7,140	9/32	109,000	69,000
1,700		43,000	20,000	7,400		109,000	69,000
2,000		49,000	24,000	7,900		117,000	75,000
2,100		49,000	24,000	7,940	5/16	117,000	75,000
2,200		53,000	27,000	8,000		117,000	75,000
2,300		53,000	27,000	8,500		117,000	75,000
2,380	3/32	57,000	30,000	8,730	11/32	125,000	81,000
2,500		57,000	30,000	9,000		125,000	81,000
2,600		57,000	30,000	9,300		125,000	81,000
2,780	7/64	61,000	33,000	9,500		125,000	81,000
2,900		61,000	33,000	9,800		133,000	87,000
3,000		61,000	33,000	10,000		133,000	87,000
3,100		65,000	36,000	10,200		133,000	87,000
3,170	1/8	65,000	36,000	10,500		133,000	87,000
3,300		65,000	36,000	11,000		142,000	94,000
3,500		70,000	39,000	11,110	7/16	142,000	94,000
3,570	9/64	70,000	39,000	11,500		142,000	94,000
3,600		70,000	39,000	12,000		151,000	101,000
3,700		70,000	39,000	12,500		151,000	101,000
4,000		75,000	43,000	13,000		151,000	101,000
4,100		75,000	43,000	13,500		160,000	108,000
4,200		75,000	43,000	14,000		160,000	108,000
4,760	3/16	86,000	52,000				
4,800		86,000	52,000				
5,000		86,000	52,000				
5,160	13/64	86,000	52,000				
5,400		93,000	57,000				
5,500		93,000	57,000				
5,560	7/32	93,000	57,000				
5,950	15/64	93,000	57,000				
6,000		93,000	57,000				

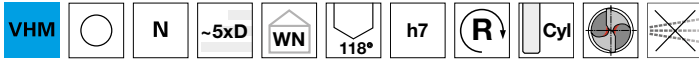


## Spiralbohrer kurz

Artikel-Nr. 89244

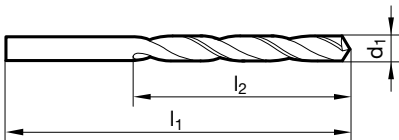


P	M	K	N	S	H
○	○	○	●	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Grauguss • Bronzen, Messing • Aluminium und Al-Legierungen • Magnesium und Mg-Legierungen • Kunststoffe und faserverstärkte Kunststoffe



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
1,000		34,000	12,000	4,600		80,000	47,000
1,100		36,000	14,000	4,700		80,000	47,000
1,200		38,000	16,000	4,760	3/16	86,000	52,000
1,300		38,000	16,000	4,800		86,000	52,000
1,400		40,000	18,000	4,900		86,000	52,000
1,500		40,000	18,000	5,000		86,000	52,000
1,600		43,000	20,000	5,100		86,000	52,000
1,700		43,000	20,000	5,160	13/64	86,000	52,000
1,800		46,000	22,000	5,200		86,000	52,000
1,900		46,000	22,000	5,300		86,000	52,000
2,000		49,000	24,000	5,400		93,000	57,000
2,100		49,000	24,000	5,500		93,000	57,000
2,200		53,000	27,000	5,560	7/32	93,000	57,000
2,300		53,000	27,000	5,600		93,000	57,000
2,380	3/32	57,000	30,000	5,700		93,000	57,000
2,400		57,000	30,000	5,800		93,000	57,000
2,500		57,000	30,000	5,900		93,000	57,000
2,600		57,000	30,000	5,950	15/64	93,000	57,000
2,700		61,000	33,000	6,000		93,000	57,000
2,780	7/64	61,000	33,000	6,100		101,000	63,000
2,800		61,000	33,000	6,200		101,000	63,000
2,900		61,000	33,000	6,300		101,000	63,000
3,000		61,000	33,000	6,350	1/4	101,000	63,000
3,100		65,000	36,000	6,400		101,000	63,000
3,170	1/8	65,000	36,000	6,500		101,000	63,000
3,200		65,000	36,000	6,600		101,000	63,000
3,300		65,000	36,000	6,700		101,000	63,000
3,400		70,000	39,000	6,800		109,000	69,000
3,500		70,000	39,000	6,900		109,000	69,000
3,570	9/64	70,000	39,000	7,000		109,000	69,000
3,600		70,000	39,000	7,100		109,000	69,000
3,700		70,000	39,000	7,140	9/32	109,000	69,000
3,800		75,000	43,000	7,200		109,000	69,000
3,900		75,000	43,000	7,300		109,000	69,000
3,970	5/32	75,000	43,000	7,400		109,000	69,000
4,000		75,000	43,000	7,500		109,000	69,000
4,100		75,000	43,000	7,600		117,000	75,000
4,200		75,000	43,000	7,700		117,000	75,000
4,300		80,000	47,000	7,800		117,000	75,000
4,370	11/64	80,000	47,000	7,900		117,000	75,000
4,400		80,000	47,000	7,940	5/16	117,000	75,000
4,500		80,000	47,000	8,000		117,000	75,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
8,200		117,000	75,000	9,900		133,000	87,000
8,300		117,000	75,000	10,000		133,000	87,000
8,400		117,000	75,000	10,200		133,000	87,000
8,500		117,000	75,000	10,300		133,000	87,000
8,600		125,000	81,000	10,500		133,000	87,000
8,700		125,000	81,000	10,720	27/64	142,000	94,000
8,730	11/32	125,000	81,000	11,000		142,000	94,000
8,800		125,000	81,000	11,110	7/16	142,000	94,000
8,900		125,000	81,000	11,500		142,000	94,000
9,000		125,000	81,000	11,910	15/32	151,000	101,000
9,100		125,000	81,000	12,000		151,000	101,000
9,200		125,000	81,000				
9,300		125,000	81,000				
9,400		125,000	81,000				
9,500		125,000	81,000				
9,600		133,000	87,000				
9,700		133,000	87,000				
9,800		133,000	87,000				

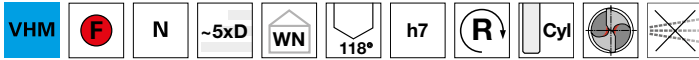


## Spiralbohrer kurz

Artikel-Nr. 89261

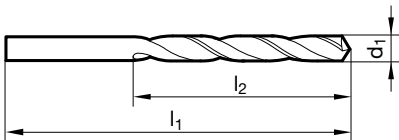


P	M	K	N	S	H
○	○	○	●	○	



Ausspitzung  $\geq \text{Ø } 2,060$  • Flächenanschliff • Hauptschneidenform gerade

Al-Werkstoffe mit hohem Si-Gehalt • Automatenstähle, Vergütungsstähle • Bau- und Einsatzstähle • Gusswerkstoffe • Kunststoffe und faserverstärkte Kunststoffe • Magnesium und Mg-Legierungen • Messing



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
1,000		34,000	12,000	3,800		75,000	43,000
1,100		36,000	14,000	3,900		75,000	43,000
1,190	3/64	38,000	16,000	3,970	5/32	75,000	43,000
1,200		38,000	16,000	4,000		75,000	43,000
1,300		38,000	16,000	4,040		75,000	43,000
1,400		40,000	18,000	4,100		75,000	43,000
1,500		40,000	18,000	4,200		75,000	43,000
1,590	1/16	43,000	20,000	4,300		80,000	47,000
1,600		43,000	20,000	4,370	11/64	80,000	47,000
1,700		43,000	20,000	4,400		80,000	47,000
1,780		46,000	22,000	4,500		80,000	47,000
1,800		46,000	22,000	4,600		80,000	47,000
1,850		46,000	22,000	4,700		80,000	47,000
1,900		46,000	22,000	4,760	3/16	86,000	52,000
1,980	5/64	49,000	24,000	4,800		86,000	52,000
2,000		49,000	24,000	4,850		86,000	52,000
2,060		49,000	24,000	4,900		86,000	52,000
2,100		49,000	24,000	5,000		86,000	52,000
2,200		53,000	27,000	5,060		86,000	52,000
2,300		53,000	27,000	5,100		86,000	52,000
2,380	3/32	57,000	30,000	5,160	13/64	86,000	52,000
2,400		57,000	30,000	5,200		86,000	52,000
2,500		57,000	30,000	5,300		86,000	52,000
2,530		57,000	30,000	5,400		93,000	57,000
2,600		57,000	30,000	5,500		93,000	57,000
2,700		61,000	33,000	5,560	7/32	93,000	57,000
2,780	7/64	61,000	33,000	5,600		93,000	57,000
2,800		61,000	33,000	5,700		93,000	57,000
2,900		61,000	33,000	5,800		93,000	57,000
2,950		61,000	33,000	5,900		93,000	57,000
3,000		61,000	33,000	5,950	15/64	93,000	57,000
3,050		65,000	36,000	6,000		93,000	57,000
3,100		65,000	36,000	6,100		101,000	63,000
3,170	1/8	65,000	36,000	6,200		101,000	63,000
3,200		65,000	36,000	6,300		101,000	63,000
3,300		65,000	36,000	6,350	1/4	101,000	63,000
3,400		70,000	39,000	6,400		101,000	63,000
3,450		70,000	39,000	6,500		101,000	63,000
3,500		70,000	39,000	6,600		101,000	63,000
3,570	9/64	70,000	39,000	6,700		101,000	63,000
3,600		70,000	39,000	6,750	17/64	109,000	69,000
3,700		70,000	39,000	6,800		109,000	69,000



## Spiralbohrer kurz

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
6,900		109,000	69,000	9,130	23/64	125,000	81,000
7,000		109,000	69,000	9,200		125,000	81,000
7,100		109,000	69,000	9,500		125,000	81,000
7,140	9/32	109,000	69,000	9,520	3/8	133,000	87,000
7,300		109,000	69,000	9,600		133,000	87,000
7,400		109,000	69,000	9,800		133,000	87,000
7,500		109,000	69,000	9,920	25/64	133,000	87,000
7,540	19/64	117,000	75,000	10,000		133,000	87,000
7,600		117,000	75,000	10,200		133,000	87,000
7,800		117,000	75,000	10,300		133,000	87,000
7,900		117,000	75,000	10,320	13/32	133,000	87,000
7,940	5/16	117,000	75,000	10,500		133,000	87,000
8,000		117,000	75,000	10,720	27/64	142,000	94,000
8,030		117,000	75,000	11,000		142,000	94,000
8,100		117,000	75,000	11,110	7/16	142,000	94,000
8,200		117,000	75,000	11,500		142,000	94,000
8,330	21/64	117,000	75,000	12,000		151,000	101,000
8,400		117,000	75,000				
8,500		117,000	75,000				
8,600		125,000	81,000				
8,700		125,000	81,000				
8,730	11/32	125,000	81,000				
9,000		125,000	81,000				
9,100		125,000	81,000				

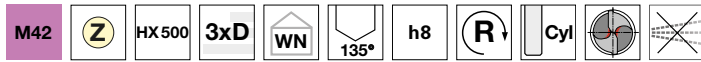


## Kurznutbohrer

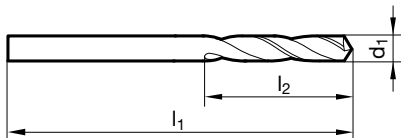
Artikel-Nr. 81000



P	M	K	N	S	H
●	○	●	○	●	○



Ausspitzung  $\geq \varnothing 1,000$  • besonders hohe Verschleißfestigkeit • optimierter Kreuzanschliff • 8%-kobaltlegierter HSCO-Schnellarbeitsstahl für die Hochleistungsbearbeitung in Bau- und Einsatzstähle • verschleißfeste Bleche • Hardox



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	34,000	6,000	8,000	117,000	37,000
1,500	40,000	9,000	8,500	117,000	37,000
2,000	49,000	12,000	9,000	125,000	40,000
2,500	57,000	14,000	9,500	125,000	40,000
3,000	61,000	16,000	10,000	133,000	43,000
3,200	65,000	18,000	10,200	133,000	43,000
3,300	65,000	18,000	10,500	133,000	43,000
3,500	70,000	20,000	11,000	142,000	47,000
4,000	75,000	22,000	11,500	142,000	47,000
4,200	75,000	22,000	12,000	151,000	51,000
4,500	80,000	24,000	12,500	151,000	51,000
5,000	86,000	26,000	13,000	151,000	51,000
5,500	93,000	28,000			
6,000	93,000	28,000			
6,500	101,000	31,000			
6,800	109,000	34,000			
7,000	109,000	34,000			
7,500	109,000	34,000			

	Hardox HiTuf	Hardox 400	Hardox 450	Hardox 500
$v_c$ (m/min)	~11	~8	~6	~4
vrc	~3	~2	~1	
$\varnothing$	f/rpm			
2.5	0.035/1400	0.025/1000	0.015/770	0.005/500
3	0.04/1200	0.03/850	0.02/640	0.01/430
4	0.05/900	0.04/650	0.03/480	0.02/320
5	0.06/700	0.05/510	0.04/400	0.03/255
6	0.07/590	0.06/430	0.05/320	0.04/220
7	0.08/500	0.07/370	0.06/280	0.05/190
8	0.09/440	0.08/320	0.07/240	0.06/160
10	0.11/350	0.10/260	0.09/200	0.08/130
13	0.14/270	0.13/200	0.12/150	0.1/100





## Spiralbohrer mit verst. Zylinderschaft

Artikel-Nr. 84805

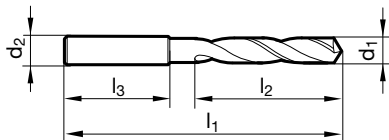


P	M	K	N	S	H
•	•	•	•		



Ausspitzung  $\geq \varnothing 2,000$  • Flächenanschliff • geringe Vorschubkraft notwendig • PM-Co-legierter HSS-Stahl • geringes Drehmoment notwendig • höhere Verschleißfestigkeit • universell einsetzbar

Stähle (legiert/unleg.) bis 800 N/mm<sup>2</sup> • Kalt-/Warmarbeitsstähle • rostfreie Stähle • NE-Metalle • Gusswerkstoffe • Kunststoffe • Wälzlagerstähle



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
1,000		3,000	38,000	6,000	28,000	4,600		6,000	68,000	24,000	36,000
1,100		3,000	39,000	7,000	28,000	4,650		6,000	68,000	24,000	36,000
1,200		3,000	40,000	8,000	28,000	4,700		6,000	68,000	24,000	36,000
1,300		3,000	40,000	8,000	28,000	4,760	3/16	6,000	70,000	26,000	36,000
1,400		3,000	41,000	9,000	28,000	4,800		6,000	70,000	26,000	36,000
1,500		3,000	41,000	9,000	28,000	4,900		6,000	70,000	26,000	36,000
1,600		3,000	42,000	10,000	28,000	5,000		6,000	70,000	26,000	36,000
1,700		3,000	42,000	10,000	28,000	5,100		6,000	70,000	26,000	36,000
1,800		3,000	43,000	11,000	28,000	5,160	13/64	6,000	70,000	26,000	36,000
1,900		3,000	43,000	11,000	28,000	5,200		6,000	70,000	26,000	36,000
2,000		3,000	44,000	12,000	28,000	5,300		6,000	70,000	26,000	36,000
2,100		3,000	44,000	12,000	28,000	5,400		6,000	72,000	28,000	36,000
2,200		3,000	45,000	13,000	28,000	5,500		6,000	72,000	28,000	36,000
2,300		3,000	45,000	13,000	28,000	5,550		6,000	72,000	28,000	36,000
2,380	3/32	3,000	46,000	14,000	28,000	5,560	7/32	6,000	72,000	28,000	36,000
2,400		3,000	46,000	14,000	28,000	5,600		6,000	72,000	28,000	36,000
2,500		3,000	46,000	14,000	28,000	5,700		6,000	72,000	28,000	36,000
2,600		3,000	46,000	14,000	28,000	5,800		6,000	72,000	28,000	36,000
2,700		3,000	48,000	16,000	28,000	5,900		6,000	72,000	28,000	36,000
2,780	7/64	3,000	48,000	16,000	28,000	5,950	15/64	6,000	72,000	28,000	36,000
2,800		3,000	48,000	16,000	28,000	6,000		6,000	72,000	28,000	36,000
2,900		3,000	48,000	16,000	28,000	6,100		8,000	75,000	31,000	36,000
3,000		3,000	48,000	16,000	28,000	6,200		8,000	75,000	31,000	36,000
3,100		4,000	50,000	18,000	28,000	6,300		8,000	75,000	31,000	36,000
3,170	1/8	4,000	50,000	18,000	28,000	6,350	1/4	8,000	75,000	31,000	36,000
3,200		4,000	50,000	18,000	28,000	6,400		8,000	75,000	31,000	36,000
3,300		4,000	50,000	18,000	28,000	6,500		8,000	75,000	31,000	36,000
3,400		4,000	52,000	20,000	28,000	6,600		8,000	75,000	31,000	36,000
3,500		4,000	52,000	20,000	28,000	6,700		8,000	75,000	31,000	36,000
3,570	9/64	4,000	52,000	20,000	28,000	6,750	17/64	8,000	78,000	34,000	36,000
3,600		4,000	52,000	20,000	28,000	6,800		8,000	78,000	34,000	36,000
3,700		4,000	52,000	20,000	28,000	6,900		8,000	78,000	34,000	36,000
3,800		4,000	54,000	22,000	28,000	7,000		8,000	78,000	34,000	36,000
3,900		4,000	54,000	22,000	28,000	7,100		8,000	78,000	34,000	36,000
3,970	5/32	4,000	54,000	22,000	28,000	7,140	9/32	8,000	78,000	34,000	36,000
4,000		4,000	54,000	22,000	28,000	7,200		8,000	78,000	34,000	36,000
4,100		6,000	66,000	22,000	36,000	7,300		8,000	78,000	34,000	36,000
4,200		6,000	66,000	22,000	36,000	7,400		8,000	78,000	34,000	36,000
4,300		6,000	68,000	24,000	36,000	7,500		8,000	78,000	34,000	36,000
4,370	11/64	6,000	68,000	24,000	36,000	7,540	19/64	8,000	81,000	37,000	36,000
4,400		6,000	68,000	24,000	36,000	7,550		8,000	81,000	37,000	36,000
4,500		6,000	68,000	24,000	36,000	7,600		8,000	81,000	37,000	36,000



## Spiralbohrer mit verst. Zylinderschaft

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
7,700		8,000	81,000	37,000	36,000	11,500		12,000	104,000	47,000	45,000
7,800		8,000	81,000	37,000	36,000	11,510	29/64	12,000	104,000	47,000	45,000
7,900		8,000	81,000	37,000	36,000	11,600		12,000	104,000	47,000	45,000
7,940	5/16	8,000	81,000	37,000	36,000	11,700		12,000	104,000	47,000	45,000
8,000		8,000	81,000	37,000	36,000	11,800		12,000	104,000	47,000	45,000
8,100		10,000	87,000	37,000	40,000	11,900		12,000	108,000	51,000	45,000
8,200		10,000	87,000	37,000	40,000	11,910	15/32	12,000	108,000	51,000	45,000
8,300		10,000	87,000	37,000	40,000	12,000		12,000	108,000	51,000	45,000
8,330	21/64	10,000	87,000	37,000	40,000	12,100		16,000	111,000	51,000	48,000
8,400		10,000	87,000	37,000	40,000	12,200		16,000	111,000	51,000	48,000
8,500		10,000	87,000	37,000	40,000	12,300	31/64	16,000	111,000	51,000	48,000
8,600		10,000	91,000	40,000	40,000	12,400		16,000	111,000	51,000	48,000
8,700		10,000	91,000	40,000	40,000	12,500		16,000	111,000	51,000	48,000
8,730	11/32	10,000	91,000	40,000	40,000	12,600		16,000	111,000	51,000	48,000
8,800		10,000	91,000	40,000	40,000	12,700	1/2	16,000	111,000	51,000	48,000
8,900		10,000	91,000	40,000	40,000	12,800		16,000	111,000	51,000	48,000
9,000		10,000	91,000	40,000	40,000	12,900		16,000	111,000	51,000	48,000
9,100		10,000	91,000	40,000	40,000	13,000		16,000	111,000	51,000	48,000
9,130	23/64	10,000	91,000	40,000	40,000	13,100	33/64	16,000	111,000	51,000	48,000
9,200		10,000	91,000	40,000	40,000	13,490	17/32	16,000	114,000	54,000	48,000
9,300		10,000	91,000	40,000	40,000	13,500		16,000	114,000	54,000	48,000
9,400		10,000	91,000	40,000	40,000	13,890	35/64	16,000	114,000	54,000	48,000
9,500		10,000	91,000	40,000	40,000	14,000		16,000	114,000	54,000	48,000
9,520	3/8	10,000	93,000	43,000	40,000	14,290	9/16	16,000	116,000	56,000	48,000
9,550		10,000	93,000	43,000	40,000	14,500		16,000	116,000	56,000	48,000
9,600		10,000	93,000	43,000	40,000	15,000		16,000	116,000	56,000	48,000
9,700		10,000	93,000	43,000	40,000	15,500		16,000	118,000	58,000	48,000
9,800		10,000	93,000	43,000	40,000	15,870	5/8	16,000	118,000	58,000	48,000
9,900		10,000	93,000	43,000	40,000	16,000		16,000	118,000	58,000	48,000
9,920	25/64	10,000	93,000	43,000	40,000	16,500		20,000	126,000	60,000	50,000
10,000		10,000	93,000	43,000	40,000	16,670	21/32	20,000	126,000	60,000	50,000
10,100		12,000	100,000	43,000	45,000	17,000		20,000	126,000	60,000	50,000
10,200		12,000	100,000	43,000	45,000	17,500		20,000	128,000	62,000	50,000
10,300		12,000	100,000	43,000	45,000	18,000		20,000	128,000	62,000	50,000
10,320	13/32	12,000	100,000	43,000	45,000	18,500		20,000	130,000	64,000	50,000
10,400		12,000	100,000	43,000	45,000	19,000		20,000	130,000	64,000	50,000
10,500		12,000	100,000	43,000	45,000	19,500		20,000	132,000	66,000	50,000
10,600		12,000	100,000	43,000	45,000	20,000		20,000	132,000	66,000	50,000
10,700		12,000	104,000	47,000	45,000						
10,720	27/64	12,000	104,000	47,000	45,000						
10,800		12,000	104,000	47,000	45,000						
10,900		12,000	104,000	47,000	45,000						
11,000		12,000	104,000	47,000	45,000						
11,100		12,000	104,000	47,000	45,000						
11,110	7/16	12,000	104,000	47,000	45,000						
11,200		12,000	104,000	47,000	45,000						
11,300		12,000	104,000	47,000	45,000						
11,400		12,000	104,000	47,000	45,000						



## Spiralbohrer mit verst. Zylinderschaft

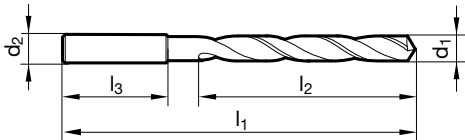
Artikel-Nr. 84801



P	M	K	N	S	H
•	•	•	•		



Ausspitzung  $\geq \varnothing 2,000$  • Flächenanschliff • geringe Vorschubkraft notwendig • geringes Drehmoment notwendig • PM-Co-legierter HSS-Stahl • höhere Verschleißfestigkeit • universell einsetzbar  
 Stähle (legiert/unleg.) bis 800 N/mm<sup>2</sup> • Kalt-/Warmarbeitsstähle • rostfreie Stähle • NE-Metalle • Gusswerkstoffe • Kunststoffe



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
2,000		3,000	56,000	24,000	28,000	5,300		6,000	96,000	52,000	36,000
2,100		3,000	56,000	24,000	28,000	5,400		6,000	101,000	57,000	36,000
2,200		3,000	59,000	27,000	28,000	5,500		6,000	101,000	57,000	36,000
2,300		3,000	59,000	27,000	28,000	5,550		6,000	101,000	57,000	36,000
2,380	3/32	3,000	62,000	30,000	28,000	5,560	7/32	6,000	101,000	57,000	36,000
2,400		3,000	62,000	30,000	28,000	5,600		6,000	101,000	57,000	36,000
2,500		3,000	62,000	30,000	28,000	5,700		6,000	101,000	57,000	36,000
2,600		3,000	62,000	30,000	28,000	5,800		6,000	101,000	57,000	36,000
2,700		3,000	65,000	33,000	28,000	5,900		6,000	101,000	57,000	36,000
2,780	7/64	3,000	65,000	33,000	28,000	5,950	15/64	6,000	101,000	57,000	36,000
2,800		3,000	65,000	33,000	28,000	6,000		6,000	101,000	57,000	36,000
2,900		3,000	65,000	33,000	28,000	6,100		8,000	107,000	63,000	36,000
3,000		3,000	65,000	33,000	28,000	6,200		8,000	107,000	63,000	36,000
3,100		4,000	68,000	36,000	28,000	6,300		8,000	107,000	63,000	36,000
3,170	1/8	4,000	68,000	36,000	28,000	6,350	1/4	8,000	107,000	63,000	36,000
3,200		4,000	68,000	36,000	28,000	6,400		8,000	107,000	63,000	36,000
3,300		4,000	68,000	36,000	28,000	6,500		8,000	107,000	63,000	36,000
3,400		4,000	71,000	39,000	28,000	6,600		8,000	107,000	63,000	36,000
3,500		4,000	71,000	39,000	28,000	6,700		8,000	107,000	63,000	36,000
3,570	9/64	4,000	71,000	39,000	28,000	6,750	17/64	8,000	113,000	69,000	36,000
3,600		4,000	71,000	39,000	28,000	6,800		8,000	113,000	69,000	36,000
3,700		4,000	71,000	39,000	28,000	6,900		8,000	113,000	69,000	36,000
3,800		4,000	75,000	43,000	28,000	7,000		8,000	113,000	69,000	36,000
3,900		4,000	75,000	43,000	28,000	7,100		8,000	113,000	69,000	36,000
3,970	5/32	4,000	75,000	43,000	28,000	7,140	9/32	8,000	113,000	69,000	36,000
4,000		4,000	75,000	43,000	28,000	7,200		8,000	113,000	69,000	36,000
4,100		6,000	87,000	43,000	36,000	7,300		8,000	113,000	69,000	36,000
4,200		6,000	87,000	43,000	36,000	7,400		8,000	113,000	69,000	36,000
4,300		6,000	91,000	47,000	36,000	7,500		8,000	113,000	69,000	36,000
4,370	11/64	6,000	91,000	47,000	36,000	7,540	19/64	8,000	119,000	75,000	36,000
4,400		6,000	91,000	47,000	36,000	7,550		8,000	119,000	75,000	36,000
4,500		6,000	91,000	47,000	36,000	7,600		8,000	119,000	75,000	36,000
4,600		6,000	91,000	47,000	36,000	7,700		8,000	119,000	75,000	36,000
4,650		6,000	91,000	47,000	36,000	7,800		8,000	119,000	75,000	36,000
4,700		6,000	91,000	47,000	36,000	7,900		8,000	119,000	75,000	36,000
4,760	3/16	6,000	96,000	52,000	36,000	7,940	5/16	8,000	119,000	75,000	36,000
4,800		6,000	96,000	52,000	36,000	8,000		8,000	119,000	75,000	36,000
4,900		6,000	96,000	52,000	36,000	8,100		10,000	125,000	75,000	40,000
5,000		6,000	96,000	52,000	36,000	8,200		10,000	125,000	75,000	40,000
5,100		6,000	96,000	52,000	36,000	8,300		10,000	125,000	75,000	40,000
5,160	13/64	6,000	96,000	52,000	36,000	8,330	21/64	10,000	125,000	75,000	40,000
5,200		6,000	96,000	52,000	36,000	8,400		10,000	125,000	75,000	40,000



## Spiralbohrer mit verst. Zylinderschaft

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
8,500		10,000	125,000	75,000	40,000	11,800		12,000	151,000	94,000	45,000
8,600		10,000	131,000	81,000	40,000	11,900		12,000	158,000	101,000	45,000
8,700		10,000	131,000	81,000	40,000	11,910	15/32	12,000	158,000	101,000	45,000
8,730	11/32	10,000	131,000	81,000	40,000	12,000		12,000	158,000	101,000	45,000
8,800		10,000	131,000	81,000	40,000	12,100		16,000	161,000	101,000	48,000
8,900		10,000	131,000	81,000	40,000	12,200		16,000	161,000	101,000	48,000
9,000		10,000	131,000	81,000	40,000	12,300	31/64	16,000	161,000	101,000	48,000
9,100		10,000	131,000	81,000	40,000	12,400		16,000	161,000	101,000	48,000
9,130	23/64	10,000	131,000	81,000	40,000	12,500		16,000	161,000	101,000	48,000
9,200		10,000	131,000	81,000	40,000	12,600		16,000	161,000	101,000	48,000
9,300		10,000	131,000	81,000	40,000	12,700	1/2	16,000	161,000	101,000	48,000
9,400		10,000	131,000	81,000	40,000	12,800		16,000	161,000	101,000	48,000
9,500		10,000	131,000	81,000	40,000	12,900		16,000	161,000	101,000	48,000
9,520	3/8	10,000	137,000	87,000	40,000	13,000		16,000	161,000	101,000	48,000
9,550		10,000	137,000	87,000	40,000	13,100	33/64	16,000	161,000	101,000	48,000
9,600		10,000	137,000	87,000	40,000	13,490	17/32	16,000	166,000	106,000	48,000
9,700		10,000	137,000	87,000	40,000	13,500		16,000	166,000	106,000	48,000
9,800		10,000	137,000	87,000	40,000	13,890	35/64	16,000	166,000	106,000	48,000
9,900		10,000	137,000	87,000	40,000	14,000		16,000	166,000	106,000	48,000
9,920	25/64	10,000	137,000	87,000	40,000	14,290	9/16	16,000	169,000	109,000	48,000
10,000		10,000	137,000	87,000	40,000	14,500		16,000	169,000	109,000	48,000
10,100		12,000	144,000	87,000	45,000	15,000		16,000	169,000	109,000	48,000
10,200		12,000	144,000	87,000	45,000	15,500		16,000	172,000	112,000	48,000
10,300		12,000	144,000	87,000	45,000	15,870	5/8	16,000	172,000	112,000	48,000
10,320	13/32	12,000	144,000	87,000	45,000	16,000		16,000	172,000	112,000	48,000
10,400		12,000	144,000	87,000	45,000	16,500		20,000	181,000	115,000	50,000
10,500		12,000	144,000	87,000	45,000	16,670	21/32	20,000	181,000	115,000	50,000
10,600		12,000	144,000	87,000	45,000	17,000		20,000	181,000	115,000	50,000
10,700		12,000	151,000	94,000	45,000	17,460	11/16	20,000	184,000	118,000	50,000
10,720	27/64	12,000	151,000	94,000	45,000	17,500		20,000	184,000	118,000	50,000
10,800		12,000	151,000	94,000	45,000	18,000		20,000	184,000	118,000	50,000
10,900		12,000	151,000	94,000	45,000	18,500		20,000	188,000	122,000	50,000
11,000		12,000	151,000	94,000	45,000	19,000		20,000	188,000	122,000	50,000
11,100		12,000	151,000	94,000	45,000	19,500		20,000	191,000	125,000	50,000
11,110	7/16	12,000	151,000	94,000	45,000	20,000		20,000	191,000	125,000	50,000
11,200		12,000	151,000	94,000	45,000						
11,300		12,000	151,000	94,000	45,000						
11,400		12,000	151,000	94,000	45,000						
11,500		12,000	151,000	94,000	45,000						
11,510	29/64	12,000	151,000	94,000	45,000						
11,600		12,000	151,000	94,000	45,000						
11,700		12,000	151,000	94,000	45,000						

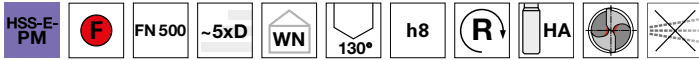


## Spiralbohrer mit verst. Zylinderschaft

Artikel-Nr. 84507

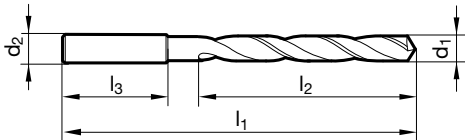


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • PM-Co-legierter HSS-Stahl • besonders hohe Verschleißfestigkeit • besonders hohe Stabilität

höherfeste Materialien, hochlegierte Stähle • Vergütungs- und Einsatzstähle • Gusseisen, Messing, Bronzen



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
2,000		3,000	56,000	24,000	28,000	6,000		6,000	101,000	57,000	36,000
2,100		3,000	56,000	24,000	28,000	6,100		8,000	107,000	63,000	36,000
2,200		3,000	59,000	27,000	28,000	6,200		8,000	107,000	63,000	36,000
2,300		3,000	59,000	27,000	28,000	6,300		8,000	107,000	63,000	36,000
2,380	3/32	3,000	62,000	30,000	28,000	6,400		8,000	107,000	63,000	36,000
2,400		3,000	62,000	30,000	28,000	6,500		8,000	107,000	63,000	36,000
2,500		3,000	62,000	30,000	28,000	6,600		8,000	107,000	63,000	36,000
2,600		3,000	62,000	30,000	28,000	6,700		8,000	107,000	63,000	36,000
2,700		3,000	65,000	33,000	28,000	6,750	17/64	8,000	113,000	69,000	36,000
2,800		3,000	65,000	33,000	28,000	6,800		8,000	113,000	69,000	36,000
2,900		3,000	65,000	33,000	28,000	6,900		8,000	113,000	69,000	36,000
3,000		3,000	65,000	33,000	28,000	7,000		8,000	113,000	69,000	36,000
3,100		4,000	68,000	36,000	28,000	7,100		8,000	113,000	69,000	36,000
3,170	1/8	4,000	68,000	36,000	28,000	7,200		8,000	113,000	69,000	36,000
3,200		4,000	68,000	36,000	28,000	7,300		8,000	113,000	69,000	36,000
3,300		4,000	68,000	36,000	28,000	7,400		8,000	113,000	69,000	36,000
3,400		4,000	71,000	39,000	28,000	7,500		8,000	113,000	69,000	36,000
3,500		4,000	71,000	39,000	28,000	7,700		8,000	119,000	75,000	36,000
3,600		4,000	71,000	39,000	28,000	7,800		8,000	119,000	75,000	36,000
3,700		4,000	71,000	39,000	28,000	8,000		8,000	119,000	75,000	36,000
3,800		4,000	75,000	43,000	28,000	8,100		10,000	125,000	75,000	40,000
3,900		4,000	75,000	43,000	28,000	8,200		10,000	125,000	75,000	40,000
4,000		4,000	75,000	43,000	28,000	8,300		10,000	125,000	75,000	40,000
4,100		6,000	87,000	43,000	36,000	8,400		10,000	125,000	75,000	40,000
4,200		6,000	87,000	43,000	36,000	8,500		10,000	125,000	75,000	40,000
4,300		6,000	91,000	47,000	36,000	8,600		10,000	131,000	81,000	40,000
4,400		6,000	91,000	47,000	36,000	8,700		10,000	131,000	81,000	40,000
4,500		6,000	91,000	47,000	36,000	8,730	11/32	10,000	131,000	81,000	40,000
4,600		6,000	91,000	47,000	36,000	8,800		10,000	131,000	81,000	40,000
4,650		6,000	91,000	47,000	36,000	9,000		10,000	131,000	81,000	40,000
4,700		6,000	91,000	47,000	36,000	9,300		10,000	131,000	81,000	40,000
4,800		6,000	96,000	52,000	36,000	9,500		10,000	131,000	81,000	40,000
4,900		6,000	96,000	52,000	36,000	9,700		10,000	137,000	87,000	40,000
5,000		6,000	96,000	52,000	36,000	9,800		10,000	137,000	87,000	40,000
5,100		6,000	96,000	52,000	36,000	9,900		10,000	137,000	87,000	40,000
5,160	13/64	6,000	96,000	52,000	36,000	10,000		10,000	137,000	87,000	40,000
5,300		6,000	96,000	52,000	36,000	10,200		12,000	144,000	87,000	45,000
5,400		6,000	101,000	57,000	36,000	10,300		12,000	144,000	87,000	45,000
5,500		6,000	101,000	57,000	36,000	10,400		12,000	144,000	87,000	45,000
5,550		6,000	101,000	57,000	36,000	10,500		12,000	144,000	87,000	45,000
5,600		6,000	101,000	57,000	36,000	10,600		12,000	144,000	87,000	45,000
5,950	15/64	6,000	101,000	57,000	36,000	11,000		12,000	151,000	94,000	45,000



## Spiralbohrer mit verst. Zylinderschaft

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
11,300		12,000	151,000	94,000	45,000	12,100		14,000	161,000	101,000	45,000
11,400		12,000	151,000	94,000	45,000	12,400		14,000	161,000	101,000	45,000
11,500		12,000	151,000	94,000	45,000	12,500		14,000	161,000	101,000	45,000
11,700		12,000	151,000	94,000	45,000	12,800		14,000	161,000	101,000	45,000
11,800		12,000	151,000	94,000	45,000	13,000		14,000	161,000	101,000	45,000
12,000		12,000	158,000	101,000	45,000						



# HARTNER

## Spiralbohrer-Sätze

Artikel-Nr. 88303



Kassette leer Code-Nr. 0,213 - 0,219  
Werkstattständer Code-Nr. 0,111 - 0,115

d1 mm	steigend um mm	Stück/Satz	Code-Nr.
1,0-5,0	0,1	41	0,111
5,1-10,0	0,1	50	0,112
1,0-10,0	0,5	19	0,113
1,0-13,0	0,5	25	0,114
1,0-5,9	0,1	50	0,115
1,0-10,0	0,5	19	0,213
1,0-13,0	0,5	25	0,214
1,0-5,9	0,1	50	0,215
6,0-10,0	0,1	41	0,216
1,0-10,5	0,5	32	0,219



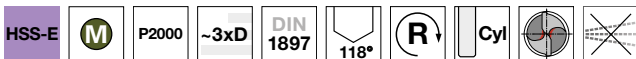
# HARTNER

## Spiralbohrer-Sätze

### Artikel-Nr. 88015



P	M	K	N	S	H
•	○	○	○		



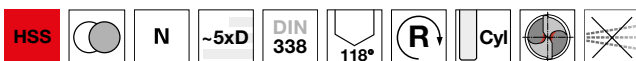
Ausspitzung  $\geq \varnothing 1,000$  • Satz in Metall-Kassette • Kegelmantelschliff

d1 mm	steigend um mm	Stück/Satz	Code-Nr.
1,0-5,0	0,1	41	0,011
5,1-10,0	0,1	50	0,012
1,0-13,0	0,5	25	0,014
1,0-10,5	0,5	24	0,018

### Artikel-Nr. 88013



P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 1,000$  • Satz in Kunststoff-Kassette • Kegelmantelschliff  
 Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen, Neusilber und Graphit

d1 mm	steigend um mm	Stück/Satz	Code-Nr.
1,0-10,0	0,5	19	0,013
1,0-13,0	0,5	25	0,014
1,0-5,9	0,1	50	0,015
6,0-10,0	0,1	41	0,016
1,0-10,5	0,5	32	0,019
1,0-5,0	0,1	41	0,311
1,0-13,0	0,5	25	0,314
1,0-5,9	0,1	50	0,315



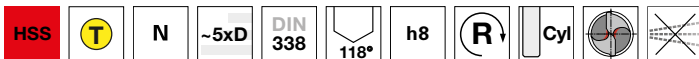


## Spiralbohrer-Sätze

### Artikel-Nr. 88016



P	M	K	N	S	H
•		•	○		



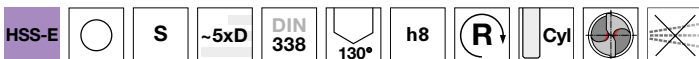
Ausspitzung  $\geq \varnothing 1,000$  • Satz in Kunststoff-Kassette • Kegelmantelanschliff • Kopfbeschichtung  
 Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen und Graphit

d1 mm	steigend um mm	Stück/Satz	Code-Nr.
1,0-13,0	0,5	25	6,014
1,0-5,9	0,1	50	6,015
6,0-10,0	0,1	41	6,016
1,0-10,5	0,5	24	6,018

### Artikel-Nr. 88014



P	M	K	N	S	H
○	•			•	



Ausspitzung  $\geq \varnothing 0,970$  • Satz in Kunststoff-Kassette • Kegelmantelanschliff  
 Titan und Titanlegierungen • rost-/säure-/hitzebest. austen. Stähle • hochfeste/kurzspan. Stähle ab 900 N/mm<sup>2</sup> • Sonderlegierungen  
 Hastelloy, Inconel, Nimonic

d1 mm	steigend um mm	Stück/Satz	Code-Nr.
1,0-5,0	0,1	41	8,011
5,1-10,0	0,1	50	8,012
1,0-10,0	0,5	19	8,013
1,0-13,0	0,5	25	8,014
1,0-10,5	0,5	24	8,018



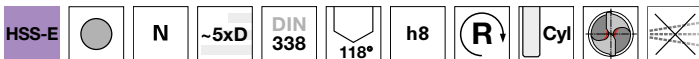
# HARTNER

## Spiralbohrer-Sätze

### Artikel-Nr. 88026



P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 1,000$  • Satz in Kunststoff-Kassette • Kegelmantelanschliff

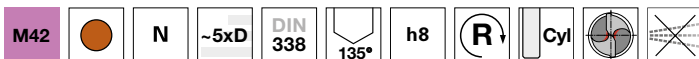
Stahl und Stahlguss (legiert und unleg.) • Gusswerkstoffe über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzgerstähle  
 • hochlegierte Stähle • Vergütungs- und Einsatzstähle

d1 mm	steigend um mm	Stück/Satz	Code-Nr.
1,0-10,0	0,5	19	3,013
1,0-13,0	0,5	25	3,014

### Artikel-Nr. 88018



P	M	K	N	S	H
•	•	•	•	•	○



Ausspitzung  $\geq \varnothing 1,000$  • bestückt mit M42-Spiralbohrer Artikel 81018

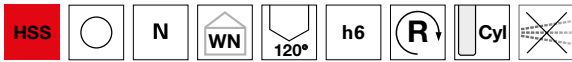
d1 mm	steigend um mm	Stück/Satz	Code-Nr.
1,0-10,0	0,5	19	0,013
1,0-13,0	0,5	25	0,014

## NC-Anbohrer

### Artikel-Nr. 81191



P	M	K	N	S	H
•	○	•	•	○	

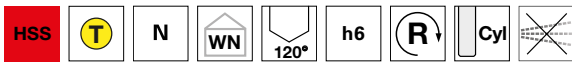


Kegelmantelanschiff • nur zum Anbohren geeignet  
universell einsetzbar

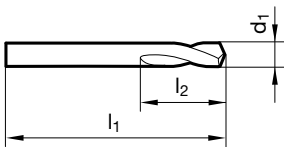
### Artikel-Nr. 84434



P	M	K	N	S	H
•	○	•	•	○	



Kegelmantelanschiff • nur zum Anbohren geeignet  
universell einsetzbar



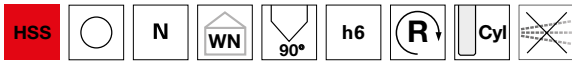
d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
3,000		46,000	12,000	12,000		102,000	30,000
4,000		55,000	12,000	14,000		107,000	33,500
5,000		62,000	14,000	15,000		111,000	33,500
6,000		66,000	16,000	16,000		115,000	37,500
8,000		79,000	21,000	20,000		131,000	45,000
10,000		89,000	25,000	25,000	63/64	151,000	53,000

## NC-Anbohrer

### Artikel-Nr. 81192



P	M	K	N	S	H
•	○	•	•	•	

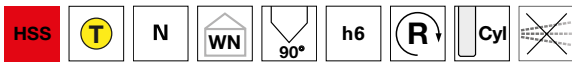


Kegelmantelanschiff • nur zum Anbohren geeignet  
universell einsetzbar

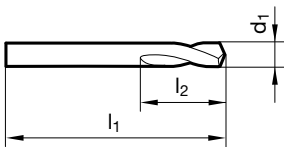
### Artikel-Nr. 84435



P	M	K	N	S	H
•	○	•	•	○	



Kegelmantelanschiff • nur zum Anbohren geeignet  
universell einsetzbar



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
3,000		46,000	12,000	12,000		102,000	30,000
4,000		55,000	12,000	14,000		107,000	33,500
5,000		62,000	14,000	16,000		115,000	37,500
6,000		66,000	16,000	20,000		131,000	45,000
8,000		79,000	21,000	25,000	63/64	151,000	53,000
10,000		89,000	25,000				

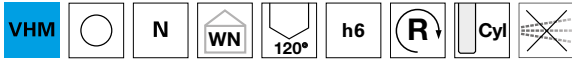


## NC-Anbohrer

### Artikel-Nr. 89242



<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
○	○	○	○	○	○



Flächenanschliff • nur zum Anbohren geeignet  
universell einsetzbar

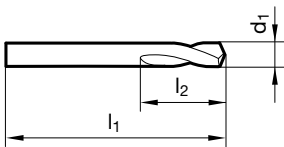
### Artikel-Nr. 89249



<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
○	○	○	○	○	○



Flächenanschliff • nur zum Anbohren geeignet  
universell einsetzbar



d1		l1	l2	d1		l1	l2
mm	inch	mm	mm	mm	inch	mm	mm
4,000		55,000	12,000	12,700	1/2	102,000	30,000
5,000		62,000	14,000	16,000		115,000	37,500
6,000		66,000	16,000	20,000		131,000	45,000
8,000		79,000	21,000				
10,000		89,000	25,000				
12,000		102,000	30,000				

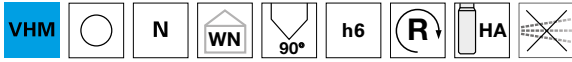


## NC-Anbohrer

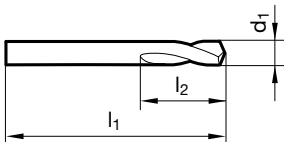
Artikel-Nr. 89243



<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
○	○	○	○	○	○



Flächenanschliff • nur zum Anbohren geeignet  
 universell einsetzbar



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
4,000	55,000	12,000	16,000	115,000	37,500
5,000	62,000	14,000	20,000	131,000	45,000
6,000	66,000	16,000			
8,000	79,000	21,000			
10,000	89,000	25,000			
12,000	102,000	30,000			

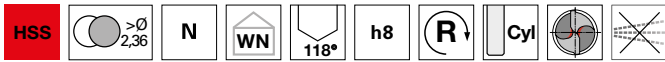


## Karosseriebohrer

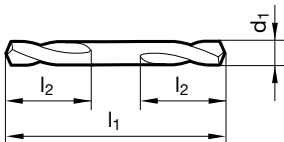
Artikel-Nr. 81190



P	M	K	N	S	H
•	○	•	•	•	



Ausspitzung  $\geq \text{Ø } 2,000$  • Kegelmantelschliff • für beidseitigen Einsatz • in Handbohrmaschinen im Karosseriebau dünnwandige Materialien



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
2,000	38,000	7,500	5,100	62,000	17,000
2,100	38,000	7,500	5,200	62,000	17,000
2,400	43,000	9,500	5,300	62,000	17,000
2,500	43,000	9,500	5,400	66,000	19,000
2,600	43,000	9,500	5,500	66,000	19,000
2,700	46,000	10,600	5,700	66,000	19,000
2,800	46,000	10,600	5,900	66,000	19,000
2,900	46,000	10,600	6,000	66,000	19,000
3,000	46,000	10,600	6,300	70,000	21,200
3,100	49,000	11,200	6,500	70,000	21,200
3,200	49,000	11,200	7,500	74,000	23,600
3,300	49,000	11,200	8,000	79,000	25,000
3,400	52,000	12,500	9,000	84,000	25,000
3,500	52,000	12,500	9,500	84,000	25,000
3,800	55,000	14,000	10,000	89,000	25,000
3,900	55,000	14,000			
4,000	55,000	14,000			
4,100	55,000	14,000			
4,200	55,000	14,000			
4,500	58,000	15,500			
4,700	58,000	15,500			
4,800	62,000	17,000			
4,900	62,000	17,000			
5,000	62,000	17,000			

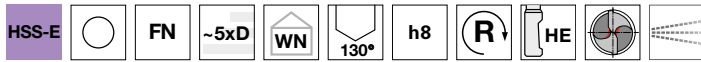


## Kühlkanalbohrer

### Artikel-Nr. 82761



P	M	K	N	S	H
•	•	•	•	•	



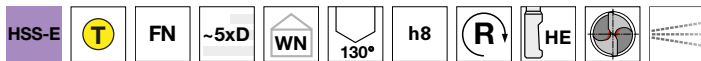
Ausspitzung  $\geq \varnothing 5,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl

langspanende Werkstoffe bis 1000 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe • NE-Metalle

### Artikel-Nr. 84461

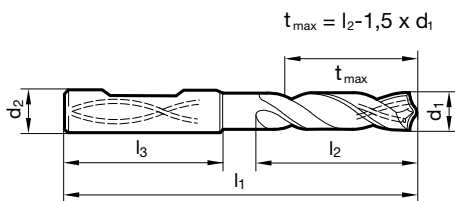


P	M	K	N	S	H
•	•	•	•	•	○



Ausspitzung  $\geq \varnothing 5,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

langspanende Werkstoffe bis 1000 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe • NE-Metalle



d1	d2	h6	l1	l2	l3	d1	d2	h6	l1	l2	l3
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
5,000	6,000		82,000	44,000	36,000	13,000	14,000		124,000	77,000	45,000
5,500	6,000		82,000	44,000	36,000	13,500	14,000		124,000	77,000	45,000
6,000	6,000		82,000	44,000	36,000	14,000	14,000		124,000	77,000	45,000
6,500	8,000		91,000	53,000	36,000	14,500	16,000		133,000	83,000	48,000
7,000	8,000		91,000	53,000	36,000	15,000	16,000		133,000	83,000	48,000
7,500	8,000		91,000	53,000	36,000	15,500	16,000		133,000	83,000	48,000
7,800	8,000		91,000	53,000	36,000	16,000	16,000		133,000	83,000	48,000
8,000	8,000		91,000	53,000	36,000	16,500	18,000		143,000	93,000	48,000
8,500	10,000		103,000	61,000	40,000	17,000	18,000		143,000	93,000	48,000
9,000	10,000		103,000	61,000	40,000	17,500	18,000		143,000	93,000	48,000
9,500	10,000		103,000	61,000	40,000	18,000	18,000		143,000	93,000	48,000
10,000	10,000		103,000	61,000	40,000	18,500	20,000		153,000	101,000	50,000
10,200	12,000		118,000	71,000	45,000	19,000	20,000		153,000	101,000	50,000
10,500	12,000		118,000	71,000	45,000	19,500	20,000		153,000	101,000	50,000
11,000	12,000		118,000	71,000	45,000	20,000	20,000		153,000	101,000	50,000
11,500	12,000		118,000	71,000	45,000						
12,000	12,000		118,000	71,000	45,000						
12,500	14,000		124,000	77,000	45,000						



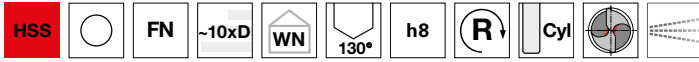


## Kühlkanalbohrer

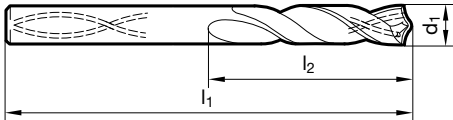
Artikel-Nr. 82710



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelanschleiff • auch zum Bohren durch Bohrbuchsen • besonders für Bohrtiefen über 5xD  
 Blechpakete • Stahl und Stahlguss, Grauguss • austenitische Stähle bis 800 N/mm<sup>2</sup>



d1 mm	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000	3,000	100,000	66,000	34,000	9,000	9,000	175,000	115,000	60,000
3,300	3,300	106,000	69,000	37,000	9,500	9,500	175,000	115,000	60,000
4,000	4,000	119,000	78,000	41,000	10,000	10,000	184,000	121,000	63,000
5,000	5,000	132,000	87,000	45,000	10,200	10,200	184,000	121,000	63,000
5,500	5,500	139,000	91,000	48,000	10,500	10,500	184,000	121,000	63,000
6,000	6,000	139,000	91,000	48,000	11,000	11,000	195,000	128,000	67,000
6,500	6,500	148,000	97,000	51,000	11,500	11,500	195,000	128,000	67,000
6,800	6,800	156,000	102,000	54,000	12,000	12,000	205,000	134,000	71,000
7,000	7,000	156,000	102,000	54,000	13,000	13,000	205,000	134,000	71,000
7,500	7,500	156,000	102,000	54,000					
8,000	8,000	165,000	109,000	56,000					
8,500	8,500	165,000	109,000	56,000					

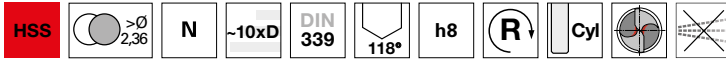


## Bohrbuchsenbohrer

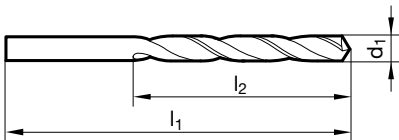
Artikel-Nr. 81210



P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • zum Bohren durch Bohrbuchsen • mit Mitnehmer nach DIN 1809  
 Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen, Neusilber und Graphit



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,800		42,000	22,000	4,900		108,000	74,000
0,950		45,000	24,000	5,000		108,000	74,000
1,000		48,000	26,000	5,100		108,000	74,000
1,200		52,000	30,000	5,200		108,000	74,000
1,250		52,000	30,000	5,300		108,000	74,000
1,350		55,000	33,000	5,350		116,000	80,000
1,400		55,000	33,000	5,400		116,000	80,000
1,450		55,000	33,000	5,500		116,000	80,000
1,500		55,000	33,000	5,550		116,000	80,000
1,700		58,000	35,000	5,600		116,000	80,000
1,800		62,000	38,000	5,700		116,000	80,000
1,900		62,000	38,000	5,750		116,000	80,000
2,000		66,000	41,000	5,800		116,000	80,000
2,300		70,000	44,000	5,900		116,000	80,000
2,350		70,000	44,000	5,950	15/64	116,000	80,000
2,400		74,000	47,000	6,000		116,000	80,000
2,450		74,000	47,000	6,200		124,000	86,000
2,500		74,000	47,000	6,400		124,000	86,000
2,600		74,000	47,000	6,500		124,000	86,000
2,900		79,000	51,000	6,600		124,000	86,000
3,000		79,000	51,000	6,700		124,000	86,000
3,050		84,000	55,000	6,750	17/64	133,000	93,000
3,100		84,000	55,000	6,900		133,000	93,000
3,200		84,000	55,000	7,000		133,000	93,000
3,250		84,000	55,000	7,100		133,000	93,000
3,300		84,000	55,000	7,200		133,000	93,000
3,400		91,000	60,000	7,400		133,000	93,000
3,500		91,000	60,000	7,500		133,000	93,000
3,600		91,000	60,000	7,600		142,000	100,000
3,700		91,000	60,000	7,700		142,000	100,000
3,750		91,000	60,000	7,800		142,000	100,000
3,800		96,000	64,000	8,000		142,000	100,000
3,900		96,000	64,000	8,200		142,000	100,000
4,000		96,000	64,000	8,250		142,000	100,000
4,050		96,000	64,000	8,500		142,000	100,000
4,200		96,000	64,000	8,600		151,000	107,000
4,300		102,000	69,000	8,700		151,000	107,000
4,400		102,000	69,000	8,800		151,000	107,000
4,500		102,000	69,000	9,000		151,000	107,000
4,600		102,000	69,000	9,100		151,000	107,000
4,700		102,000	69,000	9,400		151,000	107,000
4,800		108,000	74,000	9,500		151,000	107,000



## Bohrbuchsenbohrer

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
9,600		162,100	116,000	12,500		184,000	134,000
9,800		162,100	116,000	13,000		184,000	134,000
10,000		162,100	116,000	13,500		194,000	142,000
10,200		162,100	116,000	14,000		194,000	142,000
10,500		162,100	116,000	14,200		202,000	147,000
10,600		162,100	116,000	14,500		202,000	147,000
10,800		173,000	125,000	15,500		211,000	153,000
11,000		173,000	125,000	16,500		218,000	159,000
11,500		173,000	125,000	18,000		226,000	165,000
11,750		173,000	125,000	19,000		234,000	171,000
12,000		184,000	134,000				
12,200		184,000	134,000				



# HARTNER

## Spiralbohrer lang

Artikel-Nr. 81310

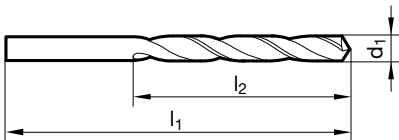


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • für tiefe Bohrungen

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen, Neusilber und Graphit



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,400		30,000	10,000	2,900		100,000	66,000
0,500		32,000	12,000	2,950		100,000	66,000
0,600		35,000	15,000	3,000		100,000	66,000
0,700		42,000	21,000	3,050		106,000	69,000
0,750		42,000	21,000	3,100		106,000	69,000
0,800		46,000	25,000	3,150		106,000	69,000
0,850		46,000	25,000	3,200		106,000	69,000
0,900		51,000	29,000	3,250		106,000	69,000
0,910		51,000	29,000	3,300		106,000	69,000
0,950		51,000	29,000	3,350		106,000	69,000
1,000		56,000	33,000	3,400		112,000	73,000
1,050		56,000	33,000	3,450		112,000	73,000
1,100		60,000	37,000	3,500		112,000	73,000
1,200		65,000	41,000	3,550		112,000	73,000
1,250		65,000	41,000	3,600		112,000	73,000
1,300		65,000	41,000	3,650		112,000	73,000
1,350		70,000	45,000	3,700		112,000	73,000
1,400		70,000	45,000	3,750		112,000	73,000
1,500		70,000	45,000	3,800		119,000	78,000
1,550		76,000	50,000	3,900		119,000	78,000
1,600		76,000	50,000	3,950		119,000	78,000
1,700		76,000	50,000	4,000		119,000	78,000
1,750		80,000	53,000	4,040		119,000	78,000
1,800		80,000	53,000	4,050		119,000	78,000
1,850		80,000	53,000	4,100		119,000	78,000
1,900		80,000	53,000	4,150		119,000	78,000
1,950		85,000	56,000	4,200		119,000	78,000
2,000		85,000	56,000	4,250		119,000	78,000
2,050		85,000	56,000	4,300		126,000	82,000
2,100		85,000	56,000	4,400		126,000	82,000
2,150		90,000	59,000	4,450		126,000	82,000
2,200		90,000	59,000	4,500		126,000	82,000
2,250		90,000	59,000	4,550		126,000	82,000
2,400		95,000	62,000	4,600		126,000	82,000
2,450		95,000	62,000	4,650		126,000	82,000
2,500		95,000	62,000	4,700		126,000	82,000
2,550		95,000	62,000	4,750		126,000	82,000
2,600		95,000	62,000	4,760	3/16	132,000	87,000
2,700		100,000	66,000	4,800		132,000	87,000
2,750		100,000	66,000	4,850		132,000	87,000
2,800		100,000	66,000	4,900		132,000	87,000
2,850		100,000	66,000	4,950		132,000	87,000



## Spiralbohrer lang

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
5,000		132,000	87,000	9,700		184,000	121,000
5,050		132,000	87,000	9,750		184,000	121,000
5,100		132,000	87,000	9,800		184,000	121,000
5,150		132,000	87,000	9,900		184,000	121,000
5,200		132,000	87,000	9,920	25/64	184,000	121,000
5,250		132,000	87,000	10,000		184,000	121,000
5,300		132,000	87,000	10,100		184,000	121,000
5,350		139,000	91,000	10,200		184,000	121,000
5,400		139,000	91,000	10,250		184,000	121,000
5,450		139,000	91,000	10,500		184,000	121,000
5,500		139,000	91,000	10,700		195,000	128,000
5,600		139,000	91,000	10,720	27/64	195,000	128,000
5,700		139,000	91,000	10,750		195,000	128,000
5,750		139,000	91,000	11,000		195,000	128,000
5,800		139,000	91,000	11,200		195,000	128,000
5,850		139,000	91,000	11,250		195,000	128,000
5,900		139,000	91,000	11,300		195,000	128,000
5,950	15/64	139,000	91,000	11,500		195,000	128,000
6,000		139,000	91,000	11,700		195,000	128,000
6,100		148,000	97,000	11,750		195,000	128,000
6,150		148,000	97,000	11,800		195,000	128,000
6,200		148,000	97,000	12,000		205,000	134,000
6,250		148,000	97,000	12,100		205,000	134,000
6,300		148,000	97,000	12,200		205,000	134,000
6,350	1/4	148,000	97,000	12,300	31/64	205,000	134,000
6,400		148,000	97,000	12,500		205,000	134,000
6,500		148,000	97,000	12,700	1/2	205,000	134,000
6,600		148,000	97,000	12,800		205,000	134,000
6,700		148,000	97,000	13,000		205,000	134,000
6,750	17/64	156,000	102,000	13,490	17/32	214,000	140,000
6,800		156,000	102,000	13,500		214,000	140,000
6,900		156,000	102,000	14,000		214,000	140,000
7,000		156,000	102,000	14,200		220,000	144,000
7,100		156,000	102,000	14,250		220,000	144,000
7,200		156,000	102,000	14,500		220,000	144,000
7,250		156,000	102,000	14,800		220,000	144,000
7,300		156,000	102,000	14,900		220,000	144,000
7,400		156,000	102,000	15,000		220,000	144,000
7,500		156,000	102,000	15,100		227,000	149,000
7,700		165,000	109,000	15,200		227,000	149,000
7,800		165,000	109,000	15,250		227,000	149,000
7,900		165,000	109,000	15,500		227,000	149,000
7,940	5/16	165,000	109,000	15,600		227,000	149,000
8,000		165,000	109,000	16,000		227,000	149,000
8,100		165,000	109,000	16,500		235,000	154,000
8,200		165,000	109,000	17,000		235,000	154,000
8,250		165,000	109,000	17,500		241,000	158,000
8,300		165,000	109,000	18,000		241,000	158,000
8,400		165,000	109,000	18,500		247,000	162,000
8,500		165,000	109,000	19,000		247,000	162,000
8,600		175,000	115,000	20,000		254,000	166,000
8,700		175,000	115,000	21,000		261,000	171,000
8,800		175,000	115,000	22,000		268,000	176,000
8,900		175,000	115,000				
9,000		175,000	115,000				
9,200		175,000	115,000				
9,300		175,000	115,000				
9,400		175,000	115,000				
9,500		175,000	115,000				
9,600		184,000	121,000				



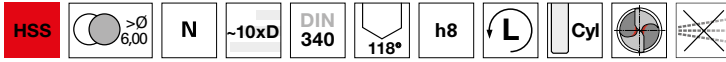
# HARTNER

## Spiralbohrer lang

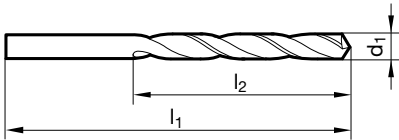
Artikel-Nr. 81315



P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \text{Ø } 15,000$  • Kegelmantelschliff • für tiefe Bohrungen • zum Bohren durch Bohrbuchsen  
 Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen, Neusilber und Graphit



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
0,900	51,000	29,000	7,900	165,000	109,000
1,200	65,000	41,000	8,000	165,000	109,000
1,250	65,000	41,000	8,500	165,000	109,000
1,500	70,000	45,000	9,000	175,000	115,000
1,550	76,000	50,000	10,000	184,000	121,000
2,800	100,000	66,000	11,000	195,000	128,000
2,900	100,000	66,000	12,000	205,000	134,000
3,000	100,000	66,000			
3,800	119,000	78,000			
4,000	119,000	78,000			
4,200	119,000	78,000			
4,500	126,000	82,000			
5,000	132,000	87,000			
5,700	139,000	91,000			
5,800	139,000	91,000			
6,000	139,000	91,000			
6,500	148,000	97,000			
7,500	156,000	102,000			



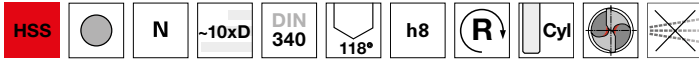
# HARTNER

## Spiralbohrer lang

Artikel-Nr. 81317

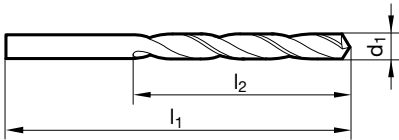


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 3,100$  • Kegelmantelschliff • mit Mitnehmer

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen, Neusilber und Graphit



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
3,100	106,000	69,000	6,600	148,000	97,000
3,400	112,000	73,000	7,000	156,000	102,000
3,600	112,000	73,000	7,300	156,000	102,000
3,700	112,000	73,000	7,400	156,000	102,000
4,000	119,000	78,000	7,500	156,000	102,000
4,300	126,000	82,000	7,900	165,000	109,000
4,500	126,000	82,000	8,000	165,000	109,000
4,900	132,000	87,000	8,250	165,000	109,000
5,000	132,000	87,000	8,400	165,000	109,000
5,500	139,000	91,000	8,700	175,000	115,000
5,700	139,000	91,000	10,000	184,000	121,000
6,100	148,000	97,000	12,200	205,000	134,000

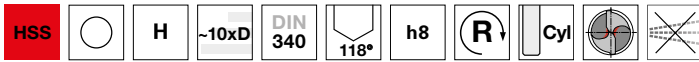


## Spiralbohrer lang

Artikel-Nr. 81320

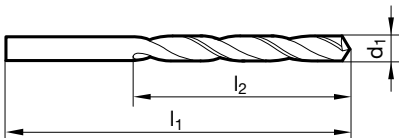


P	M	K	N	S	H
			•		



Ausspitzung  $\geq \varnothing 14,500$  • Kegelmantelschliff • für tiefe Bohrungen

harte und spröde Werkstoffe • Messing, Magnesium-Legierungen • Bronzen, Phosphorbronze • Schiefer, Glimmer, Pertinax



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
0,500	32,000	12,000	4,000	119,000	78,000
0,600	35,000	15,000	4,100	119,000	78,000
0,700	42,000	21,000	4,200	119,000	78,000
0,750	42,000	21,000	4,400	126,000	82,000
0,800	46,000	25,000	4,500	126,000	82,000
0,900	51,000	29,000	4,700	126,000	82,000
1,000	56,000	33,000	4,900	132,000	87,000
1,050	56,000	33,000	5,000	132,000	87,000
1,100	60,000	37,000	5,200	132,000	87,000
1,150	60,000	37,000	5,300	132,000	87,000
1,200	65,000	41,000	5,400	139,000	91,000
1,300	65,000	41,000	5,500	139,000	91,000
1,400	70,000	45,000	5,700	139,000	91,000
1,450	70,000	45,000	5,800	139,000	91,000
1,500	70,000	45,000	5,900	139,000	91,000
1,600	76,000	50,000	6,000	139,000	91,000
1,700	76,000	50,000	6,300	148,000	97,000
1,800	80,000	53,000	6,500	148,000	97,000
1,850	80,000	53,000	6,600	148,000	97,000
1,900	80,000	53,000	6,700	148,000	97,000
2,000	85,000	56,000	6,800	156,000	102,000
2,200	90,000	59,000	7,000	156,000	102,000
2,300	90,000	59,000	7,500	156,000	102,000
2,500	95,000	62,000	8,000	165,000	109,000
2,600	95,000	62,000	8,250	165,000	109,000
2,700	100,000	66,000	9,000	175,000	115,000
2,900	100,000	66,000	9,250	175,000	115,000
3,000	100,000	66,000	10,000	184,000	121,000
3,100	106,000	69,000	14,000	214,000	140,000
3,200	106,000	69,000	14,500	220,000	144,000
3,250	106,000	69,000			
3,300	106,000	69,000			
3,400	112,000	73,000			
3,500	112,000	73,000			
3,600	112,000	73,000			
3,900	119,000	78,000			



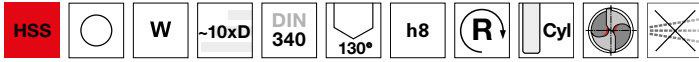


## Spiralbohrer lang

Artikel-Nr. 81330

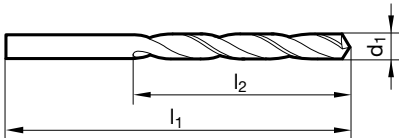


P	M	K	N	S	H
			•		



Ausspitzung  $\geq \text{Ø } 14,250$  • Kegelmantelanschliff • für tiefe Bohrungen

weiche, langspanende Werkstoffe • Aluminium, Al-Legierungen (langspanend) • Zink, Hüttenkupfer, Silumin, Elektron • Kunststoffe (weich), Holz



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,500		32,000	12,000	3,750		112,000	73,000
0,600		35,000	15,000	3,800		119,000	78,000
0,700		42,000	21,000	3,900		119,000	78,000
0,800		46,000	25,000	4,000		119,000	78,000
0,850		46,000	25,000	4,100		119,000	78,000
0,900		51,000	29,000	4,200		119,000	78,000
0,950		51,000	29,000	4,250		119,000	78,000
1,000		56,000	33,000	4,300		126,000	82,000
1,050		56,000	33,000	4,500		126,000	82,000
1,200		65,000	41,000	4,600		126,000	82,000
1,250		65,000	41,000	4,700		126,000	82,000
1,300		65,000	41,000	4,900		132,000	87,000
1,350		70,000	45,000	5,000		132,000	87,000
1,400		70,000	45,000	5,100		132,000	87,000
1,500		70,000	45,000	5,250		132,000	87,000
1,600		76,000	50,000	5,300		132,000	87,000
1,780		80,000	53,000	5,400		139,000	91,000
1,800		80,000	53,000	5,500		139,000	91,000
1,850		80,000	53,000	5,700		139,000	91,000
1,900		80,000	53,000	5,800		139,000	91,000
2,000		85,000	56,000	6,000		139,000	91,000
2,100		85,000	56,000	6,100		148,000	97,000
2,150		90,000	59,000	6,200		148,000	97,000
2,200		90,000	59,000	6,300		148,000	97,000
2,250		90,000	59,000	6,400		148,000	97,000
2,500		95,000	62,000	6,500		148,000	97,000
2,550		95,000	62,000	6,600		148,000	97,000
2,700		100,000	66,000	6,700		148,000	97,000
2,850		100,000	66,000	6,750	17/64	156,000	102,000
2,900		100,000	66,000	6,800		156,000	102,000
3,000		100,000	66,000	6,900		156,000	102,000
3,050		106,000	69,000	7,000		156,000	102,000
3,200		106,000	69,000	7,100		156,000	102,000
3,250		106,000	69,000	7,200		156,000	102,000
3,300		106,000	69,000	7,300		156,000	102,000
3,350		106,000	69,000	7,400		156,000	102,000
3,400		112,000	73,000	7,500		156,000	102,000
3,450		112,000	73,000	7,600		165,000	109,000
3,500		112,000	73,000	7,700		165,000	109,000
3,600		112,000	73,000	7,750		165,000	109,000
3,650		112,000	73,000	7,800		165,000	109,000
3,700		112,000	73,000	7,900		165,000	109,000



## Spiralbohrer lang

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
8,000		165,000	109,000	9,750		184,000	121,000
8,100		165,000	109,000	10,200		184,000	121,000
8,200		165,000	109,000	10,500		184,000	121,000
8,300		165,000	109,000	11,000		195,000	128,000
8,400		165,000	109,000	11,300		195,000	128,000
8,500		165,000	109,000	11,500		195,000	128,000
8,600		175,000	115,000	12,000		205,000	134,000
8,800		175,000	115,000	13,000		205,000	134,000
9,000		175,000	115,000	13,500		214,000	140,000
9,100		175,000	115,000	14,500		220,000	144,000
9,200		175,000	115,000	17,000		235,000	154,000
9,300		175,000	115,000				

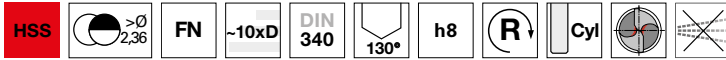


## Spiralbohrer lang

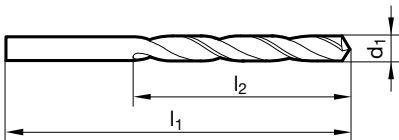
Artikel-Nr. 81340



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • weite Spannuten • bei schlechter Spanabfuhr  
 Grauguss und Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,900		51,000	29,000	4,750		126,000	82,000
1,000		56,000	33,000	4,800		132,000	87,000
1,100		60,000	37,000	5,000		132,000	87,000
1,200		65,000	41,000	5,100		132,000	87,000
1,300		65,000	41,000	5,200		132,000	87,000
1,400		70,000	45,000	5,400		139,000	91,000
1,500		70,000	45,000	5,500		139,000	91,000
1,600		76,000	50,000	5,900		139,000	91,000
1,700		76,000	50,000	6,000		139,000	91,000
1,800		80,000	53,000	6,100		148,000	97,000
1,900		80,000	53,000	6,200		148,000	97,000
2,000		85,000	56,000	6,300		148,000	97,000
2,100		85,000	56,000	6,500		148,000	97,000
2,200		90,000	59,000	6,600		148,000	97,000
2,300		90,000	59,000	6,800		156,000	102,000
2,400		95,000	62,000	6,900		156,000	102,000
2,500		95,000	62,000	7,000		156,000	102,000
2,600		95,000	62,000	7,100		156,000	102,000
2,700		100,000	66,000	7,300		156,000	102,000
2,800		100,000	66,000	7,500		156,000	102,000
2,900		100,000	66,000	7,600		165,000	109,000
3,000		100,000	66,000	7,800		165,000	109,000
3,100		106,000	69,000	8,000		165,000	109,000
3,170	1/8	106,000	69,000	8,400		165,000	109,000
3,200		106,000	69,000	8,500		165,000	109,000
3,250		106,000	69,000	8,600		175,000	115,000
3,300		106,000	69,000	8,700		175,000	115,000
3,400		112,000	73,000	8,800		175,000	115,000
3,500		112,000	73,000	9,000		175,000	115,000
3,600		112,000	73,000	9,100		175,000	115,000
3,700		112,000	73,000	9,200		175,000	115,000
3,750		112,000	73,000	9,400		175,000	115,000
3,800		119,000	78,000	9,500		175,000	115,000
3,900		119,000	78,000	9,800		184,000	121,000
4,000		119,000	78,000	9,900		184,000	121,000
4,100		119,000	78,000	10,000		184,000	121,000
4,200		119,000	78,000	10,300		184,000	121,000
4,250		119,000	78,000	10,500		184,000	121,000
4,300		126,000	82,000	10,800		195,000	128,000
4,400		126,000	82,000	11,000		195,000	128,000
4,500		126,000	82,000	11,200		195,000	128,000
4,700		126,000	82,000	11,250		195,000	128,000



## Spiralbohrer lang

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
11,500		195,000	128,000	14,000		214,000	140,000
11,800		195,000	128,000				
12,000		205,000	134,000				
12,500		205,000	134,000				
12,800		205,000	134,000				
13,000		205,000	134,000				

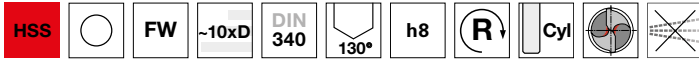


## Spiralbohrer lang

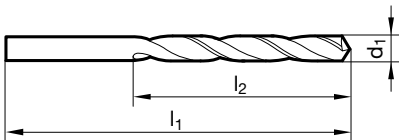
Artikel-Nr. 81350



P	M	K	N	S	H
○			●		



Ausspitzung  $\geq \varnothing 2,400$  • Kegelmantelschliff • besonders große Spannweite  
 weiche, langspanende Werkstoffe • bis 500 N/mm<sup>2</sup> • Automatenweichstähle • Aluminium, Al-Legierungen (langspanend) • Zink,  
 Hüttenkupfer, Silumin, Elektron • Zamak, Argalium, weiche Kunststoffe, Holz



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
1,000		56,000	33,000	6,600		148,000	97,000
1,100		60,000	37,000	6,700		148,000	97,000
1,500		70,000	45,000	6,900		156,000	102,000
2,000		85,000	56,000	7,000		156,000	102,000
2,100		85,000	56,000	7,100		156,000	102,000
2,200		90,000	59,000	7,200		156,000	102,000
2,400		95,000	62,000	7,500		156,000	102,000
2,500		95,000	62,000	7,600		165,000	109,000
2,700		100,000	66,000	7,700		165,000	109,000
2,800		100,000	66,000	7,800		165,000	109,000
2,900		100,000	66,000	7,900		165,000	109,000
3,000		100,000	66,000	8,000		165,000	109,000
3,100		106,000	69,000	8,100		165,000	109,000
3,200		106,000	69,000	8,300		165,000	109,000
3,250		106,000	69,000	8,400		165,000	109,000
3,300		106,000	69,000	8,500		165,000	109,000
3,400		112,000	73,000	8,600		175,000	115,000
3,500		112,000	73,000	8,800		175,000	115,000
3,600		112,000	73,000	8,900		175,000	115,000
3,700		112,000	73,000	9,000		175,000	115,000
3,800		119,000	78,000	9,100		175,000	115,000
3,900		119,000	78,000	9,200		175,000	115,000
4,000		119,000	78,000	9,300		175,000	115,000
4,100		119,000	78,000	9,400		175,000	115,000
4,200		119,000	78,000	9,600		184,000	121,000
4,400		126,000	82,000	9,700		184,000	121,000
4,500		126,000	82,000	9,800		184,000	121,000
4,700		126,000	82,000	10,000		184,000	121,000
4,800		132,000	87,000	10,100		184,000	121,000
4,900		132,000	87,000	10,500		184,000	121,000
5,000		132,000	87,000	10,700		195,000	128,000
5,400		139,000	91,000	10,800		195,000	128,000
5,500		139,000	91,000	11,200		195,000	128,000
5,600		139,000	91,000	11,500		195,000	128,000
5,700		139,000	91,000	11,600		195,000	128,000
5,800		139,000	91,000	11,800		195,000	128,000
5,900		139,000	91,000	12,000		205,000	134,000
6,000		139,000	91,000	12,200		205,000	134,000
6,100		148,000	97,000	12,300	31/64	205,000	134,000
6,200		148,000	97,000	12,400		205,000	134,000
6,300		148,000	97,000	12,500		205,000	134,000
6,500		148,000	97,000	12,800		205,000	134,000



HARTNER

### Spiralbohrer lang

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
13,000		205,000	134,000				
13,500		214,000	140,000				
14,000		214,000	140,000				



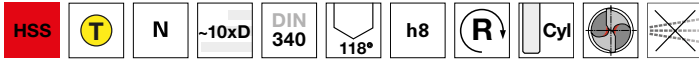
# HARTNER

## Spiralbohrer lang

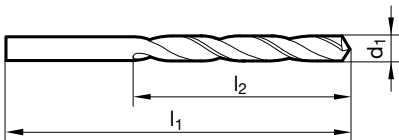
Artikel-Nr. 84418



P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelanschliff • für tiefe Bohrungen • zum Bohren durch Bohrbuchsen  
 Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen, Neusilber und Graphit



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
0,500		32,000	12,000	6,800		156,000	102,000
0,700		42,000	21,000	6,900		156,000	102,000
1,000		56,000	33,000	7,000		156,000	102,000
1,200		65,000	41,000	7,200		156,000	102,000
1,500		70,000	45,000	7,300		156,000	102,000
1,600		76,000	50,000	7,500		156,000	102,000
1,700		76,000	50,000	7,600		165,000	109,000
1,900		80,000	53,000	7,700		165,000	109,000
2,000		85,000	56,000	7,800		165,000	109,000
2,200		90,000	59,000	7,900		165,000	109,000
2,400		95,000	62,000	8,000		165,000	109,000
2,500		95,000	62,000	8,100		165,000	109,000
2,700		100,000	66,000	8,200		165,000	109,000
2,800		100,000	66,000	8,500		165,000	109,000
2,900		100,000	66,000	8,700		175,000	115,000
3,000		100,000	66,000	8,800		175,000	115,000
3,100		106,000	69,000	8,900		175,000	115,000
3,300		106,000	69,000	9,000		175,000	115,000
3,400		112,000	73,000	9,400		175,000	115,000
3,500		112,000	73,000	9,800		184,000	121,000
3,800		119,000	78,000	9,900		184,000	121,000
3,900		119,000	78,000	10,000		184,000	121,000
4,000		119,000	78,000	10,200		184,000	121,000
4,100		119,000	78,000	10,800		195,000	128,000
4,200		119,000	78,000	11,000		195,000	128,000
4,300		126,000	82,000	11,500		195,000	128,000
4,500		126,000	82,000	12,000		205,000	134,000
4,600		126,000	82,000	12,500		205,000	134,000
4,800		132,000	87,000	12,700	1/2	205,000	134,000
4,900		132,000	87,000	13,000		205,000	134,000
5,000		132,000	87,000	14,000		214,000	140,000
5,300		132,000	87,000	14,500		220,000	144,000
5,500		139,000	91,000	14,800		220,000	144,000
5,700		139,000	91,000	15,000		220,000	144,000
5,800		139,000	91,000	16,000		227,000	149,000
5,900		139,000	91,000				
6,000		139,000	91,000				
6,100		148,000	97,000				
6,200		148,000	97,000				
6,400		148,000	97,000				
6,500		148,000	97,000				
6,600		148,000	97,000				

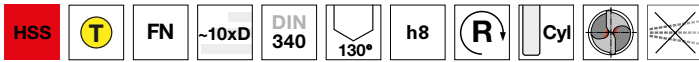


## Spiralbohrer lang

### Artikel-Nr. 84423



P	M	K	N	S	H
•		•	•		

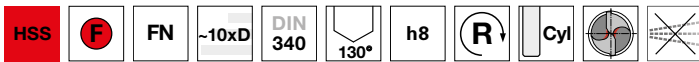


Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff • weite Spannuten • bei schlechter Spanabfuhr  
 Grauguss und Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.

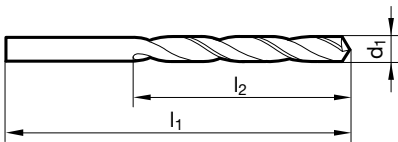
### Artikel-Nr. 84506



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff • weite Spannuten • bei schlechter Spanabfuhr  
 Grauguss und Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	56,000	33,000	5,200	132,000	87,000
1,100	60,000	37,000	5,400	139,000	91,000
1,500	70,000	45,000	5,500	139,000	91,000
1,600	76,000	50,000	5,800	139,000	91,000
1,700	76,000	50,000	5,900	139,000	91,000
1,800	80,000	53,000	6,000	139,000	91,000
1,900	80,000	53,000	6,100	148,000	97,000
2,000	85,000	56,000	6,200	148,000	97,000
2,100	85,000	56,000	6,300	148,000	97,000
2,300	90,000	59,000	6,500	148,000	97,000
2,400	95,000	62,000	6,800	156,000	102,000
2,500	95,000	62,000	6,900	156,000	102,000
2,600	95,000	62,000	7,000	156,000	102,000
2,700	100,000	66,000	7,200	156,000	102,000
2,800	100,000	66,000	7,300	156,000	102,000
2,900	100,000	66,000	7,400	156,000	102,000
3,000	100,000	66,000	7,600	165,000	109,000
3,100	106,000	69,000	7,900	165,000	109,000
3,200	106,000	69,000	8,000	165,000	109,000
3,300	106,000	69,000	8,100	165,000	109,000
3,400	112,000	73,000	8,200	165,000	109,000
3,500	112,000	73,000	8,500	165,000	109,000
3,800	119,000	78,000	8,700	175,000	115,000
4,000	119,000	78,000	9,000	175,000	115,000
4,200	119,000	78,000	9,800	184,000	121,000
4,500	126,000	82,000	10,000	184,000	121,000
4,600	126,000	82,000	11,000	195,000	128,000
4,800	132,000	87,000	11,500	195,000	128,000
4,900	132,000	87,000	12,000	205,000	134,000
5,000	132,000	87,000	12,700	205,000	134,000





HARTNER

## Spiralbohrer lang

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
14,000	214,000	140,000			



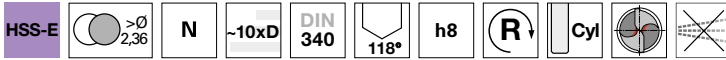


## Spiralbohrer lang

Artikel-Nr. 81311

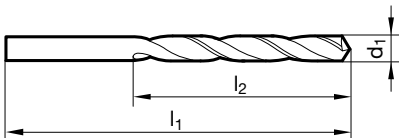


P	M	K	N	S	H
●	○	●	●	○	



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

Stähle (legiert/unleg.) und Gussarten über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle  
• Vergütungs- und Einsatzstähle



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
0,500	32,000	12,000	6,000	139,000	91,000
0,600	35,000	15,000	6,300	148,000	97,000
0,700	42,000	21,000	6,400	148,000	97,000
0,800	46,000	25,000	6,500	148,000	97,000
0,900	51,000	29,000	6,600	148,000	97,000
1,000	56,000	33,000	6,900	156,000	102,000
1,100	60,000	37,000	7,200	156,000	102,000
1,200	65,000	41,000	7,300	156,000	102,000
1,400	70,000	45,000	7,600	165,000	109,000
1,500	70,000	45,000	7,800	165,000	109,000
1,900	80,000	53,000	7,900	165,000	109,000
2,000	85,000	56,000	8,000	165,000	109,000
2,200	90,000	59,000	8,400	165,000	109,000
3,000	100,000	66,000	8,700	175,000	115,000
3,100	106,000	69,000	8,800	175,000	115,000
3,200	106,000	69,000	8,900	175,000	115,000
3,300	106,000	69,000	9,000	175,000	115,000
3,400	112,000	73,000	9,100	175,000	115,000
3,500	112,000	73,000	9,300	175,000	115,000
3,900	119,000	78,000	9,400	175,000	115,000
4,000	119,000	78,000	9,500	175,000	115,000
4,100	119,000	78,000	9,600	184,000	121,000
4,200	119,000	78,000	9,800	184,000	121,000
4,300	126,000	82,000	9,900	184,000	121,000
4,400	126,000	82,000	10,000	184,000	121,000
4,500	126,000	82,000	10,500	184,000	121,000
4,600	126,000	82,000	10,800	195,000	128,000
4,700	126,000	82,000	11,000	195,000	128,000
4,800	132,000	87,000	11,200	195,000	128,000
4,900	132,000	87,000	12,000	205,000	134,000
5,000	132,000	87,000	12,500	205,000	134,000
5,300	132,000	87,000			
5,500	139,000	91,000			
5,600	139,000	91,000			
5,700	139,000	91,000			
5,900	139,000	91,000			

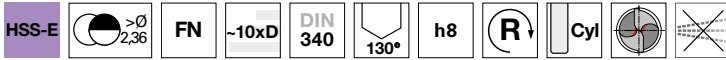


## Spiralbohrer lang

Artikel-Nr. 81341

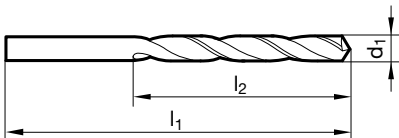


P	M	K	N	S	H
•	•	•	•		○



Ausspitzung  $\geq \varnothing 1,100$  • Kegelmantelschliff • Co-legierter HSS-Stahl • weite Spannuten • höhere Verschleißfestigkeit • bei schlechter Spanabfuhr

Stähle (legiert/unleg.) und Gussarten über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle  
• Vergütungs- und Einsatzstähle



d1	inch	l1	l2	d1	inch	l1	l2
mm		mm	mm	mm		mm	mm
1,000		56,000	33,000	5,200		132,000	87,000
1,200		65,000	41,000	5,300		132,000	87,000
1,250		65,000	41,000	5,400		139,000	91,000
1,300		65,000	41,000	5,500		139,000	91,000
1,400		70,000	45,000	5,600		139,000	91,000
1,500		70,000	45,000	5,700		139,000	91,000
1,600		76,000	50,000	5,800		139,000	91,000
1,700		76,000	50,000	5,900		139,000	91,000
1,800		80,000	53,000	6,000		139,000	91,000
1,900		80,000	53,000	6,100		148,000	97,000
2,000		85,000	56,000	6,150		148,000	97,000
2,100		85,000	56,000	6,200		148,000	97,000
2,200		90,000	59,000	6,250		148,000	97,000
2,400		95,000	62,000	6,300		148,000	97,000
2,440		95,000	62,000	6,350	1/4	148,000	97,000
2,500		95,000	62,000	6,400		148,000	97,000
2,600		95,000	62,000	6,500		148,000	97,000
2,700		100,000	66,000	6,600		148,000	97,000
2,800		100,000	66,000	6,700		148,000	97,000
2,900		100,000	66,000	6,800		156,000	102,000
3,000		100,000	66,000	6,900		156,000	102,000
3,050		106,000	69,000	7,000		156,000	102,000
3,100		106,000	69,000	7,200		156,000	102,000
3,200		106,000	69,000	7,300		156,000	102,000
3,300		106,000	69,000	7,400		156,000	102,000
3,400		112,000	73,000	7,500		156,000	102,000
3,500		112,000	73,000	7,600		165,000	109,000
3,700		112,000	73,000	7,700		165,000	109,000
3,800		119,000	78,000	7,800		165,000	109,000
3,900		119,000	78,000	7,900		165,000	109,000
4,000		119,000	78,000	8,000		165,000	109,000
4,050		119,000	78,000	8,100		165,000	109,000
4,100		119,000	78,000	8,200		165,000	109,000
4,200		119,000	78,000	8,300		165,000	109,000
4,300		126,000	82,000	8,400		165,000	109,000
4,400		126,000	82,000	8,500		165,000	109,000
4,500		126,000	82,000	8,600		175,000	115,000
4,700		126,000	82,000	8,700		175,000	115,000
4,800		132,000	87,000	8,800		175,000	115,000
4,900		132,000	87,000	8,900		175,000	115,000
5,000		132,000	87,000	9,000		175,000	115,000
5,100		132,000	87,000	9,100		175,000	115,000



## Spiralbohrer lang

d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
9,200		175,000	115,000	11,000		195,000	128,000
9,300		175,000	115,000	11,500		195,000	128,000
9,500		175,000	115,000	11,800		195,000	128,000
9,600		184,000	121,000	11,910	15/32	205,000	134,000
9,700		184,000	121,000	12,000		205,000	134,000
9,800		184,000	121,000	12,500		205,000	134,000
9,900		184,000	121,000	12,700	1/2	205,000	134,000
10,000		184,000	121,000	13,000		205,000	134,000
10,200		184,000	121,000	16,000		227,000	149,000
10,500		184,000	121,000				
10,800		195,000	128,000				
10,900		195,000	128,000				

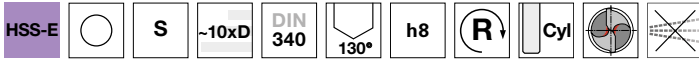


## Spiralbohrer lang

### Artikel-Nr. 81361



P	M	K	N	S	H
○	●			●	



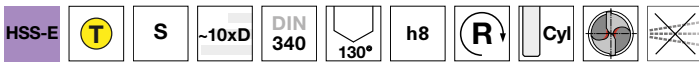
Ausspitzung  $\geq \varnothing 1,400$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

Titan und Titanlegierungen • rost-/säure-/hitzebest. austen. Stähle • hochfeste/kurzspan. Stähle ab 900 N/mm<sup>2</sup> • Wälzlagerstähle  
• Sonderlegierungen Hastelloy, Inconel, Nimonic

### Artikel-Nr. 81362

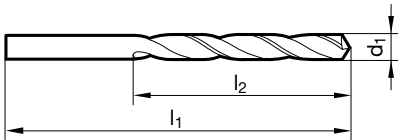


P	M	K	N	S	H
○	●			●	



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

Titan und Titanlegierungen • rost-/säure-/hitzebest. austen. Stähle • hochfeste/kurzspan. Stähle ab 900 N/mm<sup>2</sup> • Wälzlagerstähle  
• Sonderlegierungen Hastelloy, Inconel, Nimonic



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	56,000	33,000	4,000	119,000	78,000
1,100	60,000	37,000	4,100	119,000	78,000
1,200	65,000	41,000	4,200	119,000	78,000
1,300	65,000	41,000	4,300	126,000	82,000
1,400	70,000	45,000	4,400	126,000	82,000
1,500	70,000	45,000	4,500	126,000	82,000
1,600	76,000	50,000	4,600	126,000	82,000
1,700	76,000	50,000	4,700	126,000	82,000
1,800	80,000	53,000	4,800	132,000	87,000
1,900	80,000	53,000	4,900	132,000	87,000
2,000	85,000	56,000	5,000	132,000	87,000
2,100	85,000	56,000	5,100	132,000	87,000
2,200	90,000	59,000	5,200	132,000	87,000
2,300	90,000	59,000	5,300	132,000	87,000
2,400	95,000	62,000	5,400	139,000	91,000
2,500	95,000	62,000	5,500	139,000	91,000
2,600	95,000	62,000	5,600	139,000	91,000
2,700	100,000	66,000	5,700	139,000	91,000
2,800	100,000	66,000	5,800	139,000	91,000
2,900	100,000	66,000	5,900	139,000	91,000
3,000	100,000	66,000	6,000	139,000	91,000
3,100	106,000	69,000	6,100	148,000	97,000
3,200	106,000	69,000	6,200	148,000	97,000
3,300	106,000	69,000	6,300	148,000	97,000
3,400	112,000	73,000	6,400	148,000	97,000
3,500	112,000	73,000	6,500	148,000	97,000
3,600	112,000	73,000	6,600	148,000	97,000
3,700	112,000	73,000	6,700	148,000	97,000
3,800	119,000	78,000	6,800	156,000	102,000
3,900	119,000	78,000	6,900	156,000	102,000



HARTNER

## Spiralbohrer lang

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
7,000	156,000	102,000	8,500	165,000	109,000
7,100	156,000	102,000	8,700	175,000	115,000
7,200	156,000	102,000	8,800	175,000	115,000
7,300	156,000	102,000	9,000	175,000	115,000
7,500	156,000	102,000	9,500	175,000	115,000
7,700	165,000	109,000	10,000	184,000	121,000
7,800	165,000	109,000	10,500	184,000	121,000
8,000	165,000	109,000	11,000	195,000	128,000
8,100	165,000	109,000	11,500	195,000	128,000
8,200	165,000	109,000	12,000	205,000	134,000
8,300	165,000	109,000	12,500	205,000	134,000
8,400	165,000	109,000	13,000	205,000	134,000

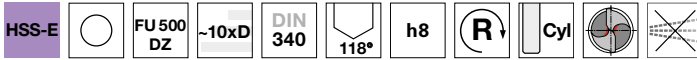


## Spiralbohrer lang

### Artikel-Nr. 84814



P	M	K	N	S	H
•	•	•	•		



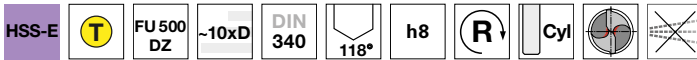
Ausspitzung  $\geq \varnothing 1,000$  • Flächenanschliff • Co-legierter HSS-Stahl • geringe Vorschubkraft notwendig • geringes Drehmoment notwendig • höhere Verschleißfestigkeit • universell einsetzbar

Stähle (legiert/unleg.) bis 800 N/mm<sup>2</sup> • Kalt-/Warmarbeitsstähle • Wälzlagerstähle • NE-Metalle • Gusswerkstoffe • rostfreie Stähle • Kunststoffe

### Artikel-Nr. 84812

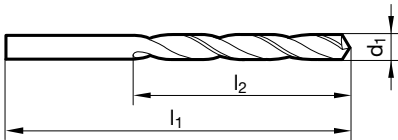


P	M	K	N	S	H
•	•	•	•		



Ausspitzung  $\geq \varnothing 1,000$  • Flächenanschliff • Co-legierter HSS-Stahl • geringes Drehmoment notwendig • geringe Vorschubkraft notwendig • höhere Verschleißfestigkeit • universell einsetzbar

Stähle (legiert/unleg.) bis 800 N/mm<sup>2</sup> • Kalt-/Warmarbeitsstähle • Wälzlagerstähle • NE-Metalle • Gusswerkstoffe • Kunststoffe • rostfreie Stähle



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	56,000	33,000	4,000	119,000	78,000
1,100	60,000	37,000	4,100	119,000	78,000
1,200	65,000	41,000	4,200	119,000	78,000
1,300	65,000	41,000	4,300	126,000	82,000
1,400	70,000	45,000	4,400	126,000	82,000
1,500	70,000	45,000	4,500	126,000	82,000
1,600	76,000	50,000	4,600	126,000	82,000
1,700	76,000	50,000	4,700	126,000	82,000
1,800	80,000	53,000	4,800	132,000	87,000
1,900	80,000	53,000	4,900	132,000	87,000
2,000	85,000	56,000	5,000	132,000	87,000
2,100	85,000	56,000	5,100	132,000	87,000
2,200	90,000	59,000	5,200	132,000	87,000
2,300	90,000	59,000	5,300	132,000	87,000
2,400	95,000	62,000	5,400	139,000	91,000
2,500	95,000	62,000	5,500	139,000	91,000
2,600	95,000	62,000	5,600	139,000	91,000
2,700	100,000	66,000	5,700	139,000	91,000
2,800	100,000	66,000	5,800	139,000	91,000
2,900	100,000	66,000	5,900	139,000	91,000
3,000	100,000	66,000	6,000	139,000	91,000
3,100	106,000	69,000	6,100	148,000	97,000
3,200	106,000	69,000	6,200	148,000	97,000
3,300	106,000	69,000	6,300	148,000	97,000
3,400	112,000	73,000	6,400	148,000	97,000
3,500	112,000	73,000	6,500	148,000	97,000
3,600	112,000	73,000	6,600	148,000	97,000
3,700	112,000	73,000	6,700	148,000	97,000
3,800	119,000	78,000	6,800	156,000	102,000
3,900	119,000	78,000	6,900	156,000	102,000



## Spiralbohrer lang

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
7,000	156,000	102,000	9,500	175,000	115,000
7,100	156,000	102,000	9,600	184,000	121,000
7,200	156,000	102,000	9,700	184,000	121,000
7,300	156,000	102,000	9,800	184,000	121,000
7,400	156,000	102,000	9,900	184,000	121,000
7,500	156,000	102,000	10,000	184,000	121,000
7,600	165,000	109,000	10,100	184,000	121,000
7,700	165,000	109,000	10,200	184,000	121,000
7,800	165,000	109,000	10,300	184,000	121,000
7,900	165,000	109,000	10,400	184,000	121,000
8,000	165,000	109,000	10,500	184,000	121,000
8,100	165,000	109,000	11,000	195,000	128,000
8,200	165,000	109,000	11,500	195,000	128,000
8,300	165,000	109,000	12,000	205,000	134,000
8,400	165,000	109,000	12,500	205,000	134,000
8,500	165,000	109,000	13,000	205,000	134,000
8,600	175,000	115,000	13,500	214,000	140,000
8,700	175,000	115,000	14,000	214,000	140,000
8,800	175,000	115,000			
9,000	175,000	115,000			
9,100	175,000	115,000			
9,200	175,000	115,000			
9,300	175,000	115,000			
9,400	175,000	115,000			



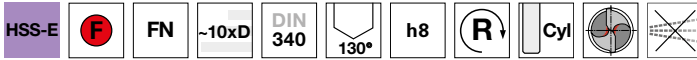


## Spiralbohrer lang

Artikel-Nr. 84508

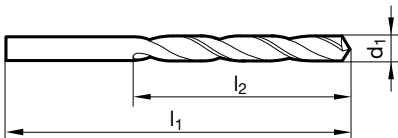


P	M	K	N	S	H
•	•	•	•		○



Ausspitzung  $\geq \varnothing 1,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • weite Spannuten • besonders hohe Verschleißfestigkeit • bei schlechter Spanabfuhr

Stähle (legiert/unleg.) und Gussarten über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle • Vergütungs- und Einsatzstähle



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	56,000	33,000	5,800	139,000	91,000
1,100	60,000	37,000	6,000	139,000	91,000
1,200	65,000	41,000	6,100	148,000	97,000
1,300	65,000	41,000	6,200	148,000	97,000
1,400	70,000	45,000	6,500	148,000	97,000
1,500	70,000	45,000	6,600	148,000	97,000
1,600	76,000	50,000	6,700	148,000	97,000
1,700	76,000	50,000	6,800	156,000	102,000
1,800	80,000	53,000	6,900	156,000	102,000
2,000	85,000	56,000	7,000	156,000	102,000
2,100	85,000	56,000	7,200	156,000	102,000
2,200	90,000	59,000	7,400	156,000	102,000
2,300	90,000	59,000	7,500	156,000	102,000
2,400	95,000	62,000	7,600	165,000	109,000
2,500	95,000	62,000	7,800	165,000	109,000
2,600	95,000	62,000	8,000	165,000	109,000
2,800	100,000	66,000	8,100	165,000	109,000
2,900	100,000	66,000	8,200	165,000	109,000
3,000	100,000	66,000	8,400	165,000	109,000
3,100	106,000	69,000	8,500	165,000	109,000
3,200	106,000	69,000	8,600	175,000	115,000
3,300	106,000	69,000	8,800	175,000	115,000
3,400	112,000	73,000	8,900	175,000	115,000
3,500	112,000	73,000	9,000	175,000	115,000
3,600	112,000	73,000	9,300	175,000	115,000
3,700	112,000	73,000	9,400	175,000	115,000
3,800	119,000	78,000	9,500	175,000	115,000
3,900	119,000	78,000	9,600	184,000	121,000
4,000	119,000	78,000	9,700	184,000	121,000
4,100	119,000	78,000	9,800	184,000	121,000
4,200	119,000	78,000	10,000	184,000	121,000
4,300	126,000	82,000	10,200	184,000	121,000
4,500	126,000	82,000	10,500	184,000	121,000
4,700	126,000	82,000	11,000	195,000	128,000
4,800	132,000	87,000	11,500	195,000	128,000
5,000	132,000	87,000	12,000	205,000	134,000
5,100	132,000	87,000			
5,200	132,000	87,000			
5,300	132,000	87,000			
5,400	139,000	91,000			
5,500	139,000	91,000			
5,600	139,000	91,000			



# HARTNER

## Spiralbohrer lang

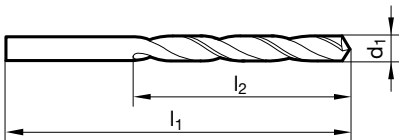
Artikel-Nr. 89286



P	M	K	N	S	H
○		○			○



Flächenanschliff • Hauptschneidenform gerade  
 glasfaserverstärkte Kunststoffe • Duroplaste mit Schmirgelwirkung auf Schneiden und Fasen



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
0,500	38,000	8,500	1,300	38,000	17,000
0,600	38,000	9,500	1,400	38,000	17,000
0,650	38,000	10,500	1,450	38,000	17,000
0,700	38,000	10,500	1,500	38,000	17,000
0,750	38,000	12,500			
0,800	38,000	12,500			
0,850	38,000	14,500			
0,900	38,000	14,500			
1,000	38,000	17,000			
1,050	38,000	17,000			
1,100	38,000	17,000			
1,200	38,000	17,000			



## Spiralbohrer überlang, Reihe 1

Artikel-Nr. 81410

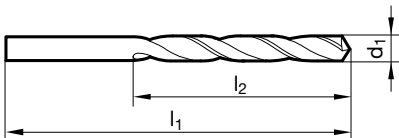


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \text{Ø } 2,400$  • Kegelmantelschliff • für extrem tiefe Bohrungen

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen, Neusilber und Graphit



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,600	115,000	75,000	5,800	205,000	140,000
1,800	120,000	80,000	5,900	205,000	140,000
1,900	120,000	80,000	6,000	205,000	140,000
2,000	125,000	85,000	6,200	215,000	150,000
2,200	135,000	90,000	6,300	215,000	150,000
2,300	135,000	90,000	6,400	215,000	150,000
2,400	140,000	95,000	6,500	215,000	150,000
2,500	140,000	95,000	6,600	215,000	150,000
2,700	150,000	100,000	6,700	215,000	150,000
2,800	150,000	100,000	6,800	225,000	155,000
3,000	150,000	100,000	7,000	225,000	155,000
3,100	155,000	105,000	7,500	225,000	155,000
3,200	155,000	105,000	7,600	240,000	165,000
3,250	155,000	105,000	7,700	240,000	165,000
3,300	155,000	105,000	7,800	240,000	165,000
3,400	165,000	115,000	8,000	240,000	165,000
3,500	165,000	115,000	8,100	240,000	165,000
3,700	165,000	115,000	8,200	240,000	165,000
3,800	175,000	120,000	8,500	240,000	165,000
3,900	175,000	120,000	8,800	250,000	175,000
4,000	175,000	120,000	9,000	250,000	175,000
4,100	175,000	120,000	9,400	250,000	175,000
4,200	175,000	120,000	9,500	250,000	175,000
4,300	185,000	125,000	10,000	265,000	185,000
4,500	185,000	125,000	10,200	265,000	185,000
4,600	185,000	125,000	10,500	265,000	185,000
4,700	185,000	125,000	11,000	280,000	195,000
4,800	195,000	135,000	11,500	280,000	195,000
4,900	195,000	135,000	11,800	280,000	195,000
5,000	195,000	135,000	12,000	295,000	205,000
5,100	195,000	135,000	12,500	295,000	205,000
5,200	195,000	135,000	13,000	295,000	205,000
5,300	195,000	135,000			
5,400	205,000	140,000			
5,500	205,000	140,000			
5,700	205,000	140,000			



## Spiralbohrer überlang, Reihe 1

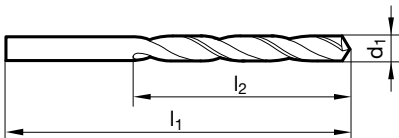
Artikel-Nr. 81440



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelanschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr  
 Grauguss und Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
2,000		125,000	85,000	6,500		215,000	150,000
2,200		135,000	90,000	6,600		215,000	150,000
2,300		135,000	90,000	6,700		215,000	150,000
2,400		140,000	95,000	6,800		225,000	155,000
2,500		140,000	95,000	7,000		225,000	155,000
2,600		140,000	95,000	7,100		225,000	155,000
2,700		150,000	100,000	7,400		225,000	155,000
2,850		150,000	100,000	7,500		225,000	155,000
2,900		150,000	100,000	7,600		240,000	165,000
2,950		150,000	100,000	7,800		240,000	165,000
3,000		150,000	100,000	8,000		240,000	165,000
3,100		155,000	105,000	8,100		240,000	165,000
3,170	1/8	155,000	105,000	8,200		240,000	165,000
3,200		155,000	105,000	8,300		240,000	165,000
3,300		155,000	105,000	8,400		240,000	165,000
3,400		165,000	115,000	8,500		240,000	165,000
3,500		165,000	115,000	8,600		250,000	175,000
3,600		165,000	115,000	8,800		250,000	175,000
3,700		165,000	115,000	9,000		250,000	175,000
3,750		165,000	115,000	9,200		250,000	175,000
3,800		175,000	120,000	9,300		250,000	175,000
3,900		175,000	120,000	9,400		250,000	175,000
4,000		175,000	120,000	9,500		250,000	175,000
4,100		175,000	120,000	9,600		265,000	185,000
4,200		175,000	120,000	9,700		265,000	185,000
4,500		185,000	125,000	9,800		265,000	185,000
4,700		185,000	125,000	9,900		265,000	185,000
4,800		195,000	135,000	10,000		265,000	185,000
5,000		195,000	135,000	10,200		265,000	185,000
5,100		195,000	135,000	10,500		265,000	185,000
5,200		195,000	135,000	11,000		280,000	195,000
5,300		195,000	135,000	11,500		280,000	195,000
5,400		205,000	140,000	11,750		280,000	195,000
5,500		205,000	140,000	11,800		280,000	195,000
5,600		205,000	140,000	12,000		295,000	205,000
5,700		205,000	140,000	12,500		295,000	205,000
5,800		205,000	140,000	12,700	1/2	295,000	205,000
5,900		205,000	140,000	13,000		295,000	205,000
6,000		205,000	140,000				
6,200		215,000	150,000				
6,300		215,000	150,000				
6,400		215,000	150,000				

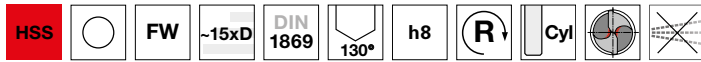


## Spiralbohrer überlang, Reihe 1

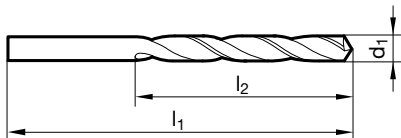
Artikel-Nr. 81450



P	M	K	N	S	H
○			●		



Ausspitzung  $\geq \text{Ø } 2,500$  • Kegelmantelschliff • für extrem tiefe Bohrungen  
 weiche und langspanende Werkstoffe bis  $500 \text{ N/mm}^2$  • Automatenweichstähle • Aluminium, Al-Legierungen (langspanend) • Zink,  
 Hüttenkupfer, Silumin, Elektron • Zamak, Argalium, weiche Kunststoffe, Holz



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
2,000	125,000	85,000	9,500	250,000	175,000
2,500	140,000	95,000			
2,600	140,000	95,000			
3,000	150,000	100,000			
3,200	155,000	105,000			
4,000	175,000	120,000			
5,000	195,000	135,000			
6,000	205,000	140,000			
6,500	215,000	150,000			
7,000	225,000	155,000			
8,000	240,000	165,000			
9,000	250,000	175,000			

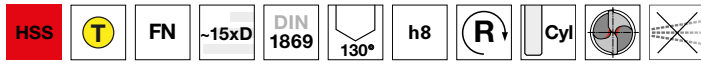


## Spiralbohrer überlang, Reihe 1

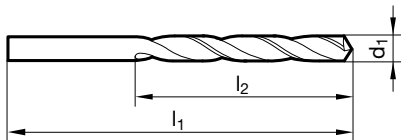
Artikel-Nr. 84425



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
2,000	125,000	85,000	6,000	205,000	140,000
2,100	125,000	85,000	7,000	225,000	155,000
2,500	140,000	95,000	8,000	240,000	165,000
3,000	150,000	100,000	9,000	250,000	175,000
3,200	155,000	105,000	10,000	265,000	185,000
3,500	165,000	115,000	11,000	280,000	195,000
4,000	175,000	120,000	12,000	295,000	205,000
4,200	175,000	120,000			
4,500	185,000	125,000			
4,600	185,000	125,000			
5,000	195,000	135,000			
5,500	205,000	140,000			

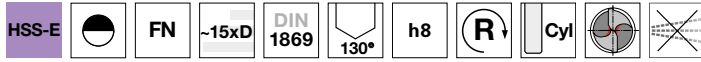


## Spiralbohrer überlang, Reihe 1

Artikel-Nr. 81441

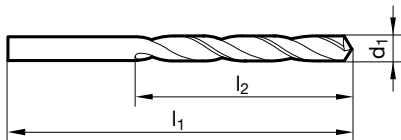


P	M	K	N	S	H
•	•	•	•	•	○



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • weite Spannuten • höhere Verschleißfestigkeit • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr

Stähle (legiert und unleg.) und Gussarten über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle • Vergütungs- und Einsatzstähle



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
3,000		150,000	100,000	7,000		225,000	155,000
3,500		165,000	115,000	8,000		240,000	165,000
4,000		175,000	120,000	8,200		240,000	165,000
4,300		185,000	125,000	8,500		240,000	165,000
4,500		185,000	125,000	9,000		250,000	175,000
4,760	3/16	195,000	135,000	9,500		250,000	175,000
4,800		195,000	135,000	10,000		265,000	185,000
5,000		195,000	135,000				
5,400		205,000	140,000				
5,500		205,000	140,000				
6,000		205,000	140,000				
6,500		215,000	150,000				

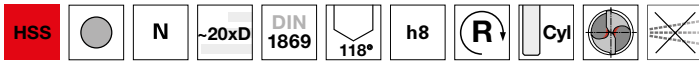


## Spiralbohrer überlang, Reihe 2

Artikel-Nr. 81510

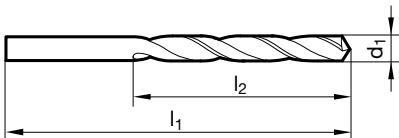


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • für extrem tiefe Bohrungen

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen, Neusilber und Graphit



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
3,000		190,000	130,000	8,500		305,000	210,000
3,170	1/8	200,000	135,000	9,000		320,000	220,000
3,300		200,000	135,000	9,500		320,000	220,000
3,500		210,000	145,000	10,000		340,000	235,000
4,000		220,000	150,000	10,500		340,000	235,000
4,200		220,000	150,000	11,000		365,000	250,000
4,500		235,000	160,000	11,500		365,000	250,000
4,800		245,000	170,000	12,000		375,000	260,000
5,000		245,000	170,000				
5,200		245,000	170,000				
5,500		260,000	180,000				
5,800		260,000	180,000				
6,000		260,000	180,000				
6,500		275,000	190,000				
6,800		290,000	200,000				
7,000		290,000	200,000				
7,500		290,000	200,000				
8,000		305,000	210,000				





## Spiralbohrer überlang, Reihe 2

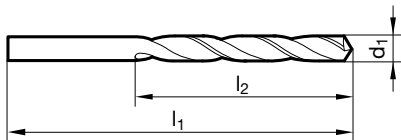
Artikel-Nr. 81540



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelanschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
2,000		160,000	110,000	8,200		305,000	210,000
2,500		180,000	120,000	8,500		305,000	210,000
2,800		190,000	130,000	9,000		320,000	220,000
3,000		190,000	130,000	9,500		320,000	220,000
3,200		200,000	135,000	9,800		340,000	235,000
3,300		200,000	135,000	10,000		340,000	235,000
3,500		210,000	145,000	10,200		340,000	235,000
4,000		220,000	150,000	10,500		340,000	235,000
4,100		220,000	150,000	10,720	27/64	365,000	250,000
4,200		220,000	150,000	11,000		365,000	250,000
4,500		235,000	160,000	11,500		365,000	250,000
5,000		245,000	170,000	12,000		375,000	260,000
5,500		260,000	180,000	12,500		375,000	260,000
6,000		260,000	180,000	12,700	1/2	375,000	260,000
6,500		275,000	190,000	13,000		375,000	260,000
7,000		290,000	200,000				
7,500		290,000	200,000				
8,000		305,000	210,000				

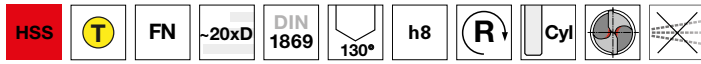


## Spiralbohrer überlang, Reihe 2

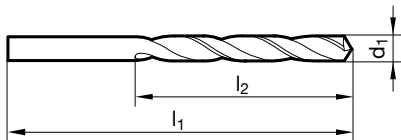
Artikel-Nr. 84426



P	M	K	N	S	H
•		•	•	○	



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
3,000	190,000	130,000	8,000	305,000	210,000
4,000	220,000	150,000	8,500	305,000	210,000
5,000	245,000	170,000			
6,000	260,000	180,000			
6,800	290,000	200,000			
7,000	290,000	200,000			

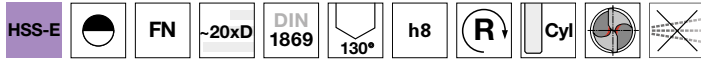


## Spiralbohrer überlang, Reihe 2

Artikel-Nr. 81541

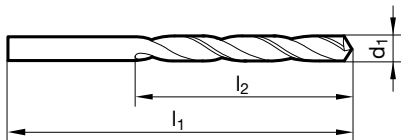


P	M	K	N	S	H
•	•	•	•		○



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr

Stähle (legiert/unleg.) und Gussarten über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle • Vergütungs- und Einsatzstähle



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
3,000		190,000	130,000	7,500		290,000	200,000
3,170	1/8	200,000	135,000	8,000		305,000	210,000
3,200		200,000	135,000	8,500		305,000	210,000
3,500		210,000	145,000	9,000		320,000	220,000
4,000		220,000	150,000	10,000		340,000	235,000
4,200		220,000	150,000				
5,000		245,000	170,000				
6,000		260,000	180,000				
6,200		275,000	190,000				
6,350	1/4	275,000	190,000				
6,500		275,000	190,000				
7,000		290,000	200,000				

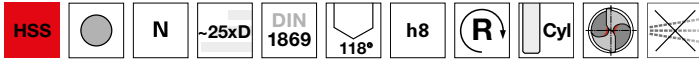


## Spiralbohrer überlang, Reihe 3

Artikel-Nr. 81610

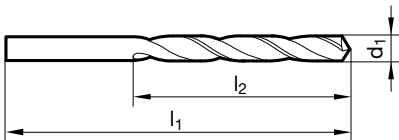


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \text{Ø } 4,000$  • Kegelmantelschliff • für extrem tiefe Bohrungen

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen und Graphit



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
3,500	265,000	180,000	10,000	430,000	295,000
4,000	280,000	190,000	11,000	455,000	310,000
5,000	315,000	210,000	12,000	480,000	330,000
5,500	330,000	225,000			
5,800	330,000	225,000			
5,900	330,000	225,000			
6,000	330,000	225,000			
7,000	370,000	250,000			
7,800	390,000	265,000			
8,000	390,000	265,000			
9,000	410,000	280,000			
9,500	410,000	280,000			

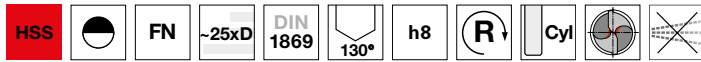


## Spiralbohrer überlang, Reihe 3

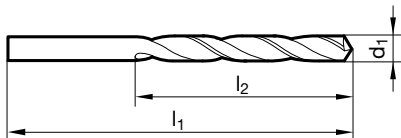
Artikel-Nr. 81640



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr  
 Grauguss und Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
2,500		225,000	150,000	8,200		390,000	265,000
3,000		240,000	160,000	8,500		390,000	265,000
3,170	1/8	250,000	170,000	9,000		410,000	280,000
3,500		265,000	180,000	9,500		410,000	280,000
3,700		265,000	180,000	9,520	3/8	430,000	295,000
4,000		280,000	190,000	10,000		430,000	295,000
4,200		280,000	190,000	10,500		430,000	295,000
4,500		295,000	200,000	11,000		455,000	310,000
5,000		315,000	210,000	11,500		455,000	310,000
5,100		315,000	210,000	12,000		480,000	330,000
5,500		330,000	225,000	12,500		480,000	330,000
6,000		330,000	225,000	13,000		480,000	330,000
6,350	1/4	350,000	235,000				
6,500		350,000	235,000				
6,800		370,000	250,000				
7,000		370,000	250,000				
7,500		370,000	250,000				
8,000		390,000	265,000				

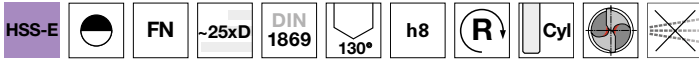


## Spiralbohrer überlang, Reihe 3

Artikel-Nr. 81641

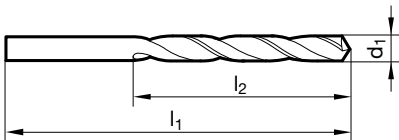


P	M	K	N	S	H
•	•		•	•	



Ausspitzung  $\geq \text{Ø } 2,500$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • weite Spannuten • höhere Verschleißbeständigkeit • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr

Stähle und Stahlguss mit hoher Festigkeit • Grauguss, Temperguss, Sphäroguss



d1 mm	inch	l1 mm	l2 mm	d1 mm	inch	l1 mm	l2 mm
2,500		225,000	150,000	6,300		350,000	235,000
3,000		240,000	160,000	6,350	1/4	350,000	235,000
3,100		250,000	170,000	6,400		350,000	235,000
3,170	1/8	250,000	170,000	6,500		350,000	235,000
3,200		250,000	170,000	6,700		350,000	235,000
3,300		250,000	170,000	6,800		370,000	250,000
3,400		265,000	180,000	7,000		370,000	250,000
3,500		265,000	180,000	7,200		370,000	250,000
3,700		265,000	180,000	7,500		370,000	250,000
3,800		280,000	190,000	7,800		390,000	265,000
3,900		280,000	190,000	7,940	5/16	390,000	265,000
3,970	5/32	280,000	190,000	8,000		390,000	265,000
4,000		280,000	190,000	8,200		390,000	265,000
4,200		280,000	190,000	8,500		390,000	265,000
4,300		295,000	200,000	8,600		410,000	280,000
4,500		295,000	200,000	8,730	11/32	410,000	280,000
4,600		295,000	200,000	8,800		410,000	280,000
4,760	3/16	315,000	210,000	9,000		410,000	280,000
4,800		315,000	210,000	9,500		410,000	280,000
4,900		315,000	210,000	9,520	3/8	430,000	295,000
5,000		315,000	210,000	10,000		430,000	295,000
5,100		315,000	210,000	10,320	13/32	430,000	295,000
5,200		315,000	210,000	10,500		430,000	295,000
5,500		330,000	225,000	11,000		455,000	310,000
5,560	7/32	330,000	225,000	11,110	7/16	455,000	310,000
5,800		330,000	225,000	11,500		455,000	310,000
5,950	15/64	330,000	225,000	12,000		480,000	330,000
6,000		330,000	225,000	12,200		480,000	330,000
6,100		350,000	235,000	12,500		480,000	330,000
6,200		350,000	235,000	13,000		480,000	330,000

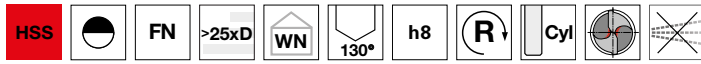


## Spiralbohrer extra lang

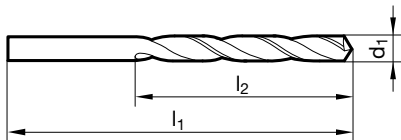
Artikel-Nr. 81740



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 6,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
6,000	500,000	400,000			
8,000	500,000	400,000			
10,000	600,000	500,000			
11,000	600,000	500,000			
12,000	600,000	500,000			



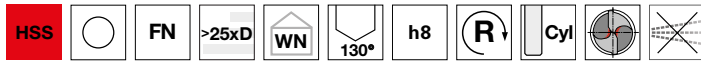
# HARTNER

## Spiralbohrer extra lang

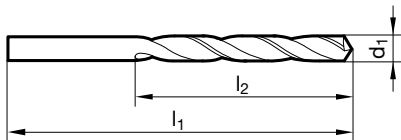
Artikel-Nr. 81750



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \varnothing 8,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis 1000 N/mm<sup>2</sup> • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
8,000	750,000	650,000			
10,000	750,000	650,000			
11,000	750,000	650,000			
12,000	750,000	650,000			





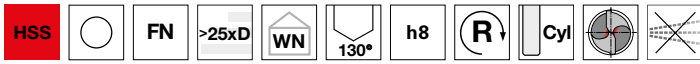
# HARTNER

## Spiralbohrer extra lang

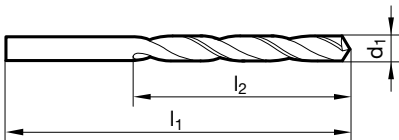
Artikel-Nr. 81760



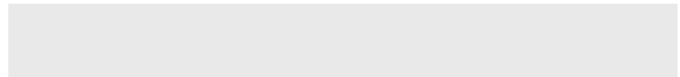
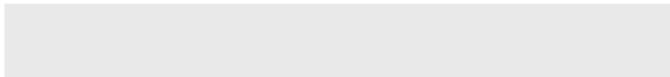
P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \text{Ø } 10,000$  • Kegelmantelanschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
10,000	1000,000	850,000			
12,000	1000,000	850,000			





## Stiftlochbohrer

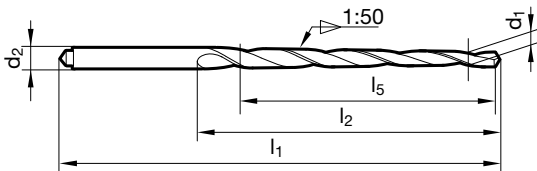
Artikel-Nr. 81810



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \text{Ø } 2,000$  • Kegelmantelschliff • für Kegelbohrungen zur Aufnahme von Kegelstiften nach DIN 1 (neu: DIN EN 22339) und DIN 7978 (neu: DIN EN 28736) • mit Mitnehmer nach DIN 1809



d1 mm	d2 mm	l1 mm	l2 mm	l5 mm	d1 mm	d2 mm	l1 mm	l2 mm	l5 mm
2,000	3,150	86,000	52,000	48,000	10,000	12,500	245,000	190,000	175,000
3,000	4,000	100,000	63,000	58,000	12,000	16,000	290,000	228,000	228,500
4,000	5,000	112,000	74,000	68,000					
5,000	6,300	122,000	81,000	73,000					
6,000	8,000	160,000	114,000	105,000					
8,000	10,000	207,000	157,000	145,000					

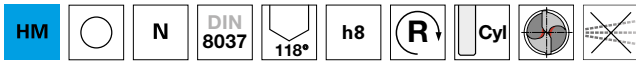


## Spiralbohrer mit HM-Schneiden

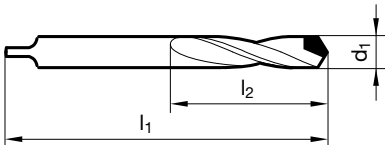
Artikel-Nr. 89301



P	M	K	N	S	H
○		○			○



Ausspitzung  $\geq \varnothing 2,600$  • Flächenanschliff • HM-bestückt • mit Mitnehmer nach DIN 1809  
 Federbandstahl • Hartguss über 300 HB • Reinmolybdän • zähnharte Bronzen



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
2,600	50,000	20,000	7,800	80,000	40,000
3,000	50,000	20,000	8,000	80,000	40,000
3,100	56,000	25,000	8,200	90,000	50,000
3,200	56,000	25,000	8,400	90,000	50,000
3,300	56,000	25,000	8,500	90,000	50,000
3,400	56,000	25,000	8,600	90,000	50,000
3,500	56,000	25,000	8,800	90,000	50,000
3,600	56,000	25,000	9,000	90,000	50,000
3,700	56,000	25,000	9,100	90,000	50,000
3,800	56,000	25,000	9,500	90,000	50,000
3,900	56,000	25,000	9,700	100,000	56,000
4,000	56,000	25,000	9,800	100,000	56,000
4,100	63,000	28,000	10,000	100,000	56,000
4,200	63,000	28,000	10,200	100,000	56,000
4,300	63,000	28,000	10,500	100,000	56,000
4,400	63,000	28,000	11,000	100,000	56,000
4,500	63,000	28,000	11,500	112,000	63,000
4,800	63,000	28,000	12,000	112,000	63,000
4,900	63,000	28,000	12,500	112,000	63,000
5,000	63,000	28,000	13,000	112,000	63,000
5,100	71,000	32,000	13,500	125,000	71,000
5,200	71,000	32,000	14,000	125,000	71,000
5,400	71,000	32,000	14,500	125,000	71,000
5,500	71,000	32,000	15,000	125,000	71,000
5,600	71,000	32,000	15,500	140,000	80,000
5,700	71,000	32,000	16,000	140,000	80,000
5,800	71,000	32,000	16,500	140,000	80,000
6,000	71,000	32,000	17,000	140,000	80,000
6,100	71,000	32,000	17,500	160,000	90,000
6,200	71,000	32,000	18,000	160,000	90,000
6,300	71,000	32,000	18,500	160,000	90,000
6,400	71,000	32,000	19,000	160,000	90,000
6,500	71,000	32,000	19,500	160,000	90,000
6,700	80,000	40,000	20,000	160,000	90,000
6,800	80,000	40,000			
7,000	80,000	40,000			
7,100	80,000	40,000			
7,200	80,000	40,000			
7,400	80,000	40,000			
7,500	80,000	40,000			
7,600	80,000	40,000			
7,700	80,000	40,000			

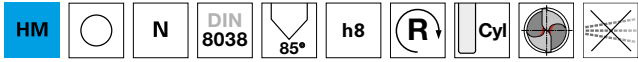


## Spiralbohrer mit HM-Schneiden

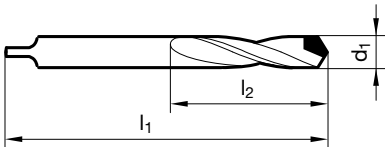
Artikel-Nr. 89303



P	M	K	N	S	H
○		○			○



Ausspitzung  $\geq \varnothing 3,100$  • Flächenanschliff • HM-bestückt • mit Mitnehmer nach DIN 1809  
 glasfaserverstärkte Kunststoffe • Duroplaste mit Schmirgelwirkung auf Schneiden und Fasen



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
3,100	56,000	25,000	6,900	80,000	40,000
3,200	56,000	25,000	7,000	80,000	40,000
4,100	63,000	28,000	7,500	80,000	40,000
4,200	63,000	28,000	8,000	80,000	40,000
4,600	63,000	28,000	8,300	90,000	50,000
5,000	63,000	28,000	8,500	90,000	50,000
5,100	71,000	32,000	9,000	90,000	50,000
5,200	71,000	32,000	10,000	100,000	56,000
5,300	71,000	32,000	10,500	100,000	56,000
5,800	71,000	32,000	11,500	112,000	63,000
6,100	71,000	32,000	13,000	112,000	63,000
6,400	71,000	32,000	19,000	160,000	90,000

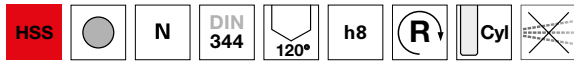


## Aufbohrer mit Zylinderschaft

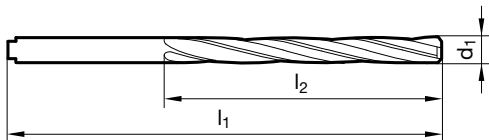
Artikel-Nr. 86010



P	M	K	N	S	H
•	○	•	○		



- Kegelmantelschliff • besonders hohe Stabilität • mit Mitnehmer nach DIN 1809 • für vorgebohrte/vorgegossene/vorgestanzte Löcher
- korrigiert Fluchtungsungenauigkeit • korrigiert Unrundheit • verbessert Bohrungsoberfläche • Anschnitt-Ø < aufzubohrendes Loch
- daher kleinsten Ø „d0“ der vorgefertigten Bohrung beachten

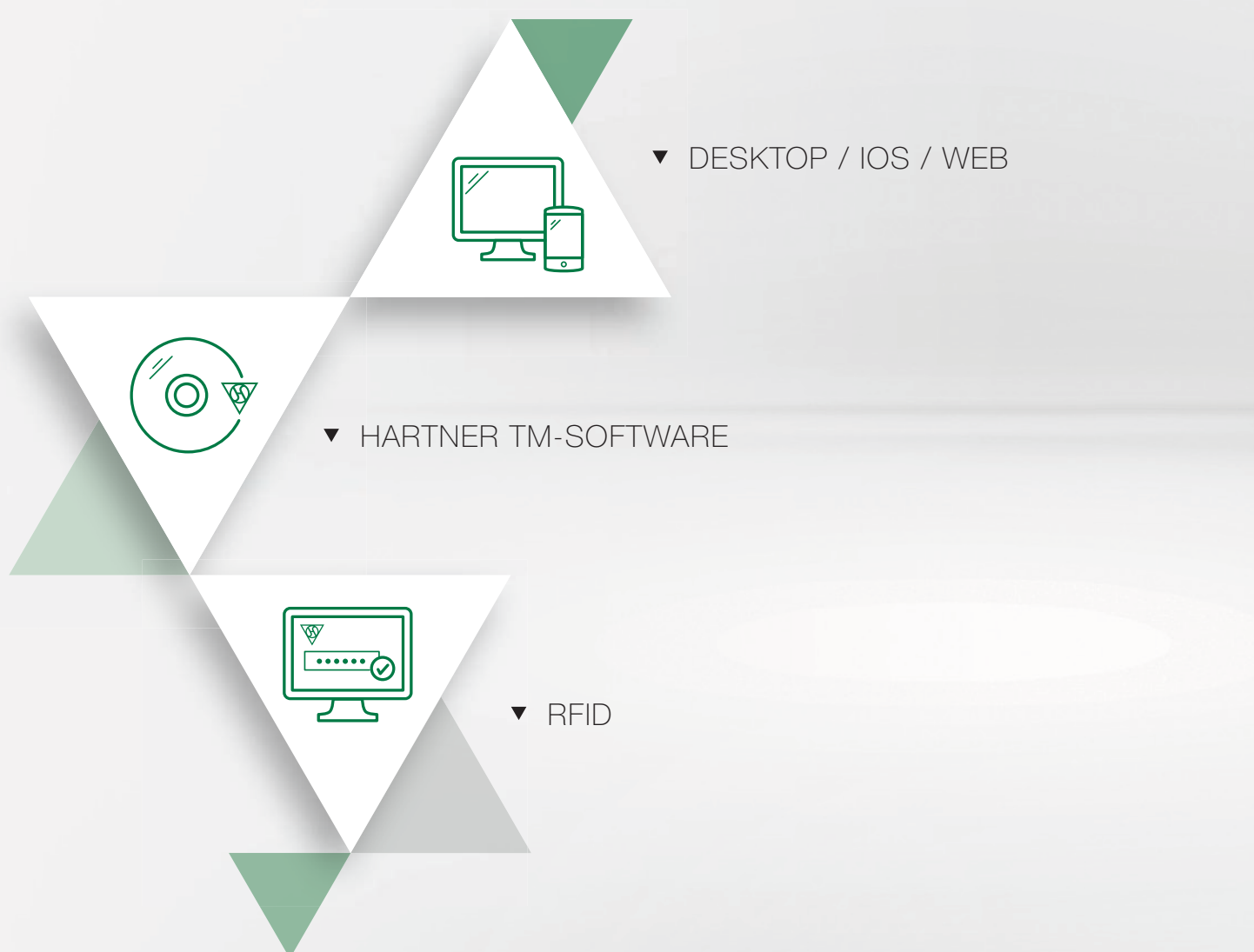


d1	inch	d0	l1	l2	d1	inch	d0	l1	l2
mm		mm	mm	mm	mm		mm	mm	mm
3,800		2,8	96,000	64,000	10,200		7,0	162,000	116,000
4,000		2,8	96,000	64,000	10,500		7,0	162,000	116,000
4,750		3,2	102,000	69,000	10,600		7,0	162,000	116,000
4,800		3,5	108,000	74,000	11,000		7,7	173,000	125,000
4,900		3,5	108,000	74,000	11,300		7,7	173,000	125,000
5,000		3,5	108,000	74,000	11,750		8,4	184,000	134,000
5,800		4,2	116,000	80,000	12,000		8,4	184,000	134,000
6,000		4,2	116,000	80,000	12,750		9,1	184,000	134,000
6,200		4,2	124,000	86,000	13,000		9,1	184,000	134,000
6,400		4,2	124,000	86,000	13,750		9,8	194,000	142,000
6,800		4,9	133,000	93,000	14,000		9,8	194,000	142,000
7,500		4,9	133,000	93,000	14,750		10,5	202,000	147,000
7,700		5,6	142,000	100,000	15,000		10,5	202,000	147,000
7,800		5,6	142,000	100,000					
8,000		5,6	142,000	100,000					
8,200		5,6	142,000	100,000					
9,800		7,0	162,000	116,000					
10,000		7,0	162,000	116,000					

# HÖCHSTE VARIABILITÄT UND FLEXIBILITÄT

## Systemeigenschaften

- ▼ rotierendes Kabinett-System mit automatisch öffnendem Rollladen
- ▼ 100 % Kontrolle der ausgegebenen Artikel
- ▼ schnelle individuelle Fach-Konfiguration
- ▼ Fachgrößen in unterschiedlichen Abmessungen möglich
- ▼ von der einzelnen WSP, über den Ø6 mm Spiralbohrer, Handschuhe, bis hin zum Tieflochbohrer kann im Automaten alles eingelagert und über die Hartner TM-Software verwaltet und ausgegeben werden
- ▼ automatischer Bestellprozess in der In-house programmierten Hartner TM-Software
- ▼ variable Lagerfachhöhen von 25 mm bis zu 1525 mm in einer 25 mm Teilung möglich
- ▼ maximal 987 Fächer (in der kleinsten Konfiguration)
- ▼ Entnahmezeit unter 10 s
- ▼ 24/7 Verfügbarkeit
- ▼ maximale Zuladung von 544 kg erreichbar
- ▼ wartungsarme Konstruktion





# HARTNER

Precision Cutting Tools



## **TOOL MANAGEMENT**

TM 826







# HARTNER

Precision Cutting Tools

Spiralbohrer  
mit Morsekegel




## SPIRALBOHRER MIT MORSEKEGEL

aus HSS, HSS-E, Hartmetall-bestückt  
blank und beschichtet





P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Spiralbohrer

		DIN 345	N	<b>HSS</b>		rechts	MK	~5xD	3,000 - 75,000	<b>82010</b>	173
		DIN 345	W	<b>HSS</b>		rechts	MK	~5xD	6,800 - 30,500	<b>82030</b>	175
		DIN 345	N	<b>HSS</b>		rechts	MK	~5xD	8,000 - 30,000	<b>84460</b>	176
		DIN 345	N	<b>HSS-E</b>		rechts	MK	~5xD	5,000 - 50,000	<b>82011</b>	177
		DIN 345	IS	<b>HSS-E</b>		rechts	MK	~5xD	11,500 - 32,000	<b>82012</b>	178
		DIN 345	FN	<b>HSS-E</b>		rechts	MK	~5xD	19,000 - 19,500	<b>84660</b>	179
		DIN 345	N	<b>HSS-E</b>		rechts	MK	~5xD	8,000 - 23,000	<b>84859</b>	180

## Spiralbohrer kurz



		Werksnorm	V	<b>HSS-E</b>		rechts	MK	~3xD	10,000 - 28,000	<b>82971</b>	181
		Werksnorm	IS	<b>HSS-E</b>		rechts	MK	~3xD	10,000 - 31,000	<b>82972</b>	182

## NC-Anbohrer




		Werksnorm	N	<b>HSS</b>		rechts	MK		12,000 - 25,000	<b>82191</b>	183
		Werksnorm	N	<b>HSS</b>		rechts	MK		12,000 - 25,000	<b>82192</b>	183

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Spiralbohrer lang

	•	•	○			DIN 341	N	HSS	○	rechts	MK	~10xD	4,000 - 50,000	82210	184
	•	○	•	•	○	DIN 341	N	HSS-E	○	rechts	MK	~10xD	5,000 - 30,000	82211	185





## Spiralbohrer überlang, Reihe 1

	•	•	○			DIN 1870	N	HSS	○	rechts	MK	~15xD	8,500 - 38,000	82310	186
	•	•	•			DIN 1870	FN	HSS	○ <sup>+0</sup> / <sub>16,0</sub>	rechts	MK	~15xD	8,000 - 30,000	82340	187
	•	•	•	•	○	DIN 1870	FN	HSS-E	○ <sup>+0</sup> / <sub>16,0</sub>	rechts	MK	~15xD	10,000 - 20,000	82341	188

## Spiralbohrer überlang, Reihe 2




	•	•	○			DIN 1870	N	HSS	○	rechts	MK	~20xD	8,500 - 30,000	82410	189
	•	•	•			DIN 1870	FN	HSS	○ <sup>+0</sup> / <sub>16,0</sub>	rechts	MK	~20xD	8,000 - 30,000	82440	190

## Spiralbohrer extra lang


	•	•	•			Werksnorm	FN	HSS	○ <sup>+0</sup> / <sub>16,0</sub>	rechts	MK	>20xD	8,000 - 20,000	82466	191
	•	•	•			Werksnorm	FN	HSS	○ <sup>+0</sup> / <sub>16,0</sub>	rechts	MK	20xD	14,000 - 38,000	82467	192
	•	•	•			Werksnorm	FN	HSS	○	rechts	MK	>20xD	14,000 - 18,000	82468	193
	•	•	•			Werksnorm	FN	HSS	○	rechts	MK	>20xD	15,000 - 18,000	82469	194

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Kühlkanalbohrer lang

	•	○	•	•	○	Werksnorm	N	HSS	○	rechts	MK	~10xD	10,000 - 40,000	82521	195
	•	○	•	•	○	Werksnorm	FN	HSS	○	rechts	MK	~10xD	10,000 - 20,000	82535	196
	•	•	•	•	○	Werksnorm	FN	HSS-E	○	rechts	MK	~10xD	15,000 - 32,500	82525	197



## Kühlkanalbohrer überlang

	•	•	•	•	○	Werksnorm	FN	HSS-E	○	rechts	MK	~15xD	14,000 - 20,000	82515	198
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## Spiralbohrer mit HM-Schneiden

	○	○	○	○	○	DIN 8041	N	HM	○	rechts	MK		8,500 - 40,000	89302	199
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## Aufbohrer mit Morsekegel

	•	○	•	○	○	DIN 343	N	HSS	○	rechts	MK		8,000 - 40,000	86110	200
	•	○	•	•	○	DIN 343	N	HSS-E	○	rechts	MK		12,000 - 22,000	86111	201

## Stiftlochbohrer

	•	○	•	○	○	DIN 1898	N	HSS	○	rechts	MK		5,000 - 20,000	82810	202
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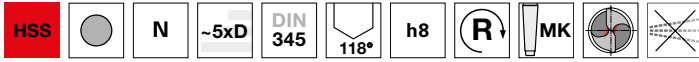


## Spiralbohrer

Artikel-Nr. 82010

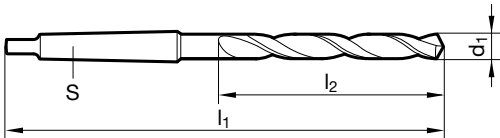


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 14,100$  • Kegelmantelschliff

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen, Neusilber und Graphit



d1		S	l1	l2	d1		S	l1	l2
mm	inch		mm	mm	mm	inch		mm	mm
3,000		MK-1	114,000	33,000	10,250		MK-1	168,000	87,000
3,300		MK-1	117,000	36,000	10,300		MK-1	168,000	87,000
3,600		MK-1	120,000	39,000	10,500		MK-1	168,000	87,000
3,750		MK-1	120,000	39,000	10,600		MK-1	168,000	87,000
4,000		MK-1	124,000	43,000	10,700		MK-1	175,000	94,000
4,200		MK-1	124,000	43,000	10,750		MK-1	175,000	94,000
4,250		MK-1	124,000	43,000	10,800		MK-1	175,000	94,000
4,500		MK-1	128,000	47,000	11,000		MK-1	175,000	94,000
4,900		MK-1	133,000	52,000	11,100		MK-1	175,000	94,000
5,000		MK-1	133,000	52,000	11,200		MK-1	175,000	94,000
5,200		MK-1	133,000	52,000	11,250		MK-1	175,000	94,000
5,500		MK-1	138,000	57,000	11,500		MK-1	175,000	94,000
5,700		MK-1	138,000	57,000	11,750		MK-1	175,000	94,000
6,000		MK-1	138,000	57,000	11,800		MK-1	175,000	94,000
6,200		MK-1	144,000	63,000	12,000		MK-1	182,000	101,000
6,500		MK-1	144,000	63,000	12,100		MK-1	182,000	101,000
6,700		MK-1	144,000	63,000	12,200		MK-1	182,000	101,000
6,750	17/64	MK-1	150,000	69,000	12,250		MK-1	182,000	101,000
6,800		MK-1	150,000	69,000	12,300	31/64	MK-1	182,000	101,000
7,000		MK-1	150,000	69,000	12,500		MK-1	182,000	101,000
7,250		MK-1	150,000	69,000	12,750		MK-1	182,000	101,000
7,500		MK-1	150,000	69,000	12,800		MK-1	182,000	101,000
7,900		MK-1	156,000	75,000	13,000		MK-1	182,000	101,000
8,000		MK-1	156,000	75,000	13,200		MK-1	182,000	101,000
8,100		MK-1	156,000	75,000	13,250		MK-1	189,000	108,000
8,200		MK-1	156,000	75,000	13,490	17/32	MK-1	189,000	108,000
8,250		MK-1	156,000	75,000	13,500		MK-1	189,000	108,000
8,400		MK-1	156,000	75,000	13,750		MK-1	189,000	108,000
8,500		MK-1	156,000	75,000	13,800		MK-1	189,000	108,000
8,700		MK-1	162,000	81,000	14,000		MK-1	189,000	108,000
8,750		MK-1	162,000	81,000	14,100		MK-2	212,000	114,000
8,800		MK-1	162,000	81,000	14,200		MK-2	212,000	114,000
9,000		MK-1	162,000	81,000	14,250		MK-2	212,000	114,000
9,200		MK-1	162,000	81,000	14,300		MK-2	212,000	114,000
9,250		MK-1	162,000	81,000	14,500		MK-2	212,000	114,000
9,500		MK-1	162,000	81,000	14,600		MK-2	212,000	114,000
9,700		MK-1	168,000	87,000	14,750		MK-2	212,000	114,000
9,750		MK-1	168,000	87,000	15,000		MK-2	212,000	114,000
9,800		MK-1	168,000	87,000	15,250		MK-2	218,000	120,000
10,000		MK-1	168,000	87,000	15,500		MK-2	218,000	120,000
10,100		MK-1	168,000	87,000	15,750		MK-2	218,000	120,000
10,200		MK-1	168,000	87,000	15,800		MK-2	218,000	120,000



## Spiralbohrer

d1 mm	inch	S	l1 mm	l2 mm	d1 mm	inch	S	l1 mm	l2 mm
16,000		MK-2	218,000	120,000	29,750		MK-3	296,000	175,000
16,100		MK-2	223,000	125,000	30,000		MK-3	296,000	175,000
16,200		MK-2	223,000	125,000	30,250		MK-3	301,000	180,000
16,250		MK-2	223,000	125,000	30,500		MK-3	301,000	180,000
16,500		MK-2	223,000	125,000	30,600		MK-3	301,000	180,000
16,750		MK-2	223,000	125,000	30,750		MK-3	301,000	180,000
17,000		MK-2	223,000	125,000	31,000		MK-3	301,000	180,000
17,250		MK-2	228,000	130,000	31,250		MK-3	301,000	180,000
17,500		MK-2	228,000	130,000	31,500		MK-3	301,000	180,000
17,750		MK-2	228,000	130,000	31,750	1 1/4	MK-3	306,000	185,000
18,000		MK-2	228,000	130,000	32,000		MK-4	334,000	185,000
18,200		MK-2	233,000	135,000	32,500		MK-4	334,000	185,000
18,250		MK-2	233,000	135,000	33,000		MK-4	334,000	185,000
18,500		MK-2	233,000	135,000	33,500		MK-4	334,000	185,000
18,750		MK-2	233,000	135,000	34,000		MK-4	339,000	190,000
19,000		MK-2	233,000	135,000	34,500		MK-4	339,000	190,000
19,250		MK-2	238,000	140,000	35,000		MK-4	339,000	190,000
19,500		MK-2	238,000	140,000	35,500		MK-4	339,000	190,000
19,700		MK-2	238,000	140,000	36,000		MK-4	344,000	195,000
19,750		MK-2	238,000	140,000	36,500		MK-4	344,000	195,000
20,000		MK-2	238,000	140,000	37,000		MK-4	344,000	195,000
20,100		MK-2	243,000	145,000	37,500		MK-4	344,000	195,000
20,200		MK-2	243,000	145,000	38,000		MK-4	349,000	200,000
20,250		MK-2	243,000	145,000	38,500	1 33/64	MK-4	349,000	200,000
20,400		MK-2	243,000	145,000	39,000		MK-4	349,000	200,000
20,500		MK-2	243,000	145,000	39,500		MK-4	349,000	200,000
20,750		MK-2	243,000	145,000	40,000		MK-4	349,000	200,000
21,000		MK-2	243,000	145,000	40,500		MK-4	354,000	205,000
21,250		MK-2	248,000	150,000	41,000		MK-4	354,000	205,000
21,500		MK-2	248,000	150,000	41,500		MK-4	354,000	205,000
21,750		MK-2	248,000	150,000	42,000		MK-4	354,000	205,000
22,000		MK-2	248,000	150,000	42,500		MK-4	354,000	205,000
22,100		MK-2	248,000	150,000	43,000		MK-4	359,000	210,000
22,200		MK-2	248,000	150,000	43,500		MK-4	359,000	210,000
22,250		MK-2	248,000	150,000	44,000		MK-4	359,000	210,000
22,500		MK-2	253,000	155,000	44,500		MK-4	359,000	210,000
22,750		MK-2	253,000	155,000	45,000		MK-4	359,000	210,000
23,000		MK-2	253,000	155,000	45,500		MK-4	364,000	215,000
23,250		MK-3	276,000	155,000	46,000		MK-4	364,000	215,000
23,500		MK-3	276,000	155,000	46,500		MK-4	364,000	215,000
23,750		MK-3	281,000	160,000	47,000		MK-4	364,000	215,000
24,000		MK-3	281,000	160,000	47,500		MK-4	364,000	215,000
24,250		MK-3	281,000	160,000	48,000		MK-4	369,000	220,000
24,500		MK-3	281,000	160,000	48,500		MK-4	369,000	220,000
24,750		MK-3	281,000	160,000	49,000		MK-4	369,000	220,000
25,000	63/64	MK-3	281,000	160,000	49,500		MK-4	369,000	220,000
25,200		MK-3	286,000	165,000	50,000		MK-4	369,000	220,000
25,250		MK-3	286,000	165,000	50,500		MK-4	374,000	225,000
25,400	1	MK-3	286,000	165,000	51,000		MK-5	412,000	225,000
25,500		MK-3	286,000	165,000	52,000		MK-5	412,000	225,000
25,750		MK-3	286,000	165,000	53,000		MK-5	412,000	225,000
25,800	1 1/64	MK-3	286,000	165,000	54,000		MK-5	417,000	230,000
26,000		MK-3	286,000	165,000	55,000		MK-5	417,000	230,000
26,250		MK-3	286,000	165,000	56,000		MK-5	417,000	230,000
26,500		MK-3	286,000	165,000	56,500		MK-5	422,000	235,000
27,000		MK-3	291,000	170,000	57,000		MK-5	422,000	235,000
27,250		MK-3	291,000	170,000	58,000		MK-5	422,000	235,000
27,500		MK-3	291,000	170,000	59,000		MK-5	422,000	235,000
27,750		MK-3	291,000	170,000	60,000		MK-5	422,000	235,000
28,000		MK-3	291,000	170,000	62,000		MK-5	427,000	240,000
28,250		MK-3	296,000	175,000	63,000		MK-5	427,000	240,000
28,500		MK-3	296,000	175,000	65,000		MK-5	432,000	245,000
28,750		MK-3	296,000	175,000	70,000		MK-5	437,000	250,000
29,000		MK-3	296,000	175,000	75,000		MK-5	442,000	255,000
29,250		MK-3	296,000	175,000					
29,500		MK-3	296,000	175,000					

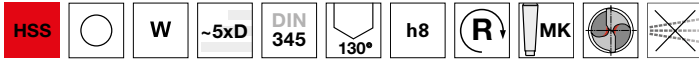


## Spiralbohrer

Artikel-Nr. 82030

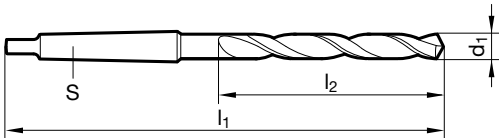


P	M	K	N	S	H
			•		



Ausspitzung  $\geq \varnothing 15,000$  • Kegelmantelschliff

weiche, langspanende Werkstoffe • Aluminium, Al-Legierungen (langspanend) • Zink, Hüttenkupfer, Silumin, Elektron



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
6,800	MK-1	150,000	69,000	15,000	MK-2	212,000	114,000
8,500	MK-1	156,000	75,000	24,300	MK-3	281,000	160,000
9,000	MK-1	162,000	81,000	30,500	MK-3	301,000	180,000
9,500	MK-1	162,000	81,000				
10,000	MK-1	168,000	87,000				
12,000	MK-1	182,000	101,000				



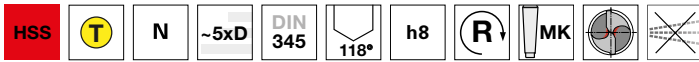
# HARTNER

## Spiralbohrer

Artikel-Nr. 84460

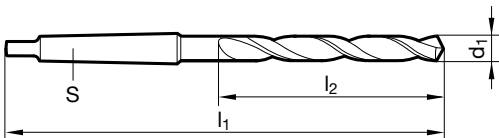


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 5,500$  • Kegelmantelanschliff

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen und Graphit



d1 mm	inch	S	l1 mm	l2 mm	d1 mm	inch	S	l1 mm	l2 mm
8,000		MK-1	156,000	75,000	18,000		MK-2	228,000	130,000
8,500		MK-1	156,000	75,000	18,500		MK-2	233,000	135,000
9,000		MK-1	162,000	81,000	19,000		MK-2	233,000	135,000
9,500		MK-1	162,000	81,000	19,500		MK-2	238,000	140,000
10,000		MK-1	168,000	87,000	20,000		MK-2	238,000	140,000
10,200		MK-1	168,000	87,000	20,500		MK-2	243,000	145,000
10,250		MK-1	168,000	87,000	21,000		MK-2	243,000	145,000
10,500		MK-1	168,000	87,000	22,000		MK-2	248,000	150,000
10,750		MK-1	175,000	94,000	22,500		MK-2	253,000	155,000
11,000		MK-1	175,000	94,000	23,000		MK-2	253,000	155,000
11,250		MK-1	175,000	94,000	24,000		MK-3	281,000	160,000
11,500		MK-1	175,000	94,000	24,500		MK-3	281,000	160,000
12,000		MK-1	182,000	101,000	25,000	63/64	MK-3	281,000	160,000
12,500		MK-1	182,000	101,000	25,500		MK-3	286,000	165,000
12,750		MK-1	182,000	101,000	26,000		MK-3	286,000	165,000
13,000		MK-1	182,000	101,000	26,500		MK-3	286,000	165,000
13,250		MK-1	189,000	108,000	27,000		MK-3	291,000	170,000
13,500		MK-1	189,000	108,000	28,000		MK-3	291,000	170,000
13,750		MK-1	189,000	108,000	28,500		MK-3	296,000	175,000
14,000		MK-1	189,000	108,000	29,000		MK-3	296,000	175,000
14,250		MK-2	212,000	114,000	29,500		MK-3	296,000	175,000
14,500		MK-2	212,000	114,000	30,000		MK-3	296,000	175,000
14,750		MK-2	212,000	114,000					
15,000		MK-2	212,000	114,000					
15,500		MK-2	218,000	120,000					
16,000		MK-2	218,000	120,000					
16,250		MK-2	223,000	125,000					
16,500		MK-2	223,000	125,000					
17,000		MK-2	223,000	125,000					
17,500		MK-2	228,000	130,000					



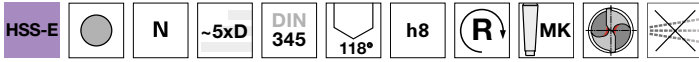


## Spiralbohrer

Artikel-Nr. 82011

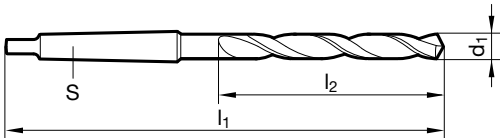


P	M	K	N	S	H
●	○	●	○		



Ausspitzung  $\geq \varnothing 5,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit

Stähle (legiert/unleg.) und Gussarten über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle  
• Vergütungs- und Einsatzstähle



d1 mm	inch	S	l1 mm	l2 mm	d1 mm	inch	S	l1 mm	l2 mm
5,000		MK-1	133,000	52,000	18,500		MK-2	233,000	135,000
6,000		MK-1	138,000	57,000	19,000		MK-2	233,000	135,000
7,000		MK-1	150,000	69,000	19,050	3/4	MK-2	238,000	140,000
7,500		MK-1	150,000	69,000	19,500		MK-2	238,000	140,000
8,000		MK-1	156,000	75,000	20,000		MK-2	238,000	140,000
8,500		MK-1	156,000	75,000	20,500		MK-2	243,000	145,000
9,000		MK-1	162,000	81,000	20,750		MK-2	243,000	145,000
9,500		MK-1	162,000	81,000	21,000		MK-2	243,000	145,000
10,000		MK-1	168,000	87,000	21,500		MK-2	248,000	150,000
10,250		MK-1	168,000	87,000	22,000		MK-2	248,000	150,000
10,500		MK-1	168,000	87,000	22,500		MK-2	253,000	155,000
11,000		MK-1	175,000	94,000	23,000		MK-2	253,000	155,000
11,500		MK-1	175,000	94,000	23,500		MK-3	276,000	155,000
12,000		MK-1	182,000	101,000	24,000		MK-3	281,000	160,000
12,200		MK-1	182,000	101,000	24,500		MK-3	281,000	160,000
12,250		MK-1	182,000	101,000	25,000	63/64	MK-3	281,000	160,000
12,500		MK-1	182,000	101,000	25,250		MK-3	286,000	165,000
12,750		MK-1	182,000	101,000	25,500		MK-3	286,000	165,000
13,000		MK-1	182,000	101,000	26,000		MK-3	286,000	165,000
13,200		MK-1	182,000	101,000	26,500		MK-3	286,000	165,000
13,500		MK-1	189,000	108,000	27,000		MK-3	291,000	170,000
13,800		MK-1	189,000	108,000	27,500		MK-3	291,000	170,000
14,000		MK-1	189,000	108,000	28,000		MK-3	291,000	170,000
14,200		MK-2	212,000	114,000	28,500		MK-3	296,000	175,000
14,290	9/16	MK-2	212,000	114,000	28,570	1 1/8	MK-3	296,000	175,000
14,500		MK-2	212,000	114,000	29,000		MK-3	296,000	175,000
14,750		MK-2	212,000	114,000	29,500		MK-3	296,000	175,000
15,000		MK-2	212,000	114,000	30,000		MK-3	296,000	175,000
15,250		MK-2	218,000	120,000	31,000		MK-3	301,000	180,000
15,500		MK-2	218,000	120,000	31,500		MK-3	301,000	180,000
15,750		MK-2	218,000	120,000	32,000		MK-4	334,000	185,000
16,000		MK-2	218,000	120,000	33,000		MK-4	334,000	185,000
16,250		MK-2	223,000	125,000	34,000		MK-4	339,000	190,000
16,500		MK-2	223,000	125,000	35,000		MK-4	339,000	190,000
16,750		MK-2	223,000	125,000	36,000		MK-4	344,000	195,000
17,000		MK-2	223,000	125,000	38,000		MK-4	349,000	200,000
17,250		MK-2	228,000	130,000	40,000		MK-4	349,000	200,000
17,460	11/16	MK-2	228,000	130,000	50,000		MK-4	369,000	220,000
17,500		MK-2	228,000	130,000					
17,750		MK-2	228,000	130,000					
18,000		MK-2	228,000	130,000					
18,200		MK-2	233,000	135,000					



# HARTNER

## Spiralbohrer

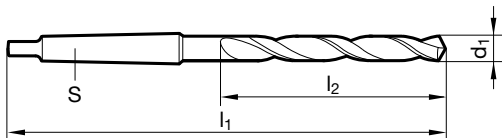
Artikel-Nr. 82012



P	M	K	N	S	H
○	●		○	●	



INOX-Drill • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
rost-/säure-/hitzebest. austenit. Stähle (V2A und V4A)



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
11,500	MK-1	175,000	94,000	20,000	MK-2	238,000	140,000
12,000	MK-1	182,000	101,000	20,500	MK-2	243,000	145,000
14,000	MK-1	189,000	108,000	21,000	MK-2	243,000	145,000
15,000	MK-2	212,000	114,000	22,000	MK-2	248,000	150,000
15,500	MK-2	218,000	120,000	22,500	MK-2	253,000	155,000
16,000	MK-2	218,000	120,000	23,000	MK-2	253,000	155,000
16,500	MK-2	223,000	125,000	26,000	MK-3	286,000	165,000
17,000	MK-2	223,000	125,000	27,500	MK-3	291,000	170,000
17,250	MK-2	228,000	130,000	28,000	MK-3	291,000	170,000
17,500	MK-2	228,000	130,000	31,500	MK-3	301,000	180,000
18,000	MK-2	228,000	130,000	32,000	MK-4	334,000	185,000
19,500	MK-2	238,000	140,000				

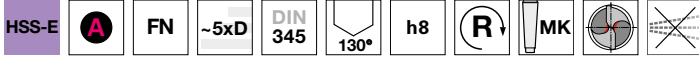


## Spiralbohrer

Artikel-Nr. 84660

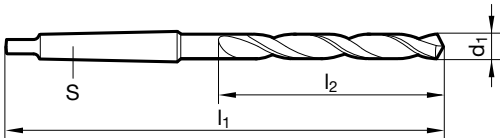


P	M	K	N	S	H
○		●	○		

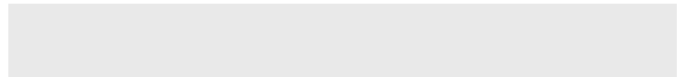
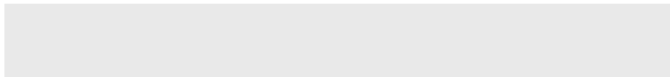


Ausspitzung  $\geq \varnothing 14,200$  • Kegelmantelanschliff • weite Spannuten • Co-legierter HSS-Stahl • höhere Verschleißbeständigkeit  
 • besonders für Bohrtiefen über 3xD

Stähle (legiert/unleg.) und Gussarten über 1000 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle  
 • Vergütungs- und Einsatzstähle



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
19,000	MK-2	233,000	135,000				
19,500	MK-2	238,000	140,000				



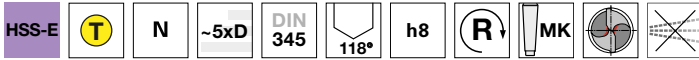


## Spiralbohrer

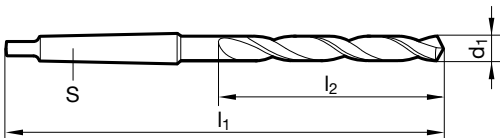
Artikel-Nr. 84859



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 8,000$  • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißbeständigkeit  
 Stähle (legiert/unleg.) und Gussarten über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle  
 • Vergütungs- und Einsatzstähle



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
8,000	MK-1	156,000	75,000	15,000	MK-2	212,000	114,000
10,000	MK-1	168,000	87,000	23,000	MK-2	253,000	155,000
11,000	MK-1	175,000	94,000				
12,000	MK-1	182,000	101,000				
13,000	MK-1	182,000	101,000				
14,000	MK-1	189,000	108,000				

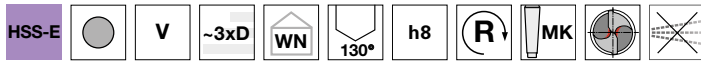


## Spiralbohrer kurz

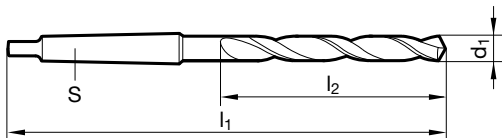
Artikel-Nr. 82971



P	M	K	N	S	H
•	•	•	○	•	○



Ausspitzung  $\geq \varnothing 10,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
schwer zu bearbeitende Werkstoffe • rost-/säurebest. Stähle • Federstähle, austenitische Stähle



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
10,000	MK-1	138,000	57,000	20,000	MK-3	212,000	91,000
10,200	MK-1	138,000	57,000	21,000	MK-3	216,000	95,000
10,500	MK-1	138,000	57,000	21,500	MK-3	219,000	98,000
11,500	MK-1	142,000	61,000	22,000	MK-3	219,000	98,000
12,000	MK-1	147,000	66,000	23,000	MK-3	222,000	101,000
12,500	MK-1	147,000	66,000	24,000	MK-3	225,000	104,000
13,000	MK-1	147,000	66,000	25,000	MK-3	225,000	104,000
13,500	MK-2	168,000	70,000	26,000	MK-4	256,000	107,000
14,000	MK-2	168,000	70,000	27,000	MK-4	259,000	110,000
14,500	MK-2	172,000	74,000	28,000	MK-4	259,000	110,000
15,000	MK-2	172,000	74,000				
15,500	MK-2	176,000	78,000				
16,000	MK-2	176,000	78,000				
17,000	MK-2	179,000	81,000				
17,500	MK-2	183,000	85,000				
18,000	MK-2	183,000	85,000				
18,500	MK-2	186,000	88,000				
19,000	MK-2	186,000	88,000				



## Spiralbohrer kurz

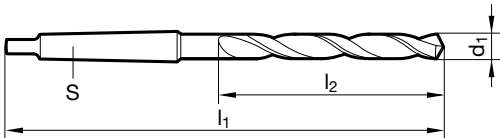
Artikel-Nr. 82972



P	M	K	N	S	H
○	●	○	○	○	○



INOX-Drill • Kegelmantelschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit  
rost-/säure-/hitzebest. austenit. Stähle (V2A und V4A)



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
10,000	MK-1	138,000	57,000	27,500	MK-4	259,000	110,000
10,500	MK-1	138,000	57,000	28,500	MK-4	263,000	114,000
10,800	MK-1	142,000	61,000	29,000	MK-4	263,000	114,000
11,500	MK-1	142,000	61,000	29,500	MK-4	263,000	114,000
11,800	MK-1	142,000	61,000	30,500	MK-4	266,000	117,000
12,000	MK-1	147,000	66,000	31,000	MK-4	266,000	117,000
15,000	MK-2	172,000	74,000				
19,750	MK-3	212,000	91,000				
21,750	MK-3	219,000	98,000				
22,750	MK-3	222,000	101,000				
26,000	MK-4	256,000	107,000				
27,000	MK-4	259,000	110,000				

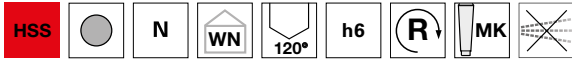


## NC-Anbohrer

### Artikel-Nr. 82191



P	M	K	N	S	H
•	○	•	•	○	

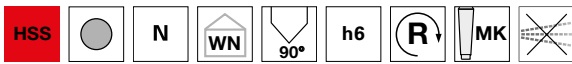


Kegelmantelanschliff • nur zum Anbohren geeignet • besonders hohe Stabilität

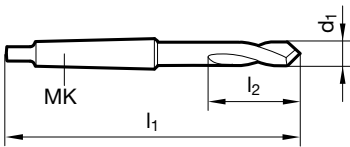
### Artikel-Nr. 82192



P	M	K	N	S	H
•	○	•	•	○	



Kegelmantelanschliff • nur zum Anbohren geeignet • besonders hohe Stabilität



d1	inch	S	l1	l2	d1	inch	S	l1	l2
mm			mm	mm	mm			mm	mm
12,000		MK-1	122,000	30,000					
16,000		MK-2	148,000	37,500					
20,000		MK-2	148,000	45,000					
25,000		MK-3	171,000	53,000					

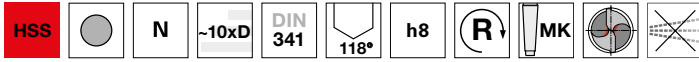


## Spiralbohrer lang

Artikel-Nr. 82210

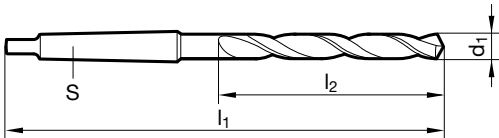


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 14,500$  • Kegelmantelanschliff • zum Bohren durch Bohrbuchsen

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sintereisen, Neusilber und Graphit



d1 mm	inch	S	l1 mm	l2 mm	d1 mm	inch	S	l1 mm	l2 mm
4,000		MK-1	145,000	64,000	21,000		MK-2	282,000	184,000
4,200		MK-1	145,000	64,000	21,400		MK-2	289,000	191,000
5,000		MK-1	155,000	74,000	21,500		MK-2	289,000	191,000
5,200		MK-1	155,000	74,000	22,000		MK-2	289,000	191,000
5,500		MK-1	161,000	80,000	22,500		MK-2	296,000	198,000
6,000		MK-1	161,000	80,000	23,000		MK-2	296,000	198,000
6,500		MK-1	167,000	86,000	23,250		MK-3	319,000	198,000
6,800		MK-1	174,000	93,000	24,000		MK-3	327,000	206,000
7,800		MK-1	181,000	100,000	24,500		MK-3	327,000	206,000
8,000		MK-1	181,000	100,000	25,000	63/64	MK-3	327,000	206,000
8,200		MK-1	181,000	100,000	25,500		MK-3	335,000	214,000
8,500		MK-1	181,000	100,000	26,000		MK-3	335,000	214,000
9,000		MK-1	188,000	107,000	26,500		MK-3	335,000	214,000
9,900		MK-1	197,000	116,000	27,000		MK-3	343,000	222,000
10,000		MK-1	197,000	116,000	27,500		MK-3	343,000	222,000
10,200		MK-1	197,000	116,000	28,000		MK-3	343,000	222,000
10,500		MK-1	197,000	116,000	29,000		MK-3	351,000	230,000
11,000		MK-1	206,000	125,000	29,500		MK-3	351,000	230,000
11,500		MK-1	206,000	125,000	30,000		MK-3	351,000	230,000
11,800		MK-1	206,000	125,000	31,000		MK-3	360,000	239,000
12,000		MK-1	215,000	134,000	32,000		MK-4	397,000	248,000
12,500		MK-1	215,000	134,000	33,000		MK-4	397,000	248,000
13,000		MK-1	215,000	134,000	34,000		MK-4	406,000	257,000
13,500		MK-1	223,000	142,000	35,000		MK-4	406,000	257,000
13,750		MK-1	223,000	142,000	36,000		MK-4	416,000	267,000
14,000		MK-1	223,000	142,000	37,000		MK-4	416,000	267,000
14,500		MK-2	245,000	147,000	38,000		MK-4	426,000	277,000
14,750		MK-2	245,000	147,000	39,000		MK-4	426,000	277,000
15,000		MK-2	245,000	147,000	39,500		MK-4	426,000	277,000
15,500		MK-2	251,000	153,000	40,000		MK-4	426,000	277,000
15,750		MK-2	251,000	153,000	41,000		MK-4	436,000	287,000
16,000		MK-2	251,000	153,000	42,000		MK-4	436,000	287,000
16,500		MK-2	257,000	159,000	44,000		MK-4	447,000	298,000
17,000		MK-2	257,000	159,000	45,000		MK-4	447,000	298,000
17,250		MK-2	263,000	165,000	48,000		MK-4	470,000	321,000
17,500		MK-2	263,000	165,000	49,000		MK-4	470,000	321,000
18,000		MK-2	263,000	165,000	50,000		MK-4	470,000	321,000
18,750		MK-2	269,000	171,000					
19,000		MK-2	269,000	171,000					
19,500		MK-2	275,000	177,000					
20,000		MK-2	275,000	177,000					
20,500		MK-2	282,000	184,000					



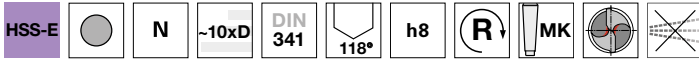


## Spiralbohrer lang

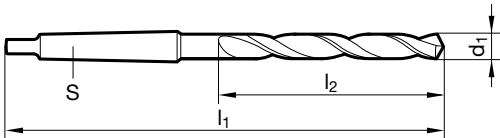
Artikel-Nr. 82211



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 5,000$  • Kegelmantelanschliff • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit • zum Bohren durch Bohrbuchsen  
 Stähle (legiert und unleg.) und Gussarten über 800 N/mm<sup>2</sup> • Warm- und Kaltarbeitsstähle • Wälzlagerstähle • hochlegierte Stähle  
 • Vergütungs- und Einsatzstähle



d1 mm	inch	S	l1 mm	l2 mm	d1 mm	inch	S	l1 mm	l2 mm
5,000		MK-1	155,000	74,000	20,000		MK-2	275,000	177,000
6,800		MK-1	174,000	93,000	25,000	63/64	MK-3	327,000	206,000
8,500		MK-1	181,000	100,000	30,000		MK-3	351,000	230,000
10,000		MK-1	197,000	116,000					
10,200		MK-1	197,000	116,000					
11,500		MK-1	206,000	125,000					
12,000		MK-1	215,000	134,000					
13,000		MK-1	215,000	134,000					
14,000		MK-1	223,000	142,000					
14,500		MK-2	245,000	147,000					
16,000		MK-2	251,000	153,000					
18,000		MK-2	263,000	165,000					

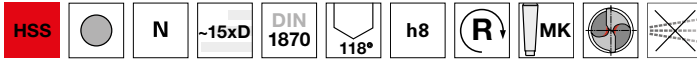


## Spiralbohrer überlang, Reihe 1

Artikel-Nr. 82310

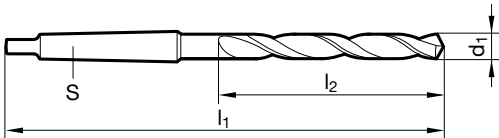


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \text{Ø } 8,500$  • Kegelmantelschliff • für extrem tiefe Bohrungen

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen und Graphit



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
8,500	MK-1	265,000	165,000	22,000	MK-2	405,000	270,000
9,000	MK-1	275,000	175,000	22,500	MK-2	405,000	270,000
9,500	MK-1	275,000	175,000	23,000	MK-2	405,000	270,000
10,000	MK-1	285,000	185,000	23,500	MK-3	425,000	270,000
10,200	MK-1	285,000	185,000	24,000	MK-3	440,000	290,000
11,000	MK-1	300,000	195,000	24,500	MK-3	440,000	290,000
11,800	MK-1	300,000	195,000	25,000	MK-3	440,000	290,000
12,500	MK-1	310,000	205,000	26,000	MK-3	440,000	290,000
13,000	MK-1	310,000	205,000	26,500	MK-3	440,000	290,000
14,000	MK-1	325,000	220,000	30,000	MK-3	460,000	305,000
14,500	MK-2	340,000	220,000	30,500	MK-3	480,000	320,000
15,000	MK-2	340,000	220,000	33,000	MK-4	505,000	320,000
15,750	MK-2	355,000	230,000	38,000	MK-4	555,000	360,000
15,800	MK-2	355,000	230,000				
16,000	MK-2	355,000	230,000				
16,250	MK-2	355,000	230,000				
17,000	MK-2	355,000	230,000				
17,500	MK-2	370,000	245,000				
17,750	MK-2	370,000	245,000				
18,000	MK-2	370,000	245,000				
18,500	MK-2	370,000	245,000				
19,000	MK-2	370,000	245,000				
20,000	MK-2	385,000	260,000				
21,000	MK-2	385,000	260,000				



## Spiralbohrer überlang, Reihe 1

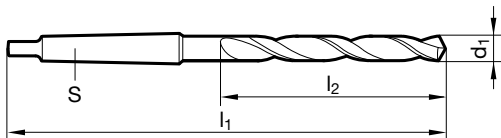
Artikel-Nr. 82340



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \text{Ø } 8,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr  
 Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	inch	S	l1 mm	l2 mm	d1 mm	inch	S	l1 mm	l2 mm
8,000		MK-1	265,000	165,000	17,500		MK-2	370,000	245,000
8,500		MK-1	265,000	165,000	18,000		MK-2	370,000	245,000
9,000		MK-1	275,000	175,000	19,000		MK-2	370,000	245,000
10,000		MK-1	285,000	185,000	19,500		MK-2	385,000	260,000
10,500		MK-1	285,000	185,000	20,000		MK-2	385,000	260,000
11,000		MK-1	300,000	195,000	20,500		MK-2	385,000	260,000
11,500		MK-1	300,000	195,000	21,000		MK-2	385,000	260,000
12,000		MK-1	310,000	205,000	22,000		MK-2	405,000	270,000
12,500		MK-1	310,000	205,000	23,000		MK-2	405,000	270,000
13,000		MK-1	310,000	205,000	24,000		MK-3	440,000	290,000
13,500		MK-1	325,000	220,000	25,000	63/64	MK-3	440,000	290,000
14,000		MK-1	325,000	220,000	26,000		MK-3	440,000	290,000
14,500		MK-2	340,000	220,000	28,000		MK-3	460,000	305,000
15,000		MK-2	340,000	220,000	29,000		MK-3	460,000	305,000
15,500		MK-2	355,000	230,000	30,000		MK-3	460,000	305,000
16,000		MK-2	355,000	230,000					
16,500		MK-2	355,000	230,000					
17,000		MK-2	355,000	230,000					



## Spiralbohrer überlang, Reihe 1

Artikel-Nr. 82341

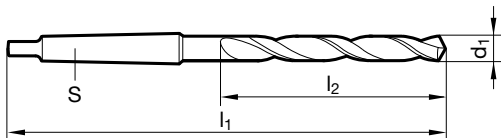


P	M	K	N	S	H
•	•	•	•	•	○



Ausspitzung  $\geq \text{Ø } 10,000$  • Kegelmantelschliff • weite Spannuten • höhere Verschleißfestigkeit • Co-legierter HSS-Stahl • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr

Stähle und Stahlguss mit hoher Festigkeit • Grauguss, Temperguss, Sphäroguss



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
10,000	MK-1	285,000	185,000	16,000	MK-2	355,000	230,000
12,000	MK-1	310,000	205,000	16,500	MK-2	355,000	230,000
12,500	MK-1	310,000	205,000	17,000	MK-2	355,000	230,000
13,000	MK-1	310,000	205,000	18,000	MK-2	370,000	245,000
14,000	MK-1	325,000	220,000	19,000	MK-2	370,000	245,000
15,000	MK-2	340,000	220,000	20,000	MK-2	385,000	260,000

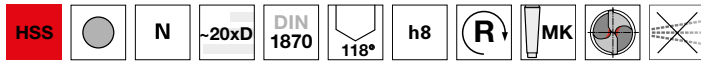


## Spiralbohrer überlang, Reihe 2

Artikel-Nr. 82410

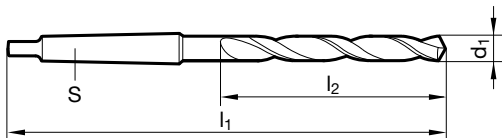


P	M	K	N	S	H
•		•	○		



Ausspitzung  $\geq \varnothing 8,500$  • Kegelmantelschliff • für extrem tiefe Bohrungen

Stahl und Stahlguss (legiert und unleg.) • Grauguss, Temperguss, Sphäroguss • Sinterisen und Graphit



d1 mm	inch	S	l1 mm	l2 mm	d1 mm	inch	S	l1 mm	l2 mm
8,500		MK-1	330,000	210,000	19,000		MK-2	465,000	310,000
9,000		MK-1	345,000	220,000	20,000		MK-2	490,000	325,000
9,500		MK-1	345,000	220,000	21,000		MK-2	490,000	325,000
10,000		MK-1	360,000	235,000	22,000		MK-2	515,000	345,000
10,500		MK-1	360,000	235,000	23,000		MK-2	515,000	345,000
11,000		MK-1	375,000	250,000	25,000	63/64	MK-3	555,000	365,000
11,750		MK-1	375,000	250,000	28,000		MK-3	580,000	385,000
11,800		MK-1	375,000	250,000	30,000		MK-3	580,000	385,000
13,000		MK-1	395,000	260,000					
13,500		MK-1	410,000	275,000					
14,000		MK-1	410,000	275,000					
14,500		MK-2	425,000	275,000					
15,000		MK-2	425,000	275,000					
15,500		MK-2	445,000	295,000					
15,750		MK-2	445,000	295,000					
16,000		MK-2	445,000	295,000					
16,250		MK-2	445,000	295,000					
18,000		MK-2	465,000	310,000					



## Spiralbohrer überlang, Reihe 2

Artikel-Nr. 82440

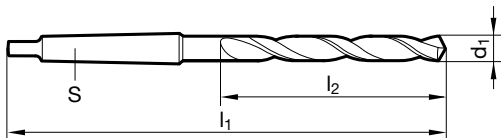


P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \text{Ø } 8,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr

Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	inch	S	l1 mm	l2 mm	d1 mm	inch	S	l1 mm	l2 mm
8,000		MK-1	330,000	210,000	18,000		MK-2	465,000	310,000
8,500		MK-1	330,000	210,000	18,500		MK-2	465,000	310,000
9,500		MK-1	345,000	220,000	19,000		MK-2	465,000	310,000
10,000		MK-1	360,000	235,000	19,500		MK-2	490,000	325,000
10,500		MK-1	360,000	235,000	20,000		MK-2	490,000	325,000
11,000		MK-1	375,000	250,000	20,500		MK-2	490,000	325,000
12,000		MK-1	395,000	260,000	21,000		MK-2	490,000	325,000
12,500		MK-1	395,000	260,000	21,500		MK-2	515,000	345,000
13,000		MK-1	395,000	260,000	22,000		MK-2	515,000	345,000
13,500		MK-1	410,000	275,000	23,000		MK-2	515,000	345,000
14,000		MK-1	410,000	275,000	24,000		MK-3	555,000	365,000
14,500		MK-2	425,000	275,000	25,000	63/64	MK-3	555,000	365,000
15,000		MK-2	425,000	275,000	26,000		MK-3	555,000	365,000
15,500		MK-2	445,000	295,000	28,000		MK-3	580,000	385,000
16,000		MK-2	445,000	295,000	29,000		MK-3	580,000	385,000
16,500		MK-2	445,000	295,000	30,000		MK-3	580,000	385,000
17,000		MK-2	445,000	295,000					
17,500		MK-2	465,000	310,000					



## Spiralbohrer extra lang

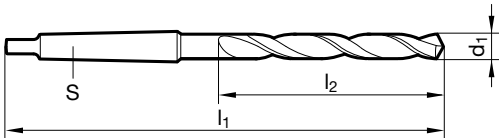
Artikel-Nr. 82466



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \text{Ø } 8,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
8,000	MK-1	500,000	420,000	20,000	MK-2	500,000	400,000
8,500	MK-1	500,000	420,000				
9,000	MK-1	500,000	420,000				
10,000	MK-1	500,000	420,000				
12,000	MK-1	500,000	420,000				
13,000	MK-1	500,000	420,000				
14,000	MK-1	500,000	420,000				
15,000	MK-2	500,000	400,000				
16,000	MK-2	500,000	400,000				
17,000	MK-2	500,000	400,000				
18,000	MK-2	500,000	400,000				
19,000	MK-2	500,000	400,000				



## Spiralbohrer extra lang

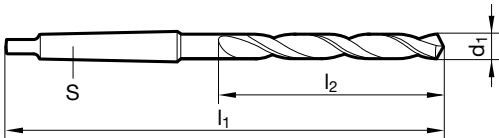
Artikel-Nr. 82467



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \text{Ø } 14,000$  • Kegelmantelanschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
14,000	MK-1	600,000	500,000	32,000	MK-4	600,000	450,000
15,000	MK-2	600,000	500,000	35,000	MK-4	600,000	450,000
16,000	MK-2	600,000	500,000	38,000	MK-4	600,000	450,000
18,000	MK-2	600,000	500,000				
19,000	MK-2	600,000	500,000				
20,000	MK-2	600,000	500,000				
21,000	MK-2	600,000	500,000				
22,000	MK-2	600,000	500,000				
23,000	MK-2	600,000	500,000				
24,000	MK-3	600,000	475,000				
25,000	MK-3	600,000	475,000				
30,000	MK-3	600,000	475,000				



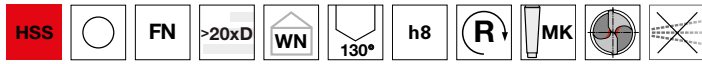


## Spiralbohrer extra lang

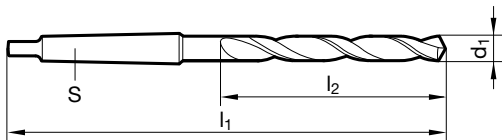
Artikel-Nr. 82468



P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \text{Ø } 14,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
14,000	MK-1	750,000	650,000				
15,000	MK-2	750,000	650,000				
16,000	MK-2	750,000	650,000				
18,000	MK-2	750,000	650,000				



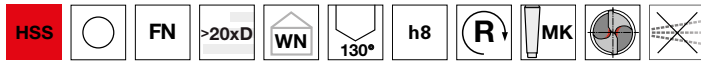
# HARTNER

## Spiralbohrer extra lang

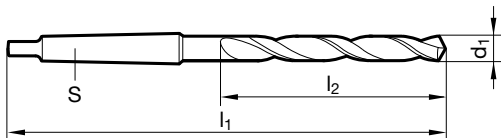
Artikel-Nr. 82469



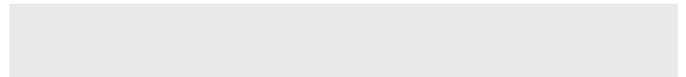
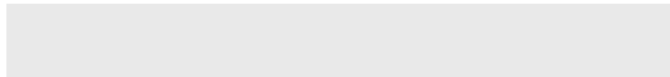
P	M	K	N	S	H
•		•	•		



Ausspitzung  $\geq \text{Ø } 15,000$  • Kegelmantelschliff • weite Spannuten • für extrem tiefe Bohrungen • bei schlechter Spanabfuhr Grauguss und Stähle bis  $1000 \text{ N/mm}^2$  • Ausnahmen: CrNi-Stähle, VA-Stähle u.ä.



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
15,000	MK-2	1000,000	850,000				
18,000	MK-2	1000,000	850,000				



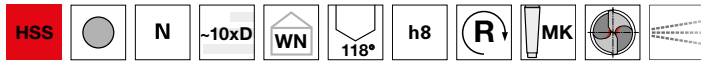


## Kühlkanalbohrer lang

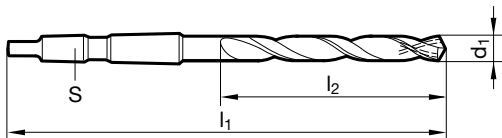
Artikel-Nr. 82521



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 10,000$  • Kegelmantelanschliff • Kühlmittelzufuhr axial durch den Morsekegel • zum Bohren durch Bohrbuchsen Blechpakete • Stahl und Stahlguss, Grauguss • austenitische Stähle bis 800 N/mm<sup>2</sup>



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
10,000	MK-2	233,000	116,000	22,000	MK-3	327,000	191,000
11,000	MK-2	242,000	125,000	23,000	MK-3	334,000	198,000
12,000	MK-2	251,000	134,000	24,000	MK-3	342,000	206,000
13,000	MK-2	251,000	134,000	25,000	MK-3	342,000	206,000
13,200	MK-2	251,000	134,000	26,000	MK-3	350,000	214,000
13,500	MK-2	259,000	142,000	26,500	MK-3	350,000	214,000
13,800	MK-2	259,000	142,000	27,000	MK-4	385,000	222,000
14,000	MK-2	259,000	142,000	28,000	MK-4	385,000	222,000
15,000	MK-2	264,000	147,000	29,000	MK-4	393,000	230,000
16,000	MK-2	270,000	153,000	30,000	MK-4	393,000	230,000
17,000	MK-2	276,000	159,000	32,000	MK-4	421,000	248,000
18,000	MK-2	282,000	165,000	34,000	MK-4	430,000	257,000
18,500	MK-3	307,000	171,000	35,000	MK-4	430,000	257,000
18,750	MK-3	307,000	171,000	40,000	MK-4	450,000	277,000
19,000	MK-3	307,000	171,000				
19,500	MK-3	313,000	177,000				
20,000	MK-3	313,000	177,000				
21,000	MK-3	320,000	184,000				

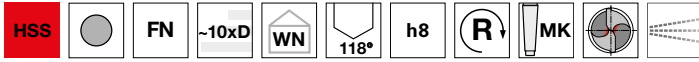


## Kühlkanalbohrer lang

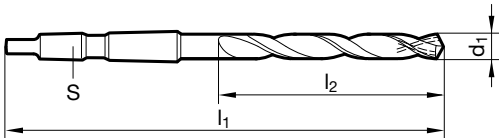
Artikel-Nr. 82535



P	M	K	N	S	H
•	○	•	•		



Ausspitzung  $\geq \varnothing 10,000$  • Kegelmantelanschliff • Kühlmittelzufuhr axial durch den Morsekegel • zum Bohren durch Bohrbuchsen Blechpakete • Stahl und Stahlguss, Grauguss • austenitische Stähle bis 800 N/mm<sup>2</sup>



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
10,000	MK-2	224,000	116,000	18,500	MK-3	303,000	171,000
10,500	MK-2	224,000	116,000	19,000	MK-3	303,000	171,000
11,000	MK-2	233,000	125,000	19,500	MK-3	309,000	177,000
11,500	MK-2	233,000	125,000	20,000	MK-3	309,000	177,000
12,000	MK-2	242,000	134,000				
12,500	MK-2	242,000	134,000				
15,000	MK-2	255,000	147,000				
16,000	MK-2	261,000	153,000				
16,500	MK-2	267,000	159,000				
17,000	MK-2	267,000	159,000				
17,500	MK-2	273,000	165,000				
18,000	MK-2	273,000	165,000				

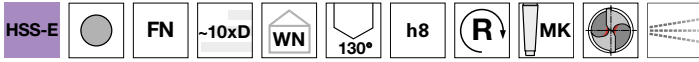


## Kühlkanalbohrer lang

Artikel-Nr. 82525

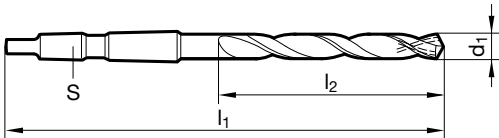


P	M	K	N	S	H
•	•	•	•	•	○



Ausspitzung  $\geq \text{Ø } 15,000$  • Kegelmantelanschliff • Kühlmittelzufuhr axial durch den Morsekegel • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit • zum Bohren durch Bohrbuchsen

festen und hochfesten Stählen • Stahlguss, Grauguss • rost-/säure-/hitzebeständige Stähle • Festigkeiten bis zu 1300 N/mm<sup>2</sup>



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
15,000	MK-2	264,000	147,000				
17,000	MK-2	276,000	159,000				
18,000	MK-2	282,000	165,000				
21,000	MK-3	320,000	184,000				
22,000	MK-3	327,000	191,000				
32,500	MK-4	421,000	248,000				

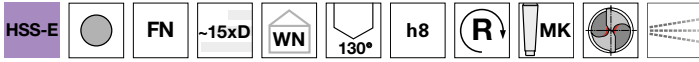


## Kühlkanalbohrer überlang

Artikel-Nr. 82515

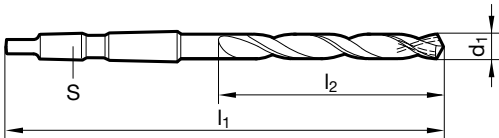


P	M	K	N	S	H
•	•	•	•	•	○



Ausspitzung  $\geq \text{Ø } 14,000$  • Kegelmantelschliff • Kühlmittelzufuhr axial durch den Morsekegel • Co-legierter HSS-Stahl • höhere Verschleißfestigkeit • zum Bohren durch Bohrbuchsen

festen und hochfesten Stählen • Stahlguss, Grauguss • rost-/säure-/hitzebeständige Stähle • Festigkeiten bis zu 1300 N/mm<sup>2</sup>



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
14,000	MK-2	337,000	220,000				
16,000	MK-2	347,000	230,000				
18,000	MK-2	362,000	245,000				
20,000	MK-3	396,000	260,000				

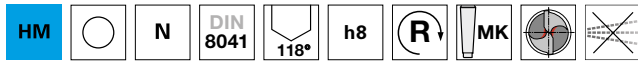


## Spiralbohrer mit HM-Schneiden

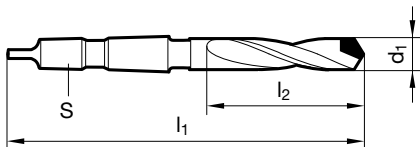
Artikel-Nr. 89302



P	M	K	N	S	H
○		○			○



Ausspitzung  $\geq \varnothing 8,500$  • Flächenanschliff • HM-bestückt  
 Federbandstahl • Hartguss über 300 HB • Reinstmolybdän • zähnharte Bronzen



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
8,500	MK-1	135,000	45,000	18,000	MK-2	185,000	80,000
10,000	MK-1	140,000	50,000	19,000	MK-2	185,000	80,000
10,200	MK-1	140,000	50,000	20,000	MK-3	215,000	90,000
10,500	MK-1	140,000	50,000	21,500	MK-3	215,000	90,000
11,000	MK-1	140,000	50,000	22,000	MK-3	215,000	90,000
11,500	MK-1	146,000	56,000	25,000	MK-3	225,000	100,000
12,000	MK-1	146,000	56,000	26,500	MK-4	260,000	110,000
12,500	MK-1	146,000	56,000	27,000	MK-4	260,000	110,000
13,000	MK-1	146,000	56,000	29,000	MK-4	275,000	125,000
13,500	MK-2	168,000	63,000	30,000	MK-4	275,000	125,000
14,000	MK-2	168,000	63,000	32,000	MK-4	275,000	125,000
14,500	MK-2	168,000	63,000	33,000	MK-4	290,000	140,000
15,000	MK-2	168,000	63,000	40,000	MK-4	310,000	160,000
15,500	MK-2	175,000	70,000				
16,000	MK-2	175,000	70,000				
16,500	MK-2	175,000	70,000				
17,000	MK-2	175,000	70,000				
17,500	MK-2	185,000	80,000				



## Aufbohrer mit Morsekegel

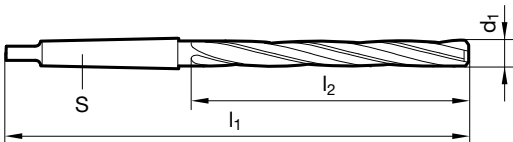
Artikel-Nr. 86110



P	M	K	N	S	H
•	○	•	○		



Kegelmantelschliff • dreischneidig • besonders hohe Stabilität • für vorgebohrte/vorgegossene/vorgestanzte Löcher • korrigiert Fluchtungsungenauigkeit • korrigiert Unrundheit • verbessert Bohrungs Oberfläche • Anschnitt-Ø < aufzubohrendes Loch • daher kleinsten Ø „d0“ der vorgefertigten Bohrung beachten • nach Aufbohren einwandfrei Fertigreiben



d1 mm	d0 mm	S	l1 mm	l2 mm	d1 mm	d0 mm	S	l1 mm	l2 mm
8,000	5,6	MK-1	156,000	75,000	22,700	16,0	MK-2	253,000	155,000
9,000	6,3	MK-1	162,000	81,000	23,000	16,0	MK-2	253,000	155,000
9,800	7,0	MK-1	168,000	87,000	24,000	16,6	MK-3	281,000	160,000
10,000	7,0	MK-1	168,000	87,000	25,000	17,3	MK-3	281,000	160,000
10,100	7,0	MK-1	168,000	87,000	25,700	18,0	MK-3	286,000	165,000
11,000	7,7	MK-1	175,000	94,000	26,000	18,0	MK-3	286,000	165,000
11,500	7,7	MK-1	175,000	94,000	26,700	18,6	MK-3	291,000	170,000
11,750	8,4	MK-1	182,000	101,000	27,000	18,6	MK-3	291,000	170,000
13,000	9,1	MK-1	182,000	101,000	27,700	19,3	MK-3	291,000	170,000
13,750	9,8	MK-1	189,000	108,000	28,000	19,3	MK-3	291,000	170,000
14,000	9,8	MK-1	189,000	108,000	29,000	20,0	MK-3	296,000	175,000
14,100	10,5	MK-2	212,000	114,000	29,700	20,5	MK-3	296,000	175,000
14,750	10,5	MK-2	212,000	114,000	30,000	20,5	MK-3	296,000	175,000
15,000	10,5	MK-2	212,000	114,000	31,000	21,0	MK-3	301,000	180,000
15,750	11,2	MK-2	218,000	120,000	31,600	22,0	MK-4	334,000	185,000
16,000	11,2	MK-2	218,000	120,000	32,000	22,0	MK-4	334,000	185,000
16,250	11,9	MK-2	223,000	125,000	32,600	23,0	MK-4	334,000	185,000
16,750	11,9	MK-2	223,000	125,000	33,000	23,0	MK-4	334,000	185,000
17,000	11,9	MK-2	223,000	125,000	34,000	24,0	MK-4	339,000	190,000
17,750	12,6	MK-2	228,000	130,000	35,000	25,0	MK-4	339,000	190,000
18,000	12,6	MK-2	228,000	130,000	35,600	25,5	MK-4	344,000	195,000
18,700	13,3	MK-2	233,000	135,000	36,000	25,5	MK-4	344,000	195,000
19,000	13,3	MK-2	233,000	135,000	36,600	26,0	MK-4	344,000	195,000
19,700	14,0	MK-2	238,000	140,000	37,600	26,5	MK-4	349,000	200,000
19,750	14,0	MK-2	238,000	140,000	38,000	26,5	MK-4	349,000	200,000
20,000	14,0	MK-2	238,000	140,000	39,000	27,0	MK-4	349,000	200,000
20,700	14,6	MK-2	243,000	145,000	40,000	28,0	MK-4	349,000	200,000
21,000	14,6	MK-2	243,000	145,000					
21,700	15,3	MK-2	248,000	150,000					
22,000	15,3	MK-2	248,000	150,000					





## Aufbohrer mit Morsekegel

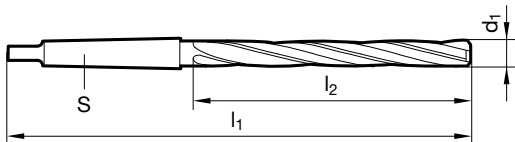
Artikel-Nr. 86111



P	M	K	N	S	H
•	○	•	•	○	



Kegelmantelanschliff • dreischneidig • besonders hohe Stabilität • für vorgebohrte/vorgegossene/vorgestanzte Löcher • korrigiert Fluchtungsungenauigkeit • korrigiert Unrundheit • verbessert Bohrungsfläche • Anschnitt-Ø < aufzubohrendes Loch • daher kleinsten Ø „d0“ der vorgefertigten Bohrung beachten • nach Aufbohren einwandfrei Fertigreiben



d1 mm	d0 mm	S	l1 mm	l2 mm
12,000	8,400	MK-1	182,000	101,000
14,000	9,800	MK-1	189,000	108,000
22,000	15,300	MK-2	248,000	150,000

d1 mm	d0 mm	S	l1 mm	l2 mm
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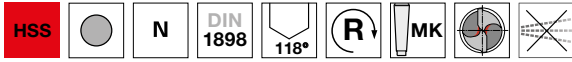


## Stiftlochbohrer

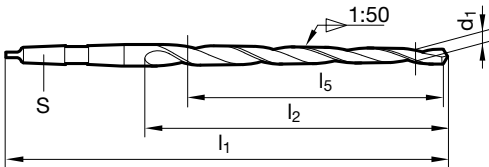
Artikel-Nr. 82810



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \text{Ø } 13,000$  • Kegelmantelschliff • für Kegelbohrungen zur Aufnahme von Kegelstiften nach DIN 1 (neu: DIN EN 22339), DIN 7978 (neu: DIN EN 28736), DIN 7977 (neu: DIN EN 28737) und DIN 258



d1 mm	S	l1 mm	l2 mm	l5 mm	d1 mm	S	l1 mm	l2 mm	l5 mm
5,000	MK-1	155,000	81,000	75,000	14,000	MK-2	325,000	229,000	220,000
6,000	MK-1	187,000	108,000	105,000	16,000	MK-2	335,000	239,000	230,000
8,000	MK-1	227,000	149,000	145,000	20,000	MK-3	377,000	263,000	250,000
10,000	MK-1	257,000	180,000	175,000					
12,000	MK-2	315,000	219,000	210,000					
13,000	MK-2	325,000	229,000	220,000					



# HARTNER

Precision Cutting Tools

## Polierte Spannuten mit höchster Oberflächengüte

- ▼ optimaler Spänetransport
- ▼ Reduktion der Prozesskräfte durch Verringerung der Reibung zwischen Span und Werkzeug

## Spitzenanschliff

- ▼ Kegelmantelanschliff mit konkaver Schneide – kurzer Spanbruch
- ▼ Robuste Schneidenform mit Schneideckenschutz (Negativfase)

NEW

## Mikrogeometrie

- ▼ Schneidkantenpräparation durch Nassstrahlen und Polieren
- ▼ Verhinderung von Mikroausbrüchen und Aufbauschneiden
- ▼ Reduktion der Schnittkräfte und Prozesstemperaturen

## 4 Führungsfasen

für beste Bohrungsqualität und höchste Laufruhe

# TS 100 HPC





# HARTNER

Precision Cutting Tools

TS-Drills

## TS-DRILLS

High-Tech-Werkzeug aus Vollhartmetall  
blank und beschichtet











P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## TS-Drills ohne Innenkühlung

	•	○	•	○	○	DIN 6537K	TS 100 U	VHM		rechts	HE	3xD	3,000 - 19,500	89264	210
	•	○	•	○	○	DIN 6537K	TS 100 U	VHM		rechts	HA	3xD	3,000 - 20,000	89413	212
	•	○	•	○	○	DIN 6537K	TS 100 U	VHM		rechts	HE	3xD	3,000 - 20,000	89402	212
	•	○	•	○	○	DIN 6537K	TS 100 H	VHM		rechts	HA	3xD	3,000 - 20,000	89422	214
	•	○	•	○	○	DIN 6539	TS 100 U	VHM		rechts	zyl.	3xD	3,000 - 16,000	89237	216
	•	○	•	○	○	DIN 6539	TS 100 U	VHM		rechts	zyl.	3xD	3,000 - 16,000	89401	216
	•	○	•	○	○	DIN 6537L	TS 100 U	VHM		rechts	HA	5xD	3,000 - 20,000	89414	218
	•	○	•	○	○	DIN 6537L	TS 100 U	VHM		rechts	HE	5xD	3,000 - 20,000	89417	218
	•	○	•	○	○	Werksnorm	TS 100 U	VHM		rechts	zyl.	5xD	5,160 - 16,000	89275	220

## TS-Drills mit Innenkühlung

	•	○	○	○	○	DIN 6538K	TS 80 U	HM		rechts	HE	3xD	10,000 - 25,000	89306	221
	•	○	•	○	○	DIN 6537K	TS 100 U	VHM		rechts	HE	3xD	3,000 - 20,000	89266	222
	•	○	•	○	○	DIN 6537K	TS 100 U	VHM		rechts	HA	3xD	3,000 - 20,000	89410	223
	•	○	•	○	○	DIN 6537K	TS 100 U	VHM		rechts	HE	3xD	3,000 - 20,000	89415	223

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
	•				○	DIN 6537K	TS 100 H	VHM		rechts	HA	3xD	3,000 - 20,000	89423	225
	•				○	DIN 6537K	TS 100 H	VHM		rechts	HE	3xD	3,000 - 20,000	89424	225
	○	•			○	DIN 6537K	TS 100 INOX	VHM		rechts	HA	3xD	3,000 - 20,000	89450	227
	○	•			○	DIN 6537K	TS 100 INOX	VHM		rechts	HE	3xD	3,000 - 20,000	89550	227
		•			○	Werksnorm	TS 150 GG	VHM		rechts	HA	4xD	3,000 - 20,000	89292	229
	•	○	○	○		DIN 6538M	TS 80 U	HM		rechts	HE	5xD	9,800 - 25,000	89307	230
	•	○	•	○	○	DIN 6537L	TS 100 U	VHM		rechts	HE	5xD	3,000 - 19,500	89272	231
	•	○	•	○	○	DIN 6537L	TS 100 U	VHM		rechts	HA	5xD	3,000 - 20,000	89411	232
	•	○	•	○	○	DIN 6537L	TS 100 U	VHM		rechts	HE	5xD	3,000 - 20,000	89408	232
		•				DIN 6537L	TS 100 R	VHM		rechts	HA	5xD	3,000 - 20,000	89420	234
	•				○	DIN 6537L	TS 100 H	VHM		rechts	HA	5xD	3,000 - 20,000	89425	236
	•				○	DIN 6537L	TS 100 H	VHM		rechts	HE	5xD	3,000 - 20,000	89426	236
	○	•			○	DIN 6537L	TS 100 INOX	VHM		rechts	HA	5xD	3,000 - 20,000	89451	238
	○	•			○	DIN 6537L	TS 100 INOX	VHM		rechts	HE	5xD	3,000 - 20,000	89551	238

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
			•			DIN 6537L	TS 100 ALU	VHM	○	rechts	HA	5xD	3,000 - 20,000	89560	240
•	○	○	○	○	○	DIN 6537L	TS 100 HPC	VHM	Ⓡ	rechts	HA	5xD	3,000 - 20,000	89460	242
•	○	○	○	○	○	DIN 6538L	TS 80 U	HM	Ⓡ	rechts	HE	7xD	10,000 - 22,000	89308	244
		•	○			Werksnorm	TS 150 GG	VHM	○	rechts	HA	7xD	3,000 - 20,000	89294	245
•	○	•	○	○	○	Werksnorm	TS 100 U	VHM	Ⓡ	rechts	HA	7xD	3,000 - 20,000	89412	246
•	○	•	○	○	○	Werksnorm	TS 100 U	VHM	Ⓡ	rechts	HE	7xD	3,000 - 20,000	89416	246
		•				Werksnorm	TS 100 R	VHM	Ⓡ	rechts	HA	7xD	4,000 - 20,000	89421	248
•			•	○		Werksnorm	TS 100 H	VHM	Ⓡ	rechts	HA	7xD	3,000 - 16,000	89427	250
•	○	○	○	○	○	Werksnorm	TS 100 HPC	VHM	Ⓡ	rechts	HA	7xD	3,000 - 20,000	89461	251
		•	○			Werksnorm	TS 150 GG	VHM	○	rechts	HA	10xD	3,000 - 20,000	89293	253
		○	•			Werksnorm	TS 150 GG	VHM	○	rechts	HA	10xD	3,000 - 20,000	89295	253
•	○	•	○	○	○	Werksnorm	TS 100 U	VHM	Ⓡ	rechts	HA	12xD	3,000 - 20,000	89418	255
•	•	•	○	○	○	Werksnorm	TS 100 T	VHM	Ⓡ	rechts	HA	15xD	3,000 - 16,000	86509	257
•	•	•	○	○	○	Werksnorm	TS 100 T	VHM	Ⓡ	rechts	HA	20xD	3,000 - 16,000	86511	258



P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## TS-Drills mit Innenkühlung



•	•	•	○	○	Werksnorm	TS 100 T	VHM	ⓐ	rechts	HA	25xD	3,000 - 16,000	86512	259
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•	•	•	○	○	Werksnorm	TS 100 T	VHM	ⓐ	rechts	HA	30xD	3,000 - 14,000	86513	260
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•	•	•	○	○	Werksnorm	TS 100 T	VHM	ⓐ	rechts	HA	40xD	3,000 - 10,000	86514	261
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## TS-Drills, 3-schneidig



	•	•			DIN 6537L	TS 3 G	VHM	○	rechts	HA	5xD	3,000 - 20,000	89247	262
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	○	○			DIN 6539	TS 3 G	VHM	○	rechts	zyl.	5xD	3,000 - 20,000	89239	263
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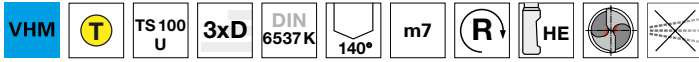


## TS-Drills ohne Innenkühlung

Artikel-Nr. 89264

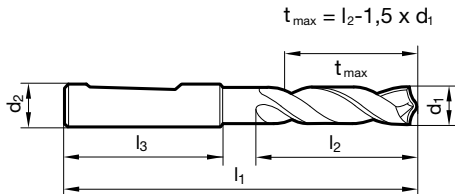


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	62,000	20,000	36,000	7,800		8,000	79,000	41,000	36,000
3,170	1/8	6,000	62,000	20,000	36,000	7,900		8,000	79,000	41,000	36,000
3,200		6,000	62,000	20,000	36,000	8,000		8,000	79,000	41,000	36,000
3,300		6,000	62,000	20,000	36,000	8,100		10,000	89,000	47,000	40,000
3,400		6,000	62,000	20,000	36,000	8,200		10,000	89,000	47,000	40,000
3,500		6,000	62,000	20,000	36,000	8,300		10,000	89,000	47,000	40,000
3,600		6,000	62,000	20,000	36,000	8,400		10,000	89,000	47,000	40,000
3,700		6,000	62,000	20,000	36,000	8,500		10,000	89,000	47,000	40,000
3,900		6,000	66,000	24,000	36,000	8,600		10,000	89,000	47,000	40,000
4,000		6,000	66,000	24,000	36,000	8,700		10,000	89,000	47,000	40,000
4,100		6,000	66,000	24,000	36,000	8,800		10,000	89,000	47,000	40,000
4,200		6,000	66,000	24,000	36,000	8,900		10,000	89,000	47,000	40,000
4,300		6,000	66,000	24,000	36,000	9,000		10,000	89,000	47,000	40,000
4,500		6,000	66,000	24,000	36,000	9,100		10,000	89,000	47,000	40,000
4,600		6,000	66,000	24,000	36,000	9,300		10,000	89,000	47,000	40,000
4,700		6,000	66,000	24,000	36,000	9,400		10,000	89,000	47,000	40,000
4,760	3/16	6,000	66,000	28,000	36,000	9,500		10,000	89,000	47,000	40,000
4,800		6,000	66,000	28,000	36,000	9,600		10,000	89,000	47,000	40,000
4,900		6,000	66,000	28,000	36,000	9,700		10,000	89,000	47,000	40,000
5,000		6,000	66,000	28,000	36,000	9,800		10,000	89,000	47,000	40,000
5,100		6,000	66,000	28,000	36,000	9,900		10,000	89,000	47,000	40,000
5,200		6,000	66,000	28,000	36,000	10,000		10,000	89,000	47,000	40,000
5,300		6,000	66,000	28,000	36,000	10,100		12,000	102,000	55,000	45,000
5,400		6,000	66,000	28,000	36,000	10,200		12,000	102,000	55,000	45,000
5,500		6,000	66,000	28,000	36,000	10,300		12,000	102,000	55,000	45,000
5,560	7/32	6,000	66,000	28,000	36,000	10,500		12,000	102,000	55,000	45,000
5,700		6,000	66,000	28,000	36,000	10,600		12,000	102,000	55,000	45,000
5,800		6,000	66,000	28,000	36,000	10,800		12,000	102,000	55,000	45,000
5,900		6,000	66,000	28,000	36,000	11,000		12,000	102,000	55,000	45,000
6,000		6,000	66,000	28,000	36,000	11,100		12,000	102,000	55,000	45,000
6,100		8,000	79,000	34,000	36,000	11,200		12,000	102,000	55,000	45,000
6,200		8,000	79,000	34,000	36,000	11,400		12,000	102,000	55,000	45,000
6,300		8,000	79,000	34,000	36,000	11,500		12,000	102,000	55,000	45,000
6,400		8,000	79,000	34,000	36,000	11,600		12,000	102,000	55,000	45,000
6,500		8,000	79,000	34,000	36,000	11,700		12,000	102,000	55,000	45,000
6,600		8,000	79,000	34,000	36,000	11,800		12,000	102,000	55,000	45,000
6,800		8,000	79,000	34,000	36,000	11,900		12,000	102,000	55,000	45,000
7,000		8,000	79,000	34,000	36,000	12,000		12,000	102,000	55,000	45,000
7,400		8,000	79,000	41,000	36,000	12,200		14,000	107,000	60,000	45,000
7,500		8,000	79,000	41,000	36,000	12,300	31/64	14,000	107,000	60,000	45,000
7,600		8,000	79,000	41,000	36,000	12,500		14,000	107,000	60,000	45,000
7,700		8,000	79,000	41,000	36,000	13,000		14,000	107,000	60,000	45,000



## TS-Drills ohne Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
13,200		14,000	107,000	60,000	45,000	16,200		18,000	123,000	73,000	48,000
13,300		14,000	107,000	60,000	45,000	16,300		18,000	123,000	73,000	48,000
13,500		14,000	107,000	60,000	45,000	16,500		18,000	123,000	73,000	48,000
14,000		14,000	107,000	60,000	45,000	17,000		18,000	123,000	73,000	48,000
14,200		16,000	115,000	65,000	48,000	17,500		18,000	123,000	73,000	48,000
14,300		16,000	115,000	65,000	48,000	18,000		18,000	123,000	73,000	48,000
14,500		16,000	115,000	65,000	48,000	19,000		20,000	131,000	79,000	50,000
15,000		16,000	115,000	65,000	48,000	19,200		20,000	131,000	79,000	50,000
15,800		16,000	115,000	65,000	48,000	19,500		20,000	131,000	79,000	50,000
15,870	5/8	16,000	115,000	65,000	48,000						
16,000		16,000	115,000	65,000	48,000						
16,100		18,000	123,000	73,000	48,000						



## TS-Drills ohne Innenkühlung

### Artikel-Nr. 89413



P	M	K	N	S	H
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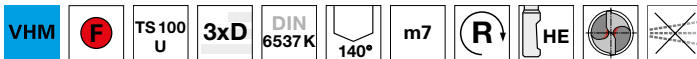
Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen

### Artikel-Nr. 89402

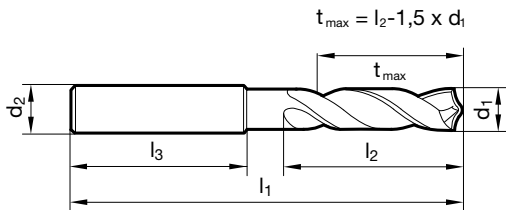


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		6,000	62,000	20,000	36,000	4,760	3/16	6,000	66,000	28,000	36,000
3,100		6,000	62,000	20,000	36,000	4,800		6,000	66,000	28,000	36,000
3,170	1/8	6,000	62,000	20,000	36,000	4,900		6,000	66,000	28,000	36,000
3,200		6,000	62,000	20,000	36,000	5,000		6,000	66,000	28,000	36,000
3,250		6,000	62,000	20,000	36,000	5,100		6,000	66,000	28,000	36,000
3,300		6,000	62,000	20,000	36,000	5,160	13/64	6,000	66,000	28,000	36,000
3,400		6,000	62,000	20,000	36,000	5,200		6,000	66,000	28,000	36,000
3,500		6,000	62,000	20,000	36,000	5,300		6,000	66,000	28,000	36,000
3,570	9/64	6,000	62,000	20,000	36,000	5,400		6,000	66,000	28,000	36,000
3,600		6,000	62,000	20,000	36,000	5,500		6,000	66,000	28,000	36,000
3,700		6,000	62,000	20,000	36,000	5,550		6,000	66,000	28,000	36,000
3,800		6,000	66,000	24,000	36,000	5,560	7/32	6,000	66,000	28,000	36,000
3,900		6,000	66,000	24,000	36,000	5,600		6,000	66,000	28,000	36,000
3,970	5/32	6,000	66,000	24,000	36,000	5,700		6,000	66,000	28,000	36,000
4,000		6,000	66,000	24,000	36,000	5,800		6,000	66,000	28,000	36,000
4,100		6,000	66,000	24,000	36,000	5,900		6,000	66,000	28,000	36,000
4,200		6,000	66,000	24,000	36,000	5,950	15/64	6,000	66,000	28,000	36,000
4,300		6,000	66,000	24,000	36,000	6,000		6,000	66,000	28,000	36,000
4,370	11/64	6,000	66,000	24,000	36,000	6,100		8,000	79,000	34,000	36,000
4,400		6,000	66,000	24,000	36,000	6,200		8,000	79,000	34,000	36,000
4,500		6,000	66,000	24,000	36,000	6,300		8,000	79,000	34,000	36,000
4,600		6,000	66,000	24,000	36,000	6,350	1/4	8,000	79,000	34,000	36,000
4,650		6,000	66,000	24,000	36,000	6,400		8,000	79,000	34,000	36,000
4,700		6,000	66,000	24,000	36,000	6,500		8,000	79,000	34,000	36,000



## TS-Drills ohne Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,600		8,000	79,000	34,000	36,000	11,400		12,000	102,000	55,000	45,000
6,700		8,000	79,000	34,000	36,000	11,500		12,000	102,000	55,000	45,000
6,750	17/64	8,000	79,000	34,000	36,000	11,600		12,000	102,000	55,000	45,000
6,800		8,000	79,000	34,000	36,000	11,700		12,000	102,000	55,000	45,000
6,900		8,000	79,000	34,000	36,000	11,800		12,000	102,000	55,000	45,000
7,000		8,000	79,000	34,000	36,000	11,900		12,000	102,000	55,000	45,000
7,100		8,000	79,000	41,000	36,000	11,910	15/32	12,000	102,000	55,000	45,000
7,140	9/32	8,000	79,000	41,000	36,000	12,000		12,000	102,000	55,000	45,000
7,200		8,000	79,000	41,000	36,000	12,100		14,000	107,000	60,000	45,000
7,300		8,000	79,000	41,000	36,000	12,200		14,000	107,000	60,000	45,000
7,400		8,000	79,000	41,000	36,000	12,300	31/64	14,000	107,000	60,000	45,000
7,500		8,000	79,000	41,000	36,000	12,400		14,000	107,000	60,000	45,000
7,540	19/64	8,000	79,000	41,000	36,000	12,500		14,000	107,000	60,000	45,000
7,600		8,000	79,000	41,000	36,000	12,600		14,000	107,000	60,000	45,000
7,700		8,000	79,000	41,000	36,000	12,700	1/2	14,000	107,000	60,000	45,000
7,800		8,000	79,000	41,000	36,000	12,800		14,000	107,000	60,000	45,000
7,900		8,000	79,000	41,000	36,000	12,900		14,000	107,000	60,000	45,000
7,940	5/16	8,000	79,000	41,000	36,000	13,000		14,000	107,000	60,000	45,000
8,000		8,000	79,000	41,000	36,000	13,100	33/64	14,000	107,000	60,000	45,000
8,100		10,000	89,000	47,000	40,000	13,200		14,000	107,000	60,000	45,000
8,200		10,000	89,000	47,000	40,000	13,300		14,000	107,000	60,000	45,000
8,300		10,000	89,000	47,000	40,000	13,500		14,000	107,000	60,000	45,000
8,330	21/64	10,000	89,000	47,000	40,000	13,600		14,000	107,000	60,000	45,000
8,400		10,000	89,000	47,000	40,000	13,700		14,000	107,000	60,000	45,000
8,500		10,000	89,000	47,000	40,000	13,800		14,000	107,000	60,000	45,000
8,600		10,000	89,000	47,000	40,000	13,900		14,000	107,000	60,000	45,000
8,700		10,000	89,000	47,000	40,000	14,000		14,000	107,000	60,000	45,000
8,730	11/32	10,000	89,000	47,000	40,000	14,100		16,000	115,000	65,000	48,000
8,800		10,000	89,000	47,000	40,000	14,200		16,000	115,000	65,000	48,000
8,900		10,000	89,000	47,000	40,000	14,290	9/16	16,000	115,000	65,000	48,000
9,000		10,000	89,000	47,000	40,000	14,300		16,000	115,000	65,000	48,000
9,100		10,000	89,000	47,000	40,000	14,500		16,000	115,000	65,000	48,000
9,130	23/64	10,000	89,000	47,000	40,000	14,700		16,000	115,000	65,000	48,000
9,200		10,000	89,000	47,000	40,000	14,900		16,000	115,000	65,000	48,000
9,250		10,000	89,000	47,000	40,000	15,000		16,000	115,000	65,000	48,000
9,300		10,000	89,000	47,000	40,000	15,100		16,000	115,000	65,000	48,000
9,400		10,000	89,000	47,000	40,000	15,200		16,000	115,000	65,000	48,000
9,500		10,000	89,000	47,000	40,000	15,300		16,000	115,000	65,000	48,000
9,520	3/8	10,000	89,000	47,000	40,000	15,500		16,000	115,000	65,000	48,000
9,600		10,000	89,000	47,000	40,000	15,700		16,000	115,000	65,000	48,000
9,700		10,000	89,000	47,000	40,000	15,800		16,000	115,000	65,000	48,000
9,800		10,000	89,000	47,000	40,000	16,000		16,000	115,000	65,000	48,000
9,900		10,000	89,000	47,000	40,000	16,200		18,000	123,000	73,000	48,000
9,920	25/64	10,000	89,000	47,000	40,000	16,500		18,000	123,000	73,000	48,000
10,000		10,000	89,000	47,000	40,000	17,000		18,000	123,000	73,000	48,000
10,100		12,000	102,000	55,000	45,000	17,500		18,000	123,000	73,000	48,000
10,200		12,000	102,000	55,000	45,000	18,000		18,000	123,000	73,000	48,000
10,300		12,000	102,000	55,000	45,000	18,500		20,000	131,000	79,000	50,000
10,320	13/32	12,000	102,000	55,000	45,000	19,000		20,000	131,000	79,000	50,000
10,400		12,000	102,000	55,000	45,000	19,500		20,000	131,000	79,000	50,000
10,500		12,000	102,000	55,000	45,000	20,000		20,000	131,000	79,000	50,000
10,600		12,000	102,000	55,000	45,000						
10,700		12,000	102,000	55,000	45,000						
10,800		12,000	102,000	55,000	45,000						
10,900		12,000	102,000	55,000	45,000						
11,000		12,000	102,000	55,000	45,000						
11,100		12,000	102,000	55,000	45,000						
11,110	7/16	12,000	102,000	55,000	45,000						
11,200		12,000	102,000	55,000	45,000						
11,300		12,000	102,000	55,000	45,000						

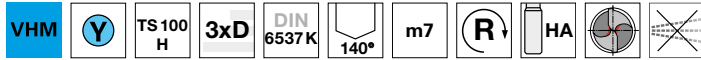


## TS-Drills ohne Innenkühlung

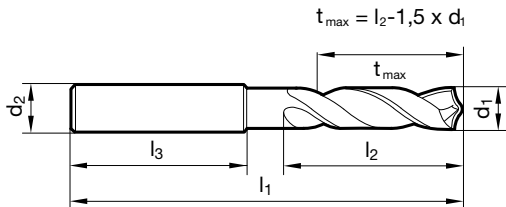
Artikel-Nr. 89422



P	M	K	N	S	H
•				•	○



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • Hauptschneidenform leicht konkav • optimierte Schneidengeometrie  
 legierte und hochfeste Stähle bis 1400 N/mm<sup>2</sup> • Inconel, Hastelloy, Monel • Titan und Titanlegierungen



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	62,000	20,000	36,000	6,100		8,000	79,000	34,000	36,000
3,100		6,000	62,000	20,000	36,000	6,200		8,000	79,000	34,000	36,000
3,170	1/8	6,000	62,000	20,000	36,000	6,300		8,000	79,000	34,000	36,000
3,200		6,000	62,000	20,000	36,000	6,350	1/4	8,000	79,000	34,000	36,000
3,250		6,000	62,000	20,000	36,000	6,400		8,000	79,000	34,000	36,000
3,300		6,000	62,000	20,000	36,000	6,500		8,000	79,000	34,000	36,000
3,400		6,000	62,000	20,000	36,000	6,600		8,000	79,000	34,000	36,000
3,500		6,000	62,000	20,000	36,000	6,700		8,000	79,000	34,000	36,000
3,570	9/64	6,000	62,000	20,000	36,000	6,750	17/64	8,000	79,000	34,000	36,000
3,600		6,000	62,000	20,000	36,000	6,800		8,000	79,000	34,000	36,000
3,700		6,000	62,000	20,000	36,000	6,900		8,000	79,000	34,000	36,000
3,800		6,000	66,000	24,000	36,000	7,000		8,000	79,000	34,000	36,000
3,900		6,000	66,000	24,000	36,000	7,100		8,000	79,000	41,000	36,000
3,970	5/32	6,000	66,000	24,000	36,000	7,140	9/32	8,000	79,000	41,000	36,000
4,000		6,000	66,000	24,000	36,000	7,200		8,000	79,000	41,000	36,000
4,100		6,000	66,000	24,000	36,000	7,300		8,000	79,000	41,000	36,000
4,200		6,000	66,000	24,000	36,000	7,400		8,000	79,000	41,000	36,000
4,300		6,000	66,000	24,000	36,000	7,500		8,000	79,000	41,000	36,000
4,370	11/64	6,000	66,000	24,000	36,000	7,540	19/64	8,000	79,000	41,000	36,000
4,400		6,000	66,000	24,000	36,000	7,600		8,000	79,000	41,000	36,000
4,500		6,000	66,000	24,000	36,000	7,700		8,000	79,000	41,000	36,000
4,600		6,000	66,000	24,000	36,000	7,800		8,000	79,000	41,000	36,000
4,650		6,000	66,000	24,000	36,000	7,900		8,000	79,000	41,000	36,000
4,700		6,000	66,000	24,000	36,000	7,940	5/16	8,000	79,000	41,000	36,000
4,760	3/16	6,000	66,000	28,000	36,000	8,000		8,000	79,000	41,000	36,000
4,800		6,000	66,000	28,000	36,000	8,100		10,000	89,000	47,000	40,000
4,900		6,000	66,000	28,000	36,000	8,200		10,000	89,000	47,000	40,000
5,000		6,000	66,000	28,000	36,000	8,300		10,000	89,000	47,000	40,000
5,100		6,000	66,000	28,000	36,000	8,330	21/64	10,000	89,000	47,000	40,000
5,160	13/64	6,000	66,000	28,000	36,000	8,400		10,000	89,000	47,000	40,000
5,200		6,000	66,000	28,000	36,000	8,500		10,000	89,000	47,000	40,000
5,300		6,000	66,000	28,000	36,000	8,600		10,000	89,000	47,000	40,000
5,400		6,000	66,000	28,000	36,000	8,700		10,000	89,000	47,000	40,000
5,500		6,000	66,000	28,000	36,000	8,730	11/32	10,000	89,000	47,000	40,000
5,550		6,000	66,000	28,000	36,000	8,800		10,000	89,000	47,000	40,000
5,560	7/32	6,000	66,000	28,000	36,000	8,900		10,000	89,000	47,000	40,000
5,600		6,000	66,000	28,000	36,000	9,000		10,000	89,000	47,000	40,000
5,700		6,000	66,000	28,000	36,000	9,100		10,000	89,000	47,000	40,000
5,800		6,000	66,000	28,000	36,000	9,130	23/64	10,000	89,000	47,000	40,000
5,900		6,000	66,000	28,000	36,000	9,200		10,000	89,000	47,000	40,000
5,950	15/64	6,000	66,000	28,000	36,000	9,250		10,000	89,000	47,000	40,000
6,000		6,000	66,000	28,000	36,000	9,300		10,000	89,000	47,000	40,000



## TS-Drills ohne Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
9,400		10,000	89,000	47,000	40,000	13,000		14,000	107,000	60,000	45,000
9,500		10,000	89,000	47,000	40,000	13,300		14,000	107,000	60,000	45,000
9,520	3/8	10,000	89,000	47,000	40,000	13,500		14,000	107,000	60,000	45,000
9,600		10,000	89,000	47,000	40,000	13,700		14,000	107,000	60,000	45,000
9,700		10,000	89,000	47,000	40,000	14,000		14,000	107,000	60,000	45,000
9,800		10,000	89,000	47,000	40,000	14,200		16,000	115,000	65,000	48,000
9,900		10,000	89,000	47,000	40,000	14,290	9/16	16,000	115,000	65,000	48,000
9,920	25/64	10,000	89,000	47,000	40,000	14,300		16,000	115,000	65,000	48,000
10,000		10,000	89,000	47,000	40,000	14,500		16,000	115,000	65,000	48,000
10,100		12,000	102,000	55,000	45,000	14,700		16,000	115,000	65,000	48,000
10,200		12,000	102,000	55,000	45,000	15,000		16,000	115,000	65,000	48,000
10,300		12,000	102,000	55,000	45,000	15,200		16,000	115,000	65,000	48,000
10,320	13/32	12,000	102,000	55,000	45,000	15,300		16,000	115,000	65,000	48,000
10,400		12,000	102,000	55,000	45,000	15,500		16,000	115,000	65,000	48,000
10,500		12,000	102,000	55,000	45,000	15,700		16,000	115,000	65,000	48,000
10,600		12,000	102,000	55,000	45,000	16,000		16,000	115,000	65,000	48,000
10,700		12,000	102,000	55,000	45,000	16,300		18,000	123,000	73,000	48,000
10,800		12,000	102,000	55,000	45,000	16,500		18,000	123,000	73,000	48,000
10,900		12,000	102,000	55,000	45,000	16,900		18,000	123,000	73,000	48,000
11,000		12,000	102,000	55,000	45,000	17,000		18,000	123,000	73,000	48,000
11,100		12,000	102,000	55,000	45,000	17,300		18,000	123,000	73,000	48,000
11,110	7/16	12,000	102,000	55,000	45,000	17,500		18,000	123,000	73,000	48,000
11,200		12,000	102,000	55,000	45,000	18,000		18,000	123,000	73,000	48,000
11,300		12,000	102,000	55,000	45,000	18,500		20,000	131,000	79,000	50,000
11,400		12,000	102,000	55,000	45,000	18,900		20,000	131,000	79,000	50,000
11,500		12,000	102,000	55,000	45,000	19,000		20,000	131,000	79,000	50,000
11,600		12,000	102,000	55,000	45,000	19,050	3/4	20,000	131,000	79,000	50,000
11,700		12,000	102,000	55,000	45,000	19,300		20,000	131,000	79,000	50,000
11,800		12,000	102,000	55,000	45,000	19,500		20,000	131,000	79,000	50,000
11,900		12,000	102,000	55,000	45,000	20,000		20,000	131,000	79,000	50,000
11,910	15/32	12,000	102,000	55,000	45,000						
12,000		12,000	102,000	55,000	45,000						
12,200		14,000	107,000	60,000	45,000						
12,500		14,000	107,000	60,000	45,000						
12,700	1/2	14,000	107,000	60,000	45,000						
12,800		14,000	107,000	60,000	45,000						

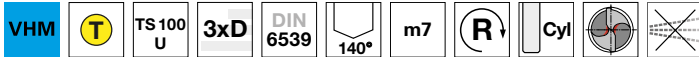


## TS-Drills ohne Innenkühlung

### Artikel-Nr. 89237



<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
●	○	●	○	○	○



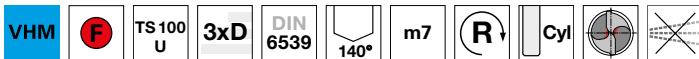
Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen

### Artikel-Nr. 89401

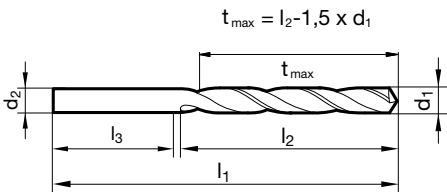


<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
●	○	●	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		3,000	46,000	16,000	30,000	6,700		6,700	70,000	31,000	39,000
3,100		3,100	49,000	18,000	31,000	6,800		6,800	74,000	34,000	40,000
3,200		3,200	49,000	18,000	31,000	7,000		7,000	74,000	34,000	40,000
3,300		3,300	49,000	18,000	31,000	7,100		7,100	74,000	34,000	40,000
3,500		3,500	52,000	20,000	32,000	7,140	9/32	7,140	74,000	34,000	40,000
3,600		3,600	52,000	20,000	32,000	7,500		7,500	74,000	34,000	40,000
3,700		3,700	52,000	20,000	32,000	7,800		7,800	79,000	37,000	42,000
3,800		3,800	55,000	22,000	33,000	8,000		8,000	79,000	37,000	42,000
3,900		3,900	55,000	22,000	33,000	8,200		8,200	79,000	37,000	42,000
4,000		4,000	55,000	22,000	33,000	8,400		8,400	79,000	37,000	42,000
4,100		4,100	55,000	22,000	33,000	8,500		8,500	79,000	37,000	42,000
4,200		4,200	55,000	22,000	33,000	8,600		8,600	84,000	40,000	44,000
4,500		4,500	58,000	24,000	34,000	8,700		8,700	84,000	40,000	44,000
5,000		5,000	62,000	26,000	36,000	8,800		8,800	84,000	40,000	44,000
5,100		5,100	62,000	26,000	36,000	9,000		9,000	84,000	40,000	44,000
5,200		5,200	62,000	26,000	36,000	9,500		9,500	84,000	40,000	44,000
5,500		5,500	66,000	28,000	38,000	9,800		9,800	89,000	43,000	46,000
5,600		5,600	66,000	28,000	38,000	10,000		10,000	89,000	43,000	46,000
5,700		5,700	66,000	28,000	38,000	10,100		10,100	89,000	43,000	46,000
5,800		5,800	66,000	28,000	38,000	10,200		10,200	89,000	43,000	46,000
6,000		6,000	66,000	28,000	38,000	10,300		10,300	89,000	43,000	46,000
6,100		6,100	70,000	31,000	39,000	10,500		10,500	89,000	43,000	46,000
6,400		6,400	70,000	31,000	39,000	10,600		10,600	89,000	43,000	46,000
6,500		6,500	70,000	31,000	39,000	10,800		10,800	95,000	47,000	48,000





## TS-Drills ohne Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
11,000		11,000	95,000	47,000	48,000	15,500		15,500	115,000	58,000	57,000
11,110	7/16	11,110	95,000	47,000	48,000	16,000		16,000	115,000	58,000	57,000
11,500		11,500	95,000	47,000	48,000						
11,800		11,800	95,000	47,000	48,000						
12,000		12,000	102,000	51,000	51,000						
12,500		12,500	102,000	51,000	51,000						
12,700	1/2	12,700	102,000	51,000	51,000						
13,000		13,000	102,000	51,000	51,000						
13,500		13,500	107,000	54,000	53,000						
14,000		14,000	107,000	54,000	53,000						
14,500		14,500	111,000	56,000	55,000						
15,000		15,000	111,000	56,000	55,000						

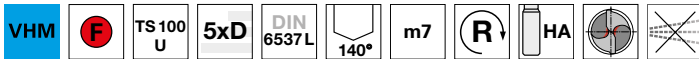


## TS-Drills ohne Innenkühlung

### Artikel-Nr. 89414



P	M	K	N	S	H
●	○	●	○	○	○



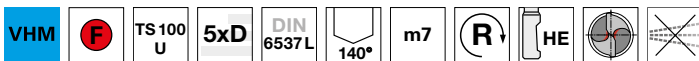
Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen

### Artikel-Nr. 89417

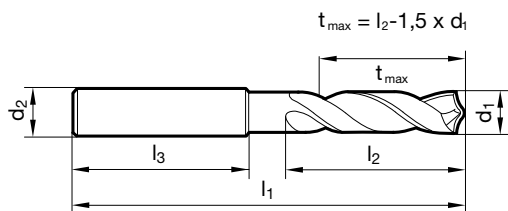


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		6,000	66,000	28,000	36,000	4,760	3/16	6,000	82,000	44,000	36,000
3,100		6,000	66,000	28,000	36,000	4,800		6,000	82,000	44,000	36,000
3,170	1/8	6,000	66,000	28,000	36,000	4,900		6,000	82,000	44,000	36,000
3,200		6,000	66,000	28,000	36,000	5,000		6,000	82,000	44,000	36,000
3,250		6,000	66,000	28,000	36,000	5,100		6,000	82,000	44,000	36,000
3,300		6,000	66,000	28,000	36,000	5,160	13/64	6,000	82,000	44,000	36,000
3,400		6,000	66,000	28,000	36,000	5,200		6,000	82,000	44,000	36,000
3,500		6,000	66,000	28,000	36,000	5,300		6,000	82,000	44,000	36,000
3,570	9/64	6,000	66,000	28,000	36,000	5,400		6,000	82,000	44,000	36,000
3,600		6,000	66,000	28,000	36,000	5,500		6,000	82,000	44,000	36,000
3,700		6,000	66,000	28,000	36,000	5,550		6,000	82,000	44,000	36,000
3,800		6,000	74,000	36,000	36,000	5,560	7/32	6,000	82,000	44,000	36,000
3,900		6,000	74,000	36,000	36,000	5,600		6,000	82,000	44,000	36,000
3,970	5/32	6,000	74,000	36,000	36,000	5,700		6,000	82,000	44,000	36,000
4,000		6,000	74,000	36,000	36,000	5,800		6,000	82,000	44,000	36,000
4,100		6,000	74,000	36,000	36,000	5,900		6,000	82,000	44,000	36,000
4,200		6,000	74,000	36,000	36,000	5,950	15/64	6,000	82,000	44,000	36,000
4,300		6,000	74,000	36,000	36,000	6,000		6,000	82,000	44,000	36,000
4,370	11/64	6,000	74,000	36,000	36,000	6,100		8,000	91,000	53,000	36,000
4,400		6,000	74,000	36,000	36,000	6,200		8,000	91,000	53,000	36,000
4,500		6,000	74,000	36,000	36,000	6,300		8,000	91,000	53,000	36,000
4,600		6,000	74,000	36,000	36,000	6,350	1/4	8,000	91,000	53,000	36,000
4,650		6,000	74,000	36,000	36,000	6,400		8,000	91,000	53,000	36,000
4,700		6,000	74,000	36,000	36,000	6,500		8,000	91,000	53,000	36,000



## TS-Drills ohne Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,600		8,000	91,000	53,000	36,000	10,900		12,000	118,000	71,000	45,000
6,700		8,000	91,000	53,000	36,000	11,000		12,000	118,000	71,000	45,000
6,750	17/64	8,000	91,000	53,000	36,000	11,100		12,000	118,000	71,000	45,000
6,800		8,000	91,000	53,000	36,000	11,110	7/16	12,000	118,000	71,000	45,000
6,900		8,000	91,000	53,000	36,000	11,200		12,000	118,000	71,000	45,000
7,000		8,000	91,000	53,000	36,000	11,300		12,000	118,000	71,000	45,000
7,100		8,000	91,000	53,000	36,000	11,400		12,000	118,000	71,000	45,000
7,140	9/32	8,000	91,000	53,000	36,000	11,500		12,000	118,000	71,000	45,000
7,200		8,000	91,000	53,000	36,000	11,600		12,000	118,000	71,000	45,000
7,300		8,000	91,000	53,000	36,000	11,700		12,000	118,000	71,000	45,000
7,400		8,000	91,000	53,000	36,000	11,800		12,000	118,000	71,000	45,000
7,500		8,000	91,000	53,000	36,000	11,900		12,000	118,000	71,000	45,000
7,540	19/64	8,000	91,000	53,000	36,000	11,910	15/32	12,000	118,000	71,000	45,000
7,600		8,000	91,000	53,000	36,000	12,000		12,000	118,000	71,000	45,000
7,700		8,000	91,000	53,000	36,000	12,100		14,000	124,000	77,000	45,000
7,800		8,000	91,000	53,000	36,000	12,200		14,000	124,000	77,000	45,000
7,900		8,000	91,000	53,000	36,000	12,500		14,000	124,000	77,000	45,000
7,940	5/16	8,000	91,000	53,000	36,000	12,700	1/2	14,000	124,000	77,000	45,000
8,000		8,000	91,000	53,000	36,000	13,000		14,000	124,000	77,000	45,000
8,100		10,000	103,000	61,000	40,000	13,100	33/64	14,000	124,000	77,000	45,000
8,200		10,000	103,000	61,000	40,000	13,500		14,000	124,000	77,000	45,000
8,300		10,000	103,000	61,000	40,000	13,700		14,000	124,000	77,000	45,000
8,330	21/64	10,000	103,000	61,000	40,000	13,800		14,000	124,000	77,000	45,000
8,400		10,000	103,000	61,000	40,000	14,000		14,000	124,000	77,000	45,000
8,500		10,000	103,000	61,000	40,000	14,100		16,000	133,000	83,000	48,000
8,600		10,000	103,000	61,000	40,000	14,200		16,000	133,000	83,000	48,000
8,700		10,000	103,000	61,000	40,000	14,290	9/16	16,000	133,000	83,000	48,000
8,730	11/32	10,000	103,000	61,000	40,000	14,500		16,000	133,000	83,000	48,000
8,800		10,000	103,000	61,000	40,000	14,700		16,000	133,000	83,000	48,000
8,900		10,000	103,000	61,000	40,000	15,000		16,000	133,000	83,000	48,000
9,000		10,000	103,000	61,000	40,000	15,100		16,000	133,000	83,000	48,000
9,100		10,000	103,000	61,000	40,000	15,200		16,000	133,000	83,000	48,000
9,130	23/64	10,000	103,000	61,000	40,000	15,500		16,000	133,000	83,000	48,000
9,200		10,000	103,000	61,000	40,000	15,700		16,000	133,000	83,000	48,000
9,250		10,000	103,000	61,000	40,000	16,000		16,000	133,000	83,000	48,000
9,300		10,000	103,000	61,000	40,000	16,500		18,000	143,000	93,000	48,000
9,400		10,000	103,000	61,000	40,000	17,000		18,000	143,000	93,000	48,000
9,500		10,000	103,000	61,000	40,000	17,500		18,000	143,000	93,000	48,000
9,520	3/8	10,000	103,000	61,000	40,000	18,000		18,000	143,000	93,000	48,000
9,600		10,000	103,000	61,000	40,000	18,500		20,000	153,000	101,000	50,000
9,700		10,000	103,000	61,000	40,000	19,000		20,000	153,000	101,000	50,000
9,800		10,000	103,000	61,000	40,000	19,500		20,000	153,000	101,000	50,000
9,900		10,000	103,000	61,000	40,000	20,000		20,000	153,000	101,000	50,000
9,920	25/64	10,000	103,000	61,000	40,000						
10,000		10,000	103,000	61,000	40,000						
10,100		12,000	118,000	71,000	45,000						
10,200		12,000	118,000	71,000	45,000						
10,300		12,000	118,000	71,000	45,000						
10,320	13/32	12,000	118,000	71,000	45,000						
10,400		12,000	118,000	71,000	45,000						
10,500		12,000	118,000	71,000	45,000						
10,600		12,000	118,000	71,000	45,000						
10,700		12,000	118,000	71,000	45,000						
10,800		12,000	118,000	71,000	45,000						

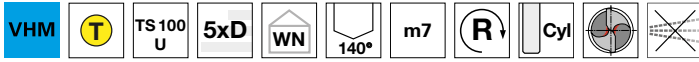


## TS-Drills ohne Innenkühlung

Artikel-Nr. 89275

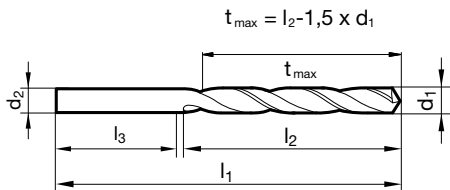


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \text{Ø } 5,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1	inch	d2 h6	l1	l2	l3	d1	inch	d2 h6	l1	l2	l3
mm		mm	mm	mm	mm	mm		mm	mm	mm	mm
5,160	13/64	5,160	76,000	38,000	38,000	9,520	3/8	9,520	105,000	60,000	45,000
5,560	7/32	5,560	81,000	41,000	40,000	9,800		9,800	105,000	60,000	45,000
5,700		5,700	81,000	41,000	40,000	10,000		10,000	105,000	60,000	45,000
5,800		5,800	81,000	41,000	40,000	10,200		10,200	112,000	66,000	46,000
6,350	1/4	6,350	81,000	41,000	40,000	10,300		10,300	112,000	66,000	46,000
6,400		6,400	81,000	41,000	40,000	10,320	13/32	10,320	112,000	66,000	46,000
6,500		6,500	81,000	41,000	40,000	10,500		10,500	112,000	66,000	46,000
6,750	17/64	6,750	83,000	43,000	40,000	10,720	27/64	10,720	114,000	68,000	46,000
6,800		6,800	83,000	43,000	40,000	10,800		10,800	114,000	68,000	46,000
7,000		7,000	83,000	43,000	40,000	11,110	7/16	11,110	118,000	71,000	47,000
7,500		7,500	87,000	45,000	42,000	11,500		11,500	118,000	71,000	47,000
7,800		7,800	90,000	48,000	42,000	11,800		11,800	121,000	73,000	48,000
7,940	5/16	7,940	90,000	48,000	42,000	11,910	15/32	11,910	121,000	73,000	48,000
8,000		8,000	90,000	48,000	42,000	12,000		12,000	121,000	73,000	48,000
8,100		8,100	96,000	53,000	43,000	12,700	1/2	12,700	137,000	78,000	59,000
8,330	21/64	8,330	96,000	53,000	43,000	13,000		13,000	137,000	78,000	59,000
8,400		8,400	96,000	53,000	43,000	13,500		13,500	144,000	84,000	60,000
8,500		8,500	96,000	53,000	43,000	14,000		14,000	147,000	86,000	61,000
8,600		8,600	98,000	55,000	43,000	14,500		14,500	151,000	89,000	62,000
8,730	11/32	8,730	98,000	55,000	43,000	15,000		15,000	153,000	91,000	62,000
8,800		8,800	98,000	55,000	43,000	15,500		15,500	157,000	94,000	63,000
9,000		9,000	98,000	55,000	43,000	16,000		16,000	160,000	96,000	64,000
9,130	23/64	9,130	102,000	58,000	44,000						
9,500		9,500	102,000	58,000	44,000						

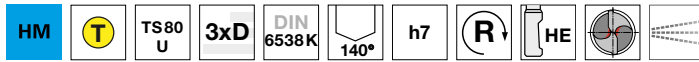


## TS-Drills mit Innenkühlung

Artikel-Nr. 89306

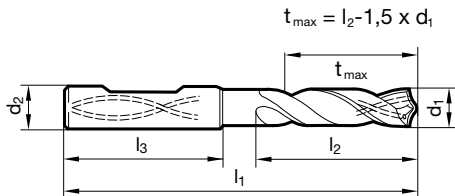


P	M	K	N	S	H
●	○	○	○		



Ausspitzung  $\geq \varnothing 10,000$  • Kegelmantelschliff • dämpft Schwingungen und Stöße • HSS-Träger mit eingelöteter HM-Platte  
 • Flächenanschliff • HM-bestückt • mit Mitnehmer nach DIN 1809

unlegierte/niedrig legierte Stähle • Grauguss, Kugelgraphitguss • Messing, Bronzen, Kunststoffe, Graphit • glasfaserverstärkte Kunststoffe • Duroplaste mit Schmirgelwirkung auf Schneiden und Fasen



d1 mm	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm	l3 mm
10,000	16,000	103,000	51,000	48,000	17,500	20,000	130,000	76,000	50,000
10,500	16,000	103,000	51,000	48,000	18,500	25,000	144,000	84,000	56,000
10,600	16,000	103,000	51,000	48,000	19,000	25,000	144,000	84,000	56,000
11,000	16,000	103,000	51,000	48,000	19,100	25,000	144,000	84,000	56,000
12,000	16,000	103,000	51,000	48,000	19,700	25,000	144,000	84,000	56,000
12,200	16,000	111,000	59,000	48,000	20,000	25,000	144,000	84,000	56,000
12,500	16,000	111,000	59,000	48,000	20,500	25,000	153,000	93,000	56,000
13,000	16,000	111,000	59,000	48,000	21,000	25,000	153,000	93,000	56,000
13,700	16,000	111,000	59,000	48,000	21,500	25,000	153,000	93,000	56,000
14,000	16,000	111,000	59,000	48,000	22,000	25,000	153,000	93,000	56,000
14,200	20,000	122,000	68,000	50,000	22,500	25,000	161,000	101,000	56,000
14,500	20,000	122,000	68,000	50,000	23,500	25,000	161,000	101,000	56,000
14,600	20,000	122,000	68,000	50,000	25,000	32,000	174,000	110,000	60,000
15,000	20,000	122,000	68,000	50,000					
15,300	20,000	122,000	68,000	50,000					
16,000	20,000	122,000	68,000	50,000					
16,500	20,000	130,000	76,000	50,000					
17,000	20,000	130,000	76,000	50,000					

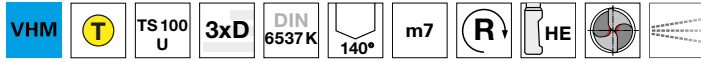


## TS-Drills mit Innenkühlung

Artikel-Nr. 89266

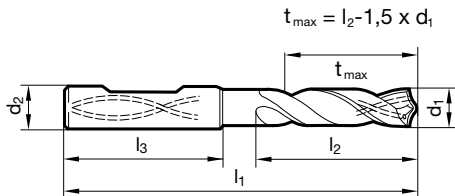


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \text{Ø } 4,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1	inch	d2 h6	l1	l2	l3	d1	inch	d2 h6	l1	l2	l3
mm		mm	mm	mm	mm	mm		mm	mm	mm	mm
3,000		6,000	62,000	20,000	36,000	9,300		10,000	89,000	47,000	40,000
3,100		6,000	62,000	20,000	36,000	9,500		10,000	89,000	47,000	40,000
3,200		6,000	62,000	20,000	36,000	9,700		10,000	89,000	47,000	40,000
3,300		6,000	62,000	20,000	36,000	9,800		10,000	89,000	47,000	40,000
3,400		6,000	62,000	20,000	36,000	10,000		10,000	89,000	47,000	40,000
3,500		6,000	62,000	20,000	36,000	10,200		12,000	102,000	55,000	45,000
3,600		6,000	62,000	20,000	36,000	10,300		12,000	102,000	55,000	45,000
3,700		6,000	62,000	20,000	36,000	10,500		12,000	102,000	55,000	45,000
3,800		6,000	66,000	24,000	36,000	10,700		12,000	102,000	55,000	45,000
4,000		6,000	66,000	24,000	36,000	10,800		12,000	102,000	55,000	45,000
4,200		6,000	66,000	24,000	36,000	11,000		12,000	102,000	55,000	45,000
4,500		6,000	66,000	24,000	36,000	11,100		12,000	102,000	55,000	45,000
4,800		6,000	66,000	28,000	36,000	11,500		12,000	102,000	55,000	45,000
5,000		6,000	66,000	28,000	36,000	11,700		12,000	102,000	55,000	45,000
5,100		6,000	66,000	28,000	36,000	11,800		12,000	102,000	55,000	45,000
5,200		6,000	66,000	28,000	36,000	12,000		12,000	102,000	55,000	45,000
5,500		6,000	66,000	28,000	36,000	12,100		14,000	107,000	60,000	45,000
5,800		6,000	66,000	28,000	36,000	12,300	31/64	14,000	107,000	60,000	45,000
6,000		6,000	66,000	28,000	36,000	12,500		14,000	107,000	60,000	45,000
6,400		8,000	79,000	34,000	36,000	13,000		14,000	107,000	60,000	45,000
6,500		8,000	79,000	34,000	36,000	13,500		14,000	107,000	60,000	45,000
6,600		8,000	79,000	34,000	36,000	14,000		14,000	107,000	60,000	45,000
6,800		8,000	79,000	34,000	36,000	14,500		16,000	115,000	65,000	48,000
6,900		8,000	79,000	34,000	36,000	15,200		16,000	115,000	65,000	48,000
7,000		8,000	79,000	34,000	36,000	15,500		16,000	115,000	65,000	48,000
7,400		8,000	79,000	41,000	36,000	16,000		16,000	115,000	65,000	48,000
7,500		8,000	79,000	41,000	36,000	16,500		18,000	123,000	73,000	48,000
7,800		8,000	79,000	41,000	36,000	17,500		18,000	123,000	73,000	48,000
8,000		8,000	79,000	41,000	36,000	18,000		18,000	123,000	73,000	48,000
8,100		10,000	89,000	47,000	40,000	18,500		20,000	131,000	79,000	50,000
8,400		10,000	89,000	47,000	40,000	19,000		20,000	131,000	79,000	50,000
8,500		10,000	89,000	47,000	40,000	20,000		20,000	131,000	79,000	50,000
8,600		10,000	89,000	47,000	40,000						
8,700		10,000	89,000	47,000	40,000						
8,800		10,000	89,000	47,000	40,000						
9,000		10,000	89,000	47,000	40,000						

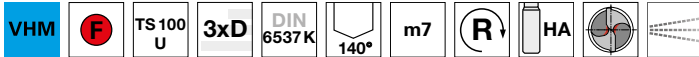


## TS-Drills mit Innenkühlung

### Artikel-Nr. 89410



P	M	K	N	S	H
●	○	●	○	○	○



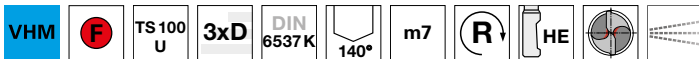
Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen

### Artikel-Nr. 89415

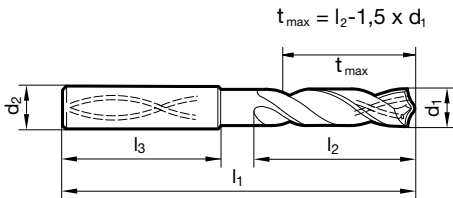


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1	inch	d2 h6	l1	l2	l3	d1	inch	d2 h6	l1	l2	l3
mm		mm	mm	mm	mm	mm		mm	mm	mm	mm
3,000		6,000	62,000	20,000	36,000	4,760	3/16	6,000	66,000	28,000	36,000
3,100		6,000	62,000	20,000	36,000	4,800		6,000	66,000	28,000	36,000
3,170	1/8	6,000	62,000	20,000	36,000	4,900		6,000	66,000	28,000	36,000
3,200		6,000	62,000	20,000	36,000	5,000		6,000	66,000	28,000	36,000
3,250		6,000	62,000	20,000	36,000	5,100		6,000	66,000	28,000	36,000
3,300		6,000	62,000	20,000	36,000	5,160	13/64	6,000	66,000	28,000	36,000
3,400		6,000	62,000	20,000	36,000	5,200		6,000	66,000	28,000	36,000
3,500		6,000	62,000	20,000	36,000	5,300		6,000	66,000	28,000	36,000
3,570	9/64	6,000	62,000	20,000	36,000	5,400		6,000	66,000	28,000	36,000
3,600		6,000	62,000	20,000	36,000	5,500		6,000	66,000	28,000	36,000
3,700		6,000	62,000	20,000	36,000	5,550		6,000	66,000	28,000	36,000
3,800		6,000	66,000	24,000	36,000	5,560	7/32	6,000	66,000	28,000	36,000
3,900		6,000	66,000	24,000	36,000	5,600		6,000	66,000	28,000	36,000
3,970	5/32	6,000	66,000	24,000	36,000	5,700		6,000	66,000	28,000	36,000
4,000		6,000	66,000	24,000	36,000	5,800		6,000	66,000	28,000	36,000
4,100		6,000	66,000	24,000	36,000	5,900		6,000	66,000	28,000	36,000
4,200		6,000	66,000	24,000	36,000	5,950	15/64	6,000	66,000	28,000	36,000
4,300		6,000	66,000	24,000	36,000	6,000		6,000	66,000	28,000	36,000
4,370	11/64	6,000	66,000	24,000	36,000	6,100		8,000	79,000	34,000	36,000
4,400		6,000	66,000	24,000	36,000	6,200		8,000	79,000	34,000	36,000
4,500		6,000	66,000	24,000	36,000	6,300		8,000	79,000	34,000	36,000
4,600		6,000	66,000	24,000	36,000	6,350	1/4	8,000	79,000	34,000	36,000
4,650		6,000	66,000	24,000	36,000	6,400		8,000	79,000	34,000	36,000
4,700		6,000	66,000	24,000	36,000	6,500		8,000	79,000	34,000	36,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,600		8,000	79,000	34,000	36,000	10,900		12,000	102,000	55,000	45,000
6,700		8,000	79,000	34,000	36,000	11,000		12,000	102,000	55,000	45,000
6,750	17/64	8,000	79,000	34,000	36,000	11,100		12,000	102,000	55,000	45,000
6,800		8,000	79,000	34,000	36,000	11,110	7/16	12,000	102,000	55,000	45,000
6,900		8,000	79,000	34,000	36,000	11,200		12,000	102,000	55,000	45,000
7,000		8,000	79,000	34,000	36,000	11,300		12,000	102,000	55,000	45,000
7,100		8,000	79,000	41,000	36,000	11,400		12,000	102,000	55,000	45,000
7,140	9/32	8,000	79,000	41,000	36,000	11,500		12,000	102,000	55,000	45,000
7,200		8,000	79,000	41,000	36,000	11,600		12,000	102,000	55,000	45,000
7,300		8,000	79,000	41,000	36,000	11,700		12,000	102,000	55,000	45,000
7,400		8,000	79,000	41,000	36,000	11,800		12,000	102,000	55,000	45,000
7,500		8,000	79,000	41,000	36,000	11,900		12,000	102,000	55,000	45,000
7,540	19/64	8,000	79,000	41,000	36,000	11,910	15/32	12,000	102,000	55,000	45,000
7,600		8,000	79,000	41,000	36,000	12,000		12,000	102,000	55,000	45,000
7,700		8,000	79,000	41,000	36,000	12,100		14,000	107,000	60,000	45,000
7,800		8,000	79,000	41,000	36,000	12,200		14,000	107,000	60,000	45,000
7,900		8,000	79,000	41,000	36,000	12,300	31/64	14,000	107,000	60,000	45,000
7,940	5/16	8,000	79,000	41,000	36,000	12,500		14,000	107,000	60,000	45,000
8,000		8,000	79,000	41,000	36,000	12,700	1/2	14,000	107,000	60,000	45,000
8,100		10,000	89,000	47,000	40,000	13,000		14,000	107,000	60,000	45,000
8,200		10,000	89,000	47,000	40,000	13,100	33/64	14,000	107,000	60,000	45,000
8,300		10,000	89,000	47,000	40,000	13,200		14,000	107,000	60,000	45,000
8,330	21/64	10,000	89,000	47,000	40,000	13,300		14,000	107,000	60,000	45,000
8,400		10,000	89,000	47,000	40,000	13,500		14,000	107,000	60,000	45,000
8,500		10,000	89,000	47,000	40,000	13,700		14,000	107,000	60,000	45,000
8,600		10,000	89,000	47,000	40,000	14,000		14,000	107,000	60,000	45,000
8,700		10,000	89,000	47,000	40,000	14,100		16,000	115,000	65,000	48,000
8,730	11/32	10,000	89,000	47,000	40,000	14,200		16,000	115,000	65,000	48,000
8,800		10,000	89,000	47,000	40,000	14,290	9/16	16,000	115,000	65,000	48,000
8,900		10,000	89,000	47,000	40,000	14,400		16,000	115,000	65,000	48,000
9,000		10,000	89,000	47,000	40,000	14,500		16,000	115,000	65,000	48,000
9,100		10,000	89,000	47,000	40,000	14,600		16,000	115,000	65,000	48,000
9,130	23/64	10,000	89,000	47,000	40,000	14,700		16,000	115,000	65,000	48,000
9,200		10,000	89,000	47,000	40,000	15,000		16,000	115,000	65,000	48,000
9,250		10,000	89,000	47,000	40,000	15,200		16,000	115,000	65,000	48,000
9,300		10,000	89,000	47,000	40,000	15,500		16,000	115,000	65,000	48,000
9,400		10,000	89,000	47,000	40,000	15,700		16,000	115,000	65,000	48,000
9,500		10,000	89,000	47,000	40,000	16,000		16,000	115,000	65,000	48,000
9,520	3/8	10,000	89,000	47,000	40,000	16,100		18,000	123,000	73,000	48,000
9,600		10,000	89,000	47,000	40,000	16,500		18,000	123,000	73,000	48,000
9,700		10,000	89,000	47,000	40,000	16,900		18,000	123,000	73,000	48,000
9,800		10,000	89,000	47,000	40,000	17,000		18,000	123,000	73,000	48,000
9,900		10,000	89,000	47,000	40,000	17,300		18,000	123,000	73,000	48,000
9,920	25/64	10,000	89,000	47,000	40,000	17,500		18,000	123,000	73,000	48,000
10,000		10,000	89,000	47,000	40,000	17,700		18,000	123,000	73,000	48,000
10,100		12,000	102,000	55,000	45,000	18,000		18,000	123,000	73,000	48,000
10,200		12,000	102,000	55,000	45,000	18,500		20,000	131,000	79,000	50,000
10,300		12,000	102,000	55,000	45,000	18,900		20,000	131,000	79,000	50,000
10,320	13/32	12,000	102,000	55,000	45,000	19,000		20,000	131,000	79,000	50,000
10,400		12,000	102,000	55,000	45,000	19,500		20,000	131,000	79,000	50,000
10,500		12,000	102,000	55,000	45,000	20,000		20,000	131,000	79,000	50,000
10,600		12,000	102,000	55,000	45,000						
10,700		12,000	102,000	55,000	45,000						
10,800		12,000	102,000	55,000	45,000						



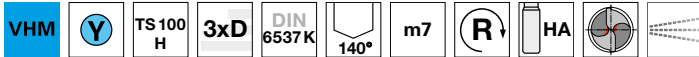


## TS-Drills mit Innenkühlung

### Artikel-Nr. 89423



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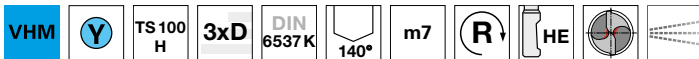


Ausspitzung  $\geq \text{Ø } 3,000$  • Kegelmantelschliff • Hauptschneidenform leicht konkav • optimierte Schneidengeometrie  
legierte und hochfeste Stähle bis  $1400 \text{ N/mm}^2$  • Inconel, Hastelloy, Monel • Titan und Titanlegierungen

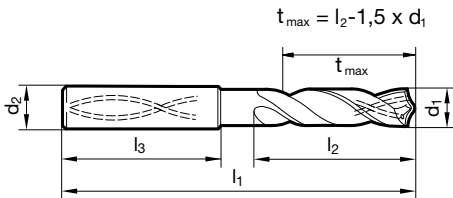
### Artikel-Nr. 89424



P	M	K	N	S	H
•				•	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Kegelmantelschliff • Hauptschneidenform leicht konkav • optimierte Schneidengeometrie  
legierte und hochfeste Stähle bis  $1400 \text{ N/mm}^2$  • Inconel, Hastelloy, Monel • Titan und Titanlegierungen



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		6,000	62,000	20,000	36,000	4,760	3/16	6,000	66,000	28,000	36,000
3,100		6,000	62,000	20,000	36,000	4,800		6,000	66,000	28,000	36,000
3,170	1/8	6,000	62,000	20,000	36,000	4,900		6,000	66,000	28,000	36,000
3,200		6,000	62,000	20,000	36,000	5,000		6,000	66,000	28,000	36,000
3,250		6,000	62,000	20,000	36,000	5,100		6,000	66,000	28,000	36,000
3,300		6,000	62,000	20,000	36,000	5,160	13/64	6,000	66,000	28,000	36,000
3,400		6,000	62,000	20,000	36,000	5,200		6,000	66,000	28,000	36,000
3,500		6,000	62,000	20,000	36,000	5,300		6,000	66,000	28,000	36,000
3,570	9/64	6,000	62,000	20,000	36,000	5,400		6,000	66,000	28,000	36,000
3,600		6,000	62,000	20,000	36,000	5,500		6,000	66,000	28,000	36,000
3,700		6,000	62,000	20,000	36,000	5,550		6,000	66,000	28,000	36,000
3,800		6,000	66,000	24,000	36,000	5,560	7/32	6,000	66,000	28,000	36,000
3,900		6,000	66,000	24,000	36,000	5,600		6,000	66,000	28,000	36,000
3,970	5/32	6,000	66,000	24,000	36,000	5,700		6,000	66,000	28,000	36,000
4,000		6,000	66,000	24,000	36,000	5,800		6,000	66,000	28,000	36,000
4,100		6,000	66,000	24,000	36,000	5,900		6,000	66,000	28,000	36,000
4,200		6,000	66,000	24,000	36,000	5,950	15/64	6,000	66,000	28,000	36,000
4,300		6,000	66,000	24,000	36,000	6,000		6,000	66,000	28,000	36,000
4,370	11/64	6,000	66,000	24,000	36,000	6,100		8,000	79,000	34,000	36,000
4,400		6,000	66,000	24,000	36,000	6,200		8,000	79,000	34,000	36,000
4,500		6,000	66,000	24,000	36,000	6,300		8,000	79,000	34,000	36,000
4,600		6,000	66,000	24,000	36,000	6,350	1/4	8,000	79,000	34,000	36,000
4,650		6,000	66,000	24,000	36,000	6,400		8,000	79,000	34,000	36,000
4,700		6,000	66,000	24,000	36,000	6,500		8,000	79,000	34,000	36,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,600		8,000	79,000	34,000	36,000	10,900		12,000	102,000	55,000	45,000
6,700		8,000	79,000	34,000	36,000	11,000		12,000	102,000	55,000	45,000
6,750	17/64	8,000	79,000	34,000	36,000	11,100		12,000	102,000	55,000	45,000
6,800		8,000	79,000	34,000	36,000	11,110	7/16	12,000	102,000	55,000	45,000
6,900		8,000	79,000	34,000	36,000	11,200		12,000	102,000	55,000	45,000
7,000		8,000	79,000	34,000	36,000	11,300		12,000	102,000	55,000	45,000
7,100		8,000	79,000	41,000	36,000	11,400		12,000	102,000	55,000	45,000
7,140	9/32	8,000	79,000	41,000	36,000	11,500		12,000	102,000	55,000	45,000
7,200		8,000	79,000	41,000	36,000	11,600		12,000	102,000	55,000	45,000
7,300		8,000	79,000	41,000	36,000	11,700		12,000	102,000	55,000	45,000
7,400		8,000	79,000	41,000	36,000	11,800		12,000	102,000	55,000	45,000
7,500		8,000	79,000	41,000	36,000	11,900		12,000	102,000	55,000	45,000
7,540	19/64	8,000	79,000	41,000	36,000	11,910	15/32	12,000	102,000	55,000	45,000
7,600		8,000	79,000	41,000	36,000	12,000		12,000	102,000	55,000	45,000
7,700		8,000	79,000	41,000	36,000	12,200		14,000	107,000	60,000	45,000
7,800		8,000	79,000	41,000	36,000	12,500		14,000	107,000	60,000	45,000
7,900		8,000	79,000	41,000	36,000	12,700	1/2	14,000	107,000	60,000	45,000
7,940	5/16	8,000	79,000	41,000	36,000	12,800		14,000	107,000	60,000	45,000
8,000		8,000	79,000	41,000	36,000	13,000		14,000	107,000	60,000	45,000
8,100		10,000	89,000	47,000	40,000	13,300		14,000	107,000	60,000	45,000
8,200		10,000	89,000	47,000	40,000	13,500		14,000	107,000	60,000	45,000
8,300		10,000	89,000	47,000	40,000	13,700		14,000	107,000	60,000	45,000
8,330	21/64	10,000	89,000	47,000	40,000	14,000		14,000	107,000	60,000	45,000
8,400		10,000	89,000	47,000	40,000	14,200		16,000	115,000	65,000	48,000
8,500		10,000	89,000	47,000	40,000	14,290	9/16	16,000	115,000	65,000	48,000
8,600		10,000	89,000	47,000	40,000	14,300		16,000	115,000	65,000	48,000
8,700		10,000	89,000	47,000	40,000	14,500		16,000	115,000	65,000	48,000
8,730	11/32	10,000	89,000	47,000	40,000	14,700		16,000	115,000	65,000	48,000
8,800		10,000	89,000	47,000	40,000	15,000		16,000	115,000	65,000	48,000
8,900		10,000	89,000	47,000	40,000	15,200		16,000	115,000	65,000	48,000
9,000		10,000	89,000	47,000	40,000	15,300		16,000	115,000	65,000	48,000
9,100		10,000	89,000	47,000	40,000	15,500		16,000	115,000	65,000	48,000
9,130	23/64	10,000	89,000	47,000	40,000	15,700		16,000	115,000	65,000	48,000
9,200		10,000	89,000	47,000	40,000	16,000		16,000	115,000	65,000	48,000
9,250		10,000	89,000	47,000	40,000	16,300		18,000	123,000	73,000	48,000
9,300		10,000	89,000	47,000	40,000	16,500		18,000	123,000	73,000	48,000
9,400		10,000	89,000	47,000	40,000	16,900		18,000	123,000	73,000	48,000
9,500		10,000	89,000	47,000	40,000	17,000		18,000	123,000	73,000	48,000
9,520	3/8	10,000	89,000	47,000	40,000	17,300		18,000	123,000	73,000	48,000
9,600		10,000	89,000	47,000	40,000	17,500		18,000	123,000	73,000	48,000
9,700		10,000	89,000	47,000	40,000	18,000		18,000	123,000	73,000	48,000
9,800		10,000	89,000	47,000	40,000	18,500		20,000	131,000	79,000	50,000
9,900		10,000	89,000	47,000	40,000	18,900		20,000	131,000	79,000	50,000
9,920	25/64	10,000	89,000	47,000	40,000	19,000		20,000	131,000	79,000	50,000
10,000		10,000	89,000	47,000	40,000	19,050	3/4	20,000	131,000	79,000	50,000
10,100		12,000	102,000	55,000	45,000	19,300		20,000	131,000	79,000	50,000
10,200		12,000	102,000	55,000	45,000	19,500		20,000	131,000	79,000	50,000
10,300		12,000	102,000	55,000	45,000	20,000		20,000	131,000	79,000	50,000
10,320	13/32	12,000	102,000	55,000	45,000						
10,400		12,000	102,000	55,000	45,000						
10,500		12,000	102,000	55,000	45,000						
10,600		12,000	102,000	55,000	45,000						
10,700		12,000	102,000	55,000	45,000						
10,800		12,000	102,000	55,000	45,000						

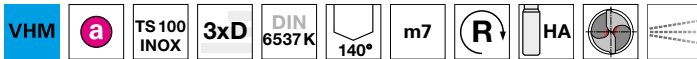


## TS-Drills mit Innenkühlung

### Artikel-Nr. 89450



P	M	K	N	S	H
○	●			○	

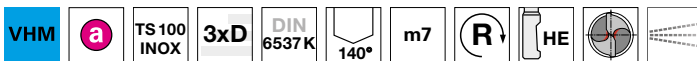


Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie  
rost-/säure-/hitzebeständige Stähle • Titan und Titanlegierungen • Inconel, Hastelloy, Monel

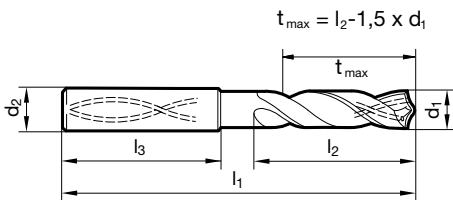
### Artikel-Nr. 89550



P	M	K	N	S	H
○	●			○	



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie  
rost-/säure-/hitzebeständige Stähle • Titan und Titanlegierungen • Inconel, Hastelloy, Monel



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		6,000	62,000	20,000	36,000	4,760	3/16	6,000	66,000	28,000	36,000
3,100		6,000	62,000	20,000	36,000	4,800		6,000	66,000	28,000	36,000
3,170	1/8	6,000	62,000	20,000	36,000	4,900		6,000	66,000	28,000	36,000
3,200		6,000	62,000	20,000	36,000	5,000		6,000	66,000	28,000	36,000
3,250		6,000	62,000	20,000	36,000	5,100		6,000	66,000	28,000	36,000
3,300		6,000	62,000	20,000	36,000	5,160	13/64	6,000	66,000	28,000	36,000
3,400		6,000	62,000	20,000	36,000	5,200		6,000	66,000	28,000	36,000
3,500		6,000	62,000	20,000	36,000	5,300		6,000	66,000	28,000	36,000
3,570	9/64	6,000	62,000	20,000	36,000	5,400		6,000	66,000	28,000	36,000
3,600		6,000	62,000	20,000	36,000	5,500		6,000	66,000	28,000	36,000
3,700		6,000	62,000	20,000	36,000	5,550		6,000	66,000	28,000	36,000
3,800		6,000	66,000	24,000	36,000	5,560	7/32	6,000	66,000	28,000	36,000
3,900		6,000	66,000	24,000	36,000	5,600		6,000	66,000	28,000	36,000
3,970	5/32	6,000	66,000	24,000	36,000	5,700		6,000	66,000	28,000	36,000
4,000		6,000	66,000	24,000	36,000	5,800		6,000	66,000	28,000	36,000
4,100		6,000	66,000	24,000	36,000	5,900		6,000	66,000	28,000	36,000
4,200		6,000	66,000	24,000	36,000	5,950	15/64	6,000	66,000	28,000	36,000
4,300		6,000	66,000	24,000	36,000	6,000		6,000	66,000	28,000	36,000
4,370	11/64	6,000	66,000	24,000	36,000	6,100		8,000	79,000	34,000	36,000
4,400		6,000	66,000	24,000	36,000	6,200		8,000	79,000	34,000	36,000
4,500		6,000	66,000	24,000	36,000	6,300		8,000	79,000	34,000	36,000
4,600		6,000	66,000	24,000	36,000	6,350	1/4	8,000	79,000	34,000	36,000
4,650		6,000	66,000	24,000	36,000	6,400		8,000	79,000	34,000	36,000
4,700		6,000	66,000	24,000	36,000	6,500		8,000	79,000	34,000	36,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,600		8,000	79,000	34,000	36,000	10,900		12,000	102,000	55,000	45,000
6,700		8,000	79,000	34,000	36,000	11,000		12,000	102,000	55,000	45,000
6,750	17/64	8,000	79,000	34,000	36,000	11,100		12,000	102,000	55,000	45,000
6,800		8,000	79,000	34,000	36,000	11,110	7/16	12,000	102,000	55,000	45,000
6,900		8,000	79,000	34,000	36,000	11,200		12,000	102,000	55,000	45,000
7,000		8,000	79,000	34,000	36,000	11,300		12,000	102,000	55,000	45,000
7,100		8,000	79,000	41,000	36,000	11,400		12,000	102,000	55,000	45,000
7,140	9/32	8,000	79,000	41,000	36,000	11,500		12,000	102,000	55,000	45,000
7,200		8,000	79,000	41,000	36,000	11,600		12,000	102,000	55,000	45,000
7,300		8,000	79,000	41,000	36,000	11,700		12,000	102,000	55,000	45,000
7,400		8,000	79,000	41,000	36,000	11,800		12,000	102,000	55,000	45,000
7,500		8,000	79,000	41,000	36,000	11,900		12,000	102,000	55,000	45,000
7,540	19/64	8,000	79,000	41,000	36,000	11,910	15/32	12,000	102,000	55,000	45,000
7,600		8,000	79,000	41,000	36,000	12,000		12,000	102,000	55,000	45,000
7,700		8,000	79,000	41,000	36,000	12,200		14,000	107,000	60,000	45,000
7,800		8,000	79,000	41,000	36,000	12,500		14,000	107,000	60,000	45,000
7,900		8,000	79,000	41,000	36,000	12,700	1/2	14,000	107,000	60,000	45,000
7,940	5/16	8,000	79,000	41,000	36,000	12,800		14,000	107,000	60,000	45,000
8,000		8,000	79,000	41,000	36,000	13,000		14,000	107,000	60,000	45,000
8,100		10,000	89,000	47,000	40,000	13,300		14,000	107,000	60,000	45,000
8,200		10,000	89,000	47,000	40,000	13,500		14,000	107,000	60,000	45,000
8,300		10,000	89,000	47,000	40,000	13,700		14,000	107,000	60,000	45,000
8,330	21/64	10,000	89,000	47,000	40,000	14,000		14,000	107,000	60,000	45,000
8,400		10,000	89,000	47,000	40,000	14,200		16,000	115,000	65,000	48,000
8,500		10,000	89,000	47,000	40,000	14,290	9/16	16,000	115,000	65,000	48,000
8,600		10,000	89,000	47,000	40,000	14,300		16,000	115,000	65,000	48,000
8,700		10,000	89,000	47,000	40,000	14,500		16,000	115,000	65,000	48,000
8,730	11/32	10,000	89,000	47,000	40,000	14,700		16,000	115,000	65,000	48,000
8,800		10,000	89,000	47,000	40,000	15,000		16,000	115,000	65,000	48,000
8,900		10,000	89,000	47,000	40,000	15,200		16,000	115,000	65,000	48,000
9,000		10,000	89,000	47,000	40,000	15,300		16,000	115,000	65,000	48,000
9,100		10,000	89,000	47,000	40,000	15,500		16,000	115,000	65,000	48,000
9,130	23/64	10,000	89,000	47,000	40,000	15,700		16,000	115,000	65,000	48,000
9,200		10,000	89,000	47,000	40,000	16,000		16,000	115,000	65,000	48,000
9,250		10,000	89,000	47,000	40,000	16,300		18,000	123,000	73,000	48,000
9,300		10,000	89,000	47,000	40,000	16,500		18,000	123,000	73,000	48,000
9,400		10,000	89,000	47,000	40,000	16,900		18,000	123,000	73,000	48,000
9,500		10,000	89,000	47,000	40,000	17,000		18,000	123,000	73,000	48,000
9,520	3/8	10,000	89,000	47,000	40,000	17,300		18,000	123,000	73,000	48,000
9,600		10,000	89,000	47,000	40,000	17,500		18,000	123,000	73,000	48,000
9,700		10,000	89,000	47,000	40,000	18,000		18,000	123,000	73,000	48,000
9,800		10,000	89,000	47,000	40,000	18,500		20,000	131,000	79,000	50,000
9,900		10,000	89,000	47,000	40,000	18,900		20,000	131,000	79,000	50,000
9,920	25/64	10,000	89,000	47,000	40,000	19,000		20,000	131,000	79,000	50,000
10,000		10,000	89,000	47,000	40,000	19,300		20,000	131,000	79,000	50,000
10,100		12,000	102,000	55,000	45,000	19,500		20,000	131,000	79,000	50,000
10,200		12,000	102,000	55,000	45,000	20,000		20,000	131,000	79,000	50,000
10,300		12,000	102,000	55,000	45,000						
10,320	13/32	12,000	102,000	55,000	45,000						
10,400		12,000	102,000	55,000	45,000						
10,500		12,000	102,000	55,000	45,000						
10,600		12,000	102,000	55,000	45,000						
10,700		12,000	102,000	55,000	45,000						
10,800		12,000	102,000	55,000	45,000						

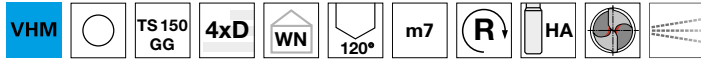


## TS-Drills mit Innenkühlung

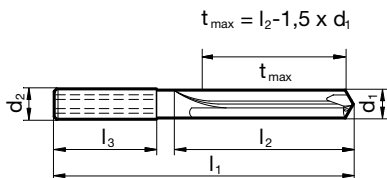
Artikel-Nr. 89292



P	M	K	N	S	H
		•	○		



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • enge Durchmessertoleranzen • sehr gute Bohrungsoberflächen • Kühlmitteldruck beachten  
 Grauguss, Temperguss, Sphäroguss



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	66,000	24,000	36,000	8,700		10,000	103,000	61,000	40,000
3,100		6,000	66,000	24,000	36,000	9,000		10,000	103,000	61,000	40,000
3,200		6,000	66,000	24,000	36,000	9,400		10,000	103,000	61,000	40,000
3,300		6,000	66,000	24,000	36,000	10,000		10,000	103,000	61,000	40,000
3,400		6,000	66,000	24,000	36,000	10,200		12,000	118,000	71,000	45,000
3,500		6,000	66,000	24,000	36,000	10,500		12,000	118,000	71,000	45,000
3,700		6,000	66,000	24,000	36,000	11,000		12,000	118,000	71,000	45,000
4,000		6,000	74,000	30,000	36,000	11,500		12,000	118,000	71,000	45,000
4,200		6,000	74,000	30,000	36,000	12,000		12,000	118,000	71,000	45,000
5,000		6,000	74,000	36,000	36,000	12,300	31/64	14,000	124,000	74,000	45,000
5,100		6,000	74,000	36,000	36,000	12,500		14,000	124,000	74,000	45,000
5,300		6,000	74,000	36,000	36,000	12,700	1/2	14,000	124,000	74,000	45,000
5,400		6,000	74,000	36,000	36,000	13,000		14,000	124,000	74,000	45,000
5,900		6,000	74,000	36,000	36,000	14,000		14,000	124,000	74,000	45,000
6,000		6,000	74,000	36,000	36,000	15,000		16,000	133,000	83,000	48,000
6,200		8,000	91,000	53,000	36,000	16,000		16,000	133,000	83,000	48,000
6,300		8,000	91,000	53,000	36,000	16,500		18,000	143,000	93,000	48,000
6,400		8,000	91,000	53,000	36,000	17,000		18,000	143,000	93,000	48,000
6,600		8,000	91,000	53,000	36,000	17,500		18,000	143,000	93,000	48,000
6,700		8,000	91,000	53,000	36,000	19,000		20,000	153,000	101,000	50,000
6,800		8,000	91,000	53,000	36,000	20,000		20,000	153,000	101,000	50,000
7,000		8,000	91,000	53,000	36,000						
7,400		8,000	91,000	53,000	36,000						
7,500		8,000	91,000	53,000	36,000						
8,000		8,000	91,000	53,000	36,000						
8,100		10,000	103,000	61,000	40,000						
8,200		10,000	103,000	61,000	40,000						
8,300		10,000	103,000	61,000	40,000						
8,400		10,000	103,000	61,000	40,000						
8,500		10,000	103,000	61,000	40,000						

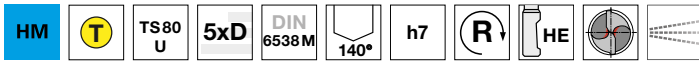


## TS-Drills mit Innenkühlung

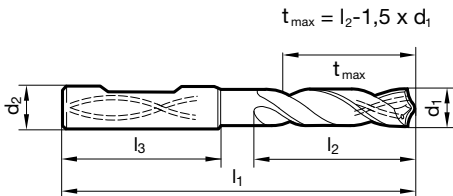
Artikel-Nr. 89307



P	M	K	N	S	H
●	○	○	○		



Ausspitzung  $\geq \varnothing 9,800$  • Kegelmantelschliff • HSS-Träger mit eingelöteter HM-Platte • dämpft Schwingungen und Stöße  
 unlegierte/niedrig legierte Stähle • Grauguss, Kugelgraphitguss • Messing, Bronzen, Kunststoffe, Graphit



d1 mm	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm	l3 mm
9,800	16,000	127,000	75,000	48,000	17,200	20,000	166,000	112,000	50,000
10,000	16,000	127,000	75,000	48,000	17,300	20,000	166,000	112,000	50,000
10,200	16,000	127,000	75,000	48,000	17,500	20,000	166,000	112,000	50,000
10,500	16,000	127,000	75,000	48,000	18,000	20,000	166,000	112,000	50,000
10,600	16,000	127,000	75,000	48,000	18,300	25,000	184,000	124,000	56,000
10,800	16,000	127,000	75,000	48,000	19,000	25,000	184,000	124,000	56,000
11,000	16,000	127,000	75,000	48,000	19,500	25,000	184,000	124,000	56,000
11,800	16,000	127,000	75,000	48,000	19,700	25,000	184,000	124,000	56,000
12,000	16,000	127,000	75,000	48,000	20,000	25,000	184,000	124,000	56,000
12,200	16,000	139,000	87,000	48,000	20,500	25,000	197,000	137,000	56,000
12,300	16,000	139,000	87,000	48,000	21,000	25,000	197,000	137,000	56,000
12,500	16,000	139,000	87,000	48,000	22,000	25,000	197,000	137,000	56,000
12,700	16,000	139,000	87,000	48,000	22,220	25,000	209,000	149,000	56,000
12,900	16,000	139,000	87,000	48,000	22,500	25,000	209,000	149,000	56,000
13,000	16,000	139,000	87,000	48,000	23,000	25,000	209,000	149,000	56,000
13,100	16,000	139,000	87,000	48,000	23,500	25,000	209,000	149,000	56,000
13,500	16,000	139,000	87,000	48,000	24,000	25,000	209,000	149,000	56,000
13,600	16,000	139,000	87,000	48,000	24,500	32,000	226,000	162,000	60,000
13,700	16,000	139,000	87,000	48,000	25,000	32,000	226,000	162,000	60,000
14,000	16,000	139,000	87,000	48,000					
14,500	20,000	154,000	100,000	50,000					
14,800	20,000	154,000	100,000	50,000					
15,000	20,000	154,000	100,000	50,000					
15,100	20,000	154,000	100,000	50,000					
15,500	20,000	154,000	100,000	50,000					
15,700	20,000	154,000	100,000	50,000					
16,000	20,000	154,000	100,000	50,000					
16,200	20,000	166,000	112,000	50,000					
16,500	20,000	166,000	112,000	50,000					
17,000	20,000	166,000	112,000	50,000					

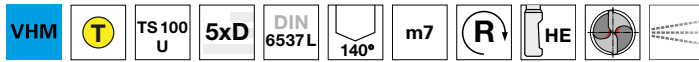


## TS-Drills mit Innenkühlung

Artikel-Nr. 89272

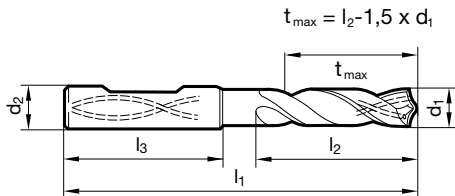


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \text{Ø } 3,700$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	66,000	28,000	36,000	9,520	3/8	10,000	103,000	61,000	40,000
3,100		6,000	66,000	28,000	36,000	9,700		10,000	103,000	61,000	40,000
3,200		6,000	66,000	28,000	36,000	9,800		10,000	103,000	61,000	40,000
3,300		6,000	66,000	28,000	36,000	10,000		10,000	103,000	61,000	40,000
3,400		6,000	66,000	28,000	36,000	10,200		12,000	118,000	71,000	45,000
3,500		6,000	66,000	28,000	36,000	10,500		12,000	118,000	71,000	45,000
3,600		6,000	66,000	28,000	36,000	10,800		12,000	118,000	71,000	45,000
3,700		6,000	66,000	28,000	36,000	11,000		12,000	118,000	71,000	45,000
3,800		6,000	74,000	36,000	36,000	11,110	7/16	12,000	118,000	71,000	45,000
3,900		6,000	74,000	36,000	36,000	11,200		12,000	118,000	71,000	45,000
5,000		6,000	82,000	44,000	36,000	11,500		12,000	118,000	71,000	45,000
5,500		6,000	82,000	44,000	36,000	11,800		12,000	118,000	71,000	45,000
5,800		6,000	82,000	44,000	36,000	12,000		12,000	118,000	71,000	45,000
5,950	15/64	6,000	82,000	44,000	36,000	12,500		14,000	124,000	77,000	45,000
6,000		6,000	82,000	44,000	36,000	13,000		14,000	124,000	77,000	45,000
6,400		8,000	91,000	53,000	36,000	13,500		14,000	124,000	77,000	45,000
6,500		8,000	91,000	53,000	36,000	14,000		14,000	124,000	77,000	45,000
6,750	17/64	8,000	91,000	53,000	36,000	14,500		16,000	133,000	83,000	48,000
6,800		8,000	91,000	53,000	36,000	15,000		16,000	133,000	83,000	48,000
7,000		8,000	91,000	53,000	36,000	15,500		16,000	133,000	83,000	48,000
7,140	9/32	8,000	91,000	53,000	36,000	15,870	5/8	16,000	133,000	83,000	48,000
7,500		8,000	91,000	53,000	36,000	16,000		16,000	133,000	83,000	48,000
7,800		8,000	91,000	53,000	36,000	16,500		18,000	143,000	93,000	48,000
8,000		8,000	91,000	53,000	36,000	17,000		18,000	143,000	93,000	48,000
8,500		10,000	103,000	61,000	40,000	17,500		18,000	143,000	93,000	48,000
8,600		10,000	103,000	61,000	40,000	18,000		18,000	143,000	93,000	48,000
8,800		10,000	103,000	61,000	40,000	19,000		20,000	153,000	101,000	50,000
9,000		10,000	103,000	61,000	40,000	19,500		20,000	153,000	101,000	50,000
9,300		10,000	103,000	61,000	40,000						
9,500		10,000	103,000	61,000	40,000						

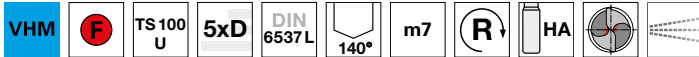


## TS-Drills mit Innenkühlung

### Artikel-Nr. 89411



P	M	K	N	S	H
●	○	●	○	○	○



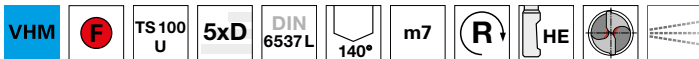
Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen

### Artikel-Nr. 89408

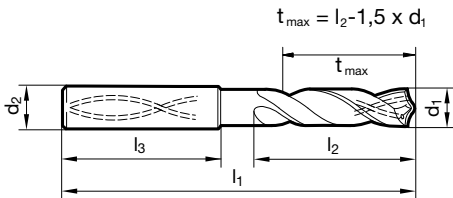


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		6,000	66,000	28,000	36,000	4,760	3/16	6,000	82,000	44,000	36,000
3,100		6,000	66,000	28,000	36,000	4,800		6,000	82,000	44,000	36,000
3,170	1/8	6,000	66,000	28,000	36,000	4,900		6,000	82,000	44,000	36,000
3,200		6,000	66,000	28,000	36,000	5,000		6,000	82,000	44,000	36,000
3,250		6,000	66,000	28,000	36,000	5,100		6,000	82,000	44,000	36,000
3,300		6,000	66,000	28,000	36,000	5,160	13/64	6,000	82,000	44,000	36,000
3,400		6,000	66,000	28,000	36,000	5,200		6,000	82,000	44,000	36,000
3,500		6,000	66,000	28,000	36,000	5,300		6,000	82,000	44,000	36,000
3,570	9/64	6,000	66,000	28,000	36,000	5,400		6,000	82,000	44,000	36,000
3,600		6,000	66,000	28,000	36,000	5,500		6,000	82,000	44,000	36,000
3,700		6,000	66,000	28,000	36,000	5,550		6,000	82,000	44,000	36,000
3,800		6,000	74,000	36,000	36,000	5,560	7/32	6,000	82,000	44,000	36,000
3,900		6,000	74,000	36,000	36,000	5,600		6,000	82,000	44,000	36,000
3,970	5/32	6,000	74,000	36,000	36,000	5,700		6,000	82,000	44,000	36,000
4,000		6,000	74,000	36,000	36,000	5,800		6,000	82,000	44,000	36,000
4,100		6,000	74,000	36,000	36,000	5,900		6,000	82,000	44,000	36,000
4,200		6,000	74,000	36,000	36,000	5,950	15/64	6,000	82,000	44,000	36,000
4,300		6,000	74,000	36,000	36,000	6,000		6,000	82,000	44,000	36,000
4,370	11/64	6,000	74,000	36,000	36,000	6,100		8,000	91,000	53,000	36,000
4,400		6,000	74,000	36,000	36,000	6,200		8,000	91,000	53,000	36,000
4,500		6,000	74,000	36,000	36,000	6,300		8,000	91,000	53,000	36,000
4,600		6,000	74,000	36,000	36,000	6,350	1/4	8,000	91,000	53,000	36,000
4,650		6,000	74,000	36,000	36,000	6,400		8,000	91,000	53,000	36,000
4,700		6,000	74,000	36,000	36,000	6,500		8,000	91,000	53,000	36,000





## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,600		8,000	91,000	53,000	36,000	11,400		12,000	118,000	71,000	45,000
6,700		8,000	91,000	53,000	36,000	11,500		12,000	118,000	71,000	45,000
6,750	17/64	8,000	91,000	53,000	36,000	11,600		12,000	118,000	71,000	45,000
6,800		8,000	91,000	53,000	36,000	11,700		12,000	118,000	71,000	45,000
6,900		8,000	91,000	53,000	36,000	11,800		12,000	118,000	71,000	45,000
7,000		8,000	91,000	53,000	36,000	11,900		12,000	118,000	71,000	45,000
7,100		8,000	91,000	53,000	36,000	11,910	15/32	12,000	118,000	71,000	45,000
7,140	9/32	8,000	91,000	53,000	36,000	12,000		12,000	118,000	71,000	45,000
7,200		8,000	91,000	53,000	36,000	12,100		14,000	124,000	77,000	45,000
7,300		8,000	91,000	53,000	36,000	12,200		14,000	124,000	77,000	45,000
7,400		8,000	91,000	53,000	36,000	12,300	31/64	14,000	124,000	77,000	45,000
7,500		8,000	91,000	53,000	36,000	12,400		14,000	124,000	77,000	45,000
7,540	19/64	8,000	91,000	53,000	36,000	12,500		14,000	124,000	77,000	45,000
7,600		8,000	91,000	53,000	36,000	12,600		14,000	124,000	77,000	45,000
7,700		8,000	91,000	53,000	36,000	12,700	1/2	14,000	124,000	77,000	45,000
7,800		8,000	91,000	53,000	36,000	12,800		14,000	124,000	77,000	45,000
7,900		8,000	91,000	53,000	36,000	13,000		14,000	124,000	77,000	45,000
7,940	5/16	8,000	91,000	53,000	36,000	13,100	33/64	14,000	124,000	77,000	45,000
8,000		8,000	91,000	53,000	36,000	13,300		14,000	124,000	77,000	45,000
8,100		10,000	103,000	61,000	40,000	13,500		14,000	124,000	77,000	45,000
8,200		10,000	103,000	61,000	40,000	13,700		14,000	124,000	77,000	45,000
8,300		10,000	103,000	61,000	40,000	13,800		14,000	124,000	77,000	45,000
8,330	21/64	10,000	103,000	61,000	40,000	14,000		14,000	124,000	77,000	45,000
8,400		10,000	103,000	61,000	40,000	14,100		16,000	133,000	83,000	48,000
8,500		10,000	103,000	61,000	40,000	14,200		16,000	133,000	83,000	48,000
8,600		10,000	103,000	61,000	40,000	14,290	9/16	16,000	133,000	83,000	48,000
8,700		10,000	103,000	61,000	40,000	14,500		16,000	133,000	83,000	48,000
8,730	11/32	10,000	103,000	61,000	40,000	14,600		16,000	133,000	83,000	48,000
8,800		10,000	103,000	61,000	40,000	14,700		16,000	133,000	83,000	48,000
8,900		10,000	103,000	61,000	40,000	14,800		16,000	133,000	83,000	48,000
9,000		10,000	103,000	61,000	40,000	15,000		16,000	133,000	83,000	48,000
9,100		10,000	103,000	61,000	40,000	15,100		16,000	133,000	83,000	48,000
9,130	23/64	10,000	103,000	61,000	40,000	15,200		16,000	133,000	83,000	48,000
9,200		10,000	103,000	61,000	40,000	15,300		16,000	133,000	83,000	48,000
9,250		10,000	103,000	61,000	40,000	15,500		16,000	133,000	83,000	48,000
9,300		10,000	103,000	61,000	40,000	15,700		16,000	133,000	83,000	48,000
9,400		10,000	103,000	61,000	40,000	15,800		16,000	133,000	83,000	48,000
9,500		10,000	103,000	61,000	40,000	16,000		16,000	133,000	83,000	48,000
9,520	3/8	10,000	103,000	61,000	40,000	16,500		18,000	143,000	93,000	48,000
9,600		10,000	103,000	61,000	40,000	16,900		18,000	143,000	93,000	48,000
9,700		10,000	103,000	61,000	40,000	17,000		18,000	143,000	93,000	48,000
9,800		10,000	103,000	61,000	40,000	17,500		18,000	143,000	93,000	48,000
9,900		10,000	103,000	61,000	40,000	18,000		18,000	143,000	93,000	48,000
9,920	25/64	10,000	103,000	61,000	40,000	18,500		20,000	153,000	101,000	50,000
10,000		10,000	103,000	61,000	40,000	18,900		20,000	153,000	101,000	50,000
10,100		12,000	118,000	71,000	45,000	19,000		20,000	153,000	101,000	50,000
10,200		12,000	118,000	71,000	45,000	19,050	3/4	20,000	153,000	101,000	50,000
10,300		12,000	118,000	71,000	45,000	19,500		20,000	153,000	101,000	50,000
10,320	13/32	12,000	118,000	71,000	45,000	20,000		20,000	153,000	101,000	50,000
10,400		12,000	118,000	71,000	45,000						
10,500		12,000	118,000	71,000	45,000						
10,600		12,000	118,000	71,000	45,000						
10,700		12,000	118,000	71,000	45,000						
10,800		12,000	118,000	71,000	45,000						
10,900		12,000	118,000	71,000	45,000						
11,000		12,000	118,000	71,000	45,000						
11,100		12,000	118,000	71,000	45,000						
11,110	7/16	12,000	118,000	71,000	45,000						
11,200		12,000	118,000	71,000	45,000						
11,300		12,000	118,000	71,000	45,000						

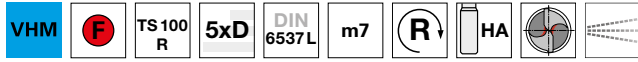


## TS-Drills mit Innenkühlung

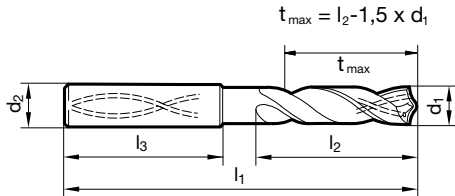
Artikel-Nr. 89420



P	M	K	N	S	H
		•			



Ausspitzung  $\geq \text{Ø } 3,000$  • patentierter Radienanschliff • Schneidenform gerade (durch Korrektur)  
 Vermikularguss GGv und ADI, CDI • Grauguss, Temperguss, Sphäroguss



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	66,000	28,000	36,000	6,100		8,000	91,000	53,000	36,000
3,100		6,000	66,000	28,000	36,000	6,200		8,000	91,000	53,000	36,000
3,170	1/8	6,000	66,000	28,000	36,000	6,300		8,000	91,000	53,000	36,000
3,200		6,000	66,000	28,000	36,000	6,350	1/4	8,000	91,000	53,000	36,000
3,250		6,000	66,000	28,000	36,000	6,400		8,000	91,000	53,000	36,000
3,300		6,000	66,000	28,000	36,000	6,500		8,000	91,000	53,000	36,000
3,400		6,000	66,000	28,000	36,000	6,600		8,000	91,000	53,000	36,000
3,500		6,000	66,000	28,000	36,000	6,700		8,000	91,000	53,000	36,000
3,570	9/64	6,000	66,000	28,000	36,000	6,750	17/64	8,000	91,000	53,000	36,000
3,600		6,000	66,000	28,000	36,000	6,800		8,000	91,000	53,000	36,000
3,700		6,000	66,000	28,000	36,000	6,900		8,000	91,000	53,000	36,000
3,800		6,000	74,000	36,000	36,000	7,000		8,000	91,000	53,000	36,000
3,900		6,000	74,000	36,000	36,000	7,100		8,000	91,000	53,000	36,000
3,970	5/32	6,000	74,000	36,000	36,000	7,140	9/32	8,000	91,000	53,000	36,000
4,000		6,000	74,000	36,000	36,000	7,200		8,000	91,000	53,000	36,000
4,100		6,000	74,000	36,000	36,000	7,300		8,000	91,000	53,000	36,000
4,200		6,000	74,000	36,000	36,000	7,400		8,000	91,000	53,000	36,000
4,300		6,000	74,000	36,000	36,000	7,500		8,000	91,000	53,000	36,000
4,370	11/64	6,000	74,000	36,000	36,000	7,540	19/64	8,000	91,000	53,000	36,000
4,400		6,000	74,000	36,000	36,000	7,600		8,000	91,000	53,000	36,000
4,500		6,000	74,000	36,000	36,000	7,700		8,000	91,000	53,000	36,000
4,600		6,000	74,000	36,000	36,000	7,800		8,000	91,000	53,000	36,000
4,650		6,000	74,000	36,000	36,000	7,900		8,000	91,000	53,000	36,000
4,700		6,000	74,000	36,000	36,000	7,940	5/16	8,000	91,000	53,000	36,000
4,760	3/16	6,000	82,000	44,000	36,000	8,000		8,000	91,000	53,000	36,000
4,800		6,000	82,000	44,000	36,000	8,100		10,000	103,000	61,000	40,000
4,900		6,000	82,000	44,000	36,000	8,200		10,000	103,000	61,000	40,000
5,000		6,000	82,000	44,000	36,000	8,300		10,000	103,000	61,000	40,000
5,100		6,000	82,000	44,000	36,000	8,330	21/64	10,000	103,000	61,000	40,000
5,160	13/64	6,000	82,000	44,000	36,000	8,400		10,000	103,000	61,000	40,000
5,200		6,000	82,000	44,000	36,000	8,500		10,000	103,000	61,000	40,000
5,300		6,000	82,000	44,000	36,000	8,600		10,000	103,000	61,000	40,000
5,400		6,000	82,000	44,000	36,000	8,700		10,000	103,000	61,000	40,000
5,500		6,000	82,000	44,000	36,000	8,730	11/32	10,000	103,000	61,000	40,000
5,550		6,000	82,000	44,000	36,000	8,800		10,000	103,000	61,000	40,000
5,560	7/32	6,000	82,000	44,000	36,000	8,900		10,000	103,000	61,000	40,000
5,600		6,000	82,000	44,000	36,000	9,000		10,000	103,000	61,000	40,000
5,700		6,000	82,000	44,000	36,000	9,100		10,000	103,000	61,000	40,000
5,800		6,000	82,000	44,000	36,000	9,130	23/64	10,000	103,000	61,000	40,000
5,900		6,000	82,000	44,000	36,000	9,200		10,000	103,000	61,000	40,000
5,950	15/64	6,000	82,000	44,000	36,000	9,250		10,000	103,000	61,000	40,000
6,000		6,000	82,000	44,000	36,000	9,300		10,000	103,000	61,000	40,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
9,400		10,000	103,000	61,000	40,000	13,000		14,000	124,000	77,000	45,000
9,500		10,000	103,000	61,000	40,000	13,100	33/64	14,000	124,000	77,000	45,000
9,520	3/8	10,000	103,000	61,000	40,000	13,300		14,000	124,000	77,000	45,000
9,600		10,000	103,000	61,000	40,000	13,400		14,000	124,000	77,000	45,000
9,700		10,000	103,000	61,000	40,000	13,500		14,000	124,000	77,000	45,000
9,800		10,000	103,000	61,000	40,000	13,700		14,000	124,000	77,000	45,000
9,900		10,000	103,000	61,000	40,000	13,800		14,000	124,000	77,000	45,000
9,920	25/64	10,000	103,000	61,000	40,000	13,900		14,000	124,000	77,000	45,000
10,000		10,000	103,000	61,000	40,000	14,000		14,000	124,000	77,000	45,000
10,100		12,000	118,000	71,000	45,000	14,100		16,000	133,000	83,000	48,000
10,200		12,000	118,000	71,000	45,000	14,200		16,000	133,000	83,000	48,000
10,300		12,000	118,000	71,000	45,000	14,290	9/16	16,000	133,000	83,000	48,000
10,320	13/32	12,000	118,000	71,000	45,000	14,300		16,000	133,000	83,000	48,000
10,400		12,000	118,000	71,000	45,000	14,400		16,000	133,000	83,000	48,000
10,500		12,000	118,000	71,000	45,000	14,500		16,000	133,000	83,000	48,000
10,600		12,000	118,000	71,000	45,000	14,600		16,000	133,000	83,000	48,000
10,700		12,000	118,000	71,000	45,000	14,700		16,000	133,000	83,000	48,000
10,720	27/64	12,000	118,000	71,000	45,000	14,900		16,000	133,000	83,000	48,000
10,800		12,000	118,000	71,000	45,000	15,000		16,000	133,000	83,000	48,000
10,900		12,000	118,000	71,000	45,000	15,100		16,000	133,000	83,000	48,000
11,000		12,000	118,000	71,000	45,000	15,200		16,000	133,000	83,000	48,000
11,100		12,000	118,000	71,000	45,000	15,300		16,000	133,000	83,000	48,000
11,110	7/16	12,000	118,000	71,000	45,000	15,400		16,000	133,000	83,000	48,000
11,200		12,000	118,000	71,000	45,000	15,500		16,000	133,000	83,000	48,000
11,300		12,000	118,000	71,000	45,000	15,600		16,000	133,000	83,000	48,000
11,400		12,000	118,000	71,000	45,000	15,700		16,000	133,000	83,000	48,000
11,500		12,000	118,000	71,000	45,000	15,800		16,000	133,000	83,000	48,000
11,600		12,000	118,000	71,000	45,000	15,870	5/8	16,000	133,000	83,000	48,000
11,700		12,000	118,000	71,000	45,000	15,900		16,000	133,000	83,000	48,000
11,800		12,000	118,000	71,000	45,000	16,000		16,000	133,000	83,000	48,000
11,900		12,000	118,000	71,000	45,000	16,500		18,000	143,000	93,000	48,000
11,910	15/32	12,000	118,000	71,000	45,000	16,670	21/32	18,000	143,000	93,000	48,000
12,000		12,000	118,000	71,000	45,000	17,000		18,000	143,000	93,000	48,000
12,100		14,000	124,000	77,000	45,000	17,500		18,000	143,000	93,000	48,000
12,200		14,000	124,000	77,000	45,000	18,000		18,000	143,000	93,000	48,000
12,300	31/64	14,000	124,000	77,000	45,000	18,500		20,000	153,000	101,000	50,000
12,400		14,000	124,000	77,000	45,000	19,000		20,000	153,000	101,000	50,000
12,500		14,000	124,000	77,000	45,000	19,500		20,000	153,000	101,000	50,000
12,600		14,000	124,000	77,000	45,000	20,000		20,000	153,000	101,000	50,000
12,700	1/2	14,000	124,000	77,000	45,000						
12,800		14,000	124,000	77,000	45,000						
12,900		14,000	124,000	77,000	45,000						

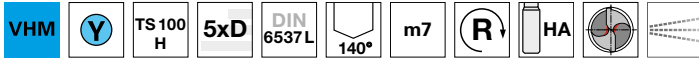


## TS-Drills mit Innenkühlung

### Artikel-Nr. 89425



P	M	K	N	S	H
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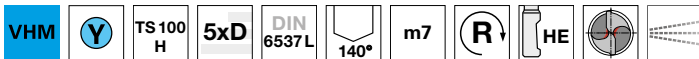


Ausspitzung  $\geq \text{Ø } 3,000$  • Kegelmantelschliff • Hauptschneidenform leicht konkav • optimierte Schneidengeometrie  
legierte und hochfeste Stähle bis  $1400 \text{ N/mm}^2$  • Inconel, Hastelloy, Monel • Titan und Titanlegierungen

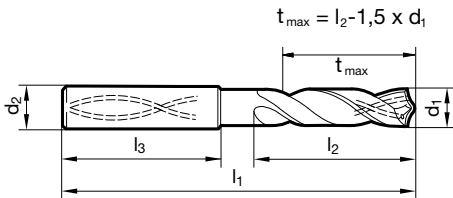
### Artikel-Nr. 89426



P	M	K	N	S	H
•				•	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Kegelmantelschliff • Hauptschneidenform leicht konkav • optimierte Schneidengeometrie  
legierte und hochfeste Stähle bis  $1400 \text{ N/mm}^2$  • Inconel, Hastelloy, Monel • Titan und Titanlegierungen



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		6,000	66,000	28,000	36,000	4,760	3/16	6,000	82,000	44,000	36,000
3,100		6,000	66,000	28,000	36,000	4,800		6,000	82,000	44,000	36,000
3,170	1/8	6,000	66,000	28,000	36,000	4,900		6,000	82,000	44,000	36,000
3,200		6,000	66,000	28,000	36,000	5,000		6,000	82,000	44,000	36,000
3,250		6,000	66,000	28,000	36,000	5,100		6,000	82,000	44,000	36,000
3,300		6,000	66,000	28,000	36,000	5,160	13/64	6,000	82,000	44,000	36,000
3,400		6,000	66,000	28,000	36,000	5,200		6,000	82,000	44,000	36,000
3,500		6,000	66,000	28,000	36,000	5,300		6,000	82,000	44,000	36,000
3,570	9/64	6,000	66,000	28,000	36,000	5,400		6,000	82,000	44,000	36,000
3,600		6,000	66,000	28,000	36,000	5,500		6,000	82,000	44,000	36,000
3,700		6,000	66,000	28,000	36,000	5,550		6,000	82,000	44,000	36,000
3,800		6,000	74,000	36,000	36,000	5,560	7/32	6,000	82,000	44,000	36,000
3,900		6,000	74,000	36,000	36,000	5,600		6,000	82,000	44,000	36,000
3,970	5/32	6,000	74,000	36,000	36,000	5,700		6,000	82,000	44,000	36,000
4,000		6,000	74,000	36,000	36,000	5,800		6,000	82,000	44,000	36,000
4,100		6,000	74,000	36,000	36,000	5,900		6,000	82,000	44,000	36,000
4,200		6,000	74,000	36,000	36,000	5,950	15/64	6,000	82,000	44,000	36,000
4,300		6,000	74,000	36,000	36,000	6,000		6,000	82,000	44,000	36,000
4,370	11/64	6,000	74,000	36,000	36,000	6,100		8,000	91,000	53,000	36,000
4,400		6,000	74,000	36,000	36,000	6,200		8,000	91,000	53,000	36,000
4,500		6,000	74,000	36,000	36,000	6,300		8,000	91,000	53,000	36,000
4,600		6,000	74,000	36,000	36,000	6,350	1/4	8,000	91,000	53,000	36,000
4,650		6,000	74,000	36,000	36,000	6,400		8,000	91,000	53,000	36,000
4,700		6,000	74,000	36,000	36,000	6,500		8,000	91,000	53,000	36,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,600		8,000	91,000	53,000	36,000	10,900		12,000	118,000	71,000	45,000
6,700		8,000	91,000	53,000	36,000	11,000		12,000	118,000	71,000	45,000
6,750	17/64	8,000	91,000	53,000	36,000	11,100		12,000	118,000	71,000	45,000
6,800		8,000	91,000	53,000	36,000	11,110	7/16	12,000	118,000	71,000	45,000
6,900		8,000	91,000	53,000	36,000	11,200		12,000	118,000	71,000	45,000
7,000		8,000	91,000	53,000	36,000	11,300		12,000	118,000	71,000	45,000
7,100		8,000	91,000	53,000	36,000	11,400		12,000	118,000	71,000	45,000
7,140	9/32	8,000	91,000	53,000	36,000	11,500		12,000	118,000	71,000	45,000
7,200		8,000	91,000	53,000	36,000	11,600		12,000	118,000	71,000	45,000
7,300		8,000	91,000	53,000	36,000	11,700		12,000	118,000	71,000	45,000
7,400		8,000	91,000	53,000	36,000	11,800		12,000	118,000	71,000	45,000
7,500		8,000	91,000	53,000	36,000	11,900		12,000	118,000	71,000	45,000
7,540	19/64	8,000	91,000	53,000	36,000	11,910	15/32	12,000	118,000	71,000	45,000
7,600		8,000	91,000	53,000	36,000	12,000		12,000	118,000	71,000	45,000
7,700		8,000	91,000	53,000	36,000	12,200		14,000	124,000	77,000	45,000
7,800		8,000	91,000	53,000	36,000	12,500		14,000	124,000	77,000	45,000
7,900		8,000	91,000	53,000	36,000	12,700	1/2	14,000	124,000	77,000	45,000
7,940	5/16	8,000	91,000	53,000	36,000	12,800		14,000	124,000	77,000	45,000
8,000		8,000	91,000	53,000	36,000	13,000		14,000	124,000	77,000	45,000
8,100		10,000	103,000	61,000	40,000	13,300		14,000	124,000	77,000	45,000
8,200		10,000	103,000	61,000	40,000	13,500		14,000	124,000	77,000	45,000
8,300		10,000	103,000	61,000	40,000	13,700		14,000	124,000	77,000	45,000
8,330	21/64	10,000	103,000	61,000	40,000	14,000		14,000	124,000	77,000	45,000
8,400		10,000	103,000	61,000	40,000	14,200		16,000	133,000	83,000	48,000
8,500		10,000	103,000	61,000	40,000	14,290	9/16	16,000	133,000	83,000	48,000
8,600		10,000	103,000	61,000	40,000	14,300		16,000	133,000	83,000	48,000
8,700		10,000	103,000	61,000	40,000	14,500		16,000	133,000	83,000	48,000
8,730	11/32	10,000	103,000	61,000	40,000	14,700		16,000	133,000	83,000	48,000
8,800		10,000	103,000	61,000	40,000	15,000		16,000	133,000	83,000	48,000
8,900		10,000	103,000	61,000	40,000	15,200		16,000	133,000	83,000	48,000
9,000		10,000	103,000	61,000	40,000	15,300		16,000	133,000	83,000	48,000
9,100		10,000	103,000	61,000	40,000	15,500		16,000	133,000	83,000	48,000
9,130	23/64	10,000	103,000	61,000	40,000	15,700		16,000	133,000	83,000	48,000
9,200		10,000	103,000	61,000	40,000	16,000		16,000	133,000	83,000	48,000
9,250		10,000	103,000	61,000	40,000	16,300		18,000	143,000	93,000	48,000
9,300		10,000	103,000	61,000	40,000	16,500		18,000	143,000	93,000	48,000
9,400		10,000	103,000	61,000	40,000	16,900		18,000	143,000	93,000	48,000
9,500		10,000	103,000	61,000	40,000	17,000		18,000	143,000	93,000	48,000
9,520	3/8	10,000	103,000	61,000	40,000	17,300		18,000	143,000	93,000	48,000
9,600		10,000	103,000	61,000	40,000	17,500		18,000	143,000	93,000	48,000
9,700		10,000	103,000	61,000	40,000	18,000		18,000	143,000	93,000	48,000
9,800		10,000	103,000	61,000	40,000	18,500		20,000	153,000	101,000	50,000
9,900		10,000	103,000	61,000	40,000	18,900		20,000	153,000	101,000	50,000
9,920	25/64	10,000	103,000	61,000	40,000	19,000		20,000	153,000	101,000	50,000
10,000		10,000	103,000	61,000	40,000	19,050	3/4	20,000	153,000	101,000	50,000
10,100		12,000	118,000	71,000	45,000	19,300		20,000	153,000	101,000	50,000
10,200		12,000	118,000	71,000	45,000	19,500		20,000	153,000	101,000	50,000
10,300		12,000	118,000	71,000	45,000	20,000		20,000	153,000	101,000	50,000
10,320	13/32	12,000	118,000	71,000	45,000						
10,400		12,000	118,000	71,000	45,000						
10,500		12,000	118,000	71,000	45,000						
10,600		12,000	118,000	71,000	45,000						
10,700		12,000	118,000	71,000	45,000						
10,800		12,000	118,000	71,000	45,000						

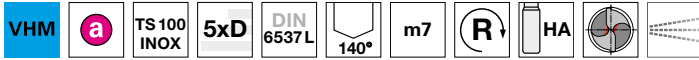


## TS-Drills mit Innenkühlung

### Artikel-Nr. 89451



P	M	K	N	S	H
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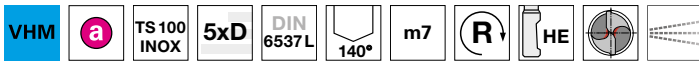


Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie  
rost-/säure-/hitzebeständige Stähle • Titan und Titanlegierungen • Inconel, Hastelloy, Monel

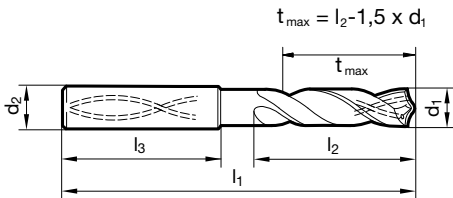
### Artikel-Nr. 89551



P	M	K	N	S	H
○	●			○	



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie  
rost-/säure-/hitzebeständige Stähle • Titan und Titanlegierungen • Inconel, Hastelloy, Monel



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		6,000	66,000	28,000	36,000	4,760	3/16	6,000	82,000	44,000	36,000
3,100		6,000	66,000	28,000	36,000	4,800		6,000	82,000	44,000	36,000
3,170	1/8	6,000	66,000	28,000	36,000	4,900		6,000	82,000	44,000	36,000
3,200		6,000	66,000	28,000	36,000	5,000		6,000	82,000	44,000	36,000
3,250		6,000	66,000	28,000	36,000	5,100		6,000	82,000	44,000	36,000
3,300		6,000	66,000	28,000	36,000	5,160	13/64	6,000	82,000	44,000	36,000
3,400		6,000	66,000	28,000	36,000	5,200		6,000	82,000	44,000	36,000
3,500		6,000	66,000	28,000	36,000	5,300		6,000	82,000	44,000	36,000
3,570	9/64	6,000	66,000	28,000	36,000	5,400		6,000	82,000	44,000	36,000
3,600		6,000	66,000	28,000	36,000	5,500		6,000	82,000	44,000	36,000
3,700		6,000	66,000	28,000	36,000	5,550		6,000	82,000	44,000	36,000
3,800		6,000	74,000	36,000	36,000	5,560	7/32	6,000	82,000	44,000	36,000
3,900		6,000	74,000	36,000	36,000	5,600		6,000	82,000	44,000	36,000
3,970	5/32	6,000	74,000	36,000	36,000	5,700		6,000	82,000	44,000	36,000
4,000		6,000	74,000	36,000	36,000	5,800		6,000	82,000	44,000	36,000
4,100		6,000	74,000	36,000	36,000	5,900		6,000	82,000	44,000	36,000
4,200		6,000	74,000	36,000	36,000	5,950	15/64	6,000	82,000	44,000	36,000
4,300		6,000	74,000	36,000	36,000	6,000		6,000	82,000	44,000	36,000
4,370	11/64	6,000	74,000	36,000	36,000	6,100		8,000	91,000	53,000	36,000
4,400		6,000	74,000	36,000	36,000	6,200		8,000	91,000	53,000	36,000
4,500		6,000	74,000	36,000	36,000	6,300		8,000	91,000	53,000	36,000
4,600		6,000	74,000	36,000	36,000	6,350	1/4	8,000	91,000	53,000	36,000
4,650		6,000	74,000	36,000	36,000	6,400		8,000	91,000	53,000	36,000
4,700		6,000	74,000	36,000	36,000	6,500		8,000	91,000	53,000	36,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,600		8,000	91,000	53,000	36,000	10,900		12,000	118,000	71,000	45,000
6,700		8,000	91,000	53,000	36,000	11,000		12,000	118,000	71,000	45,000
6,750	17/64	8,000	91,000	53,000	36,000	11,100		12,000	118,000	71,000	45,000
6,800		8,000	91,000	53,000	36,000	11,110	7/16	12,000	118,000	71,000	45,000
6,900		8,000	91,000	53,000	36,000	11,200		12,000	118,000	71,000	45,000
7,000		8,000	91,000	53,000	36,000	11,300		12,000	118,000	71,000	45,000
7,100		8,000	91,000	53,000	36,000	11,400		12,000	118,000	71,000	45,000
7,140	9/32	8,000	91,000	53,000	36,000	11,500		12,000	118,000	71,000	45,000
7,200		8,000	91,000	53,000	36,000	11,600		12,000	118,000	71,000	45,000
7,300		8,000	91,000	53,000	36,000	11,700		12,000	118,000	71,000	45,000
7,400		8,000	91,000	53,000	36,000	11,800		12,000	118,000	71,000	45,000
7,500		8,000	91,000	53,000	36,000	11,900		12,000	118,000	71,000	45,000
7,540	19/64	8,000	91,000	53,000	36,000	11,910	15/32	12,000	118,000	71,000	45,000
7,600		8,000	91,000	53,000	36,000	12,000		12,000	118,000	71,000	45,000
7,700		8,000	91,000	53,000	36,000	12,200		14,000	124,000	77,000	45,000
7,800		8,000	91,000	53,000	36,000	12,500		14,000	124,000	77,000	45,000
7,900		8,000	91,000	53,000	36,000	12,700	1/2	14,000	124,000	77,000	45,000
7,940	5/16	8,000	91,000	53,000	36,000	12,800		14,000	124,000	77,000	45,000
8,000		8,000	91,000	53,000	36,000	13,000		14,000	124,000	77,000	45,000
8,100		10,000	103,000	61,000	40,000	13,300		14,000	124,000	77,000	45,000
8,200		10,000	103,000	61,000	40,000	13,500		14,000	124,000	77,000	45,000
8,300		10,000	103,000	61,000	40,000	13,700		14,000	124,000	77,000	45,000
8,330	21/64	10,000	103,000	61,000	40,000	14,000		14,000	124,000	77,000	45,000
8,400		10,000	103,000	61,000	40,000	14,200		16,000	133,000	83,000	48,000
8,500		10,000	103,000	61,000	40,000	14,290	9/16	16,000	133,000	83,000	48,000
8,600		10,000	103,000	61,000	40,000	14,300		16,000	133,000	83,000	48,000
8,700		10,000	103,000	61,000	40,000	14,500		16,000	133,000	83,000	48,000
8,730	11/32	10,000	103,000	61,000	40,000	14,700		16,000	133,000	83,000	48,000
8,800		10,000	103,000	61,000	40,000	15,000		16,000	133,000	83,000	48,000
8,900		10,000	103,000	61,000	40,000	15,200		16,000	133,000	83,000	48,000
9,000		10,000	103,000	61,000	40,000	15,300		16,000	133,000	83,000	48,000
9,100		10,000	103,000	61,000	40,000	15,500		16,000	133,000	83,000	48,000
9,130	23/64	10,000	103,000	61,000	40,000	15,700		16,000	133,000	83,000	48,000
9,200		10,000	103,000	61,000	40,000	16,000		16,000	133,000	83,000	48,000
9,250		10,000	103,000	61,000	40,000	16,300		18,000	143,000	93,000	48,000
9,300		10,000	103,000	61,000	40,000	16,500		18,000	143,000	93,000	48,000
9,400		10,000	103,000	61,000	40,000	16,900		18,000	143,000	93,000	48,000
9,500		10,000	103,000	61,000	40,000	17,000		18,000	143,000	93,000	48,000
9,520	3/8	10,000	103,000	61,000	40,000	17,300		18,000	143,000	93,000	48,000
9,600		10,000	103,000	61,000	40,000	17,500		18,000	143,000	93,000	48,000
9,700		10,000	103,000	61,000	40,000	18,000		18,000	143,000	93,000	48,000
9,800		10,000	103,000	61,000	40,000	18,500		20,000	153,000	101,000	50,000
9,900		10,000	103,000	61,000	40,000	18,900		20,000	153,000	101,000	50,000
9,920	25/64	10,000	103,000	61,000	40,000	19,000		20,000	153,000	101,000	50,000
10,000		10,000	103,000	61,000	40,000	19,050	3/4	20,000	153,000	101,000	50,000
10,100		12,000	118,000	71,000	45,000	19,300		20,000	153,000	101,000	50,000
10,200		12,000	118,000	71,000	45,000	19,500		20,000	153,000	101,000	50,000
10,300		12,000	118,000	71,000	45,000	20,000		20,000	153,000	101,000	50,000
10,320	13/32	12,000	118,000	71,000	45,000						
10,400		12,000	118,000	71,000	45,000						
10,500		12,000	118,000	71,000	45,000						
10,600		12,000	118,000	71,000	45,000						
10,700		12,000	118,000	71,000	45,000						
10,800		12,000	118,000	71,000	45,000						

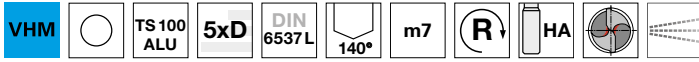


## TS-Drills mit Innenkühlung

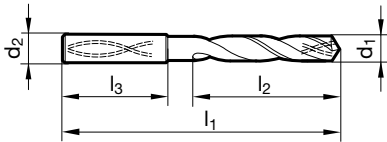
Artikel-Nr. 89560



P	M	K	N	S	H
			•		



Ausspitzung  $\geq \text{Ø } 3,000$  • Kegelmantelschliff • Hauptschneidenform konkav • optimierte Schneidengeometrie  
 Aluminium und Al-Legierungen • Kupfer-, Messing-, und Bronze-Legierungen • Kunststoffe



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	66,000	28,000	36,000	6,100		8,000	91,000	53,000	36,000
3,100		6,000	66,000	28,000	36,000	6,200		8,000	91,000	53,000	36,000
3,170	1/8	6,000	66,000	28,000	36,000	6,300		8,000	91,000	53,000	36,000
3,200		6,000	66,000	28,000	36,000	6,350	1/4	8,000	91,000	53,000	36,000
3,250		6,000	66,000	28,000	36,000	6,400		8,000	91,000	53,000	36,000
3,300		6,000	66,000	28,000	36,000	6,500		8,000	91,000	53,000	36,000
3,400		6,000	66,000	28,000	36,000	6,600		8,000	91,000	53,000	36,000
3,500		6,000	66,000	28,000	36,000	6,700		8,000	91,000	53,000	36,000
3,570	9/64	6,000	66,000	28,000	36,000	6,750	17/64	8,000	91,000	53,000	36,000
3,600		6,000	66,000	28,000	36,000	6,800		8,000	91,000	53,000	36,000
3,700		6,000	66,000	28,000	36,000	6,900		8,000	91,000	53,000	36,000
3,800		6,000	74,000	36,000	36,000	7,000		8,000	91,000	53,000	36,000
3,900		6,000	74,000	36,000	36,000	7,100		8,000	91,000	53,000	36,000
3,970	5/32	6,000	74,000	36,000	36,000	7,140	9/32	8,000	91,000	53,000	36,000
4,000		6,000	74,000	36,000	36,000	7,200		8,000	91,000	53,000	36,000
4,100		6,000	74,000	36,000	36,000	7,300		8,000	91,000	53,000	36,000
4,200		6,000	74,000	36,000	36,000	7,400		8,000	91,000	53,000	36,000
4,300		6,000	74,000	36,000	36,000	7,500		8,000	91,000	53,000	36,000
4,370	11/64	6,000	74,000	36,000	36,000	7,540	19/64	8,000	91,000	53,000	36,000
4,400		6,000	74,000	36,000	36,000	7,600		8,000	91,000	53,000	36,000
4,500		6,000	74,000	36,000	36,000	7,700		8,000	91,000	53,000	36,000
4,600		6,000	74,000	36,000	36,000	7,800		8,000	91,000	53,000	36,000
4,650		6,000	74,000	36,000	36,000	7,900		8,000	91,000	53,000	36,000
4,700		6,000	74,000	36,000	36,000	7,940	5/16	8,000	91,000	53,000	36,000
4,760	3/16	6,000	82,000	44,000	36,000	8,000		8,000	91,000	53,000	36,000
4,800		6,000	82,000	44,000	36,000	8,100		10,000	103,000	61,000	40,000
4,900		6,000	82,000	44,000	36,000	8,200		10,000	103,000	61,000	40,000
5,000		6,000	82,000	44,000	36,000	8,300		10,000	103,000	61,000	40,000
5,100		6,000	82,000	44,000	36,000	8,330	21/64	10,000	103,000	61,000	40,000
5,160	13/64	6,000	82,000	44,000	36,000	8,400		10,000	103,000	61,000	40,000
5,200		6,000	82,000	44,000	36,000	8,500		10,000	103,000	61,000	40,000
5,300		6,000	82,000	44,000	36,000	8,600		10,000	103,000	61,000	40,000
5,400		6,000	82,000	44,000	36,000	8,700		10,000	103,000	61,000	40,000
5,500		6,000	82,000	44,000	36,000	8,730	11/32	10,000	103,000	61,000	40,000
5,550		6,000	82,000	44,000	36,000	8,800		10,000	103,000	61,000	40,000
5,560	7/32	6,000	82,000	44,000	36,000	8,900		10,000	103,000	61,000	40,000
5,600		6,000	82,000	44,000	36,000	9,000		10,000	103,000	61,000	40,000
5,700		6,000	82,000	44,000	36,000	9,100		10,000	103,000	61,000	40,000
5,800		6,000	82,000	44,000	36,000	9,130	23/64	10,000	103,000	61,000	40,000
5,900		6,000	82,000	44,000	36,000	9,200		10,000	103,000	61,000	40,000
5,950	15/64	6,000	82,000	44,000	36,000	9,250		10,000	103,000	61,000	40,000
6,000		6,000	82,000	44,000	36,000	9,300		10,000	103,000	61,000	40,000





## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
9,340		10,000	103,000	61,000	40,000	13,300		14,000	124,000	77,000	45,000
9,400		10,000	103,000	61,000	40,000	13,400		14,000	124,000	77,000	45,000
9,500		10,000	103,000	61,000	40,000	13,500		14,000	124,000	77,000	45,000
9,520	3/8	10,000	103,000	61,000	40,000	13,700		14,000	124,000	77,000	45,000
9,600		10,000	103,000	61,000	40,000	13,800		14,000	124,000	77,000	45,000
9,700		10,000	103,000	61,000	40,000	14,000		14,000	124,000	77,000	45,000
9,800		10,000	103,000	61,000	40,000	14,100		16,000	133,000	83,000	48,000
9,900		10,000	103,000	61,000	40,000	14,200		16,000	133,000	83,000	48,000
9,920	25/64	10,000	103,000	61,000	40,000	14,290	9/16	16,000	133,000	83,000	48,000
10,000		10,000	103,000	61,000	40,000	14,300		16,000	133,000	83,000	48,000
10,100		12,000	118,000	71,000	45,000	14,400		16,000	133,000	83,000	48,000
10,200		12,000	118,000	71,000	45,000	14,500		16,000	133,000	83,000	48,000
10,300		12,000	118,000	71,000	45,000	14,700		16,000	133,000	83,000	48,000
10,320	13/32	12,000	118,000	71,000	45,000	14,800		16,000	133,000	83,000	48,000
10,400		12,000	118,000	71,000	45,000	15,000		16,000	133,000	83,000	48,000
10,500		12,000	118,000	71,000	45,000	15,100		16,000	133,000	83,000	48,000
10,600		12,000	118,000	71,000	45,000	15,200		16,000	133,000	83,000	48,000
10,700		12,000	118,000	71,000	45,000	15,300		16,000	133,000	83,000	48,000
10,800		12,000	118,000	71,000	45,000	15,500		16,000	133,000	83,000	48,000
10,900		12,000	118,000	71,000	45,000	15,700		16,000	133,000	83,000	48,000
11,000		12,000	118,000	71,000	45,000	15,800		16,000	133,000	83,000	48,000
11,100		12,000	118,000	71,000	45,000	16,000		16,000	133,000	83,000	48,000
11,110	7/16	12,000	118,000	71,000	45,000	16,500		18,000	143,000	93,000	48,000
11,200		12,000	118,000	71,000	45,000	16,700		18,000	143,000	93,000	48,000
11,300		12,000	118,000	71,000	45,000	16,900		18,000	143,000	93,000	48,000
11,400		12,000	118,000	71,000	45,000	17,000		18,000	143,000	93,000	48,000
11,500		12,000	118,000	71,000	45,000	17,500		18,000	143,000	93,000	48,000
11,600		12,000	118,000	71,000	45,000	17,700		18,000	143,000	93,000	48,000
11,700		12,000	118,000	71,000	45,000	18,000		18,000	143,000	93,000	48,000
11,800		12,000	118,000	71,000	45,000	18,500		20,000	153,000	101,000	50,000
11,900		12,000	118,000	71,000	45,000	18,900		20,000	153,000	101,000	50,000
11,910	15/32	12,000	118,000	71,000	45,000	19,000		20,000	153,000	101,000	50,000
12,000		12,000	118,000	71,000	45,000	19,050	3/4	20,000	153,000	101,000	50,000
12,100		14,000	124,000	77,000	45,000	19,300		20,000	153,000	101,000	50,000
12,200		14,000	124,000	77,000	45,000	19,500		20,000	153,000	101,000	50,000
12,500		14,000	124,000	77,000	45,000	20,000		20,000	153,000	101,000	50,000
12,600		14,000	124,000	77,000	45,000						
12,700	1/2	14,000	124,000	77,000	45,000						
12,800		14,000	124,000	77,000	45,000						
12,900		14,000	124,000	77,000	45,000						
13,000		14,000	124,000	77,000	45,000						
13,100	33/64	14,000	124,000	77,000	45,000						

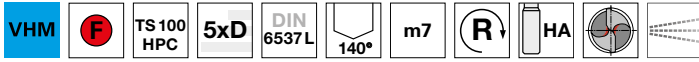


## TS-Drills mit Innenkühlung

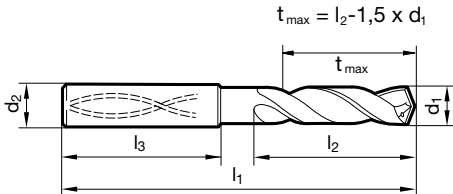
Artikel-Nr. 89460



P	M	K	N	S	H
●	○	○	○	○	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Kegelmantelschliff • Hauptschneide konkav • optimierte Schneidengeometrie • höchste Leistungsfähigkeit für die Hochleistungsbearbeitung in Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis 1400 N/mm<sup>2</sup> • rost-/säure-/hitzebeständige Stähle • Titan und Titanlegierungen • Sonderlegierungen



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	66,000	28,000	36,000	5,900		6,000	82,000	44,000	36,000
3,100		6,000	66,000	28,000	36,000	5,950	15/64	6,000	82,000	44,000	36,000
3,170	1/8	6,000	66,000	28,000	36,000	6,000		6,000	82,000	44,000	36,000
3,200		6,000	66,000	28,000	36,000	6,100		8,000	91,000	53,000	36,000
3,250		6,000	66,000	28,000	36,000	6,200		8,000	91,000	53,000	36,000
3,300		6,000	66,000	28,000	36,000	6,300		8,000	91,000	53,000	36,000
3,400		6,000	66,000	28,000	36,000	6,350	1/4	8,000	91,000	53,000	36,000
3,500		6,000	66,000	28,000	36,000	6,400		8,000	91,000	53,000	36,000
3,570	9/64	6,000	66,000	28,000	36,000	6,500		8,000	91,000	53,000	36,000
3,600		6,000	66,000	28,000	36,000	6,530		8,000	91,000	53,000	36,000
3,700		6,000	66,000	28,000	36,000	6,550		8,000	91,000	53,000	36,000
3,800		6,000	74,000	36,000	36,000	6,600		8,000	91,000	53,000	36,000
3,900		6,000	74,000	36,000	36,000	6,700		8,000	91,000	53,000	36,000
3,970	5/32	6,000	74,000	36,000	36,000	6,750	17/64	8,000	91,000	53,000	36,000
4,000		6,000	74,000	36,000	36,000	6,800		8,000	91,000	53,000	36,000
4,040		6,000	74,000	36,000	36,000	6,900		8,000	91,000	53,000	36,000
4,100		6,000	74,000	36,000	36,000	7,000		8,000	91,000	53,000	36,000
4,200		6,000	74,000	36,000	36,000	7,100		8,000	91,000	53,000	36,000
4,300		6,000	74,000	36,000	36,000	7,140	9/32	8,000	91,000	53,000	36,000
4,370	11/64	6,000	74,000	36,000	36,000	7,200		8,000	91,000	53,000	36,000
4,400		6,000	74,000	36,000	36,000	7,300		8,000	91,000	53,000	36,000
4,500		6,000	74,000	36,000	36,000	7,400		8,000	91,000	53,000	36,000
4,600		6,000	74,000	36,000	36,000	7,500		8,000	91,000	53,000	36,000
4,650		6,000	74,000	36,000	36,000	7,540	19/64	8,000	91,000	53,000	36,000
4,700		6,000	74,000	36,000	36,000	7,550		8,000	91,000	53,000	36,000
4,760	3/16	6,000	82,000	44,000	36,000	7,600		8,000	91,000	53,000	36,000
4,800		6,000	82,000	44,000	36,000	7,650		8,000	91,000	53,000	36,000
4,900		6,000	82,000	44,000	36,000	7,700		8,000	91,000	53,000	36,000
5,000		6,000	82,000	44,000	36,000	7,800		8,000	91,000	53,000	36,000
5,100		6,000	82,000	44,000	36,000	7,900		8,000	91,000	53,000	36,000
5,110		6,000	82,000	44,000	36,000	7,940	5/16	8,000	91,000	53,000	36,000
5,160	13/64	6,000	82,000	44,000	36,000	8,000		8,000	91,000	53,000	36,000
5,200		6,000	82,000	44,000	36,000	8,100		10,000	103,000	61,000	40,000
5,300		6,000	82,000	44,000	36,000	8,200		10,000	103,000	61,000	40,000
5,400		6,000	82,000	44,000	36,000	8,300		10,000	103,000	61,000	40,000
5,410		6,000	82,000	44,000	36,000	8,330	21/64	10,000	103,000	61,000	40,000
5,500		6,000	82,000	44,000	36,000	8,400		10,000	103,000	61,000	40,000
5,550		6,000	82,000	44,000	36,000	8,500		10,000	103,000	61,000	40,000
5,560	7/32	6,000	82,000	44,000	36,000	8,600		10,000	103,000	61,000	40,000
5,600		6,000	82,000	44,000	36,000	8,700		10,000	103,000	61,000	40,000
5,700		6,000	82,000	44,000	36,000	8,730	11/32	10,000	103,000	61,000	40,000
5,800		6,000	82,000	44,000	36,000	8,800		10,000	103,000	61,000	40,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
8,900		10,000	103,000	61,000	40,000	14,100		16,000	133,000	83,000	48,000
9,000		10,000	103,000	61,000	40,000	14,200		16,000	133,000	83,000	48,000
9,100		10,000	103,000	61,000	40,000	14,290	9/16	16,000	133,000	83,000	48,000
9,130	23/64	10,000	103,000	61,000	40,000	14,300		16,000	133,000	83,000	48,000
9,200		10,000	103,000	61,000	40,000	14,400		16,000	133,000	83,000	48,000
9,250		10,000	103,000	61,000	40,000	14,500		16,000	133,000	83,000	48,000
9,300		10,000	103,000	61,000	40,000	14,600		16,000	133,000	83,000	48,000
9,340		10,000	103,000	61,000	40,000	14,680	37/64	16,000	133,000	83,000	48,000
9,400		10,000	103,000	61,000	40,000	14,700		16,000	133,000	83,000	48,000
9,500		10,000	103,000	61,000	40,000	14,800		16,000	133,000	83,000	48,000
9,520	3/8	10,000	103,000	61,000	40,000	14,900		16,000	133,000	83,000	48,000
9,550		10,000	103,000	61,000	40,000	15,000		16,000	133,000	83,000	48,000
9,600		10,000	103,000	61,000	40,000	15,080	19/32	16,000	133,000	83,000	48,000
9,700		10,000	103,000	61,000	40,000	15,100		16,000	133,000	83,000	48,000
9,800		10,000	103,000	61,000	40,000	15,200		16,000	133,000	83,000	48,000
9,900		10,000	103,000	61,000	40,000	15,300		16,000	133,000	83,000	48,000
9,920	25/64	10,000	103,000	61,000	40,000	15,400		16,000	133,000	83,000	48,000
10,000		10,000	103,000	61,000	40,000	15,480	39/64	16,000	133,000	83,000	48,000
10,100		12,000	118,000	71,000	45,000	15,500		16,000	133,000	83,000	48,000
10,200		12,000	118,000	71,000	45,000	15,550		16,000	133,000	83,000	48,000
10,300		12,000	118,000	71,000	45,000	15,600		16,000	133,000	83,000	48,000
10,320	13/32	12,000	118,000	71,000	45,000	15,700		16,000	133,000	83,000	48,000
10,400		12,000	118,000	71,000	45,000	15,800		16,000	133,000	83,000	48,000
10,500		12,000	118,000	71,000	45,000	15,870	5/8	16,000	133,000	83,000	48,000
10,600		12,000	118,000	71,000	45,000	15,900		16,000	133,000	83,000	48,000
10,700		12,000	118,000	71,000	45,000	16,000		16,000	133,000	83,000	48,000
10,720	27/64	12,000	118,000	71,000	45,000	16,270	41/64	18,000	143,000	93,000	48,000
10,800		12,000	118,000	71,000	45,000	16,300		18,000	143,000	93,000	48,000
10,900		12,000	118,000	71,000	45,000	16,500		18,000	143,000	93,000	48,000
11,000		12,000	118,000	71,000	45,000	16,670	21/32	18,000	143,000	93,000	48,000
11,100		12,000	118,000	71,000	45,000	16,700		18,000	143,000	93,000	48,000
11,110	7/16	12,000	118,000	71,000	45,000	16,900		18,000	143,000	93,000	48,000
11,200		12,000	118,000	71,000	45,000	17,000		18,000	143,000	93,000	48,000
11,300		12,000	118,000	71,000	45,000	17,070	43/64	18,000	143,000	93,000	48,000
11,400		12,000	118,000	71,000	45,000	17,460	11/16	18,000	143,000	93,000	48,000
11,500		12,000	118,000	71,000	45,000	17,500		18,000	143,000	93,000	48,000
11,510	29/64	12,000	118,000	71,000	45,000	17,550		18,000	143,000	93,000	48,000
11,550		12,000	118,000	71,000	45,000	17,700		18,000	143,000	93,000	48,000
11,600		12,000	118,000	71,000	45,000	17,860	45/64	18,000	143,000	93,000	48,000
11,700		12,000	118,000	71,000	45,000	18,000		18,000	143,000	93,000	48,000
11,800		12,000	118,000	71,000	45,000	18,260	23/32	20,000	153,000	101,000	50,000
11,900		12,000	118,000	71,000	45,000	18,500		20,000	153,000	101,000	50,000
11,910	15/32	12,000	118,000	71,000	45,000	18,700		20,000	153,000	101,000	50,000
12,000		12,000	118,000	71,000	45,000	18,900		20,000	153,000	101,000	50,000
12,100		14,000	124,000	77,000	45,000	19,000		20,000	153,000	101,000	50,000
12,200		14,000	124,000	77,000	45,000	19,050	3/4	20,000	153,000	101,000	50,000
12,300	31/64	14,000	124,000	77,000	45,000	19,250		20,000	153,000	101,000	50,000
12,400		14,000	124,000	77,000	45,000	19,300		20,000	153,000	101,000	50,000
12,500		14,000	124,000	77,000	45,000	19,450	49/64	20,000	153,000	101,000	50,000
12,600		14,000	124,000	77,000	45,000	19,500		20,000	153,000	101,000	50,000
12,700	1/2	14,000	124,000	77,000	45,000	19,550		20,000	153,000	101,000	50,000
12,800		14,000	124,000	77,000	45,000	19,700		20,000	153,000	101,000	50,000
12,900		14,000	124,000	77,000	45,000	19,800		20,000	153,000	101,000	50,000
13,000		14,000	124,000	77,000	45,000	19,840	25/32	20,000	153,000	101,000	50,000
13,100	33/64	14,000	124,000	77,000	45,000	20,000		20,000	153,000	101,000	50,000
13,200		14,000	124,000	77,000	45,000						
13,300		14,000	124,000	77,000	45,000						
13,400		14,000	124,000	77,000	45,000						
13,490	17/32	14,000	124,000	77,000	45,000						
13,500		14,000	124,000	77,000	45,000						
13,600		14,000	124,000	77,000	45,000						
13,700		14,000	124,000	77,000	45,000						
13,800		14,000	124,000	77,000	45,000						
13,890	35/64	14,000	124,000	77,000	45,000						
13,900		14,000	124,000	77,000	45,000						
14,000		14,000	124,000	77,000	45,000						

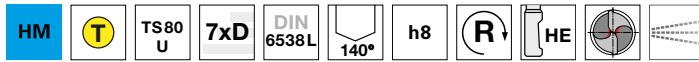


## TS-Drills mit Innenkühlung

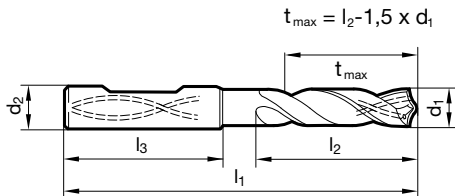
Artikel-Nr. 89308



P	M	K	N	S	H
•	○	○	○		



Ausspitzung  $\geq \varnothing 10,000$  • Kegelmantelschliff • dämpft Schwingungen und Stöße • HSS-Träger mit eingelöteter HM-Platte  
 unlegierte/niedrig legierte Stähle • Grauguss, Kugelgraphitguss • Messing, Bronzen, Kunststoffe, Graphit



d1 mm	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm	l3 mm
10,000	16,000	151,000	99,000	48,000	16,500	20,000	202,000	148,000	50,000
13,000	16,000	167,000	115,000	48,000	17,000	20,000	202,000	148,000	50,000
13,500	16,000	167,000	115,000	48,000	18,000	20,000	202,000	148,000	50,000
14,000	16,000	167,000	115,000	48,000	19,000	25,000	224,000	164,000	56,000
15,000	20,000	186,000	132,000	50,000	20,000	25,000	224,000	164,000	56,000
16,000	20,000	186,000	132,000	50,000	22,000	25,000	241,000	181,000	56,000

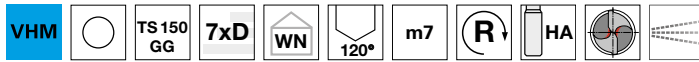


## TS-Drills mit Innenkühlung

Artikel-Nr. 89294

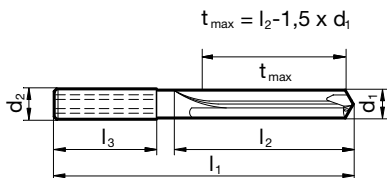


P	M	K	N	S	H
		•	○		



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • enge Durchmesser-toleranzen • sehr gute Bohrungs-oberflächen • optimalen Kühlmitteldruck beachten

Grauguss, Temperguss, Sphäroguss



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	74,000	32,000	36,000	11,500		12,000	163,000	114,000	45,000
3,100		6,000	74,000	32,000	36,000	12,000		12,000	163,000	114,000	45,000
3,200		6,000	74,000	32,000	36,000	12,300	31/64	14,000	182,000	133,000	45,000
3,500		6,000	74,000	34,000	36,000	12,500		14,000	182,000	133,000	45,000
3,600		6,000	74,000	34,000	36,000	12,700	1/2	14,000	182,000	133,000	45,000
3,700		6,000	74,000	34,000	36,000	13,000		14,000	182,000	133,000	45,000
3,800		6,000	97,000	45,000	36,000	13,500		14,000	182,000	133,000	45,000
4,000		6,000	97,000	45,000	36,000	14,000		14,000	182,000	133,000	45,000
4,100		6,000	97,000	45,000	36,000	14,500		16,000	204,000	152,000	48,000
4,200		6,000	97,000	45,000	36,000	15,000		16,000	204,000	152,000	48,000
4,300		6,000	97,000	45,000	36,000	15,500		16,000	204,000	152,000	48,000
4,400		6,000	97,000	45,000	36,000	16,000		16,000	204,000	152,000	48,000
4,500		6,000	97,000	45,000	36,000	16,500		18,000	223,000	171,000	48,000
4,700		6,000	97,000	45,000	36,000	17,000		18,000	223,000	171,000	48,000
4,800		6,000	97,000	57,000	36,000	17,500		18,000	223,000	171,000	48,000
4,900		6,000	97,000	57,000	36,000	18,000		18,000	223,000	171,000	48,000
5,000		6,000	97,000	57,000	36,000	18,500		20,000	244,000	190,000	50,000
5,500		6,000	97,000	57,000	36,000	19,000		20,000	244,000	190,000	50,000
6,000		6,000	97,000	57,000	36,000	19,500		20,000	244,000	190,000	50,000
6,500		8,000	116,000	76,000	36,000	20,000		20,000	244,000	190,000	50,000
6,800		8,000	116,000	76,000	36,000						
7,000		8,000	116,000	76,000	36,000						
7,800		8,000	116,000	76,000	36,000						
8,000		8,000	116,000	76,000	36,000						
8,500		10,000	139,000	95,000	40,000						
9,000		10,000	139,000	95,000	40,000						
10,000		10,000	139,000	95,000	40,000						
10,200		12,000	163,000	114,000	45,000						
10,500		12,000	163,000	114,000	45,000						
11,000		12,000	163,000	114,000	45,000						

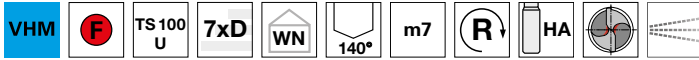


## TS-Drills mit Innenkühlung

### Artikel-Nr. 89412



P	M	K	N	S	H
●	○	●	○	○	○



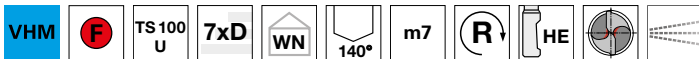
Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen

### Artikel-Nr. 89416

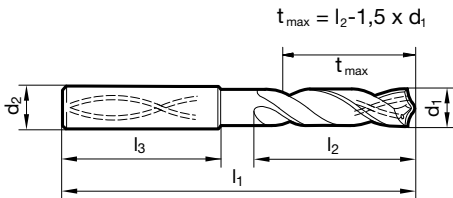


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Hauptschneidenform gerade • optimierte Schneidengeometrie

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1	inch	d2 h6	l1	l2	l3	d1	inch	d2 h6	l1	l2	l3
mm		mm	mm	mm	mm	mm		mm	mm	mm	mm
3,000		6,000	70,000	30,000	36,000	4,760	3/16	6,000	90,000	50,000	36,000
3,100		6,000	70,000	30,000	36,000	4,800		6,000	90,000	50,000	36,000
3,170	1/8	6,000	70,000	30,000	36,000	4,900		6,000	90,000	50,000	36,000
3,200		6,000	70,000	30,000	36,000	5,000		6,000	90,000	50,000	36,000
3,250		6,000	70,000	30,000	36,000	5,100		6,000	90,000	50,000	36,000
3,300		6,000	70,000	30,000	36,000	5,160	13/64	6,000	90,000	50,000	36,000
3,400		6,000	75,000	35,500	36,000	5,200		6,000	90,000	50,000	36,000
3,500		6,000	75,000	35,500	36,000	5,300		6,000	90,000	50,000	36,000
3,570	9/64	6,000	75,000	35,500	36,000	5,400		6,000	97,000	57,000	36,000
3,600		6,000	75,000	35,500	36,000	5,500		6,000	97,000	57,000	36,000
3,700		6,000	75,000	35,500	36,000	5,560	7/32	6,000	97,000	57,000	36,000
3,800		6,000	75,000	37,500	36,000	5,600		6,000	97,000	57,000	36,000
3,900		6,000	75,000	37,500	36,000	5,700		6,000	97,000	57,000	36,000
3,970	5/32	6,000	75,000	37,500	36,000	5,800		6,000	97,000	57,000	36,000
4,000		6,000	75,000	37,500	36,000	5,900		6,000	97,000	57,000	36,000
4,100		6,000	75,000	37,500	36,000	5,950	15/64	6,000	97,000	57,000	36,000
4,200		6,000	75,000	37,500	36,000	6,000		6,000	97,000	57,000	36,000
4,300		6,000	85,000	45,000	36,000	6,100		8,000	106,000	66,000	36,000
4,370	11/64	6,000	85,000	45,000	36,000	6,200		8,000	106,000	66,000	36,000
4,400		6,000	85,000	45,000	36,000	6,300		8,000	106,000	66,000	36,000
4,500		6,000	85,000	45,000	36,000	6,350	1/4	8,000	106,000	66,000	36,000
4,600		6,000	85,000	45,000	36,000	6,400		8,000	106,000	66,000	36,000
4,650		6,000	85,000	45,000	36,000	6,500		8,000	106,000	66,000	36,000
4,700		6,000	85,000	45,000	36,000	6,600		8,000	106,000	66,000	36,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
6,700		8,000	106,000	66,000	36,000	10,600		12,000	155,000	106,000	45,000
6,800		8,000	106,000	66,000	36,000	10,700		12,000	155,000	106,000	45,000
6,900		8,000	116,000	76,000	36,000	10,800		12,000	155,000	106,000	45,000
7,000		8,000	116,000	76,000	36,000	10,900		12,000	155,000	106,000	45,000
7,100		8,000	116,000	76,000	36,000	11,000		12,000	155,000	106,000	45,000
7,140	9/32	8,000	116,000	76,000	36,000	11,110	7/16	12,000	163,000	114,000	45,000
7,200		8,000	116,000	76,000	36,000	11,200		12,000	163,000	114,000	45,000
7,300		8,000	116,000	76,000	36,000	11,300		12,000	163,000	114,000	45,000
7,400		8,000	116,000	76,000	36,000	11,400		12,000	163,000	114,000	45,000
7,500		8,000	116,000	76,000	36,000	11,500		12,000	163,000	114,000	45,000
7,540	19/64	8,000	116,000	76,000	36,000	11,600		12,000	163,000	114,000	45,000
7,600		8,000	116,000	76,000	36,000	11,700		12,000	163,000	114,000	45,000
7,700		8,000	116,000	76,000	36,000	11,800		12,000	163,000	114,000	45,000
7,800		8,000	116,000	76,000	36,000	11,900		12,000	163,000	114,000	45,000
7,900		8,000	116,000	76,000	36,000	12,000		12,000	163,000	114,000	45,000
7,940	5/16	8,000	116,000	76,000	36,000	12,100		14,000	182,000	133,000	45,000
8,000		8,000	116,000	76,000	36,000	12,200		14,000	182,000	133,000	45,000
8,100		10,000	131,000	87,000	40,000	12,300	31/64	14,000	182,000	133,000	45,000
8,200		10,000	131,000	87,000	40,000	12,500		14,000	182,000	133,000	45,000
8,300		10,000	131,000	87,000	40,000	12,700	1/2	14,000	182,000	133,000	45,000
8,330	21/64	10,000	131,000	87,000	40,000	13,000		14,000	182,000	133,000	45,000
8,400		10,000	131,000	87,000	40,000	13,100	33/64	14,000	182,000	133,000	45,000
8,500		10,000	131,000	87,000	40,000	13,500		14,000	182,000	133,000	45,000
8,600		10,000	131,000	87,000	40,000	14,000		14,000	182,000	133,000	45,000
8,700		10,000	131,000	87,000	40,000	14,100		16,000	204,000	152,000	48,000
8,730	11/32	10,000	131,000	87,000	40,000	14,200		16,000	204,000	152,000	48,000
8,800		10,000	131,000	87,000	40,000	14,290	9/16	16,000	204,000	152,000	48,000
8,900		10,000	131,000	87,000	40,000	14,500		16,000	204,000	152,000	48,000
9,000		10,000	131,000	87,000	40,000	15,000		16,000	204,000	152,000	48,000
9,100		10,000	139,000	95,000	40,000	15,100		16,000	204,000	152,000	48,000
9,130	23/64	10,000	139,000	95,000	40,000	15,500		16,000	204,000	152,000	48,000
9,200		10,000	139,000	95,000	40,000	16,000		16,000	204,000	152,000	48,000
9,250		10,000	139,000	95,000	40,000	16,500		18,000	223,000	171,000	48,000
9,300		10,000	139,000	95,000	40,000	16,900		18,000	223,000	171,000	48,000
9,400		10,000	139,000	95,000	40,000	17,000		18,000	223,000	171,000	48,000
9,500		10,000	139,000	95,000	40,000	17,500		18,000	223,000	171,000	48,000
9,520	3/8	10,000	139,000	95,000	40,000	18,000		18,000	223,000	171,000	48,000
9,600		10,000	139,000	95,000	40,000	18,500		20,000	244,000	190,000	50,000
9,700		10,000	139,000	95,000	40,000	18,900		20,000	244,000	190,000	50,000
9,800		10,000	139,000	95,000	40,000	19,000		20,000	244,000	190,000	50,000
9,900		10,000	139,000	95,000	40,000	19,050	3/4	20,000	244,000	190,000	50,000
9,920	25/64	10,000	139,000	95,000	40,000	19,500		20,000	244,000	190,000	50,000
10,000		10,000	139,000	95,000	40,000	20,000		20,000	244,000	190,000	50,000
10,100		12,000	155,000	106,000	45,000						
10,200		12,000	155,000	106,000	45,000						
10,300		12,000	155,000	106,000	45,000						
10,400		12,000	155,000	106,000	45,000						
10,500		12,000	155,000	106,000	45,000						



TS-Drills mit Innenkühlung

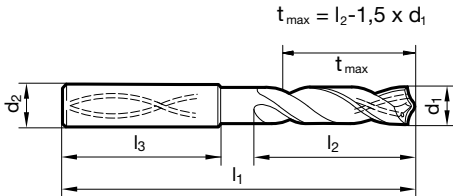
Artikel-Nr. 89421



P	M	K	N	S	H
		•			



Ausspitzung  $\geq \text{Ø} 4,000$  • patentierter Radienanschliff • Schneidenform gerade (durch Korrektur)  
 Vermikularguss GGK und ADI, CDI • Grauguss, Temperguss, Sphäroguss



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
4,000		6,000	75,000	37,500	36,000	7,200		8,000	116,000	76,000	36,000
4,100		6,000	75,000	37,500	36,000	7,300		8,000	116,000	76,000	36,000
4,200		6,000	75,000	37,500	36,000	7,400		8,000	116,000	76,000	36,000
4,300		6,000	85,000	45,000	36,000	7,500		8,000	116,000	76,000	36,000
4,370	11/64	6,000	85,000	45,000	36,000	7,540	19/64	8,000	116,000	76,000	36,000
4,400		6,000	85,000	45,000	36,000	7,600		8,000	116,000	76,000	36,000
4,500		6,000	85,000	45,000	36,000	7,700		8,000	116,000	76,000	36,000
4,600		6,000	85,000	45,000	36,000	7,800		8,000	116,000	76,000	36,000
4,650		6,000	85,000	45,000	36,000	7,900		8,000	116,000	76,000	36,000
4,700		6,000	85,000	45,000	36,000	7,940	5/16	8,000	116,000	76,000	36,000
4,760	3/16	6,000	90,000	50,000	36,000	8,000		8,000	116,000	76,000	36,000
4,800		6,000	90,000	50,000	36,000	8,100		10,000	131,000	87,000	40,000
4,900		6,000	90,000	50,000	36,000	8,200		10,000	131,000	87,000	40,000
5,000		6,000	90,000	50,000	36,000	8,300		10,000	131,000	87,000	40,000
5,100		6,000	90,000	50,000	36,000	8,330	21/64	10,000	131,000	87,000	40,000
5,160	13/64	6,000	90,000	50,000	36,000	8,400		10,000	131,000	87,000	40,000
5,200		6,000	90,000	50,000	36,000	8,500		10,000	131,000	87,000	40,000
5,300		6,000	90,000	50,000	36,000	8,600		10,000	131,000	87,000	40,000
5,400		6,000	97,000	57,000	36,000	8,700		10,000	131,000	87,000	40,000
5,500		6,000	97,000	57,000	36,000	8,730	11/32	10,000	131,000	87,000	40,000
5,550		6,000	97,000	57,000	36,000	8,800		10,000	131,000	87,000	40,000
5,560	7/32	6,000	97,000	57,000	36,000	8,900		10,000	131,000	87,000	40,000
5,600		6,000	97,000	57,000	36,000	9,000		10,000	131,000	87,000	40,000
5,700		6,000	97,000	57,000	36,000	9,100		10,000	139,000	95,000	40,000
5,800		6,000	97,000	57,000	36,000	9,130	23/64	10,000	139,000	95,000	40,000
5,900		6,000	97,000	57,000	36,000	9,200		10,000	139,000	95,000	40,000
5,950	15/64	6,000	97,000	57,000	36,000	9,250		10,000	139,000	95,000	40,000
6,000		6,000	97,000	57,000	36,000	9,300		10,000	139,000	95,000	40,000
6,100		8,000	106,000	66,000	36,000	9,400		10,000	139,000	95,000	40,000
6,200		8,000	106,000	66,000	36,000	9,500		10,000	139,000	95,000	40,000
6,300		8,000	106,000	66,000	36,000	9,520	3/8	10,000	139,000	95,000	40,000
6,350	1/4	8,000	106,000	66,000	36,000	9,600		10,000	139,000	95,000	40,000
6,400		8,000	106,000	66,000	36,000	9,700		10,000	139,000	95,000	40,000
6,500		8,000	106,000	66,000	36,000	9,800		10,000	139,000	95,000	40,000
6,600		8,000	106,000	66,000	36,000	9,900		10,000	139,000	95,000	40,000
6,700		8,000	106,000	66,000	36,000	9,920	25/64	10,000	139,000	95,000	40,000
6,750	17/64	8,000	106,000	66,000	36,000	10,000		10,000	139,000	95,000	40,000
6,800		8,000	106,000	66,000	36,000	10,100		12,000	155,000	106,000	45,000
6,900		8,000	116,000	76,000	36,000	10,200		12,000	155,000	106,000	45,000
7,000		8,000	116,000	76,000	36,000	10,300		12,000	155,000	106,000	45,000
7,100		8,000	116,000	76,000	36,000	10,320	13/32	12,000	155,000	106,000	45,000
7,140	9/32	8,000	116,000	76,000	36,000	10,400		12,000	155,000	106,000	45,000





## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
10,500		12,000	155,000	106,000	45,000	14,000		14,000	182,000	133,000	45,000
10,600		12,000	155,000	106,000	45,000	14,100		16,000	204,000	152,000	48,000
10,700		12,000	155,000	106,000	45,000	14,200		16,000	204,000	152,000	48,000
10,720	27/64	12,000	155,000	106,000	45,000	14,290	9/16	16,000	204,000	152,000	48,000
10,800		12,000	155,000	106,000	45,000	14,300		16,000	204,000	152,000	48,000
10,900		12,000	155,000	106,000	45,000	14,400		16,000	204,000	152,000	48,000
11,000		12,000	155,000	106,000	45,000	14,500		16,000	204,000	152,000	48,000
11,100		12,000	163,000	114,000	45,000	14,600		16,000	204,000	152,000	48,000
11,110	7/16	12,000	163,000	114,000	45,000	14,700		16,000	204,000	152,000	48,000
11,200		12,000	163,000	114,000	45,000	14,900		16,000	204,000	152,000	48,000
11,300		12,000	163,000	114,000	45,000	15,000		16,000	204,000	152,000	48,000
11,400		12,000	163,000	114,000	45,000	15,100		16,000	204,000	152,000	48,000
11,500		12,000	163,000	114,000	45,000	15,200		16,000	204,000	152,000	48,000
11,600		12,000	163,000	114,000	45,000	15,300		16,000	204,000	152,000	48,000
11,700		12,000	163,000	114,000	45,000	15,400		16,000	204,000	152,000	48,000
11,800		12,000	163,000	114,000	45,000	15,500		16,000	204,000	152,000	48,000
11,900		12,000	163,000	114,000	45,000	15,600		16,000	204,000	152,000	48,000
11,910	15/32	12,000	163,000	114,000	45,000	15,700		16,000	204,000	152,000	48,000
12,000		12,000	163,000	114,000	45,000	15,800		16,000	204,000	152,000	48,000
12,100		14,000	182,000	133,000	45,000	15,870	5/8	16,000	204,000	152,000	48,000
12,200		14,000	182,000	133,000	45,000	15,900		16,000	204,000	152,000	48,000
12,300	31/64	14,000	182,000	133,000	45,000	16,000		16,000	204,000	152,000	48,000
12,400		14,000	182,000	133,000	45,000	16,500		18,000	223,000	171,000	48,000
12,500		14,000	182,000	133,000	45,000	16,670	21/32	18,000	223,000	171,000	48,000
12,600		14,000	182,000	133,000	45,000	17,000		18,000	223,000	171,000	48,000
12,700	1/2	14,000	182,000	133,000	45,000	17,500		18,000	223,000	171,000	48,000
12,800		14,000	182,000	133,000	45,000	18,000		18,000	223,000	171,000	48,000
12,900		14,000	182,000	133,000	45,000	18,500		20,000	244,000	190,000	50,000
13,000		14,000	182,000	133,000	45,000	19,000		20,000	244,000	190,000	50,000
13,100	33/64	14,000	182,000	133,000	45,000	19,500		20,000	244,000	190,000	50,000
13,300		14,000	182,000	133,000	45,000	20,000		20,000	244,000	190,000	50,000
13,400		14,000	182,000	133,000	45,000						
13,500		14,000	182,000	133,000	45,000						
13,700		14,000	182,000	133,000	45,000						
13,800		14,000	182,000	133,000	45,000						
13,900		14,000	182,000	133,000	45,000						

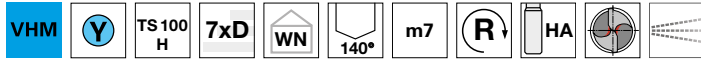


## TS-Drills mit Innenkühlung

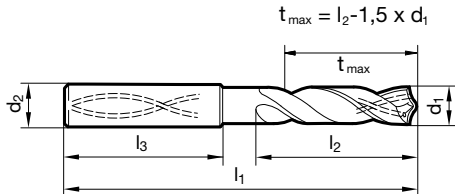
Artikel-Nr. 89427



P	M	K	N	S	H
•				•	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Kegelmantelschliff • Hauptschneidenform leicht konkav • optimierte Schneidengeometrie  
 legierte und hochfeste Stähle bis  $1400 \text{ N/mm}^2$  • Inconel, Hastelloy, Monel • Titan und Titanlegierungen



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	70,000	30,000	36,000	9,250		10,000	139,000	95,000	40,000
3,250		6,000	70,000	30,000	36,000	9,400		10,000	139,000	95,000	40,000
3,300		6,000	70,000	30,000	36,000	9,500		10,000	139,000	95,000	40,000
3,400		6,000	75,000	35,500	36,000	10,000		10,000	139,000	95,000	40,000
3,500		6,000	75,000	35,500	36,000	10,200		12,000	155,000	106,000	45,000
3,700		6,000	75,000	35,500	36,000	10,400		12,000	155,000	106,000	45,000
4,000		6,000	75,000	37,500	36,000	10,500		12,000	155,000	106,000	45,000
4,200		6,000	75,000	37,500	36,000	10,800		12,000	155,000	106,000	45,000
4,300		6,000	85,000	45,000	36,000	11,000		12,000	155,000	106,000	45,000
4,500		6,000	85,000	45,000	36,000	11,300		12,000	163,000	114,000	45,000
4,650		6,000	85,000	45,000	36,000	11,400		12,000	163,000	114,000	45,000
5,000		6,000	90,000	50,000	36,000	11,500		12,000	163,000	114,000	45,000
5,100		6,000	90,000	50,000	36,000	12,000		12,000	163,000	114,000	45,000
5,200		6,000	90,000	50,000	36,000	12,500		14,000	182,000	133,000	45,000
5,500		6,000	97,000	57,000	36,000	13,000		14,000	182,000	133,000	45,000
5,550		6,000	97,000	57,000	36,000	13,100	33/64	14,000	182,000	133,000	45,000
6,000		6,000	97,000	57,000	36,000	13,500		14,000	182,000	133,000	45,000
6,500		8,000	106,000	66,000	36,000	14,000		14,000	182,000	133,000	45,000
6,750	17/64	8,000	106,000	66,000	36,000	14,500		16,000	204,000	152,000	48,000
6,800		8,000	106,000	66,000	36,000	15,000		16,000	204,000	152,000	48,000
6,900		8,000	116,000	76,000	36,000	15,100		16,000	204,000	152,000	48,000
7,000		8,000	116,000	76,000	36,000	15,500		16,000	204,000	152,000	48,000
7,400		8,000	116,000	76,000	36,000	16,000		16,000	204,000	152,000	48,000
7,500		8,000	116,000	76,000	36,000						
7,800		8,000	116,000	76,000	36,000						
8,000		8,000	116,000	76,000	36,000						
8,500		10,000	131,000	87,000	40,000						
8,600		10,000	131,000	87,000	40,000						
8,800		10,000	131,000	87,000	40,000						
9,000		10,000	131,000	87,000	40,000						

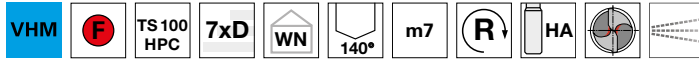


## TS-Drills mit Innenkühlung

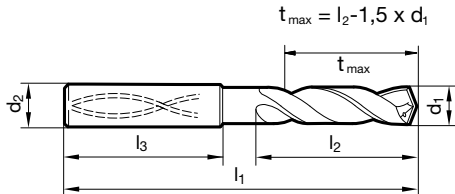
Artikel-Nr. 89461



P	M	K	N	S	H
●	○	○	○	○	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Hauptschneide konkav • Kegelmantelschliff • optimierte Schneidengeometrie • höchste Leistungsfähigkeit  
 Automatenstähle, Vergütungsstähle • rost-/säure-/hitzebeständige Stähle • Titan und Titanlegierungen • Stähle (legiert/unleg.) bis 1400 N/mm<sup>2</sup> • für die Hochleistungsbearbeitung in Bau- und Einsatzstähle • Sonderlegierungen



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	70,000	30,000	36,000	5,900		6,000	97,000	57,000	36,000
3,100		6,000	70,000	30,000	36,000	5,950	15/64	6,000	97,000	57,000	36,000
3,170	1/8	6,000	70,000	30,000	36,000	6,000		6,000	97,000	57,000	36,000
3,200		6,000	70,000	30,000	36,000	6,100		8,000	106,000	66,000	36,000
3,250		6,000	70,000	30,000	36,000	6,200		8,000	106,000	66,000	36,000
3,300		6,000	70,000	30,000	36,000	6,300		8,000	106,000	66,000	36,000
3,400		6,000	75,000	35,500	36,000	6,350	1/4	8,000	106,000	66,000	36,000
3,500		6,000	75,000	35,500	36,000	6,400		8,000	106,000	66,000	36,000
3,570	9/64	6,000	75,000	35,500	36,000	6,500		8,000	106,000	66,000	36,000
3,600		6,000	75,000	35,500	36,000	6,530		8,000	106,000	66,000	36,000
3,700		6,000	75,000	35,500	36,000	6,550		8,000	106,000	66,000	36,000
3,800		6,000	75,000	37,500	36,000	6,600		8,000	106,000	66,000	36,000
3,900		6,000	75,000	37,500	36,000	6,700		8,000	106,000	66,000	36,000
3,970	5/32	6,000	75,000	37,500	36,000	6,750	17/64	8,000	106,000	66,000	36,000
4,000		6,000	75,000	37,500	36,000	6,800		8,000	106,000	66,000	36,000
4,040		6,000	75,000	37,500	36,000	6,900		8,000	116,000	76,000	36,000
4,100		6,000	75,000	37,500	36,000	7,000		8,000	116,000	76,000	36,000
4,200		6,000	75,000	37,500	36,000	7,100		8,000	116,000	76,000	36,000
4,300		6,000	85,000	45,000	36,000	7,140	9/32	8,000	116,000	76,000	36,000
4,370	11/64	6,000	85,000	45,000	36,000	7,200		8,000	116,000	76,000	36,000
4,400		6,000	85,000	45,000	36,000	7,300		8,000	116,000	76,000	36,000
4,500		6,000	85,000	45,000	36,000	7,400		8,000	116,000	76,000	36,000
4,600		6,000	85,000	45,000	36,000	7,500		8,000	116,000	76,000	36,000
4,650		6,000	85,000	45,000	36,000	7,540	19/64	8,000	116,000	76,000	36,000
4,700		6,000	85,000	45,000	36,000	7,600		8,000	116,000	76,000	36,000
4,760	3/16	6,000	90,000	50,000	36,000	7,700		8,000	116,000	76,000	36,000
4,800		6,000	90,000	50,000	36,000	7,800		8,000	116,000	76,000	36,000
4,900		6,000	90,000	50,000	36,000	7,900		8,000	116,000	76,000	36,000
5,000		6,000	90,000	50,000	36,000	7,940	5/16	8,000	116,000	76,000	36,000
5,100		6,000	90,000	50,000	36,000	8,000		8,000	116,000	76,000	36,000
5,110		6,000	90,000	50,000	36,000	8,100		10,000	131,000	87,000	40,000
5,160	13/64	6,000	90,000	50,000	36,000	8,200		10,000	131,000	87,000	40,000
5,200		6,000	90,000	50,000	36,000	8,300		10,000	131,000	87,000	40,000
5,300		6,000	90,000	50,000	36,000	8,330	21/64	10,000	131,000	87,000	40,000
5,400		6,000	97,000	57,000	36,000	8,400		10,000	131,000	87,000	40,000
5,410		6,000	97,000	57,000	36,000	8,500		10,000	131,000	87,000	40,000
5,500		6,000	97,000	57,000	36,000	8,600		10,000	131,000	87,000	40,000
5,550		6,000	97,000	57,000	36,000	8,700		10,000	131,000	87,000	40,000
5,560	7/32	6,000	97,000	57,000	36,000	8,730	11/32	10,000	131,000	87,000	40,000
5,600		6,000	97,000	57,000	36,000	8,800		10,000	131,000	87,000	40,000
5,700		6,000	97,000	57,000	36,000	8,900		10,000	131,000	87,000	40,000
5,800		6,000	97,000	57,000	36,000	9,000		10,000	131,000	87,000	40,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
9,100		10,000	139,000	95,000	40,000	12,900		14,000	182,000	133,000	45,000
9,130	23/64	10,000	139,000	95,000	40,000	13,000		14,000	182,000	133,000	45,000
9,200		10,000	139,000	95,000	40,000	13,100	33/64	14,000	182,000	133,000	45,000
9,250		10,000	139,000	95,000	40,000	13,490	17/32	14,000	182,000	133,000	45,000
9,300		10,000	139,000	95,000	40,000	13,500		14,000	182,000	133,000	45,000
9,340		10,000	139,000	95,000	40,000	13,700		14,000	182,000	133,000	45,000
9,400		10,000	139,000	95,000	40,000	13,890	35/64	14,000	182,000	133,000	45,000
9,500		10,000	139,000	95,000	40,000	14,000		14,000	182,000	133,000	45,000
9,520	3/8	10,000	139,000	95,000	40,000	14,100		16,000	204,000	152,000	48,000
9,600		10,000	139,000	95,000	40,000	14,200		16,000	204,000	152,000	48,000
9,700		10,000	139,000	95,000	40,000	14,290	9/16	16,000	204,000	152,000	48,000
9,800		10,000	139,000	95,000	40,000	14,300		16,000	204,000	152,000	48,000
9,900		10,000	139,000	95,000	40,000	14,500		16,000	204,000	152,000	48,000
9,920	25/64	10,000	139,000	95,000	40,000	14,700		16,000	204,000	152,000	48,000
10,000		10,000	139,000	95,000	40,000	14,800		16,000	204,000	152,000	48,000
10,100		12,000	155,000	106,000	45,000	15,000		16,000	204,000	152,000	48,000
10,200		12,000	155,000	106,000	45,000	15,100		16,000	204,000	152,000	48,000
10,300		12,000	155,000	106,000	45,000	15,300		16,000	204,000	152,000	48,000
10,320	13/32	12,000	155,000	106,000	45,000	15,480	39/64	16,000	204,000	152,000	48,000
10,400		12,000	155,000	106,000	45,000	15,500		16,000	204,000	152,000	48,000
10,500		12,000	155,000	106,000	45,000	15,700		16,000	204,000	152,000	48,000
10,600		12,000	155,000	106,000	45,000	15,800		16,000	204,000	152,000	48,000
10,700		12,000	155,000	106,000	45,000	15,870	5/8	16,000	204,000	152,000	48,000
10,720	27/64	12,000	155,000	106,000	45,000	16,000		16,000	204,000	152,000	48,000
10,800		12,000	155,000	106,000	45,000	16,300		18,000	223,000	171,000	48,000
10,900		12,000	155,000	106,000	45,000	16,500		18,000	223,000	171,000	48,000
11,000		12,000	155,000	106,000	45,000	16,700		18,000	223,000	171,000	48,000
11,100		12,000	163,000	114,000	45,000	16,900		18,000	223,000	171,000	48,000
11,110	7/16	12,000	163,000	114,000	45,000	17,000		18,000	223,000	171,000	48,000
11,200		12,000	163,000	114,000	45,000	17,500		18,000	223,000	171,000	48,000
11,300		12,000	163,000	114,000	45,000	17,700		18,000	223,000	171,000	48,000
11,400		12,000	163,000	114,000	45,000	18,000		18,000	223,000	171,000	48,000
11,500		12,000	163,000	114,000	45,000	18,500		20,000	244,000	190,000	50,000
11,510	29/64	12,000	163,000	114,000	45,000	18,900		20,000	244,000	190,000	50,000
11,600		12,000	163,000	114,000	45,000	19,000		20,000	244,000	190,000	50,000
11,700		12,000	163,000	114,000	45,000	19,050	3/4	20,000	244,000	190,000	50,000
11,800		12,000	163,000	114,000	45,000	19,500		20,000	244,000	190,000	50,000
11,900		12,000	163,000	114,000	45,000	19,800		20,000	244,000	190,000	50,000
11,910	15/32	12,000	163,000	114,000	45,000	20,000		20,000	244,000	190,000	50,000
12,000		12,000	163,000	114,000	45,000						
12,100		14,000	182,000	133,000	45,000						
12,200		14,000	182,000	133,000	45,000						
12,300	31/64	14,000	182,000	133,000	45,000						
12,400		14,000	182,000	133,000	45,000						
12,500		14,000	182,000	133,000	45,000						
12,600		14,000	182,000	133,000	45,000						
12,700	1/2	14,000	182,000	133,000	45,000						
12,800		14,000	182,000	133,000	45,000						

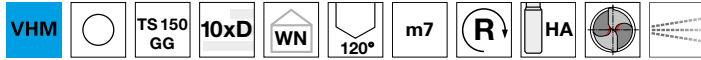


## TS-Drills mit Innenkühlung

### Artikel-Nr. 89293



P	M	K	N	S	H
		•	○		

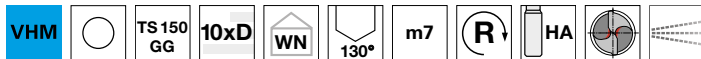


Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • enge Durchmessertoleranzen • sehr gute Bohrungsflächen • optimalen Kühlmitteldruck beachten  
Grauguss, Temperguss, Sphäroguss

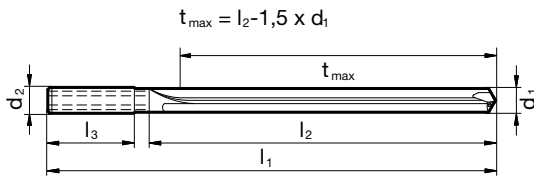
### Artikel-Nr. 89295



P	M	K	N	S	H
		○	•		



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • enge Durchmessertoleranzen • sehr gute Bohrungsflächen • optimalen Kühlmitteldruck beachten  
Aluminium und Al-Legierungen • Kupfer-, Messing-, und Bronze-Legierungen • Kunststoffe



d1	inch	d2 h6	l1	l2	l3	d1	inch	d2 h6	l1	l2	l3
mm		mm	mm	mm	mm	mm		mm	mm	mm	mm
3,000		6,000	91,000	42,000	36,000	6,000		6,000	121,000	82,000	36,000
3,100		6,000	91,000	42,000	36,000	6,350	1/4	8,000	146,000	106,000	36,000
3,170	1/8	6,000	91,000	42,000	36,000	6,500		8,000	146,000	106,000	36,000
3,200		6,000	91,000	42,000	36,000	6,800		8,000	146,000	106,000	36,000
3,250		6,000	91,000	42,000	36,000	7,000		8,000	146,000	106,000	36,000
3,300		6,000	91,000	42,000	36,000	7,140	9/32	8,000	146,000	106,000	36,000
3,400		6,000	91,000	48,000	36,000	7,500		8,000	146,000	106,000	36,000
3,500		6,000	91,000	48,000	36,000	7,800		8,000	146,000	106,000	36,000
3,570	9/64	6,000	91,000	48,000	36,000	7,940	5/16	8,000	146,000	106,000	36,000
3,600		6,000	91,000	48,000	36,000	8,000		8,000	146,000	106,000	36,000
3,700		6,000	91,000	48,000	36,000	8,500		10,000	175,000	130,000	40,000
3,800		6,000	121,000	77,000	36,000	8,730	11/32	10,000	175,000	130,000	40,000
3,900		6,000	121,000	77,000	36,000	9,000		10,000	175,000	130,000	40,000
3,970	5/32	6,000	121,000	77,000	36,000	9,500		10,000	175,000	130,000	40,000
4,000		6,000	121,000	77,000	36,000	9,520	3/8	10,000	175,000	130,000	40,000
4,200		6,000	121,000	77,000	36,000	10,000		10,000	175,000	130,000	40,000
4,300		6,000	121,000	77,000	36,000	10,200		12,000	209,000	159,000	45,000
4,400		6,000	121,000	77,000	36,000	10,500		12,000	209,000	159,000	45,000
4,500		6,000	121,000	77,000	36,000	10,720	27/64	12,000	209,000	159,000	45,000
4,700		6,000	121,000	77,000	36,000	11,000		12,000	209,000	159,000	45,000
4,800		6,000	121,000	82,000	36,000	11,110	7/16	12,000	209,000	159,000	45,000
5,000		6,000	121,000	82,000	36,000	11,500		12,000	209,000	159,000	45,000
5,160	13/64	6,000	121,000	82,000	36,000	12,000		12,000	209,000	159,000	45,000
5,500		6,000	121,000	82,000	36,000	12,500		14,000	233,000	183,000	45,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
12,700	1/2	14,000	233,000	183,000	45,000	18,500		20,000	308,000	255,000	50,000
13,000		14,000	233,000	183,000	45,000	20,000		20,000	308,000	255,000	50,000
13,500		14,000	233,000	183,000	45,000						
14,000		14,000	233,000	183,000	45,000						
14,500		16,000	260,000	207,000	48,000						
15,000		16,000	260,000	207,000	48,000						
15,500		16,000	260,000	207,000	48,000						
16,000		16,000	260,000	207,000	48,000						
16,500		18,000	284,000	231,000	48,000						
17,000		18,000	284,000	231,000	48,000						
17,500		18,000	284,000	231,000	48,000						
18,000		18,000	284,000	231,000	48,000						

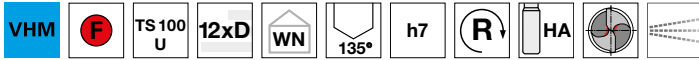


## TS-Drills mit Innenkühlung

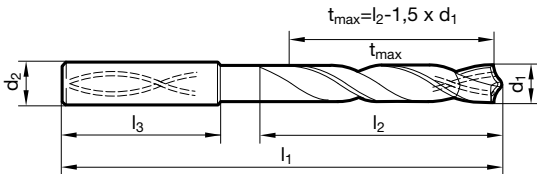
Artikel-Nr. 89418



P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \text{Ø } 3,000$  • Flächenanschliff • Kopfbeschichtung • Hauptschneidenform gerade • optimierte Schneidengeometrie  
 Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • Stähle (legiert/unleg.) bis  $1200 \text{ N/mm}^2$  • Gusswerkstoffe • Bronzen, Messing • hochlegierte AISi-Legierungen



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	90,000	50,000	36,000	6,350	1/4	8,000	146,000	108,000	36,000
3,100		6,000	90,000	50,000	36,000	6,400		8,000	146,000	108,000	36,000
3,170	1/8	6,000	90,000	50,000	36,000	6,500		8,000	146,000	108,000	36,000
3,200		6,000	90,000	50,000	36,000	6,600		8,000	146,000	108,000	36,000
3,300		6,000	90,000	50,000	36,000	6,700		8,000	146,000	108,000	36,000
3,400		6,000	90,000	50,000	36,000	6,750	17/64	8,000	146,000	108,000	36,000
3,500		6,000	90,000	50,000	36,000	6,800		8,000	146,000	108,000	36,000
3,570	9/64	6,000	90,000	50,000	36,000	6,900		8,000	146,000	108,000	36,000
3,600		6,000	90,000	50,000	36,000	7,000		8,000	146,000	108,000	36,000
3,700		6,000	90,000	50,000	36,000	7,100		8,000	146,000	108,000	36,000
3,800		6,000	102,000	64,000	36,000	7,140	9/32	8,000	146,000	108,000	36,000
3,900		6,000	102,000	64,000	36,000	7,200		8,000	146,000	108,000	36,000
3,970	5/32	6,000	102,000	64,000	36,000	7,300		8,000	146,000	108,000	36,000
4,000		6,000	102,000	64,000	36,000	7,400		8,000	146,000	108,000	36,000
4,100		6,000	102,000	64,000	36,000	7,500		8,000	146,000	108,000	36,000
4,200		6,000	102,000	64,000	36,000	7,540	19/64	8,000	146,000	108,000	36,000
4,300		6,000	102,000	64,000	36,000	7,600		8,000	146,000	108,000	36,000
4,370	11/64	6,000	102,000	64,000	36,000	7,700		8,000	146,000	108,000	36,000
4,400		6,000	102,000	64,000	36,000	7,800		8,000	146,000	108,000	36,000
4,500		6,000	102,000	64,000	36,000	7,900		8,000	146,000	108,000	36,000
4,600		6,000	102,000	64,000	36,000	7,940	5/16	8,000	146,000	108,000	36,000
4,700		6,000	102,000	64,000	36,000	8,000		8,000	146,000	108,000	36,000
4,760	3/16	6,000	116,000	78,000	36,000	8,100		10,000	162,000	120,000	40,000
4,800		6,000	116,000	78,000	36,000	8,200		10,000	162,000	120,000	40,000
4,900		6,000	116,000	78,000	36,000	8,300		10,000	162,000	120,000	40,000
5,000		6,000	116,000	78,000	36,000	8,330	21/64	10,000	162,000	120,000	40,000
5,100		6,000	116,000	78,000	36,000	8,400		10,000	162,000	120,000	40,000
5,160	13/64	6,000	116,000	78,000	36,000	8,500		10,000	162,000	120,000	40,000
5,200		6,000	116,000	78,000	36,000	8,600		10,000	162,000	120,000	40,000
5,300		6,000	116,000	78,000	36,000	8,700		10,000	162,000	120,000	40,000
5,400		6,000	116,000	78,000	36,000	8,730	11/32	10,000	162,000	120,000	40,000
5,500		6,000	116,000	78,000	36,000	8,800		10,000	162,000	120,000	40,000
5,560	7/32	6,000	116,000	78,000	36,000	8,900		10,000	162,000	120,000	40,000
5,600		6,000	116,000	78,000	36,000	9,000		10,000	162,000	120,000	40,000
5,700		6,000	116,000	78,000	36,000	9,100		10,000	162,000	120,000	40,000
5,800		6,000	116,000	78,000	36,000	9,130	23/64	10,000	162,000	120,000	40,000
5,900		6,000	116,000	78,000	36,000	9,200		10,000	162,000	120,000	40,000
5,950	15/64	6,000	116,000	78,000	36,000	9,300		10,000	162,000	120,000	40,000
6,000		6,000	116,000	78,000	36,000	9,400		10,000	162,000	120,000	40,000
6,100		8,000	146,000	108,000	36,000	9,500		10,000	162,000	120,000	40,000
6,200		8,000	146,000	108,000	36,000	9,520	3/8	10,000	162,000	120,000	40,000
6,300		8,000	146,000	108,000	36,000	9,600		10,000	162,000	120,000	40,000



## TS-Drills mit Innenkühlung

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm	d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
9,700		10,000	162,000	120,000	40,000	13,000		14,000	230,000	182,000	45,000
9,800		10,000	162,000	120,000	40,000	13,500		14,000	230,000	182,000	45,000
9,900		10,000	162,000	120,000	40,000	13,890	35/64	14,000	230,000	182,000	45,000
9,920	25/64	10,000	162,000	120,000	40,000	14,000		14,000	230,000	182,000	45,000
10,000		10,000	162,000	120,000	40,000	14,500		16,000	260,000	208,000	48,000
10,100		12,000	204,000	156,000	45,000	15,000		16,000	260,000	208,000	48,000
10,200		12,000	204,000	156,000	45,000	15,500		16,000	260,000	208,000	48,000
10,300		12,000	204,000	156,000	45,000	16,000		16,000	260,000	208,000	48,000
10,320	13/32	12,000	204,000	156,000	45,000	16,500		18,000	285,000	234,000	48,000
10,500		12,000	204,000	156,000	45,000	17,000		18,000	285,000	234,000	48,000
10,600		12,000	204,000	156,000	45,000	17,500		18,000	285,000	234,000	48,000
10,700		12,000	204,000	156,000	45,000	18,000		18,000	285,000	234,000	48,000
10,720	27/64	12,000	204,000	156,000	45,000	18,500		20,000	310,000	258,000	50,000
10,800		12,000	204,000	156,000	45,000	19,000		20,000	310,000	258,000	50,000
10,900		12,000	204,000	156,000	45,000	19,050	3/4	20,000	310,000	258,000	50,000
11,000		12,000	204,000	156,000	45,000	19,500		20,000	310,000	258,000	50,000
11,110	7/16	12,000	204,000	156,000	45,000	20,000		20,000	310,000	258,000	50,000
11,500		12,000	204,000	156,000	45,000						
11,510	29/64	12,000	204,000	156,000	45,000						
11,910	15/32	12,000	204,000	156,000	45,000						
12,000		12,000	204,000	156,000	45,000						
12,300	31/64	14,000	230,000	182,000	45,000						
12,500		14,000	230,000	182,000	45,000						
12,700	1/2	14,000	230,000	182,000	45,000						



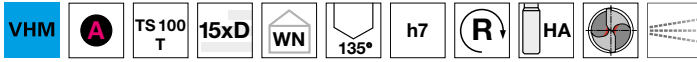


## TS-Drills mit Innenkühlung

Artikel-Nr. 86509

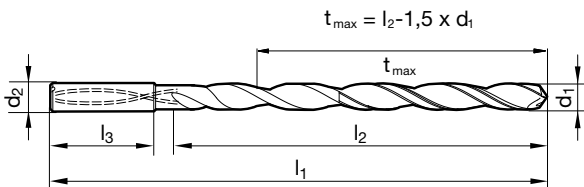


P	M	K	N	S	H
•	•	•	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • Kopfbeschichtung • Hauptschneidenform konkav • optimierter Nutquerschnitt  
 • maximaler Kühlkanalquerschnitt • Kühlmitteldruck beachten

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	95,000	55,000	36,000	7,540	19/64	8,000	183,000	143,000	36,000
3,100		6,000	106,000	66,000	36,000	7,800		8,000	183,000	143,000	36,000
3,170	1/8	6,000	106,000	66,000	36,000	7,940	5/16	8,000	183,000	143,000	36,000
3,200		6,000	106,000	66,000	36,000	8,000		8,000	183,000	143,000	36,000
3,300		6,000	106,000	66,000	36,000	8,330	21/64	10,000	204,000	160,000	40,000
3,500		6,000	116,000	76,000	36,000	8,500		10,000	204,000	160,000	40,000
3,570	9/64	6,000	116,000	76,000	36,000	8,730	11/32	10,000	204,000	160,000	40,000
3,700		6,000	116,000	76,000	36,000	8,800		10,000	204,000	160,000	40,000
3,800		6,000	116,000	76,000	36,000	9,000		10,000	204,000	160,000	40,000
3,970	5/32	6,000	116,000	76,000	36,000	9,130	23/64	10,000	221,000	177,000	40,000
4,000		6,000	116,000	76,000	36,000	9,500		10,000	221,000	177,000	40,000
4,200		6,000	133,000	93,000	36,000	9,520	3/8	10,000	221,000	177,000	40,000
4,300		6,000	133,000	93,000	36,000	9,800		10,000	221,000	177,000	40,000
4,370	11/64	6,000	133,000	93,000	36,000	9,920	25/64	10,000	221,000	177,000	40,000
4,500		6,000	133,000	93,000	36,000	10,000		10,000	221,000	177,000	40,000
4,600		6,000	133,000	93,000	36,000	10,320	13/32	12,000	247,000	198,000	45,000
4,760	3/16	6,000	133,000	93,000	36,000	10,500		12,000	247,000	198,000	45,000
4,800		6,000	133,000	93,000	36,000	10,720	27/64	12,000	247,000	198,000	45,000
5,000		6,000	133,000	93,000	36,000	11,000		12,000	247,000	198,000	45,000
5,100		6,000	150,000	110,000	36,000	11,110	7/16	12,000	263,000	214,000	45,000
5,160	13/64	6,000	150,000	110,000	36,000	11,510	29/64	12,000	263,000	214,000	45,000
5,410		6,000	150,000	110,000	36,000	11,800		12,000	263,000	214,000	45,000
5,500		6,000	150,000	110,000	36,000	11,910	15/32	12,000	263,000	214,000	45,000
5,560	7/32	6,000	150,000	110,000	36,000	12,000		12,000	263,000	214,000	45,000
5,600		6,000	150,000	110,000	36,000	12,300	31/64	14,000	297,000	248,000	45,000
5,800		6,000	150,000	110,000	36,000	12,500		14,000	297,000	248,000	45,000
5,950	15/64	6,000	150,000	110,000	36,000	12,700	1/2	14,000	297,000	248,000	45,000
6,000		6,000	150,000	110,000	36,000	13,000		14,000	297,000	248,000	45,000
6,300		8,000	167,000	127,000	36,000	13,100	33/64	14,000	297,000	248,000	45,000
6,350	1/4	8,000	167,000	127,000	36,000	13,490	17/32	14,000	297,000	248,000	45,000
6,500		8,000	167,000	127,000	36,000	13,890	35/64	14,000	297,000	248,000	45,000
6,750	17/64	8,000	167,000	127,000	36,000	14,000		14,000	297,000	248,000	45,000
6,800		8,000	167,000	127,000	36,000	14,290	9/16	16,000	333,000	281,000	48,000
7,000		8,000	167,000	127,000	36,000	15,000		16,000	333,000	281,000	48,000
7,140	9/32	8,000	183,000	143,000	36,000	15,870	5/8	16,000	333,000	281,000	48,000
7,500		8,000	183,000	143,000	36,000	16,000		16,000	333,000	281,000	48,000

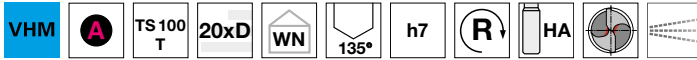


## TS-Drills mit Innenkühlung

Artikel-Nr. 86511

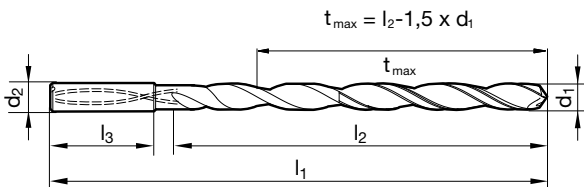


P	M	K	N	S	H
•	•	•	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • Kopfbeschichtung • Hauptschneidenform konkav • optimierter Nutquerschnitt  
 • maximaler Kühlkanalquerschnitt • Kühlmitteldruck beachten

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	110,000	70,000	36,000	7,940	5/16	8,000	223,000	183,000	36,000
3,100		6,000	123,000	83,000	36,000	8,000		8,000	223,000	183,000	36,000
3,170	1/8	6,000	123,000	83,000	36,000	8,330	21/64	10,000	249,000	205,000	40,000
3,200		6,000	123,000	83,000	36,000	8,500		10,000	249,000	205,000	40,000
3,300		6,000	123,000	83,000	36,000	8,730	11/32	10,000	249,000	205,000	40,000
3,500		6,000	136,000	96,000	36,000	8,800		10,000	249,000	205,000	40,000
3,570	9/64	6,000	136,000	96,000	36,000	9,000		10,000	249,000	205,000	40,000
3,700		6,000	136,000	96,000	36,000	9,130	23/64	10,000	271,000	227,000	40,000
3,800		6,000	136,000	96,000	36,000	9,520	3/8	10,000	271,000	227,000	40,000
3,970	5/32	6,000	136,000	96,000	36,000	9,920	25/64	10,000	271,000	227,000	40,000
4,000		6,000	136,000	96,000	36,000	10,000		10,000	271,000	227,000	40,000
4,200		6,000	158,000	118,000	36,000	10,200		12,000	302,000	253,000	45,000
4,300		6,000	158,000	118,000	36,000	10,320	13/32	12,000	302,000	253,000	45,000
4,370	11/64	6,000	158,000	118,000	36,000	10,500		12,000	302,000	253,000	45,000
4,500		6,000	158,000	118,000	36,000	10,720	27/64	12,000	302,000	253,000	45,000
4,600		6,000	158,000	118,000	36,000	11,000		12,000	302,000	253,000	45,000
4,760	3/16	6,000	158,000	118,000	36,000	11,110	7/16	12,000	323,000	274,000	45,000
4,800		6,000	158,000	118,000	36,000	11,510	29/64	12,000	323,000	274,000	45,000
5,000		6,000	158,000	118,000	36,000	11,800		12,000	323,000	274,000	45,000
5,100		6,000	180,000	140,000	36,000	11,910	15/32	12,000	323,000	274,000	45,000
5,160	13/64	6,000	180,000	140,000	36,000	12,000		12,000	323,000	274,000	45,000
5,410		6,000	180,000	140,000	36,000	12,300	31/64	14,000	367,000	318,000	45,000
5,500		6,000	180,000	140,000	36,000	12,500		14,000	367,000	318,000	45,000
5,560	7/32	6,000	180,000	140,000	36,000	12,700	1/2	14,000	367,000	318,000	45,000
5,800		6,000	180,000	140,000	36,000	13,000		14,000	367,000	318,000	45,000
5,950	15/64	6,000	180,000	140,000	36,000	13,100	33/64	14,000	367,000	318,000	45,000
6,000		6,000	180,000	140,000	36,000	13,490	17/32	14,000	367,000	318,000	45,000
6,350	1/4	8,000	202,000	162,000	36,000	13,890	35/64	14,000	367,000	318,000	45,000
6,500		8,000	202,000	162,000	36,000	14,000		14,000	367,000	318,000	45,000
6,750	17/64	8,000	202,000	162,000	36,000	14,290	9/16	16,000	413,000	361,000	48,000
6,800		8,000	202,000	162,000	36,000	15,000		16,000	413,000	361,000	48,000
7,000		8,000	202,000	162,000	36,000	15,870	5/8	16,000	413,000	361,000	48,000
7,140	9/32	8,000	223,000	183,000	36,000	16,000		16,000	413,000	361,000	48,000
7,500		8,000	223,000	183,000	36,000						
7,540	19/64	8,000	223,000	183,000	36,000						
7,800		8,000	223,000	183,000	36,000						

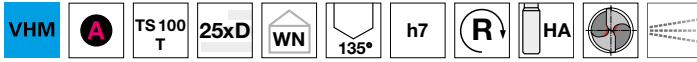


## TS-Drills mit Innenkühlung

Artikel-Nr. 86512

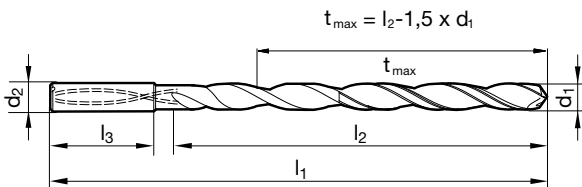


P	M	K	N	S	H
•	•	•	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • Kopfbeschichtung • Hauptschneidenform konkav • optimierter Nutquerschnitt  
 • maximaler Kühlkanalquerschnitt • Kühlmitteldruck beachten

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	125,000	85,000	36,000	7,940	5/16	8,000	263,000	223,000	36,000
3,100		6,000	141,000	101,000	36,000	8,000		8,000	263,000	223,000	36,000
3,170	1/8	6,000	141,000	101,000	36,000	8,330	21/64	10,000	294,000	250,000	40,000
3,200		6,000	141,000	101,000	36,000	8,500		10,000	294,000	250,000	40,000
3,300		6,000	141,000	101,000	36,000	8,730	11/32	10,000	294,000	250,000	40,000
3,500		6,000	156,000	116,000	36,000	8,800		10,000	294,000	250,000	40,000
3,570	9/64	6,000	156,000	116,000	36,000	9,000		10,000	294,000	250,000	40,000
3,700		6,000	156,000	116,000	36,000	9,130	23/64	10,000	321,000	277,000	40,000
3,800		6,000	156,000	116,000	36,000	9,520	3/8	10,000	321,000	277,000	40,000
3,970	5/32	6,000	156,000	116,000	36,000	9,920	25/64	10,000	321,000	277,000	40,000
4,000		6,000	156,000	116,000	36,000	10,000		10,000	321,000	277,000	40,000
4,200		6,000	183,000	143,000	36,000	10,320	13/32	12,000	359,000	310,000	45,000
4,300		6,000	183,000	143,000	36,000	10,720	27/64	12,000	359,000	310,000	45,000
4,370	11/64	6,000	183,000	143,000	36,000	11,000		12,000	359,000	310,000	45,000
4,500		6,000	183,000	143,000	36,000	11,110	7/16	12,000	386,000	337,000	45,000
4,600		6,000	183,000	143,000	36,000	11,510	29/64	12,000	386,000	337,000	45,000
4,760	3/16	6,000	183,000	143,000	36,000	11,910	15/32	12,000	386,000	337,000	45,000
4,800		6,000	183,000	143,000	36,000	12,000		12,000	386,000	337,000	45,000
5,000		6,000	183,000	143,000	36,000	12,300	31/64	14,000	437,000	388,000	45,000
5,100		6,000	210,000	170,000	36,000	12,700	1/2	14,000	437,000	388,000	45,000
5,160	13/64	6,000	210,000	170,000	36,000	13,000		14,000	437,000	388,000	45,000
5,410		6,000	210,000	170,000	36,000	13,100	33/64	14,000	437,000	388,000	45,000
5,500		6,000	210,000	170,000	36,000	13,490	17/32	14,000	437,000	388,000	45,000
5,560	7/32	6,000	210,000	170,000	36,000	13,890	35/64	14,000	437,000	388,000	45,000
5,800		6,000	210,000	170,000	36,000	14,000		14,000	437,000	388,000	45,000
5,950	15/64	6,000	210,000	170,000	36,000	14,290	9/16	16,000	493,000	441,000	48,000
6,000		6,000	210,000	170,000	36,000	15,000		16,000	493,000	441,000	48,000
6,300		8,000	237,000	197,000	36,000	15,870	5/8	16,000	493,000	441,000	48,000
6,350	1/4	8,000	237,000	197,000	36,000	16,000		16,000	493,000	441,000	48,000
6,500		8,000	237,000	197,000	36,000						
6,750	17/64	8,000	237,000	197,000	36,000						
6,800		8,000	237,000	197,000	36,000						
7,000		8,000	237,000	197,000	36,000						
7,140	9/32	8,000	263,000	223,000	36,000						
7,500		8,000	263,000	223,000	36,000						
7,540	19/64	8,000	263,000	223,000	36,000						

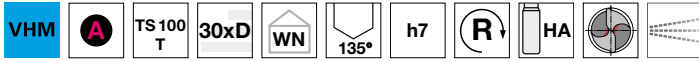


## TS-Drills mit Innenkühlung

Artikel-Nr. 86513

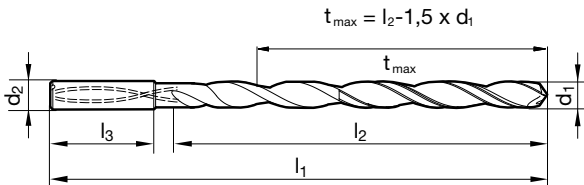


P	M	K	N	S	H
•	•	•	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • Kopfbeschichtung • Hauptschneidenform konkav • optimierter Nutquerschnitt  
 • maximaler Kühlkanalquerschnitt • Kühlmitteldruck beachten

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	140,000	100,000	36,000	7,500		8,000	303,000	263,000	36,000
3,100		6,000	158,000	118,000	36,000	7,540	19/64	8,000	303,000	263,000	36,000
3,170	1/8	6,000	158,000	118,000	36,000	7,940	5/16	8,000	303,000	263,000	36,000
3,200		6,000	158,000	118,000	36,000	8,000		8,000	303,000	263,000	36,000
3,300		6,000	158,000	118,000	36,000	8,330	21/64	10,000	339,000	295,000	40,000
3,500		6,000	176,000	136,000	36,000	8,500		10,000	339,000	295,000	40,000
3,570	9/64	6,000	176,000	136,000	36,000	8,730	11/32	10,000	339,000	295,000	40,000
3,700		6,000	176,000	136,000	36,000	8,800		10,000	339,000	295,000	40,000
3,800		6,000	176,000	136,000	36,000	9,000		10,000	339,000	295,000	40,000
3,970	5/32	6,000	176,000	136,000	36,000	9,130	23/64	10,000	371,000	327,000	40,000
4,000		6,000	176,000	136,000	36,000	9,520	3/8	10,000	371,000	327,000	40,000
4,200		6,000	208,000	168,000	36,000	9,920	25/64	10,000	371,000	327,000	40,000
4,370	11/64	6,000	208,000	168,000	36,000	10,000		10,000	371,000	327,000	40,000
4,500		6,000	208,000	168,000	36,000	10,320	13/32	12,000	412,000	363,000	45,000
4,760	3/16	6,000	208,000	168,000	36,000	10,720	27/64	12,000	412,000	363,000	45,000
5,000		6,000	208,000	168,000	36,000	11,000		12,000	412,000	363,000	45,000
5,100		6,000	240,000	200,000	36,000	11,110	7/16	12,000	443,000	394,000	45,000
5,160	13/64	6,000	240,000	200,000	36,000	11,510	29/64	12,000	443,000	394,000	45,000
5,410		6,000	240,000	200,000	36,000	11,910	15/32	12,000	443,000	394,000	45,000
5,500		6,000	240,000	200,000	36,000	12,000		12,000	443,000	394,000	45,000
5,560	7/32	6,000	240,000	200,000	36,000	12,300	31/64	14,000	507,000	458,000	45,000
5,950	15/64	6,000	240,000	200,000	36,000	12,700	1/2	14,000	507,000	458,000	45,000
6,000		6,000	240,000	200,000	36,000	13,000		14,000	507,000	458,000	45,000
6,300		8,000	272,000	232,000	36,000	13,100	33/64	14,000	507,000	458,000	45,000
6,350	1/4	8,000	272,000	232,000	36,000	13,490	17/32	14,000	507,000	458,000	45,000
6,500		8,000	272,000	232,000	36,000	13,890	35/64	14,000	507,000	458,000	45,000
6,750	17/64	8,000	272,000	232,000	36,000	14,000		14,000	507,000	458,000	45,000
6,800		8,000	272,000	232,000	36,000						
7,000		8,000	272,000	232,000	36,000						
7,140	9/32	8,000	303,000	263,000	36,000						

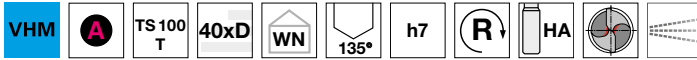


## TS-Drills mit Innenkühlung

Artikel-Nr. 86514

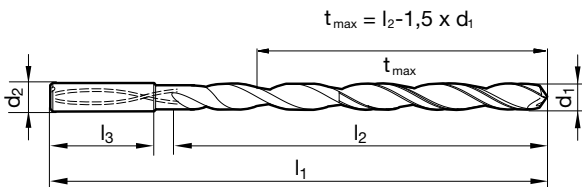


P	M	K	N	S	H
•	•	•	○	○	○



Ausspitzung  $\geq \varnothing 3,000$  • Kegelmantelschliff • Kopfbeschichtung • Hauptschneidenform konkav • optimierter Nutquerschnitt  
 • maximaler Kühlkanalquerschnitt • Kühlmitteldruck beachten

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe



d1		d2 h6	l1	l2	l3	d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm	mm	inch	mm	mm	mm	mm
3,000		6,000	170,000	130,000	36,000	5,500		6,000	280,000	240,000	36,000
3,100		6,000	193,000	153,000	36,000	5,560	7/32	6,000	300,000	260,000	36,000
3,170	1/8	6,000	193,000	153,000	36,000	5,950	15/64	6,000	300,000	260,000	36,000
3,200		6,000	193,000	153,000	36,000	6,000		6,000	300,000	260,000	36,000
3,300		6,000	193,000	153,000	36,000	6,300		8,000	322,000	282,000	36,000
3,500		6,000	193,000	153,000	36,000	6,350	1/4	8,000	322,000	282,000	36,000
3,570	9/64	6,000	216,000	176,000	36,000	6,500		8,000	322,000	282,000	36,000
3,800		6,000	216,000	176,000	36,000	6,750	17/64	8,000	342,000	302,000	36,000
3,970	5/32	6,000	216,000	176,000	36,000	6,800		8,000	342,000	302,000	36,000
4,000		6,000	216,000	176,000	36,000	7,000		8,000	342,000	302,000	36,000
4,200		6,000	238,000	198,000	36,000	7,140	9/32	8,000	363,000	323,000	36,000
4,370	11/64	6,000	238,000	198,000	36,000	7,500		8,000	363,000	323,000	36,000
4,500		6,000	238,000	198,000	36,000	7,540	19/64	8,000	383,000	343,000	36,000
4,760	3/16	6,000	258,000	218,000	36,000	7,940	5/16	8,000	383,000	343,000	36,000
5,000		6,000	258,000	218,000	36,000	8,000		8,000	383,000	343,000	36,000
5,100		6,000	280,000	240,000	36,000	8,500		10,000	409,000	365,000	40,000
5,160	13/64	6,000	280,000	240,000	36,000	9,000		10,000	429,000	386,000	40,000
5,410		6,000	280,000	240,000	36,000	10,000		10,000	471,000	427,000	40,000

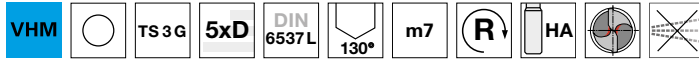


## TS-Drills, 3-schneidig

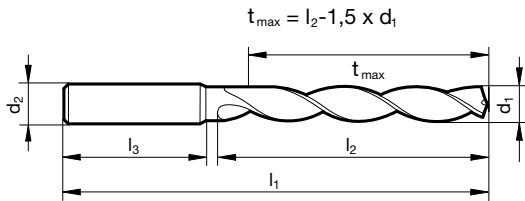
Artikel-Nr. 89247



P	M	K	N	S	H
		•	•		



Ausspitzung  $\geq \varnothing 3,000$  • Spiropointanschliff • weite Spannuten • optimales Zentrieren • für unterbrochenen Schnitt geeignet  
 Guss • langspanende Al-Legierungen • Messing, Bronzen



d1	d2	l1	l2	l3	d1	d2	l1	l2	l3
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
3,000	6,000	66,000	28,000	36,000	8,600	10,000	103,000	61,000	40,000
3,100	6,000	66,000	28,000	36,000	8,700	10,000	103,000	61,000	40,000
3,200	6,000	66,000	28,000	36,000	8,800	10,000	103,000	61,000	40,000
3,300	6,000	66,000	28,000	36,000	9,000	10,000	103,000	61,000	40,000
3,500	6,000	66,000	28,000	36,000	9,100	10,000	103,000	61,000	40,000
3,700	6,000	66,000	28,000	36,000	9,500	10,000	103,000	61,000	40,000
3,800	6,000	74,000	36,000	36,000	9,800	10,000	103,000	61,000	40,000
4,000	6,000	74,000	36,000	36,000	10,000	10,000	103,000	61,000	40,000
4,100	6,000	74,000	36,000	36,000	10,100	12,000	118,000	71,000	45,000
4,200	6,000	74,000	36,000	36,000	10,200	12,000	118,000	71,000	45,000
4,500	6,000	74,000	36,000	36,000	10,300	12,000	118,000	71,000	45,000
4,800	6,000	82,000	44,000	36,000	10,500	12,000	118,000	71,000	45,000
5,000	6,000	82,000	44,000	36,000	11,000	12,000	118,000	71,000	45,000
5,100	6,000	82,000	44,000	36,000	11,200	12,000	118,000	71,000	45,000
5,200	6,000	82,000	44,000	36,000	11,500	12,000	118,000	71,000	45,000
5,300	6,000	82,000	44,000	36,000	11,800	12,000	118,000	71,000	45,000
5,500	6,000	82,000	44,000	36,000	12,000	12,000	118,000	71,000	45,000
5,800	6,000	82,000	44,000	36,000	12,100	14,000	124,000	77,000	45,000
6,000	6,000	82,000	44,000	36,000	12,500	14,000	124,000	77,000	45,000
6,100	8,000	91,000	53,000	36,000	13,000	14,000	124,000	77,000	45,000
6,200	8,000	91,000	53,000	36,000	13,500	14,000	124,000	77,000	45,000
6,400	8,000	91,000	53,000	36,000	14,000	14,000	124,000	77,000	45,000
6,500	8,000	91,000	53,000	36,000	14,100	16,000	133,000	83,000	48,000
6,700	8,000	91,000	53,000	36,000	14,500	16,000	133,000	83,000	48,000
6,800	8,000	91,000	53,000	36,000	15,000	16,000	133,000	83,000	48,000
6,900	8,000	91,000	53,000	36,000	15,500	16,000	133,000	83,000	48,000
7,000	8,000	91,000	53,000	36,000	16,000	16,000	133,000	83,000	48,000
7,100	8,000	91,000	53,000	36,000	16,500	18,000	143,000	93,000	48,000
7,400	8,000	91,000	53,000	36,000	17,000	18,000	143,000	93,000	48,000
7,500	8,000	91,000	53,000	36,000	17,500	18,000	143,000	93,000	48,000
7,800	8,000	91,000	53,000	36,000	18,000	18,000	143,000	93,000	48,000
8,000	8,000	91,000	53,000	36,000	18,500	20,000	153,000	101,000	50,000
8,100	10,000	103,000	61,000	40,000	19,000	20,000	153,000	101,000	50,000
8,200	10,000	103,000	61,000	40,000	19,500	20,000	153,000	101,000	50,000
8,400	10,000	103,000	61,000	40,000	20,000	20,000	153,000	101,000	50,000
8,500	10,000	103,000	61,000	40,000					

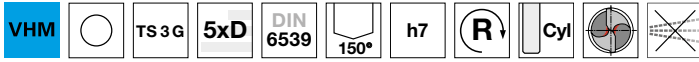


## TS-Drills, 3-schneidig

Artikel-Nr. 89239

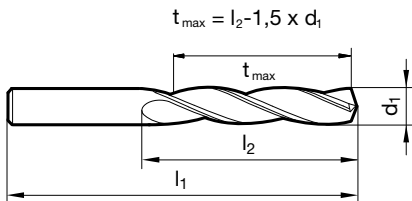


P	M	K	N	S	H
		○	○		



Ausspitzung  $\geq \varnothing 3,000$  • Flächenanschliff • für sehr maßhaltige Bohrungen • sehr gute Bohrungsflächen • für unterbrochenen Schnitt geeignet

Gusswerkstoffe • Al-Gusslegierungen



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
3,000	46,000	22,000	7,900	79,000	48,000
3,100	49,000	24,000	8,000	79,000	48,000
3,200	49,000	24,000	8,100	79,000	48,000
3,300	49,000	24,000	8,200	79,000	48,000
3,400	52,000	27,000	8,300	79,000	48,000
3,500	52,000	27,000	8,400	79,000	48,000
3,600	52,000	27,000	8,500	79,000	48,000
3,800	55,000	30,000	8,700	84,000	52,000
3,900	55,000	30,000	8,800	84,000	52,000
4,000	55,000	30,000	9,000	84,000	52,000
4,100	55,000	30,000	9,100	84,000	52,000
4,200	55,000	30,000	9,200	84,000	52,000
4,300	58,000	32,000	9,300	84,000	52,000
4,500	58,000	32,000	9,500	84,000	52,000
4,600	58,000	32,000	9,700	89,000	55,000
4,800	62,000	35,000	9,800	89,000	55,000
4,900	62,000	35,000	10,000	89,000	55,000
5,000	62,000	35,000	10,100	89,000	55,000
5,100	62,000	35,000	10,200	89,000	55,000
5,200	62,000	35,000	10,300	89,000	55,000
5,400	66,000	39,000	10,400	89,000	55,000
5,500	66,000	39,000	10,500	89,000	55,000
5,600	66,000	39,000	10,700	95,000	60,000
5,700	66,000	39,000	11,000	95,000	60,000
5,800	66,000	39,000	11,110	95,000	60,000
5,900	66,000	39,000	11,200	95,000	60,000
6,000	66,000	39,000	11,500	95,000	60,000
6,100	70,000	42,000	11,700	95,000	60,000
6,200	70,000	42,000	11,800	95,000	60,000
6,300	70,000	42,000	12,000	102,000	65,000
6,400	70,000	42,000	12,500	102,000	65,000
6,500	70,000	42,000	12,700	102,000	65,000
6,600	70,000	42,000	13,000	102,000	65,000
6,700	70,000	42,000	13,500	107,000	66,000
6,800	74,000	45,000	13,600	107,000	66,000
7,000	74,000	45,000	13,800	107,000	66,000
7,100	74,000	45,000	14,000	107,000	66,000
7,200	74,000	45,000	14,300	111,000	70,000
7,400	74,000	45,000	14,500	111,000	70,000
7,500	74,000	45,000	14,700	111,000	70,000
7,600	79,000	48,000	15,000	111,000	70,000
7,800	79,000	48,000	15,500	115,000	73,000



## TS-Drills, 3-schneidig

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
16,000	115,000	73,000			
16,500	119,000	73,000			
17,000	119,000	73,000			
18,500	127,000	76,000			
19,000	127,000	76,000			
20,000	131,000	79,000			





# HARTNER

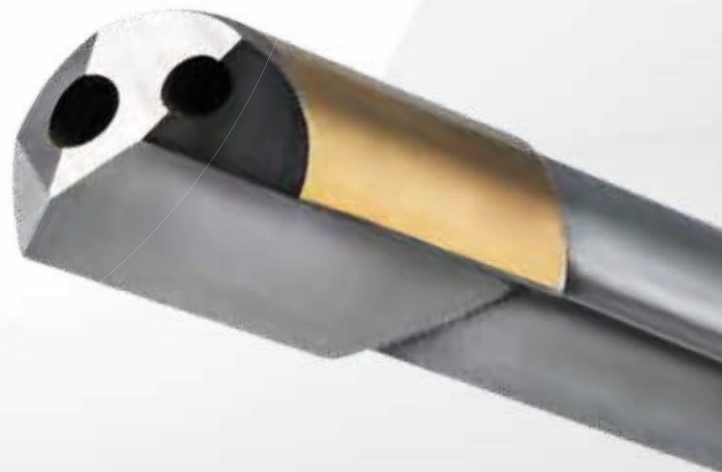
Precision Cutting Tools



**MULTIPLY**

# E 80 XXL

- ▼ ideal für Tieflochbohrmaschinen
- ▼ Gesamtlängen 800 mm / 1.200 mm / 1.600 mm / 2.000 mm
- ▼ Anwendung nicht nur im Formen- und Werkzeugbau
- ▼ polierte Spannuten für beste Spanabfuhr
- ▼ TiN-beschichtet für universelle Anwendung
- ▼ Einspannhülse T 3.1





# HARTNER

Precision Cutting Tools

## TIEFLOCHBOHRER

aus Vollhartmetall, mit HM-Kopf oder mit Wechsellplatten  
blank und beschichtet

















Tieflochbohrer













P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
<b>Einlippenbohrer E 100</b>															
						Werksnorm	TLB E 100	VHM		rechts	HA	25xD	1,000 - 16,000	89523	271
						Werksnorm	TLB E 100	VHM		rechts	HA	25xD	1,000 - 16,000	89520	271
						Werksnorm	TLB E 100	VHM		rechts	HA	50xD	1,000 - 10,000	89524	273
						Werksnorm	TLB E 100	VHM		rechts	HA	50xD	1,000 - 10,000	89521	273
						Werksnorm	TLB E 100	VHM		rechts	HA	75xD	1,000 - 7,144	89525	275
						Werksnorm	TLB E 100	VHM		rechts	HA	75xD	1,000 - 7,144	89522	275
						Werksnorm	TLB E 100	VHM		rechts	HA	45.000	1,200 - 3,200	89503	276
						Werksnorm	TLB E 100	VHM		rechts	HA	45.000	1,200 - 3,200	89510	276
						Werksnorm	TLB E 100	VHM		rechts	HA	80.000	1,200 - 5,000	89501	277
						Werksnorm	TLB E 100	VHM		rechts	HA	80.000	1,200 - 5,000	89511	277
						Werksnorm	TLB E 100	VHM		rechts	HA	120.000	1,500 - 5,000	89504	278
						Werksnorm	TLB E 100	VHM		rechts	HA	120.000	1,500 - 5,000	89512	278
						Werksnorm	TLB E 100	VHM		rechts	HA	160.000	1,500 - 8,000	89502	279
						Werksnorm	TLB E 100	VHM		rechts	HA	160.000	1,500 - 8,000	89513	279

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Einlippenbohrer E 80







	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	HA	20xD	3,970 - 12,700	89505	280
	•	•	○	○	•	Werksnorm	TLB E 80	HM		rechts	HA	20xD	3,970 - 12,700	89514	280
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	HA	30xD	3,970 - 12,700	89509	281
	•	•	○	○	•	Werksnorm	TLB E 80	HM		rechts	HA	30xD	3,970 - 12,700	89515	281
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	HA	40xD	3,970 - 12,700	89506	282
	•	•	○	○	•	Werksnorm	TLB E 80	HM		rechts	HA	40xD	3,970 - 12,700	89516	282
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	HA	80xD	4,950 - 12,650	89507	283
	•	•	○	○	•	Werksnorm	TLB E 80	HM		rechts	HA	80xD	4,950 - 12,650	89517	283

## Einlippenbohrer E 80 XXL

	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	T 3.1	GL 600	3,000 - 25,000	89539	284
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	T 3.1	GL 800	3,000 - 25,000	89540	285
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	T 3.1	GL1000	3,000 - 25,000	89544	286
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	T 3.1	GL1200	3,000 - 25,000	89541	287
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	T 3.1	GL1400	4,000 - 25,000	89545	288

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Einlippenbohrer E 80 XXL

	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	T 3.1	GL1600	4,000 - 25,000	89542	289
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	T 3.1	GL1800	4,000 - 32,000	89546	290
	•	○	•	○	○	Werksnorm	TLB E 80	HM		rechts	T 3.1	GL2000	4,000 - 32,000	89543	291

## Einlippenbohrer E 800 mit Wechselplatten

	•	○	•	○	○	Werksnorm	TLB E 800	HM		rechts	HB	30xD	12,000 - 24,000	89530	292
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## Schneidplatten für Einlippenbohrer E 800

	•	○	•	○	○	Werksnorm	VHM		rechts			12,000 - 40,000	89535	293
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## Führungsleisten für Einlippenbohrer E 800

	•	○	•	○	○	Werksnorm	VHM					12,000 - 40,000	89536	294
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## Zweilippenbohrer Z 80

			•			Werksnorm	TLB Z 80	HM	○	rechts	HA	30xD	8,000 - 12,000	89508	295
			•			Werksnorm	TLB Z 80	HM	○	rechts	HA	30xD	8,000 - 12,000	89518	295



## Einlippenbohrer E 100

Artikel-Nr. 89523

P	M	K	N	S	H
○	○	○	●	●	○



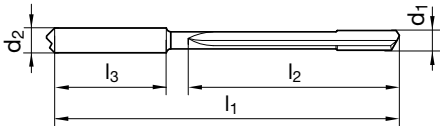
Bohrtiefe bis 25xD • Umfangsform G • VHM-Vollschäft mit MQL-Schaftende

Artikel-Nr. 89520

P	M	K	N	S	H
●	●	○	●	○	○



Bohrtiefe bis 25xD • Umfangsform G • VHM-Vollschäft mit MQL-Schaftende



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
1,000		3,000	65,000	32,000	28,000
1,191	3/64	3,000	70,000	39,000	28,000
1,500		4,000	80,000	49,000	28,000
1,588	1/16	4,000	85,000	51,000	28,000
1,984	5/64	4,000	95,000	64,000	28,000
2,000		4,000	95,000	65,000	28,000
2,381	3/32	4,000	100,000	70,000	28,000
2,500		4,000	115,000	85,000	28,000
2,778	7/64	4,000	115,000	85,000	28,000
3,000		6,000	145,000	105,000	36,000
3,175	1/8	6,000	145,000	105,000	36,000
3,500		6,000	145,000	105,000	36,000
3,572	9/64	6,000	160,000	120,000	36,000
3,969	5/32	6,000	160,000	120,000	36,000
4,000		6,000	160,000	120,000	36,000
4,366	11/64	6,000	220,000	180,000	36,000
4,763	3/16	6,000	220,000	180,000	36,000
5,000		6,000	220,000	180,000	36,000
5,159	13/64	6,000	220,000	180,000	36,000
5,556	7/32	6,000	220,000	180,000	36,000
5,953	15/64	6,000	220,000	180,000	36,000
6,000		6,000	220,000	180,000	36,000
6,350	1/4	8,000	260,000	210,000	36,000
6,500		8,000	260,000	210,000	36,000
6,747	17/64	8,000	260,000	210,000	36,000
7,000		8,000	260,000	210,000	36,000
7,144	9/32	8,000	285,000	240,000	36,000
7,541	19/64	8,000	285,000	240,000	36,000
7,938	5/16	8,000	285,000	240,000	36,000
8,000		8,000	285,000	240,000	36,000



HARTNER

## Einlippenbohrer E 100

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
9,000		10,000	350,000	300,000	40,000
10,000		10,000	350,000	300,000	40,000
11,000		12,000	420,000	360,000	45,000
11,113	7/16	12,000	420,000	360,000	45,000
12,000		12,000	420,000	360,000	45,000
12,700	1/2	14,000	455,000	396,000	45,000
14,000		14,000	500,000	437,000	45,000
15,000		16,000	535,000	468,000	48,000
15,875	5/8	16,000	560,000	495,000	48,000
16,000		16,000	565,000	499,000	48,000





## Einlippenbohrer E 100

Artikel-Nr. 89524

P	M	K	N	S	H
○	○	○	●	●	○



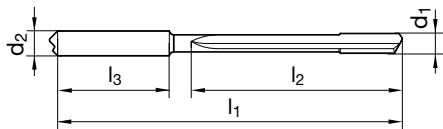
Bohrtiefe bis 25xD • Umfangsform G • VHM-Vollschäft mit MQL-Schaftende

Artikel-Nr. 89521

P	M	K	N	S	H
●	●	○	●	○	○



Bohrtiefe bis 50xD • Umfangsform G • VHM-Vollschäft mit MQL-Schaftende



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
1,000		3,000	90,000	57,000	28,000
1,191	3/64	3,000	100,000	68,000	28,000
1,500		4,000	120,000	86,000	28,000
1,588	1/16	4,000	125,000	91,000	28,000
1,984	5/64	4,000	145,000	114,000	28,000
2,000		4,000	145,000	115,000	28,000
2,381	3/32	4,000	160,000	130,000	28,000
2,500		4,000	185,000	155,000	28,000
2,778	7/64	4,000	185,000	155,000	28,000
3,000		6,000	230,000	190,000	36,000
3,175	1/8	6,000	230,000	190,000	36,000
3,500		6,000	230,000	190,000	36,000
3,572	9/64	6,000	260,000	220,000	36,000
3,969	5/32	6,000	260,000	220,000	36,000
4,000		6,000	260,000	220,000	36,000
4,366	11/64	6,000	290,000	245,000	36,000
4,763	3/16	6,000	310,000	268,000	36,000
5,000		6,000	370,000	330,000	36,000
5,159	13/64	6,000	370,000	330,000	36,000
5,556	7/32	6,000	370,000	330,000	36,000
5,953	15/64	6,000	370,000	330,000	36,000
6,000		6,000	370,000	330,000	36,000
6,350	1/4	8,000	430,000	385,000	36,000
6,500		8,000	430,000	385,000	36,000
6,747	17/64	8,000	430,000	385,000	36,000
7,000		8,000	430,000	385,000	36,000
7,144	9/32	8,000	485,000	440,000	36,000
7,541	19/64	8,000	485,000	440,000	36,000
7,938	5/16	8,000	485,000	440,000	36,000
8,000		8,000	485,000	440,000	36,000



HARTNER

## Einlippenbohrer E 100

d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
9,000		10,000	555,000	506,000	40,000
10,000		10,000	615,000	562,000	40,000



## Einlippenbohrer E 100

Artikel-Nr. 89525



P	M	K	N	S	H
○	○	○	●	●	○



Bohrtiefe bis 25xD • Umfangsform G • VHM-Vollschäft mit MQL-Schaftende

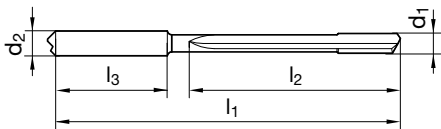
Artikel-Nr. 89522



P	M	K	N	S	H
●	●	○	●	○	○



Bohrtiefe bis 75xD • Umfangsform G • VHM-Vollschäft mit MQL-Schaftende



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
1,000		3,000	115,000	82,000	28,000
1,191	3/64	3,000	130,000	98,000	28,000
1,500		4,000	155,000	124,000	28,000
1,588	1/16	4,000	165,000	131,000	28,000
1,984	5/64	4,000	195,000	163,000	28,000
2,000		4,000	195,000	165,000	28,000
2,381	3/32	4,000	220,000	190,000	28,000
2,500		4,000	255,000	220,000	28,000
2,778	7/64	4,000	255,000	220,000	28,000
3,000		6,000	290,000	274,000	36,000
3,175	1/8	6,000	320,000	280,000	36,000
3,500		6,000	320,000	280,000	36,000
3,572	9/64	6,000	360,000	320,000	36,000
3,969	5/32	6,000	360,000	320,000	36,000
4,000		6,000	360,000	320,000	36,000
4,366	11/64	6,000	395,000	355,000	36,000
4,763	3/16	6,000	430,000	387,000	36,000
5,000		6,000	450,000	406,000	36,000
5,159	13/64	6,000	465,000	419,000	36,000
5,556	7/32	6,000	525,000	485,000	36,000
5,953	15/64	6,000	525,000	485,000	36,000
6,000		6,000	525,000	485,000	36,000
6,350	1/4	8,000	560,000	516,000	36,000
6,500		8,000	575,000	528,000	36,000
6,747	17/64	8,000	595,000	548,000	36,000
7,000		8,000	615,000	568,000	36,000
7,144	9/32	8,000	625,000	580,000	36,000



## Einlippenbohrer E 100

Artikel-Nr. 89503



P	M	K	N	S	H
○	○	○	●	○	○



Spannutlänge 45 mm • Umfangsform G

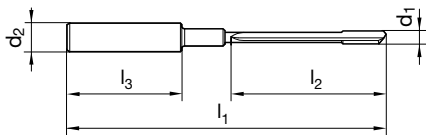
Artikel-Nr. 89510



P	M	K	N	S	H
●	○	●	○	○	○



Spannutlänge 45 mm • Umfangsform G



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
1,200		4,000	90,000	45,000	28,000
1,500		4,000	90,000	45,000	28,000
1,590	1/16	4,000	90,000	45,000	28,000
1,600		4,000	90,000	45,000	28,000
1,980	5/64	4,000	90,000	45,000	28,000
2,000		4,000	90,000	45,000	28,000
2,500		10,000	100,000	45,000	40,000
2,700		10,000	100,000	45,000	40,000
3,000		10,000	100,000	45,000	40,000
3,200		10,000	100,000	45,000	40,000



## Einlippenbohrer E 100

Artikel-Nr. 89501



P	M	K	N	S	H
○	○	○	●	○	○



Spannutlänge 80 mm • Umfangsform G

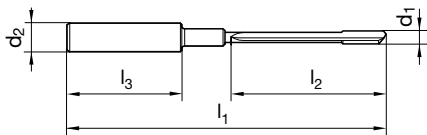
Artikel-Nr. 89511



P	M	K	N	S	H
●	○	●	○	○	○



Spannutlänge 80 mm • Umfangsform G



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
1,200		4,000	125,000	80,000	28,000
1,500		4,000	125,000	80,000	28,000
1,590	1/16	4,000	125,000	80,000	28,000
1,600		4,000	125,000	80,000	28,000
1,980	5/64	4,000	125,000	80,000	28,000
2,000		4,000	125,000	80,000	28,000
2,500		10,000	135,000	80,000	40,000
2,700		10,000	135,000	80,000	40,000
3,000		10,000	135,000	80,000	40,000
3,200		10,000	135,000	80,000	40,000
3,500		10,000	135,000	80,000	40,000
4,000		10,000	135,000	80,000	40,000
4,200		10,000	135,000	80,000	40,000
4,500		10,000	135,000	80,000	40,000
5,000		10,000	135,000	80,000	40,000



## Einlippenbohrer E 100

Artikel-Nr. 89504



P	M	K	N	S	H
○	○	○	●	○	○



Spannutlänge 120 mm • Umfangsform G

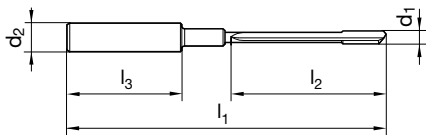
Artikel-Nr. 89512



P	M	K	N	S	H
●	○	●	○	○	○



Spannutlänge 120 mm • Umfangsform G



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
1,500		4,000	165,000	120,000	28,000
1,590	1/16	4,000	165,000	120,000	28,000
1,600		4,000	165,000	120,000	28,000
1,980	5/64	4,000	165,000	120,000	28,000
2,000		4,000	165,000	120,000	28,000
2,500		10,000	175,000	120,000	40,000
2,700		10,000	175,000	120,000	40,000
3,000		10,000	175,000	120,000	40,000
3,200		10,000	175,000	120,000	40,000
3,500		10,000	175,000	120,000	40,000
4,000		10,000	175,000	120,000	40,000
4,200		10,000	175,000	120,000	40,000
4,500		10,000	175,000	120,000	40,000
5,000		10,000	175,000	120,000	40,000



## Einlippenbohrer E 100

Artikel-Nr. 89502



P	M	K	N	S	H
○	○	○	●	○	○



Spannutlänge 160 mm • Umfangsform G

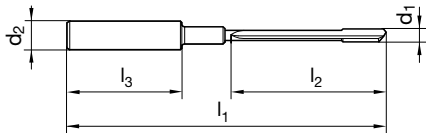
Artikel-Nr. 89513



P	M	K	N	S	H
●	○	●	○	○	○



Spannutlänge 160 mm • Umfangsform G



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
1,500		4,000	205,000	160,000	28,000
1,590	1/16	4,000	205,000	160,000	28,000
1,600		4,000	205,000	160,000	28,000
1,980	5/64	4,000	205,000	160,000	28,000
2,000		4,000	205,000	160,000	28,000
2,500		10,000	215,000	160,000	40,000
2,700		10,000	215,000	160,000	40,000
3,000		10,000	215,000	160,000	40,000
3,200		10,000	215,000	160,000	40,000
3,500		10,000	215,000	160,000	40,000
4,000		10,000	215,000	160,000	40,000
4,200		10,000	215,000	160,000	40,000
4,500		10,000	215,000	160,000	40,000
5,000		10,000	215,000	160,000	40,000
6,000		16,000	225,000	160,000	48,000
8,000		16,000	225,000	160,000	48,000



## Einlippenbohrer E 80

Artikel-Nr. 89505



P	M	K	N	S	H
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Bohrtiefe bis 20xD • Umfangsform G • mit Längsspanteiler

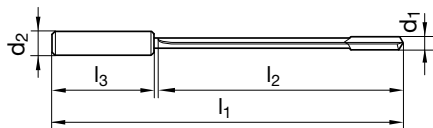
Artikel-Nr. 89514



P	M	K	N	S	H
●	●	○	○	●	○



Bohrtiefe bis 20xD • Umfangsform G • für legierte und hochlegierte Stähle



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
3,970	5/32	10,000	150,000	100,000	40,000
4,000		12,000	150,000	100,000	45,000
4,200		12,000	160,000	110,000	45,000
4,500		12,000	170,000	120,000	45,000
5,000		16,000	180,000	130,000	48,000
5,156		16,000	180,000	130,000	48,000
5,500		16,000	190,000	140,000	48,000
6,000		16,000	210,000	160,000	48,000
6,350	1/4	16,000	220,000	170,000	48,000
6,500		16,000	220,000	170,000	48,000
7,000		16,000	235,000	185,000	48,000
7,938	5/16	16,000	260,000	210,000	48,000
8,000		16,000	260,000	210,000	48,000
9,000		16,000	280,000	230,000	48,000
9,525	3/8	16,000	290,000	240,000	48,000
10,000		20,000	320,000	260,000	50,000
11,000		20,000	340,000	290,000	50,000
11,113	7/16	20,000	340,000	290,000	50,000
12,000		20,000	370,000	310,000	50,000
12,700	1/2	20,000	385,000	330,000	50,000





## Einlippenbohrer E 80

Artikel-Nr. 89509



P	M	K	N	S	H
●	○	●	○	○	○



Bohrtiefe bis 30xD • Umfangsform G • mit Längsspanteiler

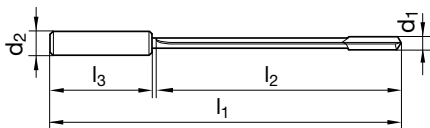
Artikel-Nr. 89515



P	M	K	N	S	H
●	●	○	○	●	○



Bohrtiefe bis 30xD • Umfangsform G • für legierte und hochlegierte Stähle



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
3,970	5/32	10,000	200,000	155,000	40,000
4,000		12,000	200,000	155,000	45,000
4,200		12,000	210,000	165,000	45,000
4,500		12,000	220,000	175,000	45,000
5,000		16,000	230,000	182,000	48,000
5,156		16,000	230,000	182,000	48,000
5,500		16,000	245,000	197,000	48,000
6,000		16,000	260,000	212,000	48,000
6,350	1/4	16,000	275,000	227,000	48,000
6,500		16,000	275,000	227,000	48,000
7,000		16,000	290,000	242,000	48,000
7,938	5/16	16,000	320,000	272,000	48,000
8,000		16,000	320,000	272,000	48,000
9,000		16,000	350,000	302,000	48,000
9,525	3/8	16,000	380,000	330,000	48,000
10,000		20,000	400,000	350,000	50,000
11,000		20,000	430,000	380,000	50,000
11,113	7/16	20,000	430,000	380,000	50,000
12,000		20,000	450,000	400,000	50,000
12,700	1/2	20,000	500,000	450,000	50,000



## Einlippenbohrer E 80

Artikel-Nr. 89506



P	M	K	N	S	H
●	○	●	○	○	○



Bohrtiefe bis 40xD • Umfangsform G • mit Längsspanteiler

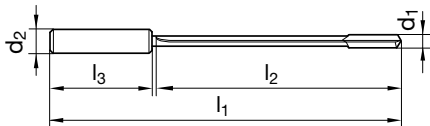
Artikel-Nr. 89516



P	M	K	N	S	H
●	●	○	○	●	○



Bohrtiefe bis 40xD • Umfangsform G • für legierte und hochlegierte Stähle



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
3,970	5/32	10,000	230,000	185,000	40,000
4,000		12,000	230,000	185,000	45,000
4,200		12,000	240,000	195,000	45,000
4,500		12,000	250,000	205,000	45,000
5,000		16,000	280,000	232,000	48,000
5,156		16,000	280,000	232,000	48,000
5,500		16,000	300,000	252,000	48,000
6,000		16,000	320,000	272,000	48,000
6,350	1/4	16,000	340,000	292,000	48,000
6,500		16,000	340,000	292,000	48,000
7,000		16,000	370,000	322,000	48,000
7,938	5/16	16,000	420,000	372,000	48,000
8,000		16,000	420,000	372,000	48,000
9,000		16,000	450,000	402,000	48,000
9,525	3/8	16,000	480,000	432,000	48,000
10,000		20,000	510,000	460,000	50,000
11,000		20,000	550,000	500,000	50,000
11,113	7/16	20,000	550,000	500,000	50,000
12,000		20,000	600,000	550,000	50,000
12,700	1/2	20,000	635,000	585,000	50,000



## Einlippenbohrer E 80

### Artikel-Nr. 89507



P	M	K	N	S	H
●	○	●	○	○	○



Bohrtiefe bis 80xD • Umfangsform G • mit Längsspanteiler • für langspanende Stähle • maximale Bohrtiefe je Werkzeug 40xD, bei größeren Bohrtiefen zuerst Bohrer Art.-Nr. 89506 verwenden

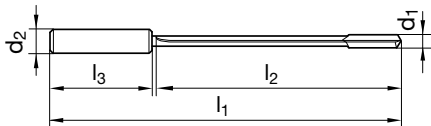
### Artikel-Nr. 89517



P	M	K	N	S	H
●	●	○	○	●	○



Bohrtiefe bis 80xD • Umfangsform G • maximale Bohrtiefe je Werkzeug 40xD, bei größeren Bohrtiefen zuerst Bohrer Art.-Nr. 89516 verwenden



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
4,950		16,000	480,000	432,000	48,000
5,106		16,000	480,000	432,000	48,000
5,950	15/64	16,000	560,000	512,000	48,000
6,300		16,000	590,000	542,000	48,000
6,950		16,000	650,000	602,000	48,000
7,888		16,000	740,000	692,000	48,000
7,950		16,000	740,000	692,000	48,000
8,950		16,000	820,000	772,000	48,000
9,475		16,000	870,000	822,000	48,000
9,950		20,000	910,000	860,000	50,000
10,950		20,000	995,000	945,000	50,000
11,063		20,000	995,000	945,000	50,000
11,950		20,000	1080,000	1030,000	50,000
12,650		20,000	1140,000	1090,000	50,000



# HARTNER

## Einlippenbohrer E 80 XXL

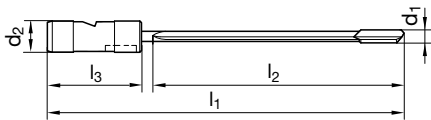
Artikel-Nr. 89539



P	M	K	N	S	H
•	○	•	○	○	○



für die Verwendung auf Tiefbohrmaschinen • Lagerartikel mit fixer Gesamtlänge für Tiefbohrmaschinen • polierte Spannuten • gelöteter Hartmetallkopf mit Umfangsform G



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		25,000	600,000	500,000	70,000
4,000		25,000	600,000	500,000	70,000
5,000		25,000	600,000	500,000	70,000
6,000		25,000	600,000	500,000	70,000
7,000		25,000	600,000	500,000	70,000
8,000		25,000	600,000	500,000	70,000
9,000		25,000	600,000	500,000	70,000
10,000		25,000	600,000	500,000	70,000
11,000		25,000	600,000	500,000	70,000
11,500		25,000	600,000	500,000	70,000
12,000		25,000	600,000	500,000	70,000
13,000		25,000	600,000	500,000	70,000
14,000		25,000	600,000	500,000	70,000
15,000		25,000	600,000	500,000	70,000
16,000		25,000	600,000	500,000	70,000
17,000		25,000	600,000	500,000	70,000
18,000		25,000	600,000	500,000	70,000
19,000		25,000	600,000	500,000	70,000
20,000		25,000	600,000	500,000	70,000
21,000		25,000	600,000	500,000	70,000
22,000		25,000	600,000	500,000	70,000
23,000		25,000	600,000	500,000	70,000
24,000		25,000	600,000	500,000	70,000
25,000	63/64	25,000	600,000	500,000	70,000



# HARTNER

## Einlippenbohrer E 80 XXL

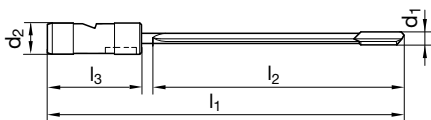
Artikel-Nr. 89540



P	M	K	N	S	H
●	○	●	○	○	○



für die Verwendung auf Tiefbohrmaschinen • Lagerartikel mit fixer Gesamtlänge für Tiefbohrmaschinen • polierte Spannuten • gelöteter Hartmetallkopf mit Umfangsform G



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		25,000	800,000	700,000	70,000
4,000		25,000	800,000	700,000	70,000
5,000		25,000	800,000	700,000	70,000
6,000		25,000	800,000	700,000	70,000
7,000		25,000	800,000	700,000	70,000
8,000		25,000	800,000	700,000	70,000
9,000		25,000	800,000	700,000	70,000
10,000		25,000	800,000	700,000	70,000
11,000		25,000	800,000	700,000	70,000
11,500		25,000	800,000	700,000	70,000
12,000		25,000	800,000	700,000	70,000
13,000		25,000	800,000	700,000	70,000
14,000		25,000	800,000	700,000	70,000
15,000		25,000	800,000	700,000	70,000
16,000		25,000	800,000	700,000	70,000
17,000		25,000	800,000	700,000	70,000
18,000		25,000	800,000	700,000	70,000
19,000		25,000	800,000	700,000	70,000
20,000		25,000	800,000	700,000	70,000
21,000		25,000	800,000	700,000	70,000
22,000		25,000	800,000	700,000	70,000
23,000		25,000	800,000	700,000	70,000
24,000		25,000	800,000	700,000	70,000
25,000	63/64	25,000	800,000	700,000	70,000



# HARTNER

## Einlippenbohrer E 80 XXL

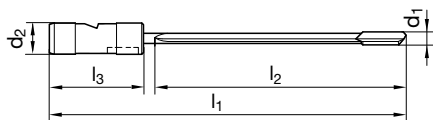
Artikel-Nr. 89544



P	M	K	N	S	H
●	○	●	○	○	○



für die Verwendung auf Tiefbohrmaschinen • Lagerartikel mit fixer Gesamtlänge für Tiefbohrmaschinen • polierte Spannuten • gelöteter Hartmetallkopf mit Umfangsform G



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		25,000	1000,000	900,000	70,000
4,000		25,000	1000,000	900,000	70,000
5,000		25,000	1000,000	900,000	70,000
6,000		25,000	1000,000	900,000	70,000
7,000		25,000	1000,000	900,000	70,000
8,000		25,000	1000,000	900,000	70,000
9,000		25,000	1000,000	900,000	70,000
10,000		25,000	1000,000	900,000	70,000
11,000		25,000	1000,000	900,000	70,000
11,500		25,000	1000,000	900,000	70,000
12,000		25,000	1000,000	900,000	70,000
13,000		25,000	1000,000	900,000	70,000
14,000		25,000	1000,000	900,000	70,000
15,000		25,000	1000,000	900,000	70,000
16,000		25,000	1000,000	900,000	70,000
17,000		25,000	1000,000	900,000	70,000
18,000		25,000	1000,000	900,000	70,000
19,000		25,000	1000,000	900,000	70,000
20,000		25,000	1000,000	900,000	70,000
21,000		25,000	1000,000	900,000	70,000
22,000		25,000	1000,000	900,000	70,000
23,000		25,000	1000,000	900,000	70,000
24,000		25,000	1000,000	900,000	70,000
25,000	63/64	25,000	1000,000	900,000	70,000



# HARTNER

## Einlippenbohrer E 80 XXL

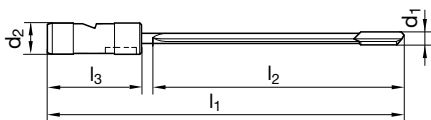
Artikel-Nr. 89541



P	M	K	N	S	H
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für die Verwendung auf Tiefbohrmaschinen • Lagerartikel mit fixer Gesamtlänge für Tiefbohrmaschinen • polierte Spannuten • gelöteter Hartmetallkopf mit Umfangsform G



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
3,000		25,000	1200,000	1100,000	70,000
4,000		25,000	1200,000	1100,000	70,000
5,000		25,000	1200,000	1100,000	70,000
6,000		25,000	1200,000	1100,000	70,000
7,000		25,000	1200,000	1100,000	70,000
8,000		25,000	1200,000	1100,000	70,000
9,000		25,000	1200,000	1100,000	70,000
10,000		25,000	1200,000	1100,000	70,000
11,000		25,000	1200,000	1100,000	70,000
11,500		25,000	1200,000	1100,000	70,000
12,000		25,000	1200,000	1100,000	70,000
13,000		25,000	1200,000	1100,000	70,000
14,000		25,000	1200,000	1100,000	70,000
15,000		25,000	1200,000	1100,000	70,000
16,000		25,000	1200,000	1100,000	70,000
17,000		25,000	1200,000	1100,000	70,000
18,000		25,000	1200,000	1100,000	70,000
19,000		25,000	1200,000	1100,000	70,000
20,000		25,000	1200,000	1100,000	70,000
21,000		25,000	1200,000	1100,000	70,000
22,000		25,000	1200,000	1100,000	70,000
23,000		25,000	1200,000	1100,000	70,000
24,000		25,000	1200,000	1100,000	70,000
25,000	63/64	25,000	1200,000	1100,000	70,000



# HARTNER

## Einlippenbohrer E 80 XXL

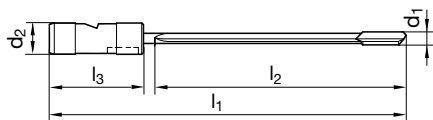
Artikel-Nr. 89545



P	M	K	N	S	H
•	○	•	○	○	○



für die Verwendung auf Tiefbohrmaschinen • Lagerartikel mit fixer Gesamtlänge für Tiefbohrmaschinen • polierte Spannuten • gelöteter Hartmetallkopf mit Umfangsform G



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
4,000		25,000	1400,000	1300,000	70,000
5,000		25,000	1400,000	1300,000	70,000
6,000		25,000	1400,000	1300,000	70,000
7,000		25,000	1400,000	1300,000	70,000
8,000		25,000	1400,000	1300,000	70,000
9,000		25,000	1400,000	1300,000	70,000
10,000		25,000	1400,000	1300,000	70,000
11,000		25,000	1400,000	1300,000	70,000
11,500		25,000	1400,000	1300,000	70,000
12,000		25,000	1400,000	1300,000	70,000
13,000		25,000	1400,000	1300,000	70,000
14,000		25,000	1400,000	1300,000	70,000
15,000		25,000	1400,000	1300,000	70,000
16,000		25,000	1400,000	1300,000	70,000
17,000		25,000	1400,000	1300,000	70,000
18,000		25,000	1400,000	1300,000	70,000
19,000		25,000	1400,000	1300,000	70,000
20,000		25,000	1400,000	1300,000	70,000
21,000		25,000	1400,000	1300,000	70,000
22,000		25,000	1400,000	1300,000	70,000
23,000		25,000	1400,000	1300,000	70,000
24,000		25,000	1400,000	1300,000	70,000
25,000	63/64	25,000	1400,000	1300,000	70,000





# HARTNER

## Einlippenbohrer E 80 XXL

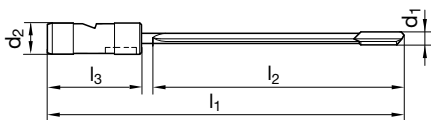
Artikel-Nr. 89542



P	M	K	N	S	H
•	○	•	○	○	○



für die Verwendung auf Tiefbohrmaschinen • Lagerartikel mit fixer Gesamtlänge für Tiefbohrmaschinen • polierte Spannuten • gelöteter Hartmetallkopf mit Umfangsform G



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
4,000		25,000	1600,000	1500,000	70,000
5,000		25,000	1600,000	1500,000	70,000
5,500		25,000	1600,000	1500,000	70,000
6,000		25,000	1600,000	1500,000	70,000
6,500		25,000	1600,000	1500,000	70,000
7,000		25,000	1600,000	1500,000	70,000
7,500		25,000	1600,000	1500,000	70,000
8,000		25,000	1600,000	1500,000	70,000
9,000		25,000	1600,000	1500,000	70,000
9,500		25,000	1600,000	1500,000	70,000
10,000		25,000	1600,000	1500,000	70,000
11,000		25,000	1600,000	1500,000	70,000
11,500		25,000	1600,000	1500,000	70,000
12,000		25,000	1600,000	1500,000	70,000
13,000		25,000	1600,000	1500,000	70,000
14,000		25,000	1600,000	1500,000	70,000
15,000		25,000	1600,000	1500,000	70,000
16,000		25,000	1600,000	1500,000	70,000
17,000		25,000	1600,000	1500,000	70,000
18,000		25,000	1600,000	1500,000	70,000
19,000		25,000	1600,000	1500,000	70,000
20,000		25,000	1600,000	1500,000	70,000
21,000		25,000	1600,000	1500,000	70,000
22,000		25,000	1600,000	1500,000	70,000
23,000		25,000	1600,000	1500,000	70,000
24,000		25,000	1600,000	1500,000	70,000
25,000	63/64	25,000	1600,000	1500,000	70,000



# HARTNER

## Einlippenbohrer E 80 XXL

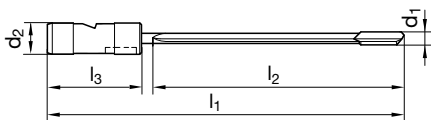
Artikel-Nr. 89546



P	M	K	N	S	H
•	○	•	○	○	○



für die Verwendung auf Tiefbohrmaschinen • Lagerartikel mit fixer Gesamtlänge für Tiefbohrmaschinen • polierte Spannuten • gelöteter Hartmetallkopf mit Umfangsform G



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
4,000		25,000	1800,000	1700,000	70,000
5,000		25,000	1800,000	1700,000	70,000
6,000		25,000	1800,000	1700,000	70,000
7,000		25,000	1800,000	1700,000	70,000
8,000		25,000	1800,000	1700,000	70,000
9,000		25,000	1800,000	1700,000	70,000
10,000		25,000	1800,000	1700,000	70,000
11,000		25,000	1800,000	1700,000	70,000
11,500		25,000	1800,000	1700,000	70,000
12,000		25,000	1800,000	1700,000	70,000
13,000		25,000	1800,000	1700,000	70,000
14,000		25,000	1800,000	1700,000	70,000
15,000		25,000	1800,000	1700,000	70,000
16,000		25,000	1800,000	1700,000	70,000
17,000		25,000	1800,000	1700,000	70,000
18,000		25,000	1800,000	1700,000	70,000
19,000		25,000	1800,000	1700,000	70,000
20,000		25,000	1800,000	1700,000	70,000
21,000		25,000	1800,000	1700,000	70,000
22,000		25,000	1800,000	1700,000	70,000
23,000		25,000	1800,000	1700,000	70,000
24,000		25,000	1800,000	1700,000	70,000
25,000	63/64	25,000	1800,000	1700,000	70,000
26,000		25,000	1800,000	1695,000	75,000
27,000		25,000	1800,000	1695,000	75,000
28,000		25,000	1800,000	1695,000	75,000
29,000		25,000	1800,000	1695,000	75,000
30,000		25,000	1800,000	1695,000	75,000
31,000		25,000	1800,000	1695,000	75,000
32,000		25,000	1800,000	1695,000	75,000



# HARTNER

## Einlippenbohrer E 80 XXL

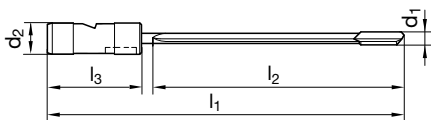
Artikel-Nr. 89543



P	M	K	N	S	H
●	○	●	○	○	○



für die Verwendung auf Tiefbohrmaschinen • Lagerartikel mit fixer Gesamtlänge für Tiefbohrmaschinen • polierte Spannuten • gelöteter Hartmetallkopf mit Umfangsform G



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
4,000		25,000	2000,000	1900,000	70,000
5,000		25,000	2000,000	1900,000	70,000
6,000		25,000	2000,000	1900,000	70,000
7,000		25,000	2000,000	1900,000	70,000
8,000		25,000	2000,000	1900,000	70,000
9,000		25,000	2000,000	1900,000	70,000
10,000		25,000	2000,000	1900,000	70,000
11,000		25,000	2000,000	1900,000	70,000
11,500		25,000	2000,000	1900,000	70,000
12,000		25,000	2000,000	1900,000	70,000
13,000		25,000	2000,000	1900,000	70,000
14,000		25,000	2000,000	1900,000	70,000
15,000		25,000	2000,000	1900,000	70,000
16,000		25,000	2000,000	1900,000	70,000
17,000		25,000	2000,000	1900,000	70,000
18,000		25,000	2000,000	1900,000	70,000
19,000		25,000	2000,000	1900,000	70,000
20,000		25,000	2000,000	1900,000	70,000
21,000		25,000	2000,000	1900,000	70,000
22,000		25,000	2000,000	1900,000	70,000
23,000		25,000	2000,000	1900,000	70,000
24,000		25,000	2000,000	1900,000	70,000
25,000	63/64	25,000	2000,000	1900,000	70,000
26,000		25,000	2000,000	1895,000	75,000
27,000		25,000	2000,000	1895,000	75,000
28,000		25,000	2000,000	1895,000	75,000
29,000		25,000	2000,000	1895,000	75,000
30,000		25,000	2000,000	1895,000	75,000
31,000		25,000	2000,000	1895,000	75,000
32,000		25,000	2000,000	1895,000	75,000



## Einlippenbohrer E 800 mit Wechselplatten

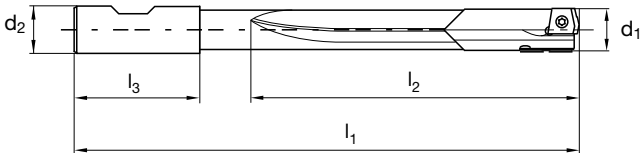
Artikel-Nr. 89530



P	M	K	N	S	H
•	○	○	•	○	



Bohrtiefe bis 30xD • mit Wechselplatten • mit Wendeführungsleisten • mit Schraubendreher • mit Schrauben • universell einsetzbar



d1 mm	inch	d2 h6 mm	l1 mm	l2 mm	l3 mm
12,000		20,000	446,000	384,000	50,000
12,700	1/2	20,000	468,000	406,000	50,000
14,000		20,000	510,000	448,000	50,000
15,000		25,000	548,000	480,000	56,000
16,000		25,000	580,000	512,000	56,000
18,000		25,000	644,000	576,000	56,000
20,000		32,000	712,000	640,000	60,000
24,000		32,000	840,000	768,000	60,000



## Schneidplatten für Einlippenbohrer E 800

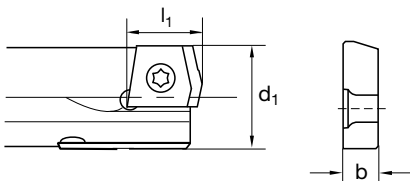
Artikel-Nr. 89535



P	M	K	N	S	H
●	○	○	●	○	



universell einsetzbar



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
12,000	10,000	2,800	12,000	25,500	15,000	4,000	25,500
12,500	10,000	2,800	12,500	25,800	15,000	4,000	25,800
12,700	10,000	2,800	12,700	26,000	16,000	5,000	26,000
13,000	10,000	2,800	13,000	26,500	16,000	5,000	26,500
13,500	10,000	2,800	13,500	27,000	16,000	5,000	27,000
14,000	10,000	2,800	14,000	27,500	16,000	5,000	27,500
14,500	10,000	2,800	14,500	28,000	16,000	5,000	28,000
15,000	10,000	2,800	15,000	28,100	16,000	5,000	28,100
16,000	12,000	3,000	16,000	28,500	16,000	5,000	28,500
16,100	12,000	3,000	16,100	29,000	16,000	5,000	29,000
16,300	12,000	3,000	16,300	29,500	16,000	5,000	29,500
16,500	12,000	3,000	16,500	29,700	16,000	5,000	29,700
17,000	12,000	3,000	17,000	30,000	18,000	6,000	30,000
17,500	12,000	3,000	17,500	30,100	18,000	6,000	30,100
18,000	12,000	3,000	18,000	30,500	18,000	6,000	30,500
18,400	12,000	3,000	18,400	31,000	18,000	6,000	31,000
18,500	12,000	3,000	18,500	31,500	18,000	6,000	31,500
19,000	12,000	3,000	19,000	32,000	18,000	6,000	32,000
19,300	12,000	3,000	19,300	32,500	18,000	6,000	32,500
19,500	12,000	3,000	19,500	33,000	18,000	6,000	33,000
19,800	12,000	3,000	19,800	33,500	18,000	6,000	33,500
20,000	15,000	4,000	20,000	34,000	19,000	6,500	34,000
20,200	15,000	4,000	20,200	34,500	19,000	6,500	34,500
20,500	15,000	4,000	20,500	35,000	19,000	6,500	35,000
21,000	15,000	4,000	21,000	35,500	19,000	6,500	35,500
21,500	15,000	4,000	21,500	36,000	19,000	6,500	36,000
22,000	15,000	4,000	22,000	36,500	19,000	6,500	36,500
22,200	15,000	4,000	22,200	37,000	19,000	6,500	37,000
22,500	15,000	4,000	22,500	37,500	19,000	6,500	37,500
23,000	15,000	4,000	23,000	37,700	19,000	6,500	37,700
23,500	15,000	4,000	23,500	38,000	20,000	7,000	38,000
24,000	15,000	4,000	24,000	38,100	20,000	7,000	38,100
24,500	15,000	4,000	24,500	38,500	20,000	7,000	38,500
25,000	15,000	4,000	25,000	39,000	20,000	7,000	39,000
25,100	15,000	4,000	25,100	39,500	20,000	7,000	39,500
25,400	15,000	4,000	25,400	40,000	20,000	7,000	40,000



## Führungsleisten für Einlippenbohrer E 800

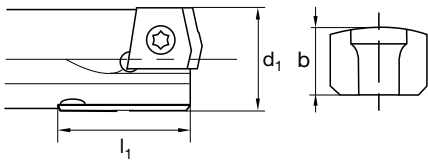
Artikel-Nr. 89536



P	M	K	N	S	H
●	○	○	●	○	



universell einsetzbar



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
12,000	19,950	2,150	12,000	25,500	25,000	3,350	25,500
12,500	19,950	2,150	12,500	25,800	25,000	3,500	25,800
12,700	19,950	2,250	12,700	26,000	25,000	3,850	26,000
13,000	19,950	2,150	13,000	26,500	25,000	3,850	26,500
13,500	19,950	2,150	13,500	27,000	25,000	3,850	27,000
14,000	19,950	2,150	14,000	27,500	25,000	3,850	27,500
14,500	19,950	2,150	14,500	28,000	25,000	3,850	28,000
15,000	19,950	2,150	15,000	28,100	25,000	3,900	28,100
16,000	20,000	2,850	16,000	28,500	25,000	3,850	28,500
16,100	20,000	2,900	16,100	29,000	25,000	3,850	29,000
16,300	20,000	3,000	16,300	29,500	25,000	3,850	29,500
16,500	20,000	2,850	16,500	29,700	25,000	3,950	29,700
17,000	20,000	2,850	17,000	30,000	30,000	4,350	30,000
17,500	20,000	2,850	17,500	30,100	30,000	4,400	30,100
18,000	20,000	2,850	18,000	30,500	30,000	4,350	30,500
18,400	20,000	3,050	18,400	31,000	30,000	4,350	31,000
18,500	20,000	2,850	18,500	31,500	30,000	4,350	31,500
19,000	20,000	2,850	19,000	32,000	30,000	4,350	32,000
19,300	20,000	3,000	19,300	32,500	30,000	4,350	32,500
19,500	20,000	2,850	19,500	33,000	30,000	4,350	33,000
19,800	20,000	3,000	19,800	33,500	30,000	4,350	33,500
20,000	25,000	3,350	20,000	34,000	30,000	4,850	34,000
20,200	25,000	3,450	20,200	34,500	30,000	4,850	34,500
20,500	25,000	3,350	20,500	35,000	30,000	4,850	35,000
21,000	25,000	3,350	21,000	35,500	30,000	4,850	35,500
21,500	25,000	3,350	21,500	36,000	30,000	4,850	36,000
22,000	25,000	3,350	22,000	36,500	30,000	4,850	36,500
22,200	25,000	3,450	22,200	37,000	30,000	4,850	37,000
22,500	25,000	3,350	22,500	37,500	30,000	4,850	37,500
23,000	25,000	3,350	23,000	37,700	30,000	4,950	37,700
23,500	25,000	3,350	23,500	38,000	30,000	5,350	38,000
24,000	25,000	3,350	24,000	38,100	30,000	5,400	38,100
24,500	25,000	3,350	24,500	38,500	30,000	5,350	38,500
25,000	25,000	3,350	25,000	39,000	30,000	5,350	39,000
25,100	25,000	3,400	25,100	39,500	30,000	5,350	39,500
25,400	25,000	3,550	25,400	40,000	30,000	5,600	40,000



## Zweilippenbohrer Z 80

Artikel-Nr. 89508



P	M	K	N	S	H
			•		



Bohrtiefe bis 30xD • 4-Fasen TLB • für Aluminium

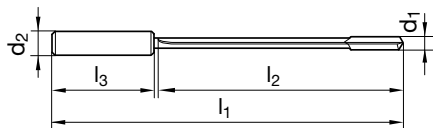
Artikel-Nr. 89518



P	M	K	N	S	H
		•			



Bohrtiefe bis 30xD • 4-Fasen TLB • für Gusswerkstoffe



d1		d2 h6	l1	l2	l3
mm	inch	mm	mm	mm	mm
8,000		16,000	330,000	280,000	48,000
10,000		20,000	390,000	340,000	50,000
12,000		20,000	450,000	400,000	50,000



## Qualitätsmerkmale

In der Zerspanungstechnik wird ab einer Bohrtiefe von 15xD und mehr vom so genannten Tieflochbohren gesprochen:

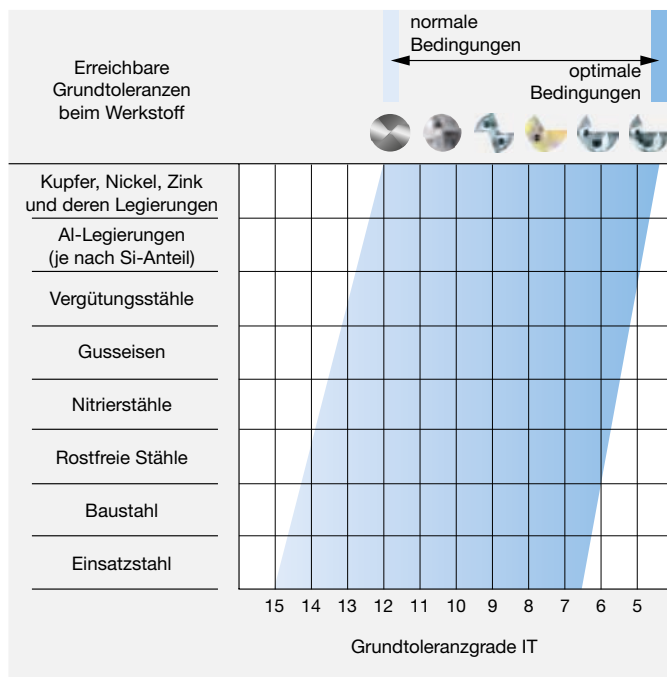
- klassische Einlippen-Tieflochbohrer aus VHM oder mit gelötetem HM-Kopf
- klassische Zweilippen-Tieflochbohrer mit gelötetem HM-Kopf
- Wechselsystem mit austauschbaren VHM-Schneiden und Leisten
- spiralisierte VHM- bzw. HSS-/HSS-E-Tieflochbohrer

Je nach Anwendungsfall und Qualitätsanforderungen an die Bohrung wird das richtige Werkzeug ausgewählt.

Die folgenden Diagramme geben eine Hilfestellung zur Werkzeugauswahl:

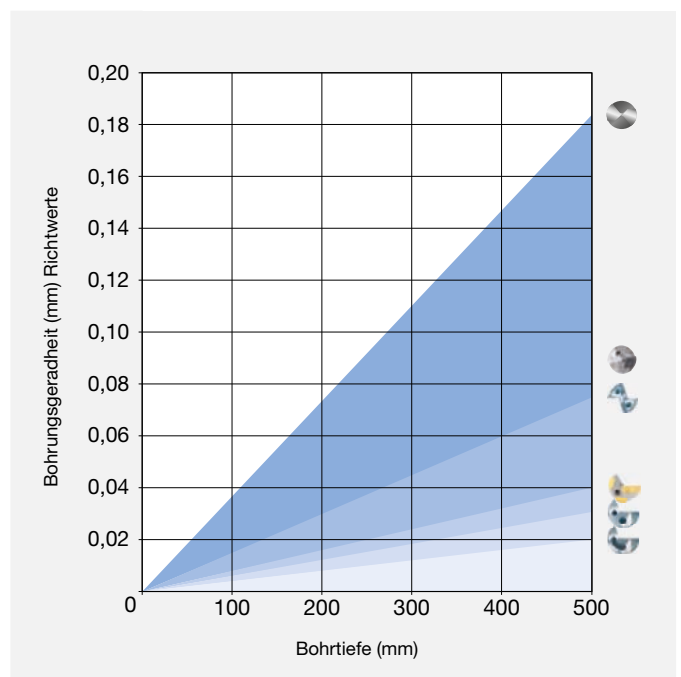
### Grundtoleranzen

Die verschiedenen Werkzeugtypen erzeugen aufgrund ihrer Bauform unterschiedliche Grundtoleranzen. Der Einlippenbohrer fertigt extrem präzise Bohrungen. Mit einem Einlippen-Tieflochbohrer können unter besten Bedingungen Toleranzen bis zu IT5 erreicht werden.



### Bohrungsgeradheit

Die Bohrungsgeradheit beschreibt eine Richtungsabweichung. Diese wird beeinflusst durch die Zentrierung des Werkzeuges beim Anbohren in Abhängigkeit von Form und Lage der Pilotierung bzw. der Bohrbuchse. Material- oder Werkstückeigenschaften als auch die Werkzeug- und Maschinenstabilität beeinflussen das Geradheitsergebnis zusätzlich.



Rauheitsklassen		N12	N11	N10	N9	N8	N7	N6	N5	N4	N3
E 100/E 80 Tiefbohren											
E 800 Tiefbohren											
Z 80/TS 100 T Tiefbohren											
HSS/HSS-E Tiefbohren											
E 100/80/800 Aufbohren											
Oberflächenwerte	Rz (µm)	160	100	63	40	15,6	7,87	4,65	2,60	1,74	0,81
Rauheitswerte	Ra (µm)	50	25	12,5	6,3	3,2	1,6	0,8	0,4	0,2	0,1

■ normale Bedingungen (Richtwerte)    
 ■ ideale Bedingungen

### Oberflächengüte

Die Rauheit der Bohrung wird von vielen Faktoren beeinflusst. Maßgebend sind Werkzeugart- und -geometrie, der Werkstoff sowie das Kühlmittel. Im Gegensatz zu mehrschneidigen Werkzeugen wird beim Einlippenbohren die Bohrungswand durch die Führungsleisten zusätzlich geglättet. Oberflächen am Werkzeug (z. B. Beschichtung) oder Kantenzustände (Verschleiß) an Haupt- und Nebenschneiden entscheiden über die Oberflächengüte.

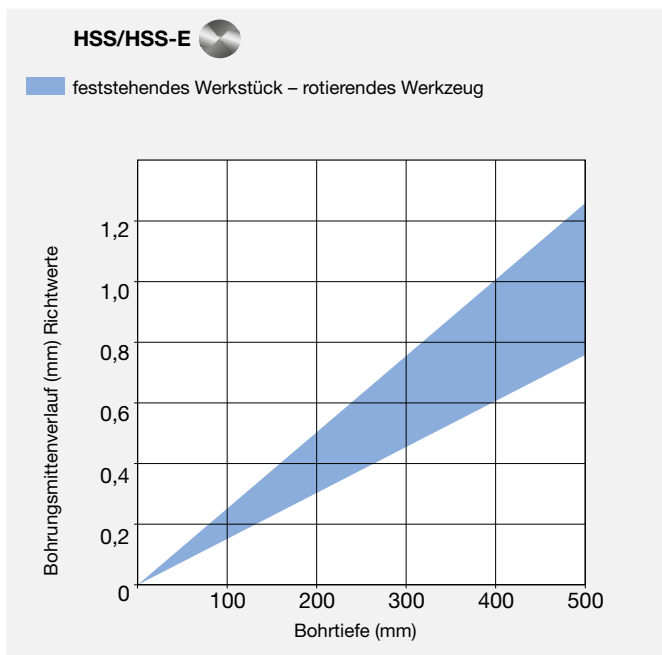
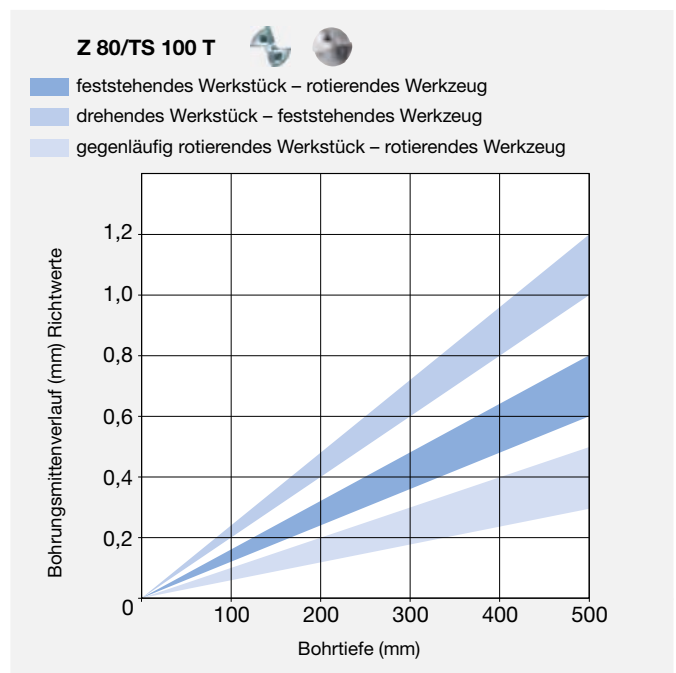
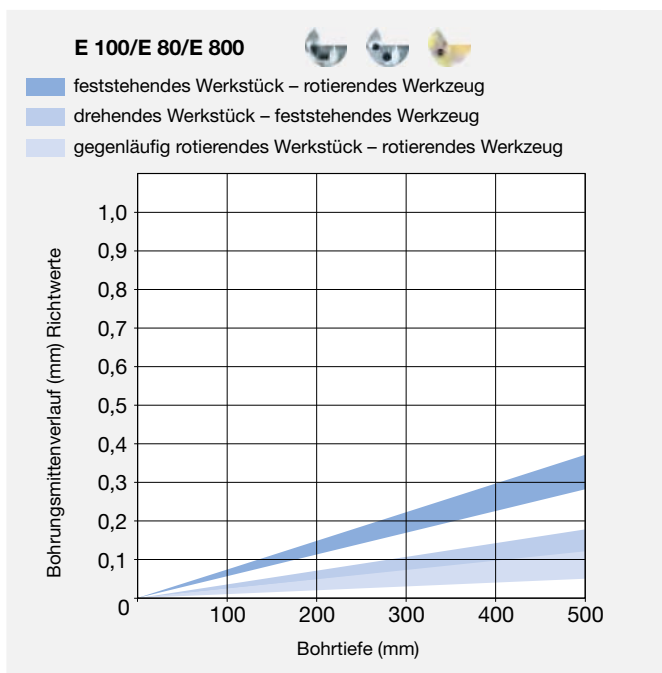




### Bohrungsmittenverlauf

Ein kontinuierliches Abdrängen des Werkzeuges bei zunehmender Bohrtiefe beschreibt den Bohrungsmittenverlauf. Neben geometrischen Eigenschaften am Bohrer beeinflussen die Schnittbedingungen, Materialgefüge und Temperaturen das Verlaufsergebnis. Bei einer Bearbeitung mit gegenläufigen Dreh-

zahlen von Werkstück und Werkzeug werden optimale Ergebnisse erzielt. Der Einlippenbohrer erzeugt im Vergleich zu mehrschneidigen Bohrem geringste Mittenabweichungen.





## Anwendung der Hartner-Schichten

Material	ISO-Gruppen	E/Z	TS 100 T	HSS
<b>C-Stähle, Automatenstähle, Mn-Stähle</b>		TiN TiSiN TiAlSiN	TiSiN TiAlZrN FIRE	FIRE - -
<b>Stahl, niedrig legiert</b>		blank TiN FIRE	FIRE TiSiN TiAlZrN	FIRE TiN -
<b>Stahl, legiert</b>		FIRE TiAlSiN	FIRE TiAlSiN AlTiN nano	FIRE TiN -
<b>Stahl, gehärtet, &lt;55 HRC</b>		TiAlSiN FIRE TiAlN	TiAlSiN FIRE TiAlN	- - -
<b>Stahl, gehärtet, 55-65 HRC</b>		TiAlSiN FIRE TiAlN	TiAlSiN FIRE TiAlN	- - -
<b>Stahl, rost- und säurebeständig</b>		SuperA AlTiZrN TiAlSiN	AlTiN nano AlTiZrN TiSiN	AlTiZrN FIRE TiN
<b>Gusseisen</b>		TiAlSiN TiSiN FIRE	TiAlSiN FIRE AlTiN nano	FIRE - -
<b>Nickelbasislegierungen (z.B. Inconel)</b>		AlTiN nano AlTiZrN TiSiN	AlTiN nano TiAlSiN FIRE	FIRE - -
<b>Titan/Titanlegierungen</b>		blank ZrN AlTiN nano	ZrN AlTiN nano	FIRE -
<b>Kobalt-Chrom-Legierungen</b>		AlTiN nano FIRE TiAlSiN	AlTiN nano TiAlSiN FIRE	- - -
<b>Edelmetalle</b>		AlTiN nano DLC	AlTiN nano	-
<b>Aluminiumknetlegierungen</b>		blank DLC -	blank DLC Diamant	blank DLC -
<b>Aluminiumgusslegierungen (&lt;12% Silizium)</b>		blank ZrN DLC	blank ZrN DLC	blank ZrN DLC
<b>Aluminiumgusslegierungen (≥12% Silizium)</b>		Diamant TiAlSiN -	Diamant - -	- - -
<b>Kupfer/Bronze/Messing</b>		blank DLC CrN	CrN DLC	TiN -
<b>Keramik</b>		Diamant TiAlSiN	Diamant	-
<b>Kunststoffe, unverstärkt</b>		blank	DLC	-
<b>Kunststoffe, faserverstärkt</b>		Diamant TiAlSiN	Diamant TiAlSiN	- -
<b>Graphit</b>		blank	-	-

**Hinweis:** Die Übersicht zeigt die allgemeinen Anwendungsempfehlungen der Hartner-Schichten.  
Die Priorisierung erfolgt jeweils von oben nach unten.



## Einführung zum Thema Tieflochbohren

In der Zerspanungstechnik wird ab einer Bohrtiefe von  $15xD$  und mehr vom so genannten Tieflochbohren gesprochen, wobei selbstverständlich auch kürzere Bohrungen mit Tieflochbohrern hergestellt werden können. Man nutzt somit die positiven Begleiterscheinungen der Bohrung wie gute Oberfläche, geringe Durchmesserabweichung und optimierte Geradheit.

### Hochdruckkühlung – inzwischen eine Selbstverständlichkeit.

Da sich in den letzten Jahren die Innenkühlung bei sämtlichen Bohrwerkzeugen durchgesetzt hat, wird der Kühlschmierstoff seinem Namen gerecht und durch Kühlkanäle dorthin gebracht, wo er dringend benötigt wird. Man erreichte mit dieser Maßnahme auch bei Spiralbohrern, Gewindeschneidern und weiteren spannenden Fertigungsverfahren deutliche Standzeit-Verbesserungen und weniger Werkzeugbrüche. Jede konventionelle Werkzeugmaschine wird heute mit Hochdruck-Innenkühlung angeboten und ist somit auch zum Tiefbohren geeignet. Der Anteil der Tieflochbohrer auf Bearbeitungszentren, Dreh- und Fräsmaschinen gewinnt immer mehr an Bedeutung. Das Verfahren wird dadurch in der Zerspanungstechnik immer populärer.

### Tipps und Tricks

- Bei Bohrtiefen über  $40xD$  empfehlen wir beim Einsatz der klassischen Tieflochbohrern mit Stahl-Schaft E 80, E 800 und Z 80 die Verwendung von zwei oder mehr Tieflochbohrern, z. B.  $\varnothing 10 \times 400 \text{ mm}$  und  $\varnothing 9,95 \times 800 \text{ mm}$ .
- Die VHM-Tieflochbohrer E 100 M und der gelötete E 100 können eine maximale Bohrtiefe von  $80xD$  mit nur einem Werkzeug erreichen.
- Tieflochbohrer für Bohrtiefen über  $40xD$  sollten im Linkslauf in die Pilotbohrung eingefahren werden.
- Beim Einwechseln von Werkzeugen ab  $40xD$  kann das Werkzeug durch Aufschalten der Hochdruck-Innenkühlung für ca. 1 Sekunde beruhigt werden.
- Für die Bearbeitung langspanender Werkstoffe empfehlen wir die Bestellung von Tieflochbohrern mit polierten Spannuten.
- Generell empfehlen wir, den Fettgehalt der Emulsion auf mindestens 8 % einzustellen.
- Einlippen-Tieflochbohrer für langspanendes Aluminium sollten mit Anschliff  $180^\circ$  und Ölraumabsatz bestellt werden.
- Ein fester Sitz von Lünettenbuchsen beruhigt den Bohrprozess und steigert die Bohrungsqualität.
- Um einen Absatz zwischen Pilot- und Tieflochbohrung zu vermeiden kann mit Umfangsform G und einer Pilotierung mit geringfügigem Untermaß ein glatter Übergang erreicht werden.
- Bei langer Spanbildung kann eine periodische Vorschubunterbrechung (ohne Rückzug) einen Bearbeitungsprozess ermöglichen.



Sämtliche Tieflochbohrer müssen beim Anbohren geführt werden. Tieflochbohrer dürfen nie mit voller Drehzahl frei im Maschinenraum bewegt werden.

Tiefbohren ist kein Buch mit sieben Siegeln, sondern durch Einhaltung von gewissen Voraussetzungen von jedermann beherrschbar. Richtwerte für den Einsatz der Hartner-Tieflochbohrer finden Sie im Kapitel Einsatzempfehlungen .

## Das Bohrverfahren auf konventionellen Maschinen (BAZ)

### Die Arbeitsschritte beim Tiefbohren

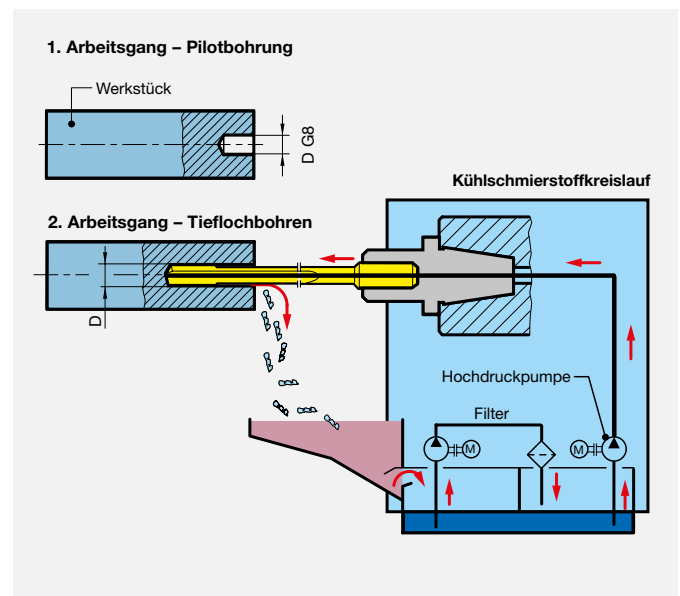
- Herstellen einer Pilotbohrung
- Einfahren mit geringer Drehzahl
- Einstellen des Kühlschmierstoffdruckes und der Drehzahl
- Kontinuierliches Bohren auf Bohrtiefe ohne Entspannen
- Abschalten der Kühlschmierstoff-Zufuhr nach Erreichen der Bohrtiefe
- Rückzug des Werkzeugs aus der Bohrung

### Vorgehensweise

Um bei der Herstellung tiefer Bohrungen optimale Bearbeitungsergebnisse insbesondere beim Anbohren auf Radien und/oder unebener Oberflächenstruktur zu erzielen, empfehlen wir folgende Bearbeitungsschritte:

1. Anfräsen einer Fläche, z. B. mit dem TF 100 MULTI-MILL. Die Fläche muss rechtwinklig zum Eintrittswinkel der Bohrbearbeitung ausgeführt werden.
2. Herstellen einer zylindrischen Pilotbohrung, z. B. mit dem TS 100 U. Dank seines Spitzenwinkels von  $140^\circ$  und seiner  $\varnothing$ -Toleranz m7 sind diese Bohrer bestens für diesen Bearbeitungsschritt geeignet.
3. Einfahren in die Pilotbohrung mit einer Drehzahl von ca. 200 U/min bei einem Vorschub von ca. 500 mm/min im Linkslauf.
4. Einstellen des Kühlschmierstoffdruckes und der Drehzahl.
5. Kontinuierliches Bohren auf Bohrtiefe ohne Entspannen. Bei Einsatz von Tieflochbohrern mit sehr großem Längen-Durchmesser-Verhältnis (z. B. VHM-Einlippenbohrern ab Spannweite 160 mm) empfehlen wir, bis zu einer Bohrtiefe von ca. 25 mm mit reduzierten Schnittparametern (ca. 75 % der optimalen Schnittgeschwindigkeit) zu arbeiten.
6. Bei Durchgangsbohrungen mit geradem, d. h.  $90^\circ$  Austritt, die Vorschubgeschwindigkeit  $v_f$  ca. 1 mm vor dem Durchbrechen auf 50 % reduzieren.
7. Bei Durchgangsbohrungen mit schrägem Austritt die Vorschubgeschwindigkeit  $v_f$  ca. 1 mm vor dem Durchbrechen auf 40 % reduzieren.
8. Nach Erreichen der Bohrtiefe Drehzahl und Kühlschmierstoff abschalten, Ausfahren mit max. 5.000 mm/min.

**Bei nicht ausreichenden Kühlmittelschmierstoffdaten kann mit reduzierten Schnittparametern gearbeitet werden. Es sind auch Druckerhöhungssysteme möglich.**

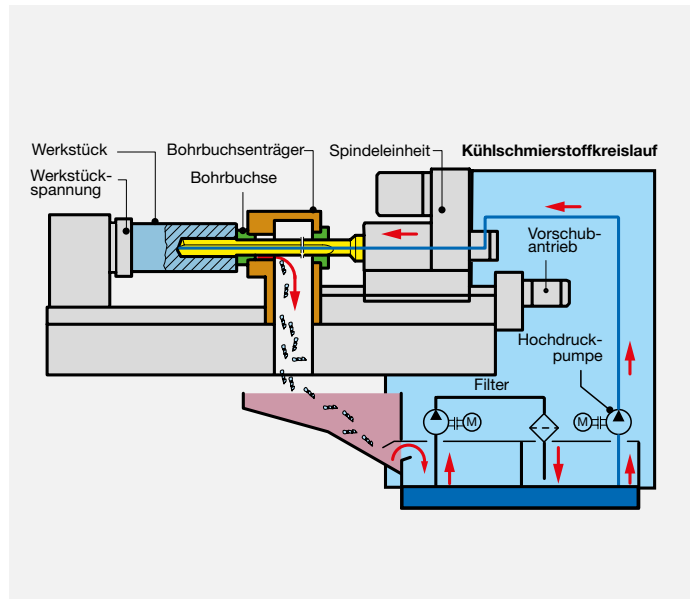




## Das Bohrverfahren auf Tiefbohrmaschinen

Bei sehr tiefen Bohrungen, in der Großserienfertigung oder bei sehr hohen Anforderungen an Oberfläche, Maßhaltigkeit und Geradheit kommt in der Regel eine Tiefbohrmaschine zum Einsatz. Die Bohrtiefe ist nahezu unbegrenzt, das Bohrwerkzeug wird mit sogenannten Lünetten geführt, die während des Bohrprozesses wie eine Ziehharmonika zusammengeschoben werden. Pilotbohrungen sind dabei nicht notwendig, da die Bohrbuchse das Werkzeug beim Anbohren führt. Ohne zu entspannen kann auf die gewünschte Bohrtiefe gebohrt werden.

Die Tiefbohrmaschine hat gegenüber der konventionellen Werkzeugmaschine mehrere Vorteile: Eine Pilotbohrung erübrigt sich, das spart Bearbeitungszeit und Werkzeugwechsel. Die Bohrtiefe kann bis zu mehreren Metern betragen, und das bei außerordentlicher Bohrungsqualität. An große Bohrtiefen angepasste Hochdruckpumpen und Filter für das Kühlmittel tragen daneben zu hoher Prozesssicherheit bei. Die Gesamtlänge der Lünetten und des Bohrbuchsenträgers ergibt die sogenannte Verlustlänge, welche bei der Längenberechnung des Werkzeuges maßgebend ist.

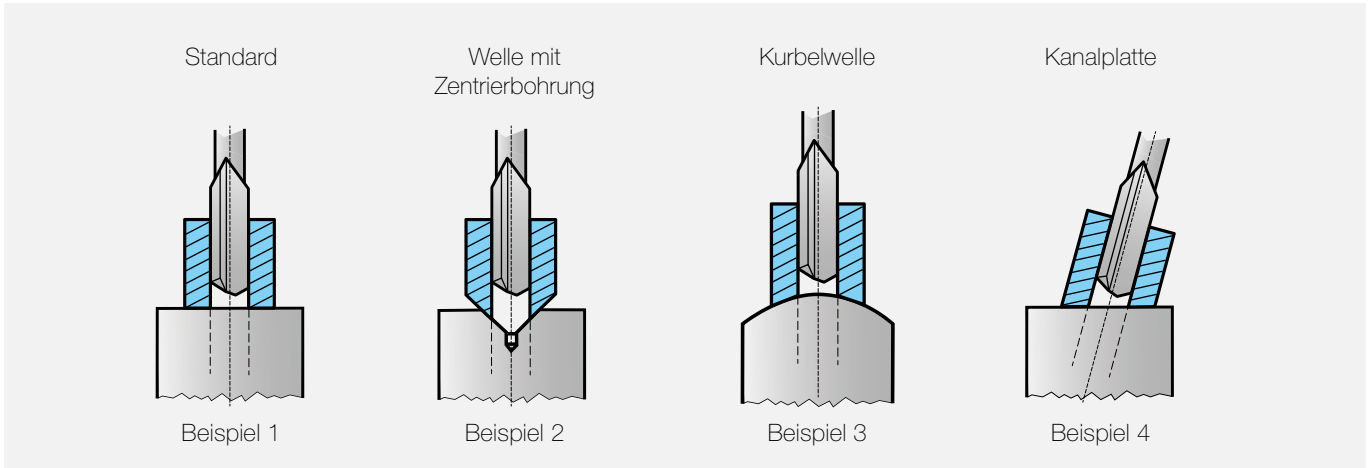




## Pilotierung und Bohrbuchse

Da es sich beim Einlippentieflochbohrer um ein einschneidiges Werkzeug handelt und dieser sich nicht selbständig zentrieren kann, muss das Werkzeug mit einer Bohrbuchse oder Pilotbohrung geführt werden. Aber auch die selbstzentrierenden Zweilippenbohrer müssen über Bohrbuchsen oder Pilotbohrungen geführt werden, da sich diese sonst aufschwingen könnten.

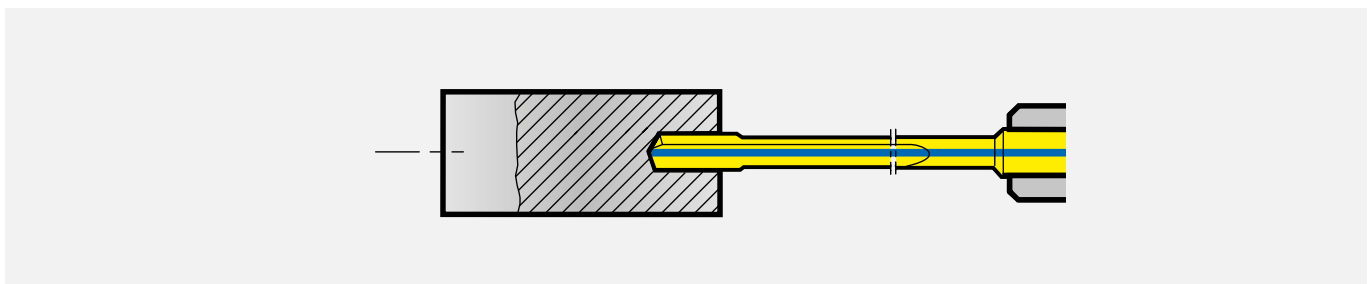
**Beispiel Bohrbuchse** mit Art.-Nr. 89600 (HSS) / 89601 (VHM)



### Zu beachten im Umgang mit Bohrbuchsen

- Die Bohrbuchse muss formschlüssig an der Anbohrkontur anliegen.
- Spiel zwischen Bohrbuchse und Werkzeug sollte so gering wie möglich gehalten werden.
- Wenn der Tieflochbohrer einen Führungsdurchmesser hat, sollte die Bohrbuchse mindestens so lang sein, dass beide Umfangsformen beim Anbohren geführt werden.
- Regelmäßige Begutachtung des Zustands der Bohrbuchse, um negativen Einflüssen auf das Werkzeug vorzubeugen.
- Wir empfehlen für Kleinserien HSS-Bohrbuchsen und für Großserien Bohrbuchsen aus VHM.

### Beispiel Pilotierung



### Richtwerte zur Pilotierungstiefe

klassische Tieflochbohrer	Nenn-Ø Folgewerkzeug				
	Ø 0,900 -1,799	Ø 1,800 -3,999	Ø 4,000 -7,999	Ø 8,000 -11,999	Ø 12,000 -52,000
bis 20xD	3,0xD	2,5xD	2,0xD	1,5xD	1,5xD
bis 30xD		3,0xD	2,5xD	2,0xD	
bis 40xD		4,0xD	3,0xD	2,5xD	



## Pilotierung und Bohrbuchse

### Anwendungsspektrum Pilotwerkzeuge

	Durchmesserbereich [mm]																		
	0,9	1,0	1,4	2,0	3,0	6,0	8,0	11,0	12,0	15,5	16,0	19,5	20,0	25,0	30,0	35,0	40,0	45,0	50,0
Kleinstbohrer	Art.-Nr. 86400 ohne IK 86405 mit IK																		
TS 100 U	Art.-Nr. 89413 ohne IK Art.-Nr. 89410 mit IK																		
Multiplex HPC	Art.-Nr. 86721 WP zum Pilotieren																		
TF 100 Pilot	Art.-Nr. 85000 4-Schneider ohne IK																		
TF 100 MULTI-MILL	Art.-Nr. 84951 4-Schneider ohne IK																		
Typ V	Art.-Nr. 84803 HSS-E ohne IK																		

#### Kleinstbohrer

- für Pilotbohrungen <math>\varnothing</math>3,000/E 100, E 80
- für Standardsituationen/ebene Anbohrfläche

#### TS 100 U

- Universal-Pilotwerkzeug  $\varnothing$ 3,000-19,500/E 100, E 80, Z 80, E 800, TS 100 T
- für Standardsituationen/ebene Anbohrfläche

#### Multiplex HPC

- WP-Pilotwerkzeug  $\varnothing$ 11,000-40,000/E 100, E 80, Z 80, E 800, TS 100 T
- für Standardsituationen/ebene Anbohrfläche

#### TF 100 Pilot

- Fräser für hochpräzise Pilotierungen  $\varnothing$ 1,400-12,000/E 100, E 80, Z 80, E 800, TS 100 T
- für Standard- und Sondersituationen/ebene, winklige, kubische oder sonstige Anbohrflächen

#### TF 100 MULTI-MILL

- Fräser für hochpräzise Pilotierungen  $\varnothing$ 4,000-52,000/E 100, E 80, Z 80, E 800, TS 100 T
- für Standard- und Sondersituationen/ebene, winklige, kubische oder sonstige Anbohrflächen

#### Typ V

- HSS Pilotbohrer  $\varnothing$ 0,900-15,500/HSS Tieflochbohrer
- für Standardsituationen/ebene Anbohrfläche

### Zu beachten im Umgang mit Pilotbohrungen

- Der Pilotierungsdurchmesser sollte G8 toleriert und die Werkzeuge grundsätzlich Nenn- $\varnothing$  m7 toleriert sein.
- Wenn der Einlippentieflochbohrer einen Führungsdurchmesser hat, sollte die Pilotbohrung mindestens so tief sein, dass beide Umfangsformen beim Anbohren geführt werden.
- Je nach Anwendung ist es teilweise von Vorteil, wenn die Pilotbohrung eine Einführfase hat.
- Wenn an die Tieflochbohrung hohe Anforderungen in Position und Verlauf gestellt wird, muss, wenn möglich, die Pilotbohrung gefräst oder auf einer Drehbank ausgedreht werden.

#### Wichtig:

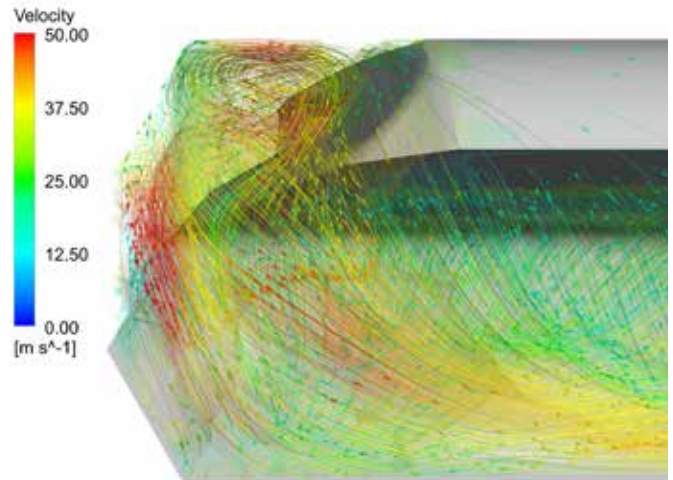
Die Qualität der Bohrbuchse und der Pilotbohrung hat einen sehr großen Einfluss auf den Bohrungsmittenverlauf und den Standweg des Folgewerkzeugs.



## Kühlschmierstoff

### Einführung

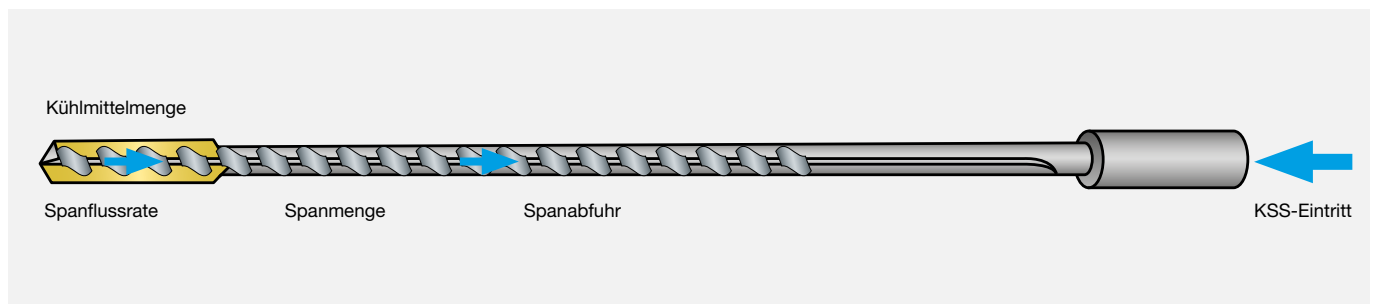
Der KSS ist einer der wichtigsten Bestandteile für das Bohren von LxD Verhältnissen größer 15xD oder im Speziellen für das Tieflochbohren. Die Auswahl der KSS-Versorgung, deren Eigenschaften sowie die Leistungen wie Druck und Volumenstrom sind entscheidend für Prozess-Performance und dadurch auch für die Bohrungsqualität. Zu hoher KSS-Druck kann Welligkeit und größeren Bohrungsverlauf erzeugen.



### Funktion

Der KSS (Öl, Emulsion, MQL, Luft) spült in erster Linie die Späne aus der Bohrung und schmiert alle werkstückberührenden Segmente des Werkzeuges (Umfang und Schneiden). Das Bohren erfolgt unter Hochdruck. Der Druck ist jedoch „nur“ die Summe aus erzeugter KSS-Menge und vorhandener Widerstände wie Kühlkanalquerschnitt- bzw. Werkzeuglänge und Spanmasse. Durch die Menge an KSS und genannter Widerstände entsteht aus hydraulischer Sicht eine Fließgeschwindigkeit, die bei korrektem Einsatz die Spankontaktzeit mit der Schneide minimal hält, ein Verstopfen der Bohrer verhindert und somit einen direkten Einfluss auf den Bearbeitungsprozess hat. Die Schmiereigenschaften

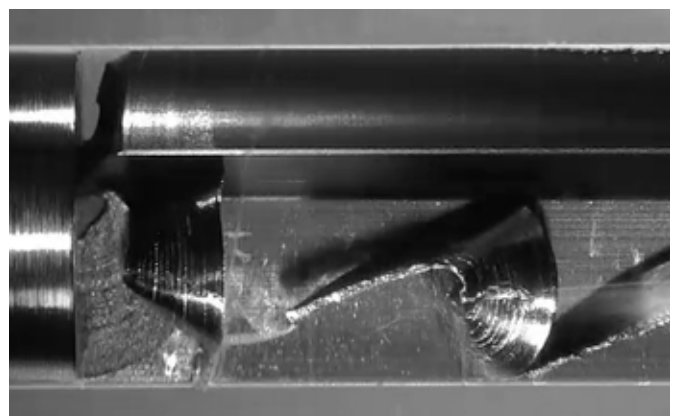
des KSS bestimmen die Spanbildung und das Oberflächen-ergebnis maßgebend. Entsprechende Additive wie EP-Zusätze (Extreme Pressure) gewährleisten das Gleiten der Führungsleisten, die unter Umständen enormer Flächenpressung und Rollkräften ausgesetzt sind.



### Filtration

Um sichere Bohrprozesse gewährleisten zu können, ist es zwingend erforderlich, eine KSS-Sauberkeit in Abhängigkeit vom Werkzeugdurchmesser bereit zu stellen:

- $< \varnothing 2,000$  maximal  $15 \mu\text{m}$
- $\varnothing 2,000$  bis  $\leq \varnothing 6,000$  maximal  $40 \mu\text{m}$
- $> \varnothing 6,000$  bis  $100 \mu\text{m}$







## Kühlschmierstoffarten

### Emulsion

Verschiedene Arten des wassermischbaren KSS, wie mineralische, synthetische oder natürliche Zusammensetzungen, beeinflussen neben dem gewähltem Fettgehalt maßgeblich den Bohrprozess. Der Fettgehalt liegt für das Tieflochbohren im Idealfall

zwischen 8-12%. Geringere Werte führen zu Einbußen in Performance bis hin zu Fehlfunktionen.



#### Emulsionseigenschaften\*

- Bei hohen Drücken sind EP-Zusätze (Extreme Pressure) in der Emulsion zu verwenden, da es ansonsten zu Schaumbildung und somit zum Verlust der Schmiereigenschaften kommen kann.
- Bei Emulsion können Drücke aufgrund der geringeren Viskosität gegenüber Öl um ca. 15 % reduziert werden, um ein vergleichbares Spülverhalten zu erreichen.
- Bei Materialsorten mit einem Chrom-Gehalt größer 12% ist mit einem Standweg von unter 1,5 m zu rechnen.

### Öl

Tiefbohröl unterscheidet sich ebenso wie die Emulsion durch seine mineralische, synthetische und natürliche Zusammensetzung. Die höhere Viskosität von Tiefbohrölen gegenüber Emulsion bestimmt zum Teil den erhöhten Kühlmittelwiderstand, welcher bei niederviskosen Ölen entweder zu hohen Fließgeschwindigkeiten (kleine Durchmesser) oder bei hochviskosen Ölen zu größeren hydraulischen Kräften führt (entscheidend bei größeren Durchmessern). Öle reagieren in ihrer Viskosität und Schmiereigenschaft stark auf Temperatur. Eine Überhitzung >50°C ist zu vermeiden um prozesssicher bohren zu können.

#### Öleigenschaften\*

- <math>\varnothing 2\text{mm}</math> 7-10mm<sup>2</sup>/s
- >math>\varnothing 2\text{mm}</math> 10-20mm<sup>2</sup>/s

### MQL / Trocken

Das Tieflochbohren ist trocken bzw. mit MQL möglich. Abhängig von Werkstoff, Durchmesser und Bohrtiefe können entsprechende Prozesse ausgeführt werden. Maßgebend sind die Form, Größe und Masse der Späne.

Trockenbearbeitung ist lediglich bei der Entstehung staubartiger Späne möglich (z. B. Graphit oder HM-Grünlinge).



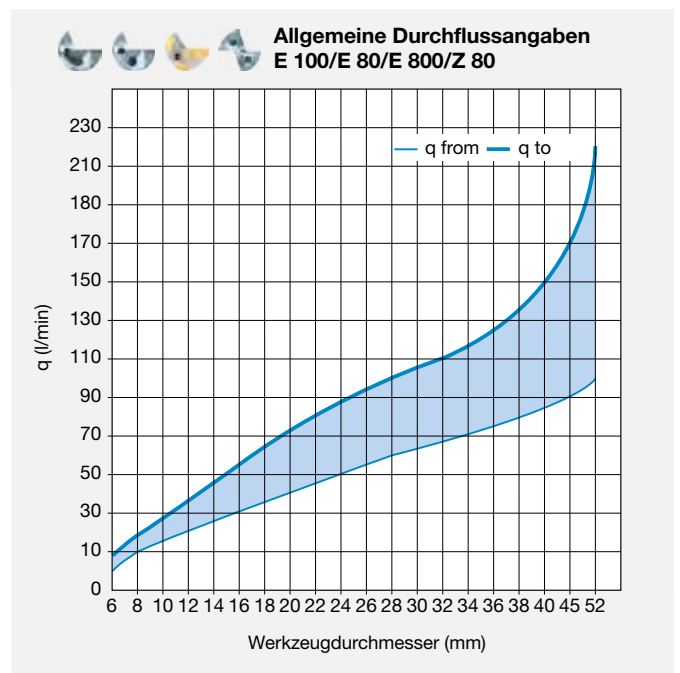
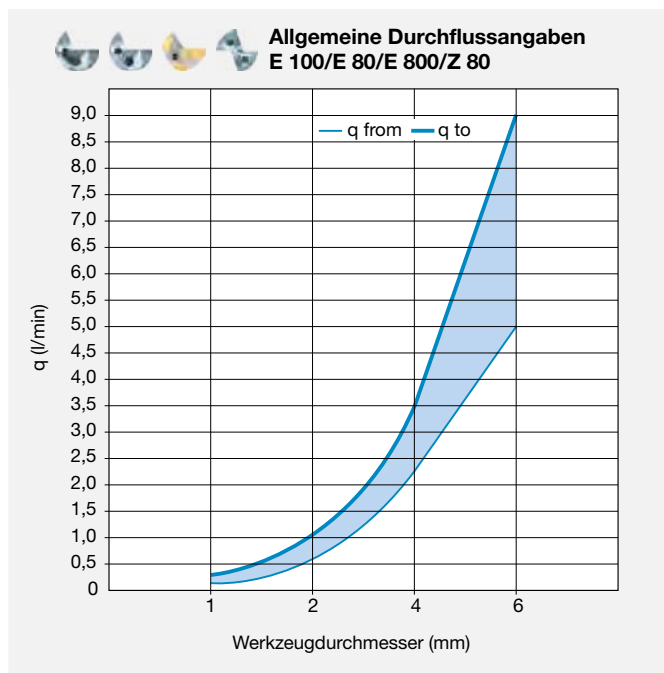
\*keine Haftungsübernahme bei Abweichung von Herstellervorgaben



## Kühlschmierstoffangaben

### Bitte beachten:

- Sämtliche Tieflochbohrer können nur mit Innenkühlung eingesetzt werden, egal ob Luft, Emulsion oder Öl. Mit Innenkühlung ist der Abtransport der Späne besser gewährleistet.
- Sämtliche Tieflochbohrer können auch mit Öl als Medium für die Innenkühlung eingesetzt werden. Es ist dann jedoch ein erhöhter Druck gegenüber Emulsion erforderlich, um die gleiche Kühlmittelmenge zu erhalten.
- Werden Tieflochbohrer mit MQL eingesetzt, kann bei kleineren Nenndurchmessern eine Druckerhöhung nötig werden, je nach Systemdruck der MQL-Anlage.
- Bei nicht ausreichenden Kühlschmierstoffdaten kann mit reduzierten Schnittparametern gearbeitet werden. Es sind auch Druckerhöhungssysteme möglich.
- Mit zunehmender Länge eines Tieflochbohrers muss mit Druckerhöhungen gerechnet werden, um die benötigte Kühlmittelmenge durch die Kühlkanäle zu transportieren.

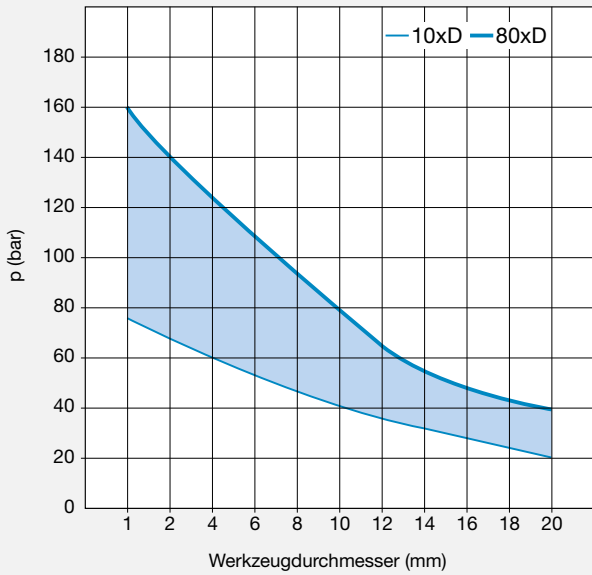




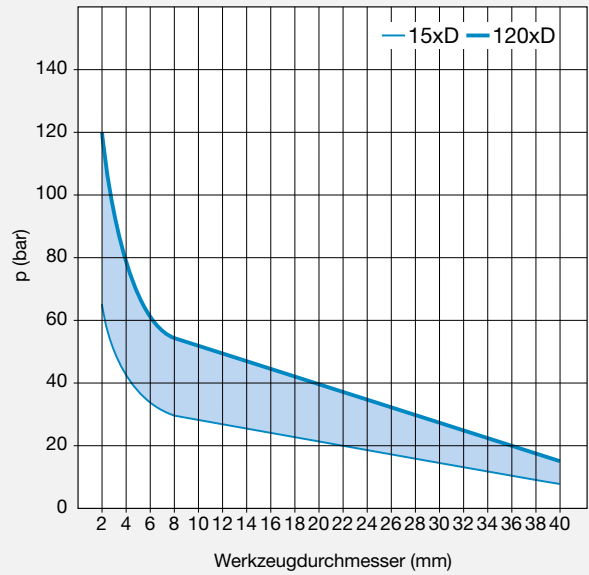
## Kühlschmierstoffangaben



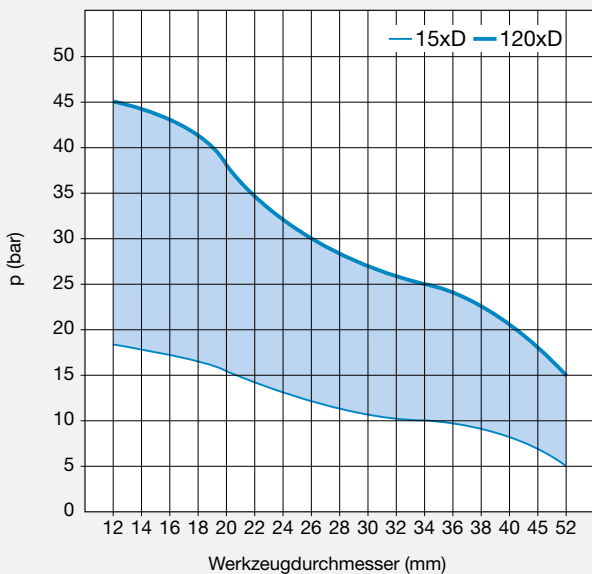
**E 100 Druckvorgaben**  
abhängig von der Werkzeuglänge



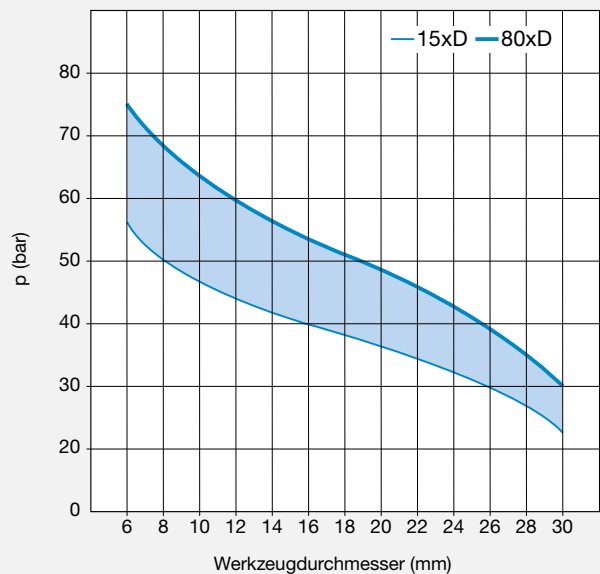
**E 80 Druckvorgaben**  
abhängig von der Werkzeuglänge



**E 800 Druckvorgaben**  
abhängig von der Werkzeuglänge



**Z 80 Druckvorgaben**  
abhängig von der Werkzeuglänge



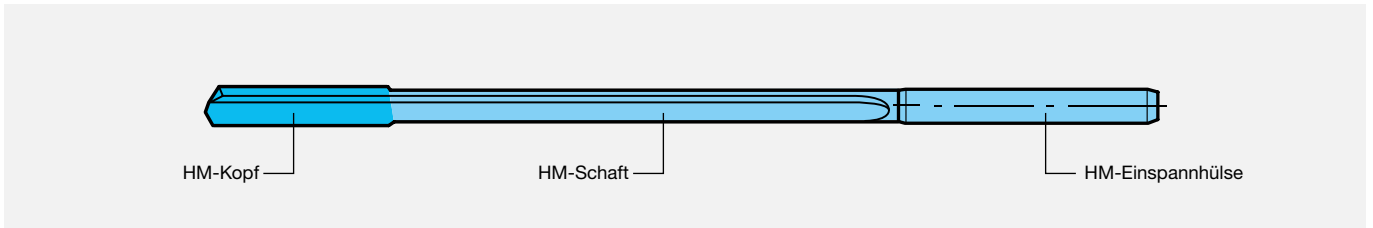


## Eigenschaften

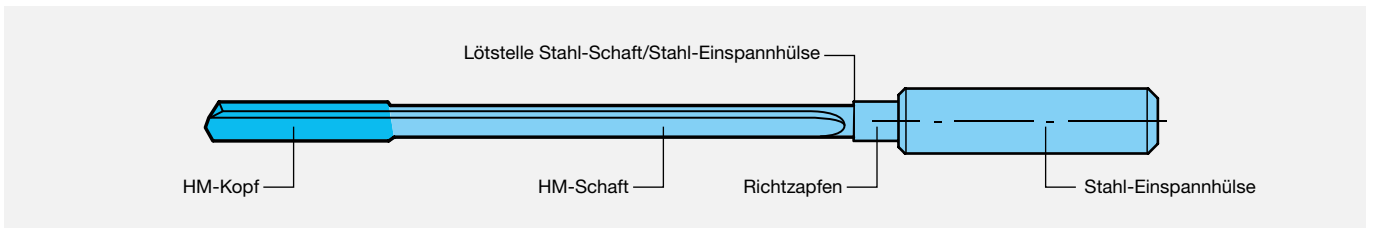
### Anwendungsspektrum

	Durchmesserbereich																		
	0,9	1,0	2,0	4,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0	30,0	35,0	40,0	45,0	50,0	52,0
E 100 M	max. Gesamtlänge 615 mm																		
E 100	max. Gesamtlänge 615 mm																		
E 80	max. Gesamtlänge 3.600 mm																		
Z 80	max. Gesamtlänge 1.000 mm																		
E 800	max. Gesamtlänge 3.600 mm																		

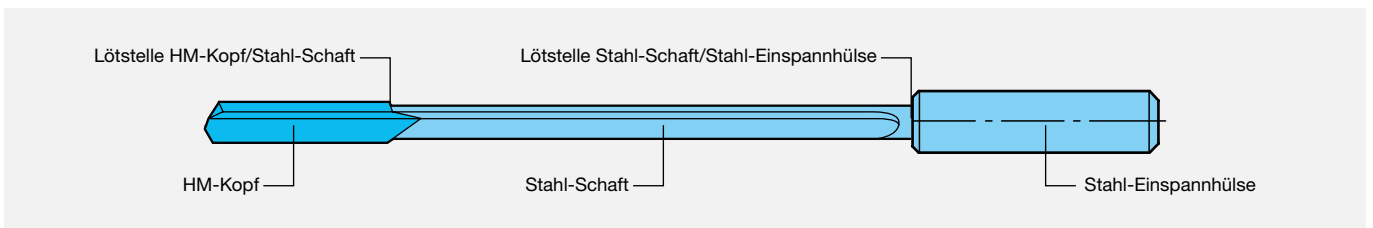
### E 100 M



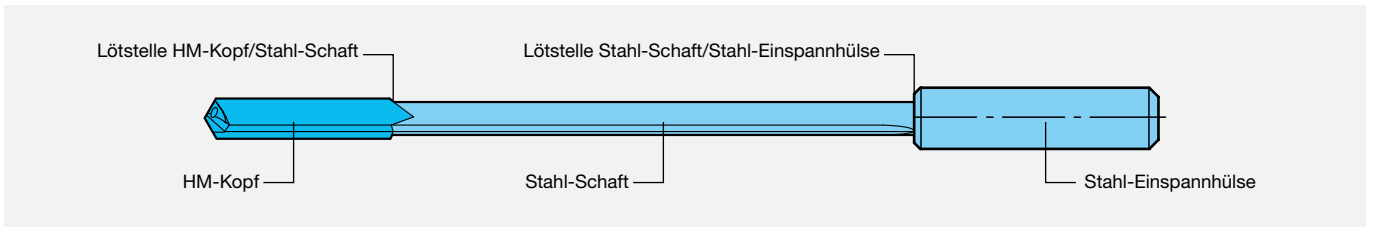
### E 100



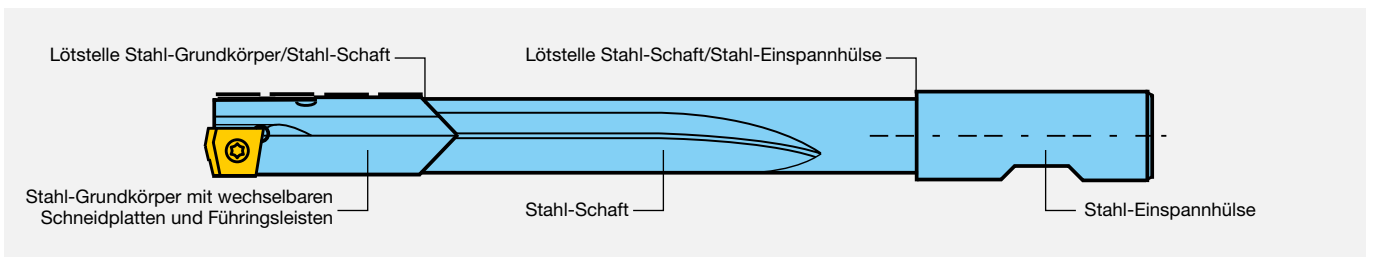
### E 80



### Z 80

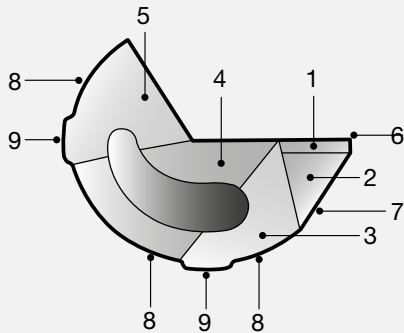


### E 800

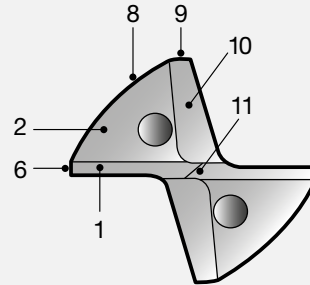




### Merkmale – Anschlag E



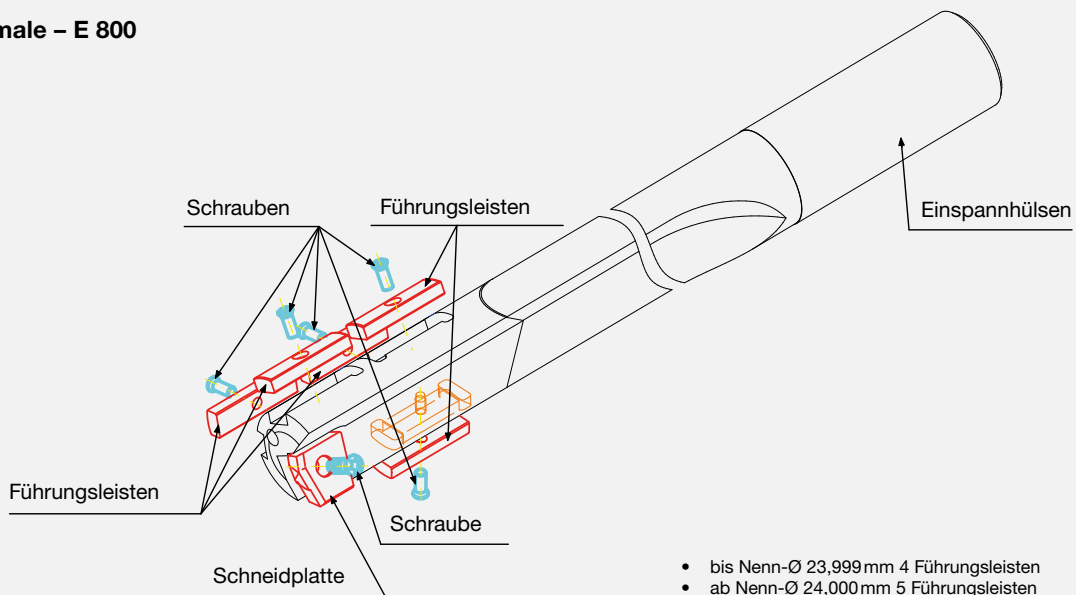
### Merkmale – Anschlag Z



#### Erklärung:

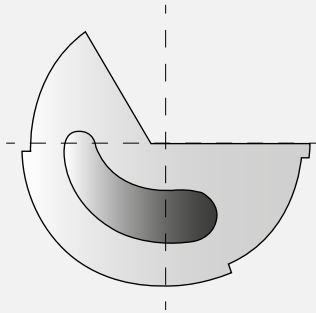
- 1 – Außenschneide 1. Freifläche
- 2 – Außenschneide 2. Freifläche
- 3 – Freifläche Spitze
- 4 – Innenschneide
- 5 – Öl-Raum
- 6 – Nebenschneide (Rundschliffase)
- 7 – Hinterschliff (Öltasche)
- 8 – Rückendurchmesser
- 9 – Stützleisten (Umfangsform)
- 10 – Ausspitzung
- 11 – Querschneide

### Merkmale – E 800





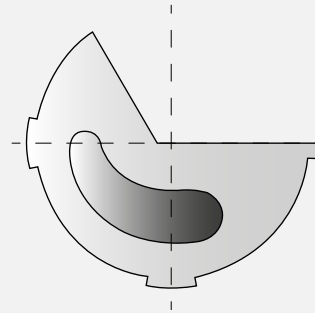
## Standard-Umfangsformen



### Umfangsform G

Standard-Umfangsform. Geeignet für die meisten Werkstoffe und Bohraufgaben. Der Werkzeugdurchmesser ist bei dieser Form nach der Fertigung nicht mehr messbar.

- für fast alle Bohraufgaben geeignet
- für alle Materialien
- geringer Bohrungsverlauf
- geringe Klemmneigung
- enge Bohrungstoleranz



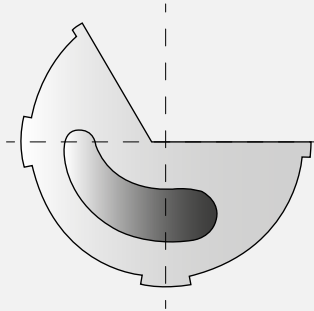
### Umfangsform C

Diese Umföngsform wird bevorzugt bei engen Bohrungstoleranzen bezüglich Bohrungsdurchmesser und Oberfläche verwendet.

- für alle Materialien
- Stahl, rostfreier Stahl, Aluminium
- geringer Bohrungsverlauf
- geringe Klemmneigung



## Sonder-Umfangsformen

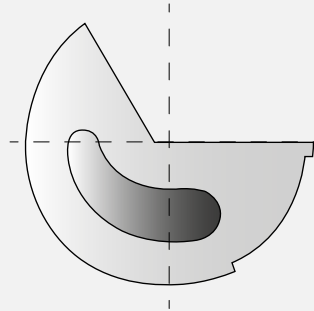


### Umfangsform A

Umfangsform für ungünstige Bohrverhältnisse beim Anbohren bzw. Überkreuzbohren. Bearbeitung von weichen Materialien und/oder schlechter Schmierleistung des Kühlschmierstoffs.

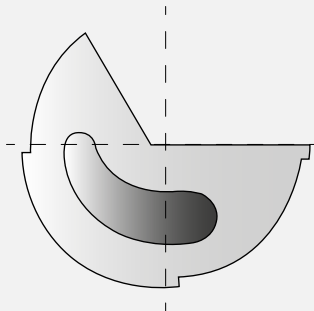
Wird für enge Bohrungstoleranzen, sowie auch als Führungsteil bei überlangen Schneidköpfen verwendet.

- Aluminium
- Kupfer



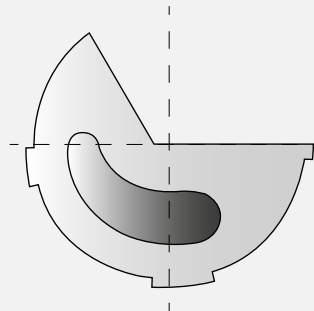
### Umfangsform D

Diese Umfangsform wird fast ausschließlich für weiche Materialien wie GG, Graphit etc. verwendet – vor allem in Verbindung mit engen Bohrungstoleranzen.



### Umfangsform E

Für sämtliche Stoffe geeignet, jedoch für größere Bohrungstoleranzen.



### Umfangsform F

Umfangsform für weichere Werkstoffe, geringere Reibung und stabile Führung, wie z. B. bei Aluminium.

Dies ist nur ein kleiner Ausschnitt unserer Sonder-Umfangsformen. Weitere Umfangsformen speziell für Ihre Anwendung auf Anfrage.



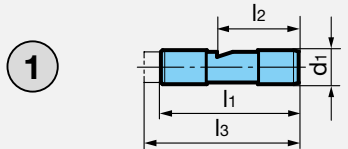
## Klassische Tieflochbohrer

Das hier vorgestellte Hülsenprogramm halten wir am Lager, es stellt jedoch nur eine Auswahl von Einspannhülsen dar. Wir fertigen natürlich auch Hülsen nach Kundenzeichnung individuell mit höchster Präzision.

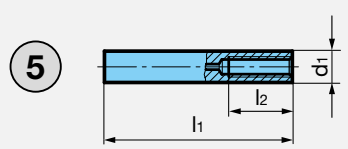
Achtung! Bei E 100 sind Spannhülsen mit Richtbund erforderlich. Informationen auf Anfrage.

### Einspannhülsen für E 80

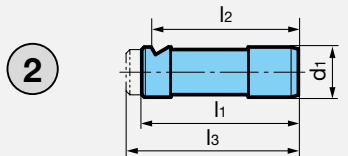
#### Einspannhülsen für Tiefbohrmaschinen



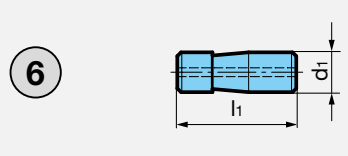
Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>
1.1	10	40	24	-
1.2	10	40	24	45
1.3	10	40	24	55
1.4	16	45	31,2	-
1.5	25	70	34	-
1.6	25	70	34	78



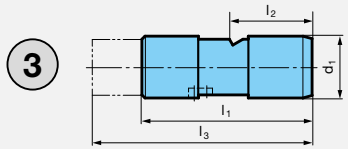
Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
5.1	10	60	20
5.2	16	80	28
5.3	25	100	50
5.4	10	100	20
5.5	10	110	24



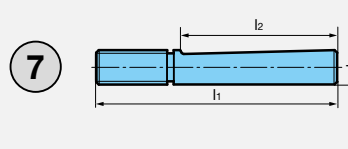
Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>
2.1	16	50	47	-
2.2	16	50	47	55
2.3	16	50	47	70



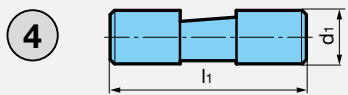
Kennzahl	d <sub>1</sub>	l <sub>1</sub>
6.1	12,7	38
6.2	19,05	70
6.3	38,1	70



Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>
3.1	25	70	34	-
3.2	25	70	34	100
3.3	25	70	34	105



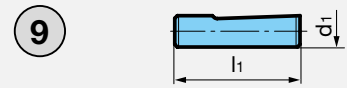
Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
7.1	16	112	73
7.2	20	126	82



Kennzahl	d <sub>1</sub>	l <sub>1</sub>
4.1	19,05	70
4.2	12,7	70
4.3	25,4	70
4.4	31,75	70
4.5	38,1	70

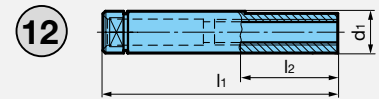
#### Einspannhülsen nach DIN 1835

Form HE



Kennzahl	d <sub>1</sub>	l <sub>1</sub>
9.1	8	36
9.2	10	40
9.3	12	45
9.4	16	48
9.5	20	50
9.6	25	56
9.7	32	60
9.8	31,75	70
9.9	38,1	70
9.10	40	70

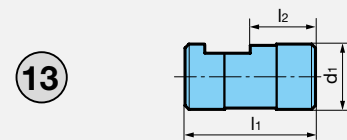
#### Einspannhülsen nach VDI-Entwurf



Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
12.1	10	68	40
12.2	16	90	40
12.3	25	112	50

auch einsetzbar auf Tiefbohrmaschinen

#### Einspannhülsen nach Speed-Bit-System



Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
13.1	16	40	14
13.2	25	50	25
13.3	35	60	20

auch einsetzbar auf Tiefbohrmaschinen

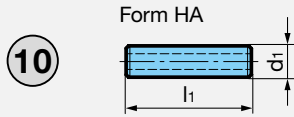




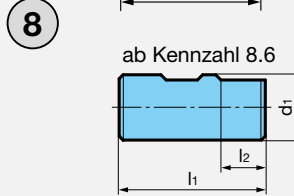
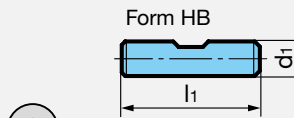
## Klassische Tieflochbohrer

### Einspannhülsen für E 80

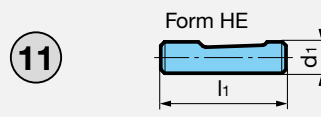
#### Einspannhülsen nach DIN 6535



Kennzahl	d <sub>1</sub>	l <sub>1</sub>
10.1	8	36
10.2	10	40
10.3	12	45
10.4	16	48
10.5	20	50
10.6	25	56
10.7	32	60
10.8	25	70
10.9	40	70

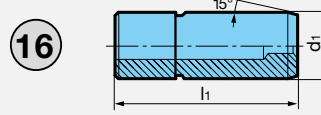


Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
8.1	8	36	-
8.2	10	40	-
8.3	12	45	-
8.4	16	48	-
8.5	20	50	-
8.6	25	56	17
8.7	32	60	19
8.8	40	70	19
8.9	50	80	23
8.10	63	90	23



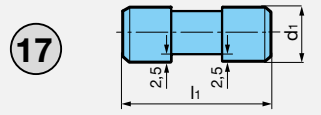
Kennzahl	d <sub>1</sub>	l <sub>1</sub>
11.1	8	36
11.2	10	40
11.3	12	45
11.4	16	48
11.5	20	50
11.6	25,4	70
11.7	25	56
11.8	32	60
11.9	40	70

ähnli. Form HA (schrumpfbar)



Kennzahl	d <sub>1</sub>	l <sub>1</sub>
16.1	10	50
16.2	16	64
16.3	20	70
16.4	25	81
16.5	32	92

ähnli. Form HE

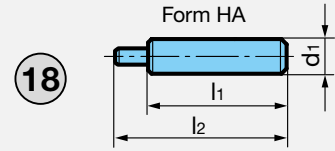


Kennzahl	d <sub>1</sub>	l <sub>1</sub>
17.1	19,05	70
17.2	25,4	70
17.3	31,75	70
17.4	38,1	70

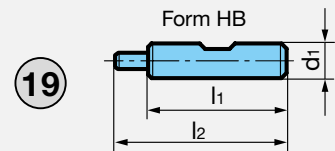
auch einsetzbar auf Tiefbohrmaschinen

### Einspannhülsen für E 100

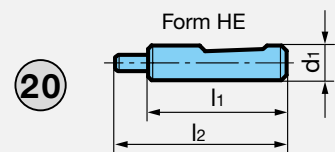
#### Einspannhülsen mit Richtzapfen nach DIN 6535



Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
4	4	28	40
6	6	36	51
10	10	40	55
12	12	45	60
16	16	48	63



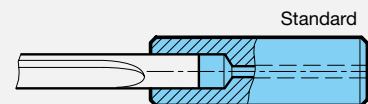
Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
4	4	28	40
6	6	36	51
10	10	40	55
12	12	45	60
16	16	48	63



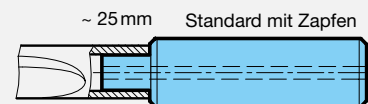
Kennzahl	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
4	4	28	40
6	6	36	51
10	10	40	55
12	12	45	60
16	16	48	63

### Fertigungsvarianten der Einspannhülsen an Tieflochbohrern mit Rohrschaft

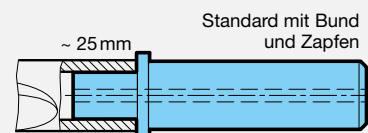
Vorgehensweise für Nenn-Ø < Hülsen-Ø  
(Differenz muss ca. 6mm sein):  
Rohrschaft sitzt in der Einspannhülse



Vorgehensweise für Nenn-Ø ≠ Hülsen-Ø  
(max. bis Gleichstand):  
Rohrschaft sitzt über dem Zapfen



Vorgehensweise für Nenn-Ø > Hülsen-Ø:  
Rohrschaft sitzt über dem Zapfen,  
dessen Innen-Ø > Hülsen-Ø ist,  
und schließt bündig mit dem Bund ab.





## Nachschleifen und Neubestücken

Selbst moderne Hochleistungswerkzeuge verschleßen auf Grund der enormen Belastung, der sie standhalten müssen, irgendwann. Hartner stellt durch fachgerechtes Nachschleifen die Leistungsfähigkeit der Werkzeuge wieder her.

Durch den Einsatz des gleichen Maschinenparks in allen Nachschleifzentren wird ein einheitlicher Qualitätsstandard sichergestellt.

VHM-Tieflochbohrer oder Tieflochbohrer mit gelötetem Kopf, können je nach Kopflänge und Verschleißmarkenbreite bis zu 10 mal nachgeschliffen werden.

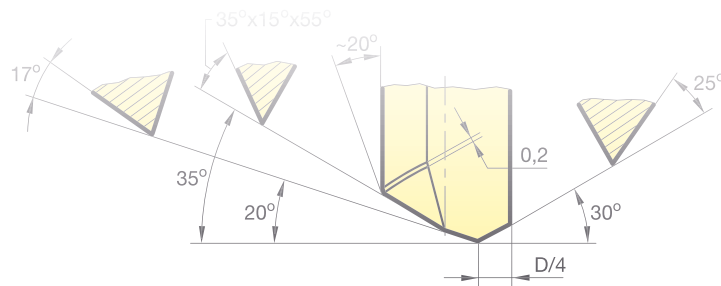
Nachfolgende Punkte sind zu beachten:

- Das Werkzeug muss beim Nachschleifen sauber geschliffen

werden, d. h. frei von jeglichen Verschleißspuren.

- Das Werkzeug ist nach dem Nachschleifen stirnseitig blank.
- Mit Mehraufwand können die Werkzeuge nachbeschichtet werden.
- Tieflochbohrer mit gelötetem Kopf können bei sehr starker Abnutzung oder Beschädigung neu bestückt werden.
- Tieflochbohrer mit Richtzapfen werden nach dem Nachschleifen auf Rundlauf geprüft und ggf. gerichtet.
- Richtwerte für die min. Kopflänge beim Nachschleifen um die Qualitätsanforderungen der Bohrung zu gewährleisten:

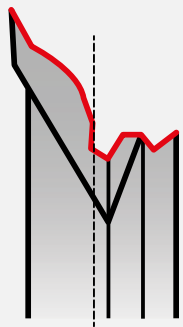

Durchmesserbereich	min. Kopflänge
Ø0,900 - Ø1,999	5 - 7 mm
Ø2,000 - Ø3,999	8 - 10 mm
Ø4,000 - Ø16,999	10 - 14 mm
Ø17,000 - Ø25,999	14 - 16 mm
Ø26,000 - Ø40,000	16 - 18 mm



	- 25°	+ 30°	0°	
	+ 20°	+ 17°	0°	D/4
	+ 35°	+ 15°	+ 55°	


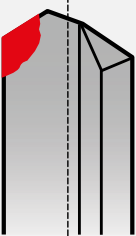
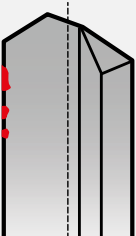


## Anwendungshinweise/Troubleshooting

Fehler	Ursachen	Gegenmaßnahmen
<b>1. Werkzeugbruch beim Anbohren</b>  	<b>Werkzeug</b> <ul style="list-style-type: none"> <li>- stumpfe Schneide</li> <li>- falscher Anschlag</li> <li>- zu hoher Vorschub</li> <li>- anbohren mit Eilgang</li> <li>- vorgeschädigtes Werkzeug (Ausbrüche, etc.)</li> <li>- zu hohes Längen x Durchmesser-verhältnis (LxD)</li> </ul>	<ul style="list-style-type: none"> <li>- nachschleifen</li> <li>- Anschlag korrigieren</li> <li>- Vorschub reduzieren</li> <li>- Anbohrvorschub wählen</li> <li>- nachschleifen</li> <li>- ggf. neues Werkzeug</li> <li>- mehrere Werkzeuge verwenden / Abstützen</li> </ul>
	<b>Pilotbohrung</b> <ul style="list-style-type: none"> <li>- zu kleiner Durchmesser</li> <li>- zu großer Durchmesser</li> <li>- zu schlechte Bohrungsqualität (verschlissenes Werkzeug)</li> <li>- falsches Einfädeln</li> </ul>	<ul style="list-style-type: none"> <li>- anderes Werkzeug (größerer Ø)</li> <li>- anderes Werkzeug (kleinerer Ø)</li> <li>- neues Werkzeug verwenden</li> <li>- Programm korrigieren</li> </ul>
	<b>Bohrbuchse</b> <ul style="list-style-type: none"> <li>- verschlissen</li> <li>- ausgebrochen</li> <li>- zu schwacher Anpressdruck / hebt beim Anbohren ab und Späne klemmen sich ein</li> <li>- Spalt zwischen Buchse und Werkstück / Späne verhaken sich, Spänestau</li> </ul>	<ul style="list-style-type: none"> <li>- neue Bohrbuchse</li> <li>- neue Bohrbuchse</li> <li>- Anpressdruck erhöhen</li> <li>- Bohrbuchsenposition korrigieren</li> </ul>
	<b>Werkstück</b> <ul style="list-style-type: none"> <li>- Aufspannung nicht in Ordnung</li> </ul>	<ul style="list-style-type: none"> <li>- Werkstück fachgerecht Aufspannen</li> </ul>
	<b>KSS</b> <ul style="list-style-type: none"> <li>- KSS-Druck zu niedrig, Spänestau</li> <li>- Medium zu stark verschmutzt --&gt; Verstopfung</li> </ul>	<ul style="list-style-type: none"> <li>- KSS-Druck erhöhen</li> <li>- Filterung kontrollieren</li> </ul>
<b>2. Werkzeug bricht am Schaft (Einspannhülse)</b>  	<b>Werkzeug</b> <ul style="list-style-type: none"> <li>- zu hohes Längen x Durchmesser-verhältnis (LxD)</li> </ul>	<ul style="list-style-type: none"> <li>- mehrere Werkzeuge verwenden / Abstützen</li> </ul>
	<b>Werkstück</b> <ul style="list-style-type: none"> <li>- Achsposition Bohrung nicht korrekt</li> </ul>	<ul style="list-style-type: none"> <li>- Werkstückspannung überprüfen</li> </ul>
	<b>Maschine</b> <ul style="list-style-type: none"> <li>- Versatz Maschine zu Werkstück</li> <li>- zu tiefe Bohrtiefe (Programmierfehler)</li> </ul>	<ul style="list-style-type: none"> <li>- Versatz überprüfen und ggf. korrigieren</li> <li>- Programmierung kontrollieren</li> </ul>

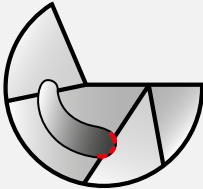
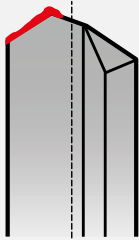
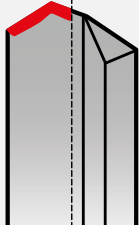


## Anwendungshinweise/Troubleshooting

Fehler	Ursachen	Gegenmaßnahmen
<b>3. Rohr verbogen/verdreht</b> 	<b>Werkzeug</b> - zu hohes Längen x Durchmesser Verhältnis (LxD) - zu hohe Zerspankräfte (spez. Drehmoment) <b>KSS</b> - KSS-Druck zu gering, Spänestau	- mehrere Werkzeuge verwenden / Abstützen - Schnittdaten reduzieren - KSS-Druck erhöhen
<b>4. Werkzeug bricht/ schiefert aus</b> 	<b>Werkzeug</b> - beim Schleifen überhitzt - Schneidkante der Nebenschneide (Rundschliffase) zu stumpf - Werkzeug nicht fest eingespannt, pulsiert axial - Werkzeug klemmt, schiefert beim Rückzug aus - maximaler Standweg überschritten - Zerspanungsleistung zu hoch - unterbrochener Schnitt - Rundlauffehler zu groß <b>Pilotbohrung</b> - zu großer Durchmesser (zu großes Spiel) <b>Bohrbuchse</b> - zu großer Durchmesser (zu großes Spiel) <b>Werkstück</b> - Aufspannung ungenügend	- Parameter beim Schleifen korrigieren - Kantenverrundung an der Nebenschneide überprüfen - Werkzeugschärfe optimieren - Schneidengeometrie oder Umfangsform ändern - Werkzeugwechselintervalle verkürzen - Schnittdaten zurücknehmen - Vorschubwerte reduzieren - Rundlauf kontrollieren / wenn möglich korrigieren - anderes Werkzeug (kleinerer Ø) - andere Bohrbuchse (kleinerer Ø) - Werkstück fachgerecht Aufspannen
<b>5. Ausbrüche an der Rundfase</b> 	<b>Werkzeug</b> - unterbrochener Schnitt <b>Pilotbohrung</b> - zu großer Durchmesser (zu großes Spiel) <b>Bohrbuchse</b> - zu großer Durchmesser (zu großes Spiel) - Spalt zwischen Bohrbuchse und Werkstück zu groß <b>Werkstück</b> - instabile Verhältnisse / Werkstückspannung ungenügend - Querbohrungen nicht verstopft (KSS-Verlust) <b>KSS</b> - ungünstiger KSS für abrasiven Werkstoff	- Vorschubwerte reduzieren - anderes Werkzeug (kleinerer Ø) - andere Bohrbuchse (kleinerer Ø) - Spalt verringern (Bohrbuchse sollte im Idealfall anliegen) - Werkstück fachgerecht Aufspannen - Querbohrungen verstopfen (Hartner Abschlussstopfen) - passendes KSS wählen, Ölgehalt der Emulsion erhöhen / Öl verwenden

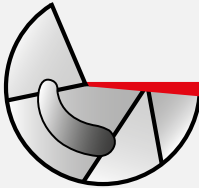
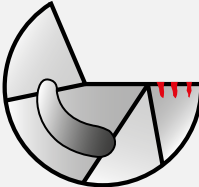
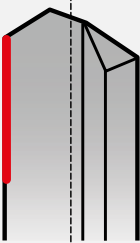


## Anwendungshinweise/Troubleshooting

Fehler	Ursachen	Gegenmaßnahmen
<b>6. Ausbrüche am Kühlkanal</b> 	<b>Werkzeug</b> <ul style="list-style-type: none"> <li>- Freiwinkel zu gering</li> <li>- Ölraumwinkel zu gering (zu wenig Öl-Durchfluss)</li> <li>- Materialanhaftungen an der Stirn</li> </ul> <b>KSS</b> <ul style="list-style-type: none"> <li>- ungünstiger KSS, falsches Öl (Viskosität) oder magere Emulsion (Materialanhaftungen)</li> <li>- unreiner KSS durch kleine Späne oder andere Verschmutzung</li> </ul>	<ul style="list-style-type: none"> <li>- Frewinkel erhöhen</li> <li>- Ölraumwinkel erhöhen/anpassen</li> <li>- Werkzeug ggf. Beschichten</li> <li>- passendes KSS wählen, Ölgehalt der Emulsion erhöhen / Öl verwenden</li> <li>- Filterung der KSS überprüfen ggf. verbessern/verfeinern</li> </ul>
<b>7. Aufbauschneide</b> 	<b>Werkzeug</b> <ul style="list-style-type: none"> <li>- Schnittgeschwindigkeit zu gering</li> <li>- Schneidenabzug/-verrundung zu groß</li> <li>- blanke Schneiden</li> <li>- ungünstiger Schneidstoff</li> <li>- ungeeignete Beschichtung</li> </ul> <b>KSS</b> <ul style="list-style-type: none"> <li>- ungünstiger KSS, falsches Öl (Viskosität) oder magere Emulsion</li> </ul>	<ul style="list-style-type: none"> <li>- Schnittgeschwindigkeit erhöhen</li> <li>- Schneidenabzug/-verrundung verringern</li> <li>- Werkzeug ggf. beschichten lassen</li> <li>- passender Schneidstoff</li> <li>- andere Beschichtung wählen</li> <li>- passendes KSS wählen, Ölgehalt der Emulsion erhöhen / Öl verwenden</li> </ul>
<b>8. Starker Kolkverschleiß</b> 	<b>Werkzeug</b> <ul style="list-style-type: none"> <li>- Schnittgeschwindigkeit zu hoch</li> <li>- ungünstige Spanform</li> <li>- ungünstiger Schneidstoff</li> </ul> <b>KSS</b> <ul style="list-style-type: none"> <li>- ungünstiger KSS, falsches Öl (Viskosität) oder magere Emulsion</li> <li>- KSS-Druck/Durchfluss zu gering</li> </ul>	<ul style="list-style-type: none"> <li>- Schnittgeschwindigkeit reduzieren</li> <li>- Anschliff anpassen</li> <li>- passenden Schneidstoff ggf. Beschichtung wählen</li> <li>- passendes KSS wählen, Ölgehalt der Emulsion erhöhen / Öl verwenden</li> <li>- KSS-Druck/Durchfluss erhöhen</li> </ul>

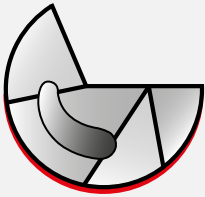
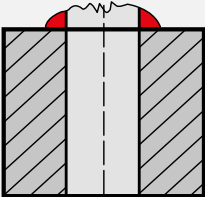
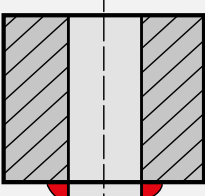


## Anwendungshinweise/Troubleshooting

Fehler	Ursachen	Gegenmaßnahmen	
<b>9. Freiflächenverschleiß</b> 	<b>Werkzeug</b>  <b>KSS</b>	<ul style="list-style-type: none"> <li>- Schnittgeschwindigkeit zu hoch</li> <li>- Span bremst zu stark an der Spanfläche</li> <li>- Vorschub zu gering</li> <li>- Freiwinkel zu gering</li> </ul> <ul style="list-style-type: none"> <li>- ungünstiger KSS, falsches Öl (Viskosität) oder magere Emulsion</li> </ul>	<ul style="list-style-type: none"> <li>- Schnittgeschwindigkeit reduzieren</li> <li>- Beschichtung an der Spanfläche entfernen</li> <li>- Vorschub erhöhen</li> <li>- Freiwinkel erhöhen</li> </ul> <ul style="list-style-type: none"> <li>- passendes KSS wählen, Ölgehalt der Emulsion erhöhen / Öl verwenden</li> </ul>
<b>10. Kammverschleiß/ Ausbröckelung</b> 	<b>Werkzeug</b>  <b>KSS</b>	<ul style="list-style-type: none"> <li>- zu hohe Zerspankräfte</li> <li>- unterbrochener Schnitt</li> <li>- falsches Hartmetall gewählt</li> <li>- zu hohe Zerspannungstemperaturen</li> </ul> <ul style="list-style-type: none"> <li>- ungünstiger KSS, falsches Öl (Viskosität) oder magere Emulsion (zu hohe Temperaturen aufgrund zu geringer Schmierung)</li> </ul>	<ul style="list-style-type: none"> <li>- Schnittdaten reduzieren</li> <li>- Vorschub reduzieren</li> <li>- anderes Hartmetall wählen</li> <li>- Schnittdaten reduzieren / Anschliffgeometrie (Ölraumwinkel) ändern</li> </ul> <ul style="list-style-type: none"> <li>- passendes KSS wählen, Ölgehalt der Emulsion erhöhen / Öl verwenden</li> </ul>
<b>11. Rundfasenverschleiß</b> 	<b>Werkzeug</b>  <b>Werkstück</b>  <b>KSS</b>	<ul style="list-style-type: none"> <li>- Rundlauffehler zu groß</li> <li>- Verjüngung zu gering</li> <li>- Schneidenabzug/-verrundung zu groß</li> <li>- ungünstiger Ölraum-Anschliff (zu wenig Durchfluss)</li> </ul> <ul style="list-style-type: none"> <li>- instabile Verhältnisse / Werkstückspannung ungenügend</li> </ul> <ul style="list-style-type: none"> <li>- ungünstiger KSS, falsches Öl (Viskosität) oder magere Emulsion</li> </ul>	<ul style="list-style-type: none"> <li>- Rundlauf kontrollieren / wenn möglich korrigieren</li> <li>- Verjüngung erhöhen</li> <li>- Schneidenabzug/-verrundung verringern</li> <li>- Ölraum-Anschliff anpassen (Winkel/Absetzen/Nut/2. Fläche)</li> </ul> <ul style="list-style-type: none"> <li>- Werkstück fachgerecht Aufspannen</li> </ul> <ul style="list-style-type: none"> <li>- passendes KSS wählen, Ölgehalt der Emulsion erhöhen / Öl verwenden</li> </ul>

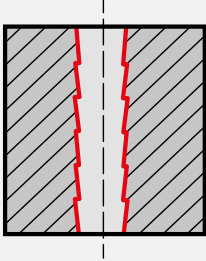
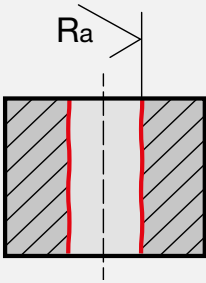
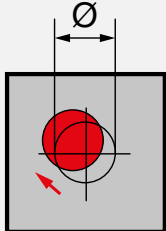


## Anwendungshinweise/Troubleshooting

Fehler	Ursachen		Gegenmaßnahmen
<p><b>12. Verschleiß an der Umfangsform</b></p> 	<p><b>Werkzeug</b></p> <p><b>Werkstück</b></p> <p><b>KSS</b></p>	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- Rundlauffehler zu groß</li> <li>- unterbrochener Schnitt</li> <li>- falsches Hartmetall ausgewählt</li> <li>- Verjüngung zu gering</li> <li>- falsche Beschichtung ausgewählt</li> </ul> <p><b>Werkstück</b></p> <ul style="list-style-type: none"> <li>- instabile Verhältnisse /Werkstückspannung ungenügend</li> </ul> <p><b>KSS</b></p> <ul style="list-style-type: none"> <li>- ungünstiger KSS für abrasiven Werkstoff</li> </ul>	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- Rundlauf kontrollieren / wenn möglich korrigieren</li> <li>- Vorschubwerte reduzieren</li> <li>- Hartmetallauswahl korrigieren</li> <li>- Verjüngung erhöhen</li> <li>- Beschichtungsauswahl korrigieren</li> </ul> <p><b>Werkstück</b></p> <ul style="list-style-type: none"> <li>- Werkstück fachgerecht Aufspannen</li> </ul> <p><b>KSS</b></p> <ul style="list-style-type: none"> <li>- passendes KSS wählen, Ölgehalt der Emulsion erhöhen / Öl verwenden</li> </ul>
<p><b>13. Starker Anbohrgrat</b></p> 	<p><b>Werkzeug</b></p> <p><b>Pilotbohrung</b></p> <p><b>Bohrbuchse</b></p>	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- zu hoher Vorschub beim Anbohren</li> <li>- Maximaler Standweg überschritten (Werkzeug stumpf)</li> <li>- Schneidenabzug/-verrundung zu groß</li> <li>- Freiwinkel zu gering</li> </ul> <p><b>Pilotbohrung</b></p> <ul style="list-style-type: none"> <li>- zu großer Durchmesser (zu großes Spiel)</li> </ul> <p><b>Bohrbuchse</b></p> <ul style="list-style-type: none"> <li>- zu großer Durchmesser (zu großes Spiel)</li> </ul>	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- Vorschub beim Anbohren reduzieren</li> <li>- Werkzeugwechselintervalle verkürzen</li> <li>- Schneidenabzug/-verrundung verringern</li> <li>- Freiwinkel erhöhen</li> </ul> <p><b>Pilotbohrung</b></p> <ul style="list-style-type: none"> <li>- anderes Werkzeug (kleinerer Ø)</li> </ul> <p><b>Bohrbuchse</b></p> <ul style="list-style-type: none"> <li>- andere Bohrbuchse (kleinerer Ø)</li> </ul>
<p><b>14. Starker Ausbohrgrat</b></p> 	<p><b>Werkzeug</b></p>	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- zu hoher Vorschub beim Ausbohren</li> <li>- maximaler Standweg überschritten (Werkzeug stumpf)</li> <li>- Schneidenabzug/-verrundung zu groß</li> </ul>	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- Vorschub beim Ausbohren reduzieren</li> <li>- Werkzeugwechselintervalle verkürzen</li> <li>- Schneidenabzug/-verrundung verringern</li> </ul>



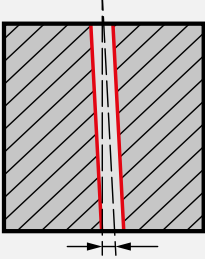
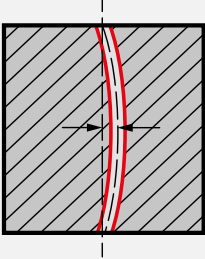
## Anwendungshinweise/Troubleshooting

Fehler	Ursachen	Gegenmaßnahmen
<b>15. Werkzeug bohrt Stufen</b> 	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- Bohrkopf sitzt nicht achsgerade auf Bohrohr (E 80/E 800)</li> <li>- Koaxialität Kopf zu Schaft zu groß</li> </ul> <p><b>Maschine</b></p> <ul style="list-style-type: none"> <li>- Achsversatz zwischen Spindelaufnahme und Bohrbuchsen bzw. Pilotbohrung zu groß</li> </ul> <p><b>KSS</b></p> <ul style="list-style-type: none"> <li>- KSS Druck zu hoch</li> </ul>	<ul style="list-style-type: none"> <li>- Kopf neu auflöten / neues Werkzeug</li> <li>- Koaxialität überprüfen / neues Werkzeug verwenden</li> <li>- Achsversatz korrigieren. Optimal sind 0,02 mm Versatz</li> <li>- KSS Druck reduzieren</li> </ul>
<b>16. Schlechte Oberfläche</b> 	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- Schneidecke ausgebrochen</li> <li>- Fase der Nebenschneide (Rundschliff-fase) zu breit</li> <li>- zu schwach ausgeprägte Verziehfase</li> <li>- zu geringer Druck auf die hintere Führungsleiste</li> <li>- Rundlauffehler zu groß</li> <li>- falsche Beschichtung ausgewählt</li> </ul> <p><b>Werkstück</b></p> <ul style="list-style-type: none"> <li>- instabile Verhältnisse / Werkstückspannung ungenügend</li> </ul> <p><b>KSS</b></p> <ul style="list-style-type: none"> <li>- KSS-Art / Emulsion nicht ausreichend</li> <li>- KSS-Menge nicht ausreichend</li> </ul>	<ul style="list-style-type: none"> <li>- Werkzeug nachschleifen</li> <li>- Werkzeugauslegung korrigieren</li> <li>- Verziehfase verbessern</li> <li>- durch Anschliffgeometrie oder durch Schälphase/Eckenradius Druck erhöhen</li> <li>- Rundlauf kontrollieren / korrigieren</li> <li>- Beschichtungsauswahl korrigieren</li> <li>- Werkstück fachgerecht Aufspannen</li> <li>- wenn möglich Öl verwenden</li> <li>- KSS-Menge (Volumen/Druck) erhöhen</li> </ul>
<b>17. Mittenversatz</b> 	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- Rundlauffehler zu groß</li> </ul> <p><b>Pilotbohrung</b></p> <ul style="list-style-type: none"> <li>- Anbohren an schräger Fläche</li> <li>- falsche Werkzeugausführung</li> </ul> <p><b>Bohrbuchse</b></p> <ul style="list-style-type: none"> <li>- Anbohren an schräger Fläche</li> <li>- Bohrbuchse verschlissen (Innen-Ø zu groß)</li> </ul> <p><b>Werkstück</b></p> <ul style="list-style-type: none"> <li>- instabile Verhältnisse / Werkstückspannung ungenügend</li> </ul> <p><b>Maschine</b></p> <ul style="list-style-type: none"> <li>- Achsversatz zwischen Spindelaufnahme und Bohrbuchse / Pilotbohrung zu groß</li> </ul>	<ul style="list-style-type: none"> <li>- Rundlauf kontrollieren / wenn möglich korrigieren</li> <li>- Pilotbohrung mit Fräser anbringen</li> <li>- LxD optimieren / Werkzeug-Ø prüfen</li> <li>- angepasste Bohrbuchse verwenden</li> <li>- neue Bohrbuchse verwenden</li> <li>- Werkstück fachgerecht Aufspannen</li> <li>- Achsversatz korrigieren. Optimal sind 0,02 mm Versatz</li> </ul>





## Anwendungshinweise/Troubleshooting

Fehler	Ursachen	Gegenmaßnahmen
<b>18. Großer Bohrungsverlauf</b>  	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- stumpfe Schneide</li> <li>- falscher Anschliff</li> <li>- falsche Umfangform</li> <li>- zu hoher Vorschub</li> <li>- zu geringe Führung</li> <li>- Rundlauffehler zu groß</li> </ul> <p><b>Pilotbohrung</b></p> <ul style="list-style-type: none"> <li>- Pilotbohrung verläuft</li> <li>- Pilotbohrung unrund</li> </ul> <p><b>Bohrbuchse</b></p> <ul style="list-style-type: none"> <li>- schlechte Bohrbuchse / Bohrbuchse zu Bohrbuchsenaufnahme nicht korrekt</li> </ul> <p><b>Werkstück</b></p> <ul style="list-style-type: none"> <li>- instabile Verhältnisse / Werkstückspannung ungenügend</li> <li>- ungünstige Bohrungsposition / sehr geringe Wandungen</li> <li>- Werkstück überhitzt (starker Temperaturanstieg)</li> </ul> <p><b>Maschine</b></p> <ul style="list-style-type: none"> <li>- Achsversatz zwischen Spindelaufnahme und Bohrbuchse / Pilotbohrung zu groß</li> </ul>	<ul style="list-style-type: none"> <li>- nachschleifen</li> <li>- Anschliff korrigieren</li> <li>- Umfangsform korrigieren</li> <li>- Vorschub reduzieren</li> <li>- langes Kopfteil verwenden</li> <li>- Rundlauf kontrollieren / wenn möglich korrigieren</li> </ul> <ul style="list-style-type: none"> <li>- Pilotbohrung prüfen ggf. anderes Wkzg.</li> <li>- Pilotwerkzeug anpassen</li> </ul> <ul style="list-style-type: none"> <li>- Bohrbuchse wechseln ggf. auch die Bohrbuchsenaufnahme</li> </ul> <ul style="list-style-type: none"> <li>- Werkstück fachgerecht Aufspannen</li> <li>- Bohrungsposition bedenken / ggf. ändern</li> <li>- Schnittdaten reduzieren</li> </ul> <ul style="list-style-type: none"> <li>- Achsversatz korrigieren. Optimal sind 0,02mm Versatz</li> </ul>
<b>19. Schlechte Bohrungsgeradheit</b>  	<p><b>Werkzeug</b></p> <ul style="list-style-type: none"> <li>- stumpfe Schneide</li> <li>- falscher Anschliff</li> <li>- falsche Umfangform</li> <li>- zu hoher Vorschub</li> <li>- zu geringe Führung</li> <li>- Rundlauffehler zu groß</li> <li>- falsche Beschichtung ausgewählt</li> <li>- zu hohes Längen x Durchmesser Verhältnis (LxD)</li> </ul> <p><b>Werkstück</b></p> <ul style="list-style-type: none"> <li>- instabile Verhältnisse / Werkstückspannung ungenügend</li> <li>- ungünstige Bohrungsposition / sehr geringe Wandungen</li> <li>- Werkstück überhitzt (starker Temperaturanstieg)</li> </ul> <p><b>Maschine</b></p> <ul style="list-style-type: none"> <li>- Werkstück ohne Gegenlauf</li> <li>- Achsversatz zwischen Spindelaufnahme und Bohrbuchse / Pilotbohrung zu groß</li> </ul>	<ul style="list-style-type: none"> <li>- nachschleifen</li> <li>- Anschliff korrigieren</li> <li>- Umfangsform korrigieren</li> <li>- Vorschub reduzieren</li> <li>- langes Kopfteil verwenden</li> <li>- Rundlauf kontrollieren / wenn möglich korrigieren</li> <li>- Beschichtungsauswahl korrigieren</li> <li>- mehrere Werkzeuge verwenden / Abstützen</li> </ul> <ul style="list-style-type: none"> <li>- Werkstück fachgerecht Aufspannen</li> <li>- Bohrungsposition bedenken / ggf. ändern</li> <li>- Schnittdaten reduzieren</li> </ul> <ul style="list-style-type: none"> <li>- wenn maschinell möglich, mit Gegenlauf Bohren</li> <li>- Achsversatz korrigieren. Optimal sind 0,02mm Versatz</li> </ul>

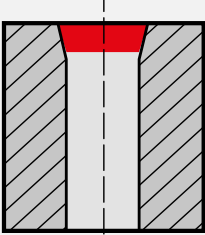
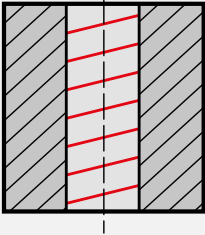
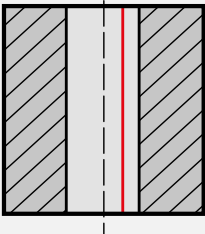


## Anwendungshinweise/Troubleshooting

Fehler	Ursachen	Gegenmaßnahmen	
<b>20. Bohrt zu groß</b> 	<ul style="list-style-type: none"> <li>Werkzeug</li> <li>KSS</li> </ul>	<ul style="list-style-type: none"> <li>- zu viel Druck auf die Nebenschneide</li> <li>- Rundlauffehler zu groß</li> <li>- KSS Druck zu hoch</li> </ul>	<ul style="list-style-type: none"> <li>- Anschliffgeometrie ändern / Druck von der Nebenschneide nehmen (D/4 auf D/3 ändern)</li> <li>- Rundlauf kontrollieren / wenn möglich korrigieren</li> <li>- KSS Druck reduzieren</li> </ul>
<b>21. Bohrt zu eng</b> 	<ul style="list-style-type: none"> <li>Werkzeug</li> </ul>	<ul style="list-style-type: none"> <li>- zu wenig Druck auf die Nebenschneide</li> <li>- falsche Umfangform</li> <li>- Werkzeug zu stark (oft) nachgeschliffen (Verjüngung)</li> </ul>	<ul style="list-style-type: none"> <li>- Anschliffgeometrie ändern / Druck auf Nebenschneide erhöhen (D/3 auf D/4 ändern)</li> <li>- Umfangsform korrigieren (Form „C“)</li> <li>- neues Werkzeug verwenden</li> </ul>
<b>22. Spänestau/Werkzeug verstopft</b> 	<ul style="list-style-type: none"> <li>Werkzeug</li> <li>KSS</li> </ul>	<ul style="list-style-type: none"> <li>- Verhältnis der Schnittgeschwindigkeit zum Vorschub passt nicht</li> <li>- Anschliffgeometrie ungünstig</li> <li>- Fließspan</li> <li>- Fließspan bei beschichtetem Werkzeug</li> <li>- ungünstiger Ölraum-Anschliff (zu wenig Durchfluss)</li> <li>- Werkzeugspannung undicht (KSS verlust)</li> </ul>	<ul style="list-style-type: none"> <li>- Verhältnis Schnittgeschwindigkeit zu Vorschub korrigieren/anpassen</li> <li>- Anschliffgeometrie anpassen um Spanbruch zu begünstigen</li> <li>- ggf. Stottervorschub programmieren</li> <li>- Beschichtung an der Spanfläche entfernen</li> <li>- Ölraum-Anschliff anpassen Winkel/Absetzen/Nut/2. Fläche)</li> <li>- Werkzeugspannung optimieren</li> <li>- KSS-Menge (Volumen/Druck) erhöhen</li> </ul>



## Anwendungshinweise/Troubleshooting

Fehler	Ursachen	Gegenmaßnahmen	
<b>23. Große Anbohrweite</b> 	<ul style="list-style-type: none"> <li><b>Werkzeug</b></li> <li><b>Pilotbohrung</b></li> <li><b>Bohrbuchse</b></li> <li><b>Werkstück</b></li> </ul>	<ul style="list-style-type: none"> <li>- zu hoher Vorschub beim Anbohren</li> <li>- Pilotbohrung verläuft / ist unrund</li> <li>- schlechte Bohrbuchse / Bohrbuchse zu Bohrbuchsenaufnahme nicht korrekt</li> <li>- instabile Verhältnisse / Werkstückspannung ungenügend Vibrationen beim Anbohren</li> </ul>	<ul style="list-style-type: none"> <li>- Vorschub beim Anbohren reduzieren</li> <li>- Pilotbohrung prüfen ggf. anderes Werkzeug</li> <li>- Bohrbuchse wechseln ggf. auch die Bohrbuchsenaufnahme</li> <li>- Werkstück fachgerecht Aufspannen</li> </ul>
<b>24. Werkzeug bohrt Drill</b> 	<ul style="list-style-type: none"> <li><b>Werkzeug</b></li> <li><b>Werkstück</b></li> </ul>	<ul style="list-style-type: none"> <li>- Zerspanungsleistung zu hoch</li> <li>- stumpfe Schneide</li> <li>- Bohrkopf sitzt nicht achsgerade auf Bohrröhr (E 80/E 800)</li> <li>- Koaxialität Kopf zu Schaft zu groß</li> <li>- falsche Umfangsform</li> <li>- instabile Verhältnisse / Werkstückspannung ungenügend, Vibrationen beim Anbohren</li> </ul>	<ul style="list-style-type: none"> <li>- Schnittdaten zurücknehmen</li> <li>- Werkzeug nachschleifen / ggf. wechseln</li> <li>- Kopf neu auflöten / neues Werkzeug</li> <li>- Koaxialität überprüfen / neues Werkzeug verwenden</li> <li>- Umfangsform korrigieren</li> <li>- Werkstück fachgerecht Aufspannen / Schwingungsdämpfer setzen</li> </ul>
<b>25. Werkzeug zieht Rückzugsriefe</b> 	<ul style="list-style-type: none"> <li><b>Werkzeug</b></li> <li><b>Werkstück</b></li> <li><b>Maschine</b></li> </ul>	<ul style="list-style-type: none"> <li>- Vorschub beim Herausziehen zu hoch</li> <li>- Schneidkanten zu scharf</li> <li>- Rundlauffehler zu groß</li> <li>- falsche Umfangsform</li> <li>- instabile Verhältnisse / Werkstückspannung ungenügend</li> <li>- Achsversatz zwischen Spindelaufnahme und Bohrbuchse / Pilotbohrung zu groß</li> </ul>	<ul style="list-style-type: none"> <li>- Vorschub reduzieren</li> <li>- Schneidkanten verrunden</li> <li>- Rundlauf kontrollieren / wenn möglich korrigieren</li> <li>- Umfangsform korrigieren</li> <li>- Werkstück fachgerecht Aufspannen</li> <li>- Achsversatz korrigieren. Optimal sind 0,02 mm Versatz</li> </ul>

  
HARTNER









# HARTNER

Precision Cutting Tools

## KLEINSTBOHRER














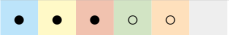


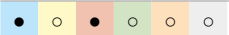


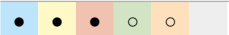

aus Vollhartmetall und HSS-E-PM  
blank und beschichtet

Kleinstbohrer


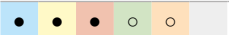


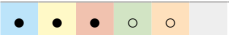


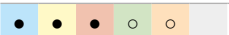



P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Kleinstbohrer ohne Kühlkanäle

		DIN 1899	N	<b>HSS-E-PM</b>		rechts	zyl.	~5xD	0,050 - 1,900	<b>87011</b>	329
		DIN 1899	N	<b>HSS-E-PM</b>		links	zyl.	~5xD	0,160 - 1,450	<b>87016</b>	331
		DIN 1899	N	<b>HSS-E-PM</b>		rechts	zyl.	~5xD	0,200 - 1,500	<b>84810</b>	332
		Werksnorm	N	<b>VHM</b>		rechts	zyl.		0,100 - 3,000	<b>86402</b>	333
		Werksnorm	N	<b>VHM</b>		rechts	zyl.	4xD	0,500 - 3,000	<b>86400</b>	334
		Werksnorm	N	<b>VHM</b>		rechts	zyl.	~5xD	0,200 - 1,300	<b>89281</b>	335
		Werksnorm	N	<b>VHM</b>		rechts	zyl.	7xD	0,500 - 3,000	<b>86401</b>	336

## Kleinstbohrer mit Kühlkanälen

		Werksnorm	N	<b>VHM</b>		rechts	zyl.	5xD	1,400 - 3,000	<b>86405</b>	337
		Werksnorm	N	<b>VHM</b>		rechts	zyl.	8xD	1,400 - 3,000	<b>86408</b>	338
		Werksnorm	N	<b>VHM</b>		rechts	zyl.	15xD	1,400 - 3,000	<b>86412</b>	339

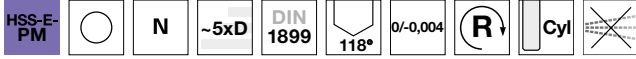




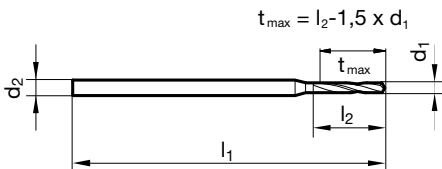
## Kleinstbohrer ohne Kühlkanäle

Artikel-Nr. 87011

P	M	K	N	S	H
•	•	•	•	○	



Flächenanschliff • <math>\varnothing 0,15\text{ mm}</math> Co-legierter HSS-Stahl • mit verstärktem Schaft  
hochlegierte Stähle



d1 mm	d2 mm	l1 mm	l2 mm	d1 mm	d2 mm	l1 mm	l2 mm
0,050	1,000	25,000	0,400	0,355	1,000	25,000	2,400
0,060	1,000	25,000	0,400	0,360	1,000	25,000	2,400
0,080	1,000	25,000	0,500	0,365	1,000	25,000	2,400
0,090	1,000	25,000	0,500	0,370	1,000	25,000	2,400
0,100	1,000	25,000	0,500	0,375	1,000	25,000	2,400
0,110	1,000	25,000	0,500	0,380	1,000	25,000	2,400
0,120	1,000	25,000	0,500	0,390	1,000	25,000	3,000
0,130	1,000	25,000	0,800	0,400	1,000	25,000	3,000
0,140	1,000	25,000	0,800	0,405	1,000	25,000	3,000
0,150	1,000	25,000	0,800	0,410	1,000	25,000	3,000
0,160	1,000	25,000	1,100	0,415	1,000	25,000	3,000
0,170	1,000	25,000	1,100	0,420	1,000	25,000	3,000
0,180	1,000	25,000	1,100	0,425	1,000	25,000	3,000
0,190	1,000	25,000	1,100	0,430	1,000	25,000	3,000
0,200	1,000	25,000	1,500	0,440	1,000	25,000	3,000
0,205	1,000	25,000	1,500	0,450	1,000	25,000	3,000
0,210	1,000	25,000	1,500	0,455	1,000	25,000	3,000
0,215	1,000	25,000	1,500	0,460	1,000	25,000	3,000
0,220	1,000	25,000	1,500	0,470	1,000	25,000	3,000
0,225	1,000	25,000	1,500	0,480	1,000	25,000	3,000
0,230	1,000	25,000	1,500	0,485	1,000	25,000	3,400
0,235	1,000	25,000	1,500	0,490	1,000	25,000	3,400
0,240	1,000	25,000	1,500	0,495	1,000	25,000	3,400
0,245	1,000	25,000	1,900	0,500	1,000	25,000	3,400
0,250	1,000	25,000	1,900	0,510	1,000	25,000	3,400
0,255	1,000	25,000	1,900	0,520	1,000	25,000	3,400
0,260	1,000	25,000	1,900	0,530	1,000	25,000	3,400
0,265	1,000	25,000	1,900	0,540	1,000	25,000	3,900
0,270	1,000	25,000	1,900	0,550	1,000	25,000	3,900
0,275	1,000	25,000	1,900	0,555	1,000	25,000	3,900
0,280	1,000	25,000	1,900	0,560	1,000	25,000	3,900
0,285	1,000	25,000	1,900	0,570	1,000	25,000	3,900
0,290	1,000	25,000	1,900	0,580	1,000	25,000	3,900
0,300	1,000	25,000	1,900	0,585	1,000	25,000	3,900
0,310	1,000	25,000	2,400	0,590	1,000	25,000	3,900
0,315	1,000	25,000	2,400	0,600	1,000	25,000	3,900
0,320	1,000	25,000	2,400	0,610	1,000	25,000	4,200
0,325	1,000	25,000	2,400	0,620	1,000	25,000	4,200
0,330	1,000	25,000	2,400	0,630	1,000	25,000	4,200
0,335	1,000	25,000	2,400	0,640	1,000	25,000	4,200
0,340	1,000	25,000	2,400	0,650	1,000	25,000	4,200
0,350	1,000	25,000	2,400	0,660	1,000	25,000	4,200



## Kleinstbohrer ohne Kühlkanäle

d1 mm	d2 mm	l1 mm	l2 mm	d1 mm	d2 mm	l1 mm	l2 mm
0,665	1,000	25,000	4,200	1,040	1,500	25,000	6,800
0,670	1,000	25,000	4,200	1,050	1,500	25,000	6,800
0,680	1,000	25,000	4,800	1,060	1,500	25,000	6,800
0,690	1,000	25,000	4,800	1,070	1,500	25,000	7,600
0,700	1,000	25,000	4,800	1,080	1,500	25,000	7,600
0,710	1,000	25,000	4,800	1,100	1,500	25,000	7,600
0,720	1,000	25,000	4,800	1,110	1,500	25,000	7,600
0,730	1,000	25,000	4,800	1,120	1,500	25,000	7,600
0,740	1,000	25,000	4,800	1,140	1,500	25,000	7,600
0,750	1,000	25,000	4,800	1,150	1,500	25,000	7,600
0,760	1,000	25,000	5,300	1,180	1,500	25,000	7,600
0,770	1,000	25,000	5,300	1,190	1,500	25,000	8,500
0,790	1,000	25,000	5,300	1,200	1,500	25,000	8,500
0,800	1,500	25,000	5,300	1,210	1,500	25,000	8,500
0,810	1,500	25,000	5,300	1,240	1,500	25,000	8,500
0,820	1,500	25,000	5,300	1,250	1,500	25,000	8,500
0,830	1,500	25,000	5,300	1,270	1,500	25,000	8,500
0,840	1,500	25,000	5,300	1,300	1,500	25,000	8,500
0,850	1,500	25,000	5,300	1,310	1,500	25,000	8,500
0,860	1,500	25,000	6,000	1,320	1,500	25,000	8,500
0,870	1,500	25,000	6,000	1,340	1,500	25,000	9,500
0,880	1,500	25,000	6,000	1,350	1,500	25,000	9,500
0,890	1,500	25,000	6,000	1,380	1,500	25,000	9,500
0,900	1,500	25,000	6,000	1,400	1,500	25,000	9,500
0,910	1,500	25,000	6,000	1,410	1,500	25,000	9,500
0,930	1,500	25,000	6,000	1,420	1,500	25,000	9,500
0,940	1,500	25,000	6,000	1,450	1,500	25,000	9,500
0,950	1,500	25,000	6,000	1,500	2,000	30,000	9,500
0,960	1,500	25,000	6,800	1,600	2,000	30,000	10,600
0,970	1,500	25,000	6,800	1,630	2,000	30,000	10,600
0,980	1,500	25,000	6,800	1,700	2,000	30,000	10,600
0,990	1,500	25,000	6,800	1,800	2,000	30,000	11,800
1,000	1,500	25,000	6,800	1,850	2,000	30,000	11,800
1,010	1,500	25,000	6,800	1,900	2,000	30,000	11,800
1,020	1,500	25,000	6,800				
1,030	1,500	25,000	6,800				



## Kleinstbohrer ohne Kühlkanäle

Artikel-Nr. 87016

P	M	K	N	S	H
•	•	•	•	○	

HSS-E-PM



N

~5xD

DIN 1899

118°

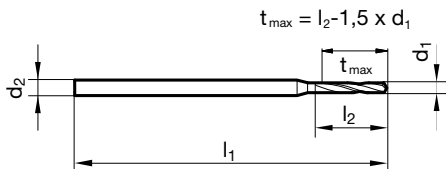
0/-0,004



Cyl



Flächenanschliff • < Ø 0,15 mm Co-legierter HSS-Stahl • mit verstärktem Schaft  
hochlegierte Stähle



d1 mm	d2 mm	l1 mm	l2 mm	d1 mm	d2 mm	l1 mm	l2 mm
0,160	1,000	25,000	1,100	0,710	1,000	25,000	4,800
0,200	1,000	25,000	1,500	0,740	1,000	25,000	4,800
0,210	1,000	25,000	1,500	0,750	1,000	25,000	4,800
0,220	1,000	25,000	1,500	0,760	1,000	25,000	5,300
0,230	1,000	25,000	1,500	0,780	1,000	25,000	5,300
0,240	1,000	25,000	1,500	0,820	1,500	25,000	5,300
0,280	1,000	25,000	1,900	0,830	1,500	25,000	5,300
0,300	1,000	25,000	1,900	0,840	1,500	25,000	5,300
0,310	1,000	25,000	2,400	0,870	1,500	25,000	6,000
0,330	1,000	25,000	2,400	0,890	1,500	25,000	6,000
0,350	1,000	25,000	2,400	0,900	1,500	25,000	6,000
0,360	1,000	25,000	2,400	0,910	1,500	25,000	6,000
0,370	1,000	25,000	2,400	0,920	1,500	25,000	6,000
0,380	1,000	25,000	2,400	0,930	1,500	25,000	6,000
0,390	1,000	25,000	3,000	0,940	1,500	25,000	6,000
0,400	1,000	25,000	3,000	0,950	1,500	25,000	6,000
0,410	1,000	25,000	3,000	0,970	1,500	25,000	6,800
0,420	1,000	25,000	3,000	0,980	1,500	25,000	6,800
0,440	1,000	25,000	3,000	0,990	1,500	25,000	6,800
0,450	1,000	25,000	3,000	1,000	1,500	25,000	6,800
0,460	1,000	25,000	3,000	1,010	1,500	25,000	6,800
0,470	1,000	25,000	3,000	1,050	1,500	25,000	6,800
0,480	1,000	25,000	3,000	1,080	1,500	25,000	7,600
0,490	1,000	25,000	3,400	1,100	1,500	25,000	7,600
0,500	1,000	25,000	3,400	1,150	1,500	25,000	7,600
0,510	1,000	25,000	3,400	1,250	1,500	25,000	8,500
0,520	1,000	25,000	3,400	1,300	1,500	25,000	8,500
0,540	1,000	25,000	3,900	1,340	1,500	25,000	9,500
0,550	1,000	25,000	3,900	1,350	1,500	25,000	9,500
0,570	1,000	25,000	3,900				
0,600	1,000	25,000	3,900				
0,610	1,000	25,000	4,200				
0,660	1,000	25,000	4,200				
0,670	1,000	25,000	4,200				
0,680	1,000	25,000	4,800				
0,700	1,000	25,000	4,800				

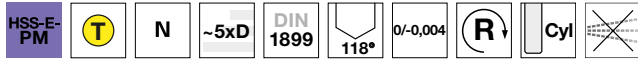


## Kleinstbohrer ohne Kühlkanäle

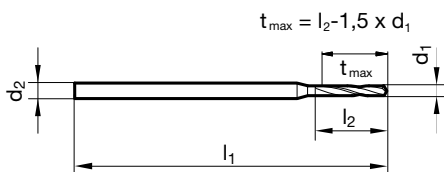
Artikel-Nr. 84810



P	M	K	N	S	H
•	•	•	•	○	



Flächenanschliff • mit verstärktem Schaft • höhere Verschleißfestigkeit  
hochlegierte Stähle



d1 mm	d2 mm	l1 mm	l2 mm	d1 mm	d2 mm	l1 mm	l2 mm
0,200	1,000	25,000	1,500	1,050	1,500	25,000	6,800
0,300	1,000	25,000	1,900	1,100	1,500	25,000	7,600
0,450	1,000	25,000	3,000	1,150	1,500	25,000	7,600
0,490	1,000	25,000	3,400	1,180	1,500	25,000	7,600
0,500	1,000	25,000	3,400	1,200	1,500	25,000	8,500
0,510	1,000	25,000	3,400	1,250	1,500	25,000	8,500
0,520	1,000	25,000	3,400	1,300	1,500	25,000	8,500
0,590	1,000	25,000	3,900	1,400	1,500	25,000	9,500
0,600	1,000	25,000	3,900	1,450	1,500	25,000	9,500
0,700	1,000	25,000	4,800	1,500	2,000	30,000	9,500
0,760	1,000	25,000	5,300				
0,800	1,500	25,000	5,300				
0,880	1,500	25,000	6,000				
0,900	1,500	25,000	6,000				
0,920	1,500	25,000	6,000				
0,950	1,500	25,000	6,000				
0,980	1,500	25,000	6,800				
1,000	1,500	25,000	6,800				

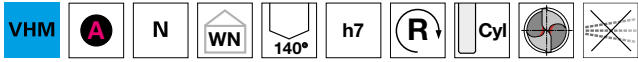


## Kleinstbohrer ohne Kühlkanäle

Artikel-Nr. 86402

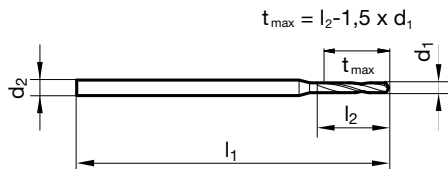


P	M	K	N	S	H
•		•			



Ausspitzung  $\geq \varnothing 0,800$  • Flächenanschliff • Einheitschaft 3 mm • Einheitslänge 38 mm

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • Gusswerkstoffe • Platinenbearbeitung



d1	inch	d2 h6	l1	l2	d1	inch	d2 h6	l1	l2
mm		mm	mm	mm	mm		mm	mm	mm
0,100		3,000	38,000	1,200	0,980		3,000	38,000	10,000
0,150		3,000	38,000	2,000	0,990		3,000	38,000	10,000
0,200		3,000	38,000	2,500	1,000		3,000	38,000	10,000
0,250		3,000	38,000	3,000	1,100		3,000	38,000	10,000
0,300		3,000	38,000	5,000	1,110		3,000	38,000	10,000
0,310		3,000	38,000	5,000	1,150		3,000	38,000	10,000
0,350		3,000	38,000	6,000	1,200		3,000	38,000	10,000
0,370		3,000	38,000	6,000	1,210		3,000	38,000	10,000
0,400		3,000	38,000	7,000	1,400		3,000	38,000	10,000
0,450		3,000	38,000	7,000	1,450		3,000	38,000	10,000
0,500		3,000	38,000	7,000	1,500		3,000	38,000	10,000
0,550		3,000	38,000	7,000	1,510		3,000	38,000	10,000
0,600		3,000	38,000	7,000	1,520		3,000	38,000	10,000
0,640		3,000	38,000	7,000	1,550		3,000	38,000	10,000
0,650		3,000	38,000	7,000	1,600		3,000	38,000	12,000
0,700		3,000	38,000	8,000	1,650		3,000	38,000	12,000
0,710		3,000	38,000	8,000	1,700		3,000	38,000	12,000
0,720		3,000	38,000	8,000	1,800		3,000	38,000	12,000
0,740		3,000	38,000	8,000	1,810		3,000	38,000	12,000
0,750		3,000	38,000	8,000	1,830		3,000	38,000	12,000
0,760		3,000	38,000	8,000	1,850		3,000	38,000	12,000
0,770		3,000	38,000	8,000	1,900		3,000	38,000	12,000
0,780		3,000	38,000	8,000	1,920		3,000	38,000	12,000
0,790		3,000	38,000	8,000	1,950		3,000	38,000	12,000
0,800		3,000	38,000	10,000	1,980		3,000	38,000	12,000
0,810		3,000	38,000	10,000	2,000		3,000	38,000	12,000
0,820		3,000	38,000	10,000	2,050		3,000	38,000	12,000
0,830		3,000	38,000	10,000	2,100		3,000	38,000	12,000
0,840		3,000	38,000	10,000	2,400		3,000	38,000	12,000
0,850		3,000	38,000	10,000	2,500		3,000	38,000	12,000
0,860		3,000	38,000	10,000	2,600		3,000	38,000	12,000
0,870		3,000	38,000	10,000	2,750		3,000	38,000	12,000
0,880		3,000	38,000	10,000	2,950		3,000	38,000	12,000
0,890		3,000	38,000	10,000	3,000		3,000	38,000	12,000
0,900		3,000	38,000	10,000					
0,910		3,000	38,000	10,000					
0,920		3,000	38,000	10,000					
0,930		3,000	38,000	10,000					
0,940		3,000	38,000	10,000					
0,950		3,000	38,000	10,000					
0,960		3,000	38,000	10,000					
0,970		3,000	38,000	10,000					

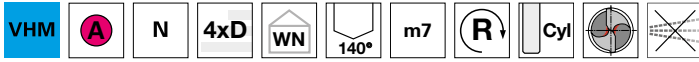


## Kleinstbohrer ohne Kühlkanäle

Artikel-Nr. 86400

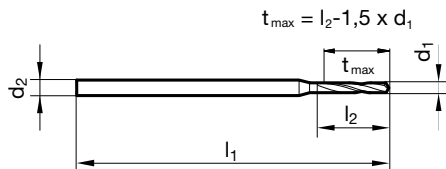


P	M	K	N	S	H
•	•	•	○	○	



Ausspitzung  $\geq \text{Ø } 0,500$  • Flächenanschliff • Hauptschneidenform gerade • geschliffener Schneidenabzug

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe



d1	inch	d2 h6	l1	l2	d1	inch	d2 h6	l1	l2
mm		mm	mm	mm	mm		mm	mm	mm
0,500		3,000	47,000	3,000	1,950		3,000	52,000	11,700
0,550		3,000	47,000	3,300	1,980		4,000	59,000	12,000
0,600		3,000	47,000	3,600	2,000		4,000	59,000	12,000
0,650		3,000	47,000	3,900	2,050		4,000	59,000	12,300
0,700		3,000	47,000	4,200	2,100		4,000	59,000	12,600
0,750		3,000	47,000	4,500	2,150		4,000	59,000	12,900
0,800		3,000	47,000	4,800	2,200		4,000	59,000	13,200
0,850		3,000	47,000	5,100	2,250		4,000	59,000	13,500
0,900		3,000	47,000	5,400	2,300		4,000	59,000	13,800
0,950		3,000	47,000	5,700	2,350		4,000	59,000	14,100
1,000		3,000	47,000	6,000	2,380		4,000	59,000	14,400
1,050		3,000	47,000	6,300	2,400		4,000	59,000	14,400
1,100		3,000	47,000	6,600	2,450		4,000	59,000	14,700
1,150		3,000	47,000	6,900	2,500		4,000	59,000	15,000
1,200		3,000	47,000	7,200	2,550		4,000	59,000	15,300
1,250		3,000	47,000	7,500	2,600		4,000	59,000	15,600
1,300		3,000	47,000	7,800	2,650		4,000	59,000	15,900
1,350		3,000	47,000	8,100	2,700		4,000	59,000	16,200
1,400		3,000	47,000	8,400	2,750		4,000	59,000	16,500
1,450		3,000	47,000	8,700	2,780		4,000	59,000	16,800
1,500		3,000	47,000	9,000	2,800		4,000	59,000	16,800
1,550		3,000	47,000	9,300	2,850		4,000	59,000	17,100
1,590		3,000	47,000	9,600	2,900		4,000	59,000	17,400
1,600		3,000	47,000	9,600	2,950		4,000	59,000	17,700
1,650		3,000	47,000	9,900	3,000		4,000	59,000	18,000
1,700		3,000	47,000	10,200					
1,750		3,000	47,000	10,500					
1,800		3,000	52,000	10,800					
1,850		3,000	52,000	11,100					
1,900		3,000	52,000	11,400					

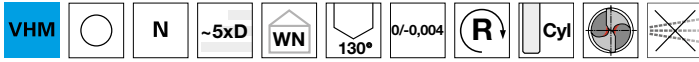


## Kleinstbohrer ohne Kühlkanäle

Artikel-Nr. 89281

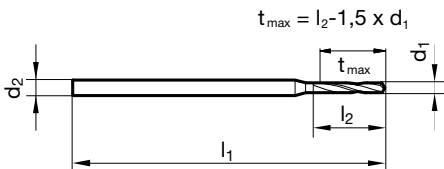


P	M	K	N	S	H
●	○	●	○	○	○



Ausspitzung  $\geq \varnothing 0,800$  • Flächenanschliff • Hauptschneidenform gerade

Bau- und Einsatzstähle • Gusswerkstoffe • Bronzen, Messing • Aluminium und Al-Legierungen • Magnesium und Mg-Legierungen  
• Kunststoffe und faserverstärkte Kunststoffe



d1 mm	d2 mm	l1 mm	l2 mm	d1 mm	d2 mm	l1 mm	l2 mm
0,200	1,000	25,000	1,500	0,800	1,500	25,000	5,300
0,300	1,000	25,000	1,900	1,000	1,500	25,000	6,800
0,400	1,000	25,000	3,000	1,100	1,500	25,000	7,600
0,500	1,000	25,000	3,400	1,250	1,500	25,000	8,500
0,600	1,000	25,000	3,900	1,300	1,500	25,000	8,500
0,700	1,000	25,000	4,800				

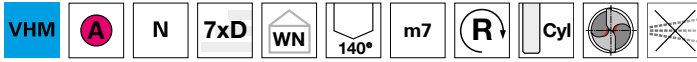


## Kleinstbohrer ohne Kühlkanäle

Artikel-Nr. 86401

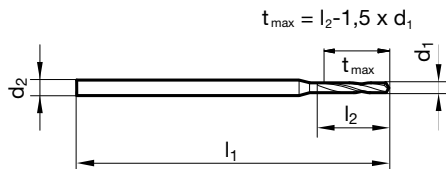


P	M	K	N	S	H
•	•	•	○	○	



Ausspitzung  $\geq \text{Ø } 0,500$  • Flächenanschliff • Hauptschneidenform gerade • geschliffener Schneidenabzug

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe



d1	inch	d2 h6	l1	l2	d1	inch	d2 h6	l1	l2
mm		mm	mm	mm	mm		mm	mm	mm
0,500		3,000	47,000	4,000	1,950		3,000	52,000	17,600
0,550		3,000	47,000	4,400	1,980		4,000	63,000	18,000
0,600		3,000	47,000	4,800	2,000		4,000	63,000	18,000
0,650		3,000	47,000	5,200	2,050		4,000	63,000	18,500
0,700		3,000	47,000	5,600	2,100		4,000	63,000	18,900
0,750		3,000	47,000	6,000	2,150		4,000	63,000	19,400
0,800		3,000	47,000	6,400	2,200		4,000	63,000	19,800
0,850		3,000	47,000	6,800	2,250		4,000	63,000	20,300
0,900		3,000	47,000	7,200	2,300		4,000	63,000	20,700
0,950		3,000	47,000	7,600	2,350		4,000	63,000	21,200
1,000		3,000	47,000	8,000	2,380		4,000	63,000	21,600
1,050		3,000	47,000	8,400	2,400		4,000	63,000	21,600
1,100		3,000	47,000	8,800	2,450		4,000	63,000	22,100
1,150		3,000	47,000	9,200	2,500		4,000	63,000	22,500
1,200		3,000	52,000	10,800	2,550		4,000	63,000	23,000
1,250		3,000	52,000	11,300	2,600		4,000	67,000	23,400
1,300		3,000	52,000	11,700	2,650		4,000	67,000	23,900
1,350		3,000	52,000	12,200	2,700		4,000	67,000	24,300
1,400		3,000	52,000	12,600	2,750		4,000	67,000	24,800
1,450		3,000	52,000	13,100	2,780		4,000	67,000	25,200
1,500		3,000	52,000	13,500	2,800		4,000	67,000	25,200
1,550		3,000	52,000	14,000	2,850		4,000	67,000	25,700
1,590		3,000	52,000	14,400	2,900		4,000	67,000	26,100
1,600		3,000	52,000	14,400	2,950		4,000	67,000	26,600
1,650		3,000	52,000	14,900	3,000		4,000	67,000	27,000
1,700		3,000	52,000	15,300					
1,750		3,000	52,000	15,800					
1,800		3,000	52,000	16,200					
1,850		3,000	52,000	16,700					
1,900		3,000	52,000	17,100					



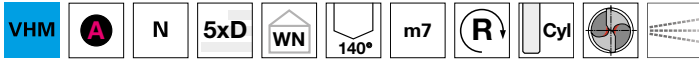


## Kleinstbohrer mit Kühlkanälen

Artikel-Nr. 86405

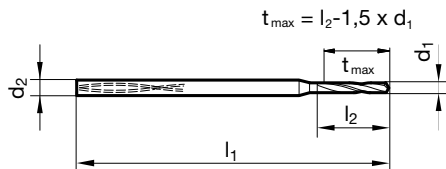


P	M	K	N	S	H
•	•	•	○	○	



Ausspitzung  $\geq \text{Ø } 1,400$  • Flächenanschliff • Hauptschneidenform gerade • geschliffener Schneidenabzug

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup> • rostfreie Stähle • Gusswerkstoffe



d1	inch	d2 h6	l1	l2	d1	inch	d2 h6	l1	l2
mm		mm	mm	mm	mm		mm	mm	mm
1,400		4,000	52,000	11,000	2,450		4,000	62,000	20,000
1,450		4,000	52,000	12,000	2,500		4,000	62,000	20,000
1,500		4,000	52,000	12,000	2,550		4,000	62,000	20,000
1,550		4,000	52,000	12,000	2,600		4,000	66,000	21,000
1,590		4,000	52,000	13,000	2,650		4,000	66,000	21,000
1,600		4,000	52,000	13,000	2,700		4,000	66,000	22,000
1,650		4,000	52,000	13,000	2,750		4,000	66,000	22,000
1,700		4,000	56,000	14,000	2,780		4,000	66,000	22,000
1,750		4,000	56,000	14,000	2,800		4,000	66,000	22,000
1,800		4,000	56,000	14,000	2,850		4,000	66,000	23,000
1,850		4,000	56,000	15,000	2,900		4,000	66,000	23,000
1,900		4,000	56,000	15,000	2,950		4,000	66,000	24,000
1,950		4,000	56,000	16,000	3,000		4,000	66,000	24,000
1,980		4,000	56,000	16,000					
2,000		4,000	56,000	16,000					
2,050		4,000	56,000	16,000					
2,100		4,000	62,000	17,000					
2,150		4,000	62,000	17,000					
2,200		4,000	62,000	18,000					
2,250		4,000	62,000	18,000					
2,300		4,000	62,000	18,000					
2,350		4,000	62,000	19,000					
2,380		4,000	62,000	19,000					
2,400		4,000	62,000	19,000					

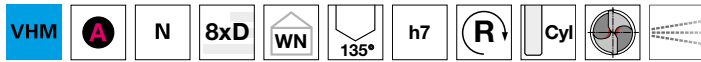


## Kleinstbohrer mit Kühlkanälen

Artikel-Nr. 86408

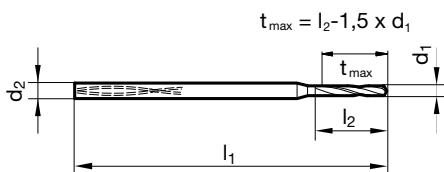


P	M	K	N	S	H
•	•	•	○	○	



Ausspitzung  $\geq \text{Ø } 1,400$  • Flächenanschliff • Hauptschneidenform gerade • geschliffener Schneidenabzug

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis  $1200 \text{ N/mm}^2$  • rostfreie Stähle • Gusswerkstoffe



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1,400	4,000	52,000	15,000	2,600	4,000	66,000	29,000
1,500	4,000	52,000	17,000	2,700	4,000	66,000	30,000
1,600	4,000	52,000	18,000	2,800	4,000	66,000	31,000
1,700	4,000	56,000	19,000	2,900	4,000	66,000	32,000
1,800	4,000	56,000	20,000	3,000	4,000	66,000	33,000
1,900	4,000	56,000	21,000				
2,000	4,000	56,000	22,000				
2,100	4,000	62,000	23,000				
2,200	4,000	62,000	24,000				
2,300	4,000	62,000	25,000				
2,400	4,000	62,000	26,000				
2,500	4,000	62,000	28,000				

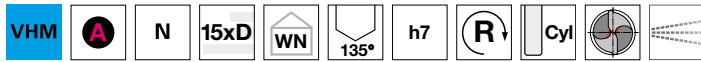


## Kleinstbohrer mit Kühlkanälen

Artikel-Nr. 86412

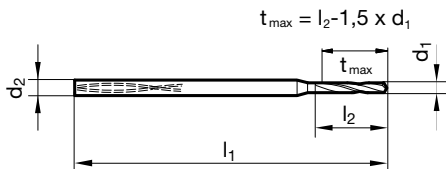


P	M	K	N	S	H
•	•	•	○	○	



Ausspitzung  $\geq \text{Ø } 1,400$  • Flächenanschliff • Hauptschneidenform gerade • geschliffener Schneidenabzug

Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis  $1200 \text{ N/mm}^2$  • rostfreie Stähle • Gusswerkstoffe



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1,400	4,000	62,000	25,000	2,600	4,000	87,000	47,000
1,500	4,000	62,000	27,000	2,700	4,000	87,000	48,000
1,600	4,000	62,000	29,000	2,800	4,000	87,000	50,000
1,700	4,000	70,000	31,000	2,900	4,000	87,000	52,000
1,800	4,000	70,000	32,000	3,000	4,000	87,000	54,000
1,900	4,000	70,000	34,000				
2,000	4,000	70,000	36,000				
2,100	4,000	78,000	38,000				
2,200	4,000	78,000	40,000				
2,300	4,000	78,000	42,000				
2,400	4,000	78,000	44,000				
2,500	4,000	78,000	45,000				





# HARTNER

Precision Cutting Tools

## STUFENBOHRER/ ZENTRIERBOHRER

Kurzstufenbohrer, Mehrfasenstufenbohrer aus  
HSS und VHM mit Zylinderschaft und Morsekegel  
Zentrierbohrer aus HSS, HSS-E und VHM  
blank und beschichtet









Stufenbohrer  
Zentrierbohrer

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Senk- winkel/ Form	d1/mm	Artikel-Nr.	Progr. Seite
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## Stufenbohrer für Zentrierungen DIN 332

	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	○	rechts	zyl.	90	8,000 - 40,000	<b>85910</b>	345
	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	○	rechts	zyl.	90	8,000 - 40,000	<b>85911</b>	345
	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	○	rechts	zyl.	90	8,000 - 20,000	<b>85912</b>	346
	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	○	rechts	MK	90	14,000 - 40,000	<b>85914</b>	347

## Kurzstufenbohrer mit Zylinderschaft






	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	Ⓡ	rechts	zyl.	90	3,400 - 13,500	<b>84445</b>	348
	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	○	rechts	zyl.	90	6,000 - 19,000	<b>85916</b>	349
	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	○	rechts	zyl.	90	6,600 - 21,500	<b>85917</b>	350
	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	○	rechts	zyl.	180	6,000 - 18,000	<b>85918</b>	351
	•	○	•	•	○	Werksnorm	N	<b>HSS</b>	○	rechts	zyl.	90	3,400 - 13,500	<b>85920</b>	352
	○	○	○	•	○	Werksnorm	N	<b>VHM</b>	○	rechts	HE	90	5,500 - 9,000	<b>89254</b>	353

## Mehrfasenstufenbohrer mit Zylinderschaft






	•	○	•	○	○	DIN 8374	N	<b>HSS</b>	○	rechts	zyl.	90	6,000 - 19,000	<b>85010</b>	354
	•	○	•	○	○	DIN 8374	N	<b>HSS</b>	○	rechts	zyl.	90	7,500 - 19,000	<b>85218</b>	355

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Senk- winkel/ Form	d1/mm	Artikel-Nr.	Progr. Seite
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## Mehrfasenstufenbohrer mit Zylinderschaft

		DIN 8376	N	<b>HSS</b>		rechts	zyl.	180	6,000 - 18,000	<b>85210</b>	356
		DIN 8378	N	<b>HSS</b>		rechts	zyl.	90	3,400 - 13,500	<b>85310</b>	357
		Werksnorm	N	<b>HSS</b>		rechts	zyl.	90	6,600 - 17,200	<b>85110</b>	358
		Werksnorm	N	<b>HSS</b>		rechts	zyl.	180	5,900 - 16,500	<b>85216</b>	359
			N	<b>VHM</b>		rechts	zyl.	180	6,000 - 11,000	<b>89252</b>	360

## Mehrfasenstufenbohrer mit Morsekegel











		DIN 8375	N	<b>HSS</b>		rechts	MK	90	12,000 - 23,000	<b>85619</b>	361
		DIN 8377	N	<b>HSS</b>		rechts	MK	180	10,000 - 33,000	<b>85610</b>	362
		DIN 8379	N	<b>HSS</b>		rechts	MK	90	9,000 - 22,000	<b>85710</b>	363
		Werksnorm	N	<b>HSS</b>		rechts	MK	90	11,000 - 26,000	<b>85510</b>	364
		Werksnorm	N	<b>HSS</b>		rechts	MK	180	9,400 - 33,000	<b>85616</b>	365

## Zentrierbohrer ohne Fläche




		DIN 333	N	<b>HSS</b>		rechts	zyl.	A	0,500 - 12,500	<b>83100</b>	366
		DIN 333	N	<b>HSS</b>		rechts	zyl.	A	0,500 - 12,500	<b>84450</b>	366

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Senk- winkel/ Form	d1/mm	Artikel-Nr.	Progr. Seite
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## Zentrierbohrer ohne Fläche

	•	○	•	•	○	DIN 333	N	HSS	○	links	zyl.	A	0,500 - 4,000	83105	367
	•	○	•	•	○	DIN 333	N	HSS	○	rechts	zyl.	R	0,500 - 10,000	83000	368
	•	○	•	•	○	DIN 333	N	HSS	T	rechts	zyl.	R	0,500 - 10,000	84448	368
	•	○	•	•	○	DIN 333	N	HSS	○	rechts	zyl.	A	1,000 - 10,000	83300	369
	•	○	•	•	○	DIN 333	N	HSS	○	rechts	zyl.	B	1,000 - 10,000	83200	370
	•	○	•	•	○	DIN 333	N	HSS	○	links	zyl.	R	1,000 - 4,000	83005	371
	•	○	•	•	○	Werksnorm	N	HSS	○	rechts	zyl.	A	1,000 - 3,150	83110	372
	•	•	•	•	○	DIN 333	N	HSS-E	○	rechts	zyl.	A	1,000 - 4,000	83101	373
	•	•	•	○	•	DIN 333	N	HSS-E	F	rechts	zyl.	A	0,500 - 4,000	83102	374
	○	○	○	○	○	Werksnorm	N	VHM	○	rechts	zyl.	A	0,500 - 6,300	83370	375

## Zentrierbohrer mit Fläche

	•	○	•	•	○	DIN 333	N	HSS	○	rechts	zyl.	A	1,600 - 10,000	83600	376
	•	○	•	•	○	DIN 333	N	HSS	○	rechts	zyl.	R	1,600 - 10,000	83500	376
	•	○	•	•	○	DIN 333	N	HSS	○	rechts	zyl.	B	1,600 - 8,000	83700	377



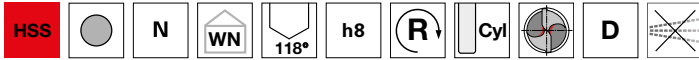


## Stufenbohrer für Zentrierungen DIN 332

### Artikel-Nr. 85910



P	M	K	N	S	H
•	○	•	•	○	

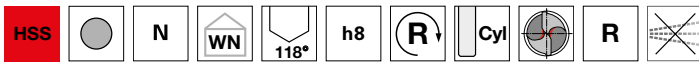


Ausspitzung  $\geq \varnothing 8,000$  • Kegelmantelschliff • mit Fläche am Schaft • Senkwinkel 60° • für Gewindekernbohrungen mit Zentrierung nach DIN 332, Blatt 2, Form D • Einsatz auf Zentrier-/Ablängmaschinen

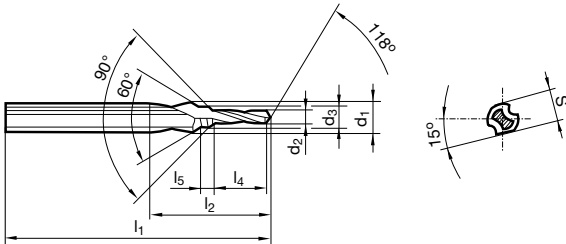
### Artikel-Nr. 85911



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 8,000$  • Kegelmantelschliff • mit Fläche am Schaft • Senkwinkel 60° • für Gewindekernbohrungen mit Zentrierung nach DIN 332, Blatt 2, Form DR • Einsatz auf Zentrier-/Ablängmaschinen



d1 h7 mm	d3 h11 mm	d2 h8 mm	S mm	l1 mm	l2 mm	l4 mm	l5 mm	für Gewinde
8,000	4,300	3,300	6,750	63,000	23,000	1,600	11,000	M 4
10,000	5,300	4,200	8,450	67,000	27,000	2,150	13,000	M 5
12,500	6,400	5,000	10,450	71,000	33,000	2,900	16,000	M 6
14,000	8,400	6,800	12,500	88,000	41,000	3,500	19,500	M 8
16,000	10,500	8,500	14,850	94,000	47,000	4,700	23,000	M10
20,000	13,000	10,200	18,450	105,000	59,000	6,500	28,000	M12
25,000	17,000	14,000	23,400	132,000	67,000	8,300	33,000	M16
31,500	21,000	17,500	29,350	145,000	76,500	10,350	38,000	M20
40,000	25,000	21,000	36,500	160,000	90,000	12,000	45,000	M24

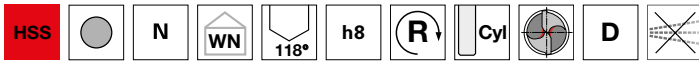


## Stufenbohrer für Zentrierungen DIN 332

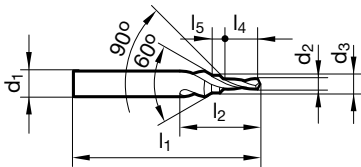
Artikel-Nr. 85912



P	M	K	N	S	H
•	○	•	•		



Ausspitzung  $\geq \varnothing 8,000$  • Kegelmantelschliff • Senkwinkel  $60^\circ$  • für Gewindekernbohrungen mit Zentrierung nach DIN 332, Blatt 2, Form D



d1 h7 mm	d3 h11 mm	d2 h8 mm	l1 mm	l2 mm	l4 mm	l5 mm	für Gewinde
8,000	4,300	3,300	63,000	23,000	11,000	1,600	M 4
10,000	5,300	4,200	67,000	27,000	13,000	2,150	M 5
12,500	6,400	5,000	71,000	33,000	16,000	2,900	M 6
14,000	8,400	6,800	88,000	41,000	19,500	3,500	M 8
16,000	10,500	8,500	94,000	47,000	23,000	4,700	M10
20,000	13,000	10,200	105,000	59,000	28,000	6,500	M12

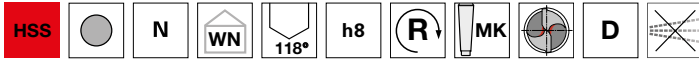


## Stufenbohrer für Zentrierungen DIN 332

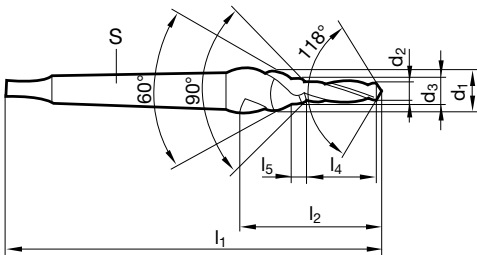
Artikel-Nr. 85914



P	M	K	N	S	H
•	○	•	•	•	



Ausspitzung  $\geq \text{Ø } 14,000$  • Kegelmantelschliff • Senkwinkel  $60^\circ$  • für Gewindekernbohrungen mit Zentrierung nach DIN 332, Blatt 2, Form D



d1 h7 mm	d3 h11 mm	d2 h8 mm	S	l1 mm	l2 mm	l4 mm	l5 mm	für Gewinde
14,000	8,400	6,800	MK-1	110,000	41,000	3,500	19,500	M 8
16,000	10,500	8,500	MK-2	131,000	47,000	4,700	23,000	M10
20,000	13,000	10,200	MK-2	145,000	59,000	6,500	28,000	M12
25,000	17,000	14,000	MK-3	172,000	67,000	8,300	33,000	M16
31,500	21,000	17,500	MK-3	184,000	76,500	10,350	38,000	M20
40,000	25,000	21,000	MK-4	222,000	90,000	12,000	45,000	M24



## Kurzstufenbohrer mit Zylinderschaft

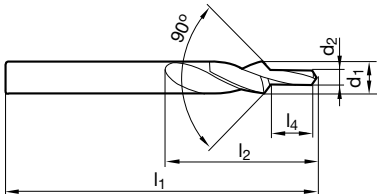
Artikel-Nr. 84445



P	M	K	N	S	H
•	○	•	•		



Ausspitzung  $\geq \varnothing 3,400$  • Kegelmantelschliff • sehr torsionsstabil • für CNC- und NC-Maschinen • für Gewindekernbohrungen nach DIN 336 • für Freisenkungen  $90^\circ$  entsprechend den Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h6 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
3,400	2,500	52,000	20,000	8,800	M 3
6,600	5,000	70,000	31,000	16,500	M 6
9,000	6,800	84,000	40,000	21,000	M 8
11,000	8,500	95,000	47,000	25,500	M10
13,500	10,200	107,000	54,000	30,000	M12

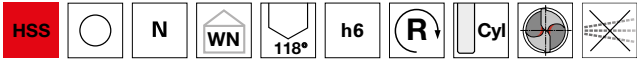


## Kurzstufenbohrer mit Zylinderschaft

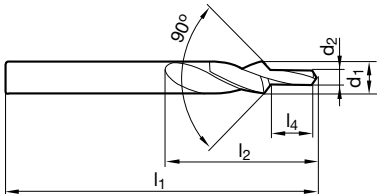
Artikel-Nr. 85916



P	M	K	N	S	H
•	○	•	•	•	



Ausspitzung  $\geq \varnothing 6,000$  • Kegelmantelschliff • sehr torsionsstabil • für CNC- und NC-Maschinen • für Durchgangsbohrungen nach DIN EN 20273, Reihe fein • für Schraubenkopfsenkungen  $90^\circ$  • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h6 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
6,000	3,200	66,000	28,000	9,000	M 3
8,000	4,300	79,000	37,000	11,000	M 4
10,000	5,300	89,000	43,000	13,000	M 5
11,500	6,400	95,000	47,000	15,000	M 6
15,000	8,400	111,000	56,000	19,000	M 8
19,000	10,500	127,000	64,000	23,000	M10

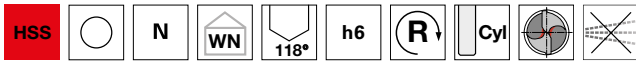


## Kurzstufenbohrer mit Zylinderschaft

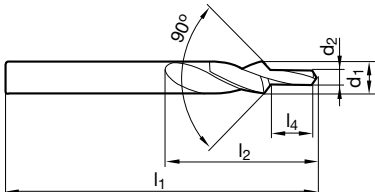
Artikel-Nr. 85917



P	M	K	N	S	H
•	○	•	•	•	



Ausspitzung  $\geq \varnothing 6,600$  • Kegelmantelschliff • sehr torsionsstabil • für CNC- und NC-Maschinen • für Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • für Schraubkopfsenkungen  $90^\circ$  nach DIN 74, Form A • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h6 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
6,600	3,400	70,000	31,000	9,000	M 3
9,000	4,500	84,000	40,000	11,000	M 4
11,000	5,500	95,000	47,000	13,000	M 5
13,000	6,600	102,000	51,000	15,000	M 6
17,200	9,000	123,000	62,000	19,000	M 8
21,500	11,000	141,000	70,000	23,000	M10

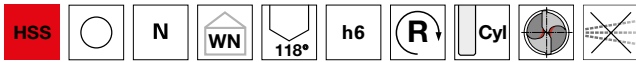


## Kurzstufenbohrer mit Zylinderschaft

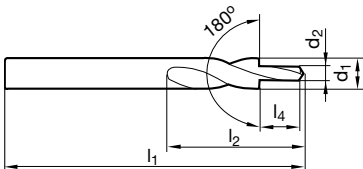
Artikel-Nr. 85918



P	M	K	N	S	H
•	○	•	•	•	



Ausspitzung  $\geq \varnothing 6,000$  • Kegelmantelschliff • sehr torsionsstabil • für CNC- und NC-Maschinen • für Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • für Schraubenkopfsenkungen  $180^\circ$  nach DIN 974-1, Reihe 1 • für Schrauben nach DIN 6912, 7984, 34821, DIN EN ISO 1207, 4762, 14579, 14580 • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h6 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
6,000	3,400	66,000	28,000	9,000	M 3
8,000	4,500	79,000	37,000	11,000	M 4
10,000	5,500	89,000	43,000	13,000	M 5
11,000	6,600	95,000	47,000	15,000	M 6
15,000	9,000	111,000	56,000	19,000	M 8
18,000	11,000	123,000	62,000	23,000	M10

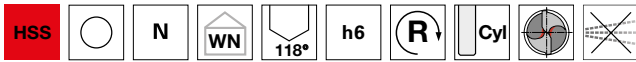


## Kurzstufenbohrer mit Zylinderschaft

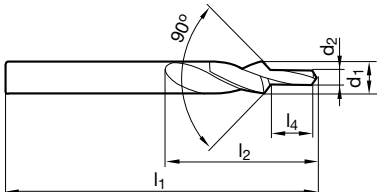
Artikel-Nr. 85920



P	M	K	N	S	H
•	○	•	•	•	



Ausspitzung  $\geq \varnothing 3,400$  • Kegelmantelschliff • sehr torsionsstabil • für CNC- und NC-Maschinen • für Gewindekernbohrungen nach DIN 336 • für Freisenkungen  $90^\circ$  entsprechend den Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h6 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
3,400	2,500	52,000	20,000	8,800	M 3
4,500	3,300	58,000	24,000	11,400	M 4
5,500	4,200	66,000	28,000	13,600	M 5
6,600	5,000	70,000	31,000	16,500	M 6
9,000	6,800	84,000	40,000	21,000	M 8
11,000	8,500	95,000	47,000	25,500	M10
13,500	10,200	107,000	54,000	30,000	M12



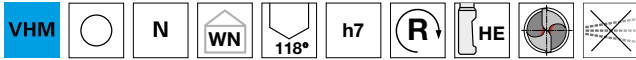


## Kurzstufenbohrer mit Zylinderschaft

Artikel-Nr. 89254

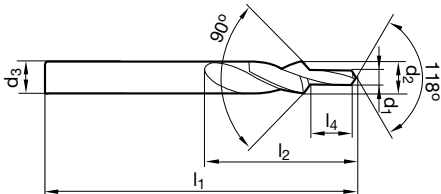


P	M	K	N	S	H
○	○	○	●	○	○



Ausspitzung  $\geq \varnothing 3,400$  • Flächenanschliff • sehr torsionsstabil • für CNC- und NC-Maschinen • für Gewindekernbohrungen nach DIN 336 • für Freisenkungen  $90^\circ$  entsprechend den Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser

Stahlguss, Grauguss, Hartguss • Mangan-Hartstähle, Bronzen • Leicht- und Buntmetalle • abrasive Werkstoffe (AlSi-Legierungen)  
 • faserverstärkte Kunststoffe • Duroplaste mit Schmirgelwirkung auf Schneiden und Fasen



d1 h7 mm	d2 h9 mm	d3 mm	l1 mm	l2 mm	l4 mm	für Gewinde
5,500	4,200	6,000	66,000	28,000	13,600	M 5
6,600	5,000	8,000	70,000	31,000	16,500	M 6
9,000	6,800	10,000	84,000	40,000	21,000	M 8

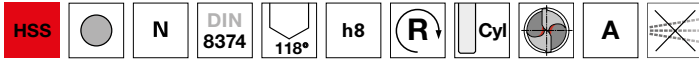


## Mehrfasenstufenbohrer mit Zylinderschaft

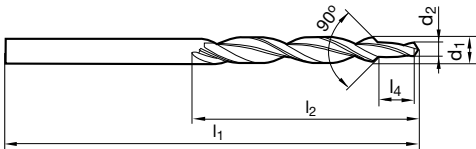
Artikel-Nr. 85010



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 6,000$  • Kegelmantelschliff • für Durchgangsbohrungen nach DIN EN 20273, Reihe fein • für Schraubenkopfsenkungen  $90^\circ$  • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
6,000	3,200	93,000	57,000	9,000	M 3
8,000	4,300	117,000	75,000	11,000	M 4
10,000	5,300	133,000	87,000	13,000	M 5
11,500	6,400	142,000	94,000	15,000	M 6
15,000	8,400	169,000	114,000	19,000	M 8
19,000	10,500	198,000	135,000	23,000	M10

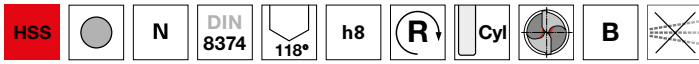


## Mehrfasenstufenbohrer mit Zylinderschaft

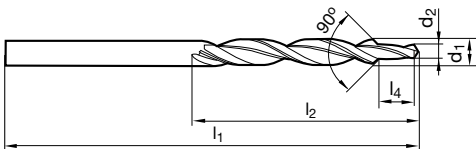
Artikel-Nr. 85218



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 7,500$  • Kegelmantelschliff • für Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • für Schraubenkopfsenkungen  $90^\circ$  nach DIN 74, Form A und F • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
7,500	3,400	109,000	69,000	9,000	M 3
9,700	4,500	133,000	87,000	11,000	M 4
12,000	5,500	151,000	101,000	13,000	M 5
14,500	6,600	169,000	114,000	15,000	M 6
19,000	9,000	198,000	135,000	19,000	M 8

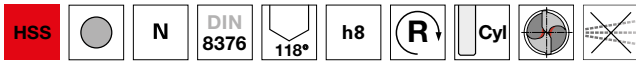


## Mehrfasenstufenbohrer mit Zylinderschaft

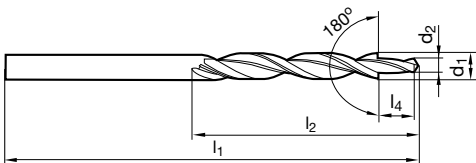
Artikel-Nr. 85210



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 6,000$  • Kegelmantelschliff • für Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • für Schraubenkopfsenkungen  $180^\circ$  nach DIN 974-1, Reihe 1 • für Schrauben nach DIN 6912, 7984, 34821, DIN EN ISO 1207, 4762, 14579, 14580 und DIN 7513, 7516, 7500-1 • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
6,000	3,400	93,000	57,000	9,000	M 3
8,000	4,500	117,000	75,000	11,000	M 4
10,000	5,500	133,000	87,000	13,000	M 5
11,000	6,600	142,000	94,000	15,000	M 6
15,000	9,000	169,000	114,000	19,000	M 8
18,000	11,000	191,000	130,000	23,000	M10

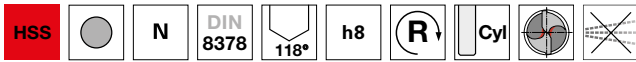


## Mehrfasenstufenbohrer mit Zylinderschaft

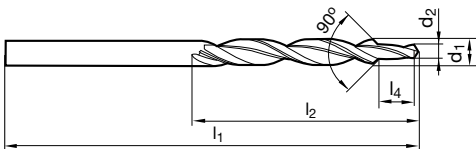
Artikel-Nr. 85310



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 3,400$  • Kegelmantelschliff • für Gewidekernbohrungen nach DIN 336 • für Freisenkungen  $90^\circ$  entsprechend den Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
3,400	2,500	70,000	39,000	8,800	M 3
4,500	3,300	80,000	47,000	11,400	M 4
5,500	4,200	93,000	57,000	13,600	M 5
6,600	5,000	101,000	63,000	16,500	M 6
9,000	6,800	125,000	81,000	21,000	M 8
11,000	8,500	142,000	94,000	25,500	M10
13,500	10,200	160,000	108,000	30,000	M12

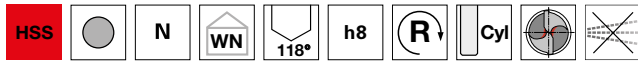


## Mehrfasenstufenbohrer mit Zylinderschaft

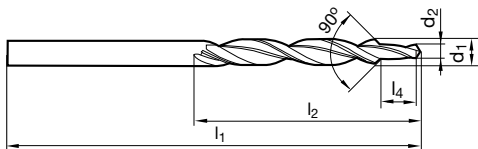
Artikel-Nr. 85110



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 6,600$  • Kegelmantelschliff • für Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • für Schraubenkopfsenkungen  $90^\circ$  nach DIN 74 Teil 1 (Ausgabe 12.1980 zurückgezogen), Form A und B, Ausführung mittel • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
6,600	3,400	101,000	63,000	9,000	M 3
9,000	4,500	125,000	81,000	11,000	M 4
11,000	5,500	142,000	94,000	13,000	M 5
13,000	6,600	151,000	101,000	15,000	M 6
17,200	9,000	191,000	130,000	19,000	M 8

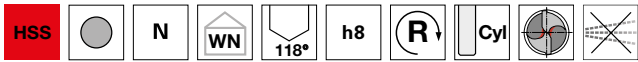


## Mehrfasenstufenbohrer mit Zylinderschaft

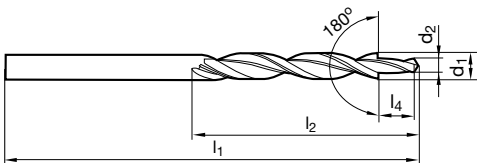
Artikel-Nr. 85216



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 5,900$  • Kegelmantelschliff • für Durchgangsbohrungen mit alten Senkungen Form H, J, K nach DIN 75 Teil 2 (Ausgabe 04.1968 zurückgezogen), Ausführung mittel und fein • für Schrauben nach DIN 84, 912, 6912 • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
5,900	3,200	93,000	57,000	11,000	M 3
7,400	4,300	109,000	69,000	13,000	M 4
9,400	5,300	125,000	81,000	16,000	M 5
10,000	5,800	133,000	87,000	16,000	M 5
10,400	6,400	133,000	87,000	19,000	M 6
11,000	7,000	142,000	94,000	19,000	M 6
13,500	8,400	160,000	108,000	22,000	M 8
16,500	10,500	184,000	125,000	25,000	M10

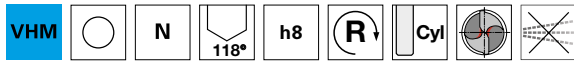


## Mehrfasenstufenbohrer mit Zylinderschaft

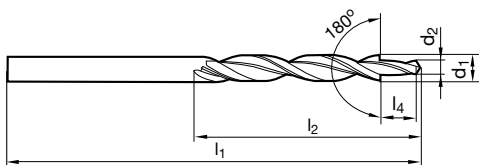
Artikel-Nr. 89252



P	M	K	N	S	H
○	○	○	○	●	○



Ausspitzung  $\geq \varnothing 8,000$  • Kegelmantelschliff • für Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • für Schraubenkopfsenkungen  $180^\circ$  nach DIN 974-1, Reihe 1 • für Schrauben nach DIN 6912, 7984, 34821, DIN EN ISO 1207, 4762, 14579, 14580 und DIN 7513, 7516, 7500-1 • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	für Gewinde
6,000	3,400	93,000	57,000	9,000	M 3
10,000	5,500	133,000	87,000	13,000	M 5
11,000	6,600	142,000	94,000	15,000	M 6



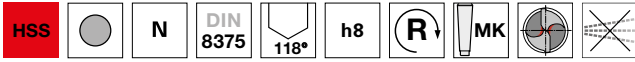


## Mehrfasenstufenbohrer mit Morsekegel

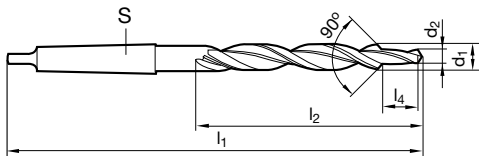
Artikel-Nr. 85619



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 12,000$  • Kegelmantelschliff • für Durchgangsbohrungen nach DIN EN 20273, Reihe fein • für Schraubenkopfsenkungen  $90^\circ$  nach DIN 74, Form A und F • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	S	l1 mm	l2 mm	l4 mm	für Gewinde
12,000	5,500	MK-1	182,000	101,000	13,000	M 5
14,500	6,600	MK-2	212,000	114,000	15,000	M 6
19,000	9,000	MK-2	233,000	135,000	19,000	M 8
23,000	11,000	MK-2	253,000	155,000	23,000	M10

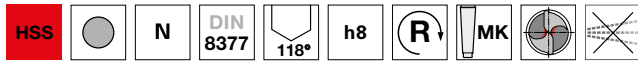


## Mehrfasenstufenbohrer mit Morsekegel

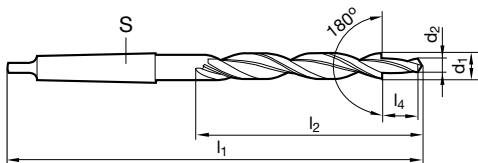
Artikel-Nr. 85610



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 10,000$  • Kegelmantelschliff • für Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • für Schraubenkopfsenkungen 180° nach DIN 974-1, Reihe 1 • für Schrauben nach DIN 6912, 7984, 34821, DIN EN ISO 1207, 4762, 14579, 14580 und DIN 7513, 7516, 7500-1 • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	S	l1 mm	l2 mm	l4 mm	für Gewinde
10,000	5,500	MK-1	168,000	87,000	13,000	M 5
11,000	6,600	MK-1	175,000	94,000	15,000	M 6
15,000	9,000	MK-2	212,000	114,000	19,000	M 8
18,000	11,000	MK-2	228,000	130,000	23,000	M10
20,000	13,500	MK-2	238,000	140,000	27,000	M12
24,000	15,500	MK-3	281,000	160,000	31,000	M14
26,000	17,500	MK-3	286,000	165,000	35,000	M16
30,000	20,000	MK-3	296,000	175,000	39,000	M18
33,000	22,000	MK-4	334,000	185,000	43,000	M20

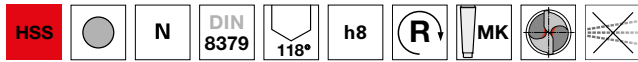


## Mehrfasenstufenbohrer mit Morsekegel

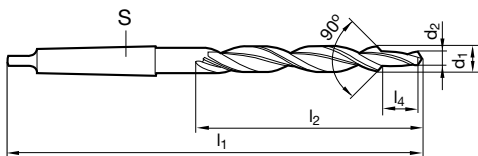
Artikel-Nr. 85710



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 9,000$  • Kegelmantelschliff • für Gewindekernbohrungen nach DIN 336 • für Freisenkungen  $90^\circ$  entsprechend den Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	S	l1 mm	l2 mm	l4 mm	für Gewinde
9,000	6,800	MK-1	162,000	81,000	21,000	M 8
11,000	8,500	MK-1	175,000	94,000	25,500	M10
13,500	10,200	MK-1	189,000	108,000	30,000	M12
15,500	12,000	MK-2	218,000	120,000	34,500	M14
17,500	14,000	MK-2	228,000	130,000	38,500	M16
20,000	15,500	MK-2	238,000	140,000	43,500	M18
22,000	17,500	MK-2	248,000	150,000	47,500	M20

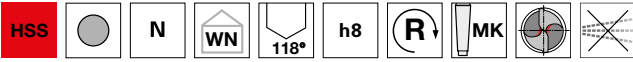


## Mehrfasenstufenbohrer mit Morsekegel

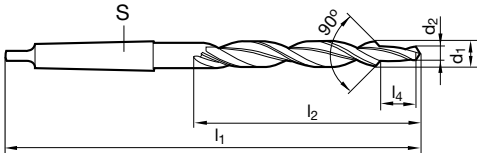
Artikel-Nr. 85510



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \text{Ø } 11,000$  • Kegelmantelschliff • für Durchgangsbohrungen nach DIN EN 20273, Reihe mittel • für Schraubenkopfsenkungen  $90^\circ$  nach DIN 74 Teil 1 (Ausgabe 12.1980 zurückgezogen), Form A und B, Ausführung mittel • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	S	l1 mm	l2 mm	l4 mm	für Gewinde
11,000	5,500	MK-1	175,000	94,000	13,000	M 5
13,000	6,600	MK-1	182,000	101,000	15,000	M 6
17,200	9,000	MK-2	228,000	130,000	19,000	M 8
21,500	11,000	MK-2	248,000	150,000	23,000	M10
26,000	14,000	MK-3	286,000	165,000	27,000	M12

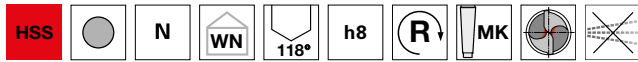


## Mehrfasenstufenbohrer mit Morsekegel

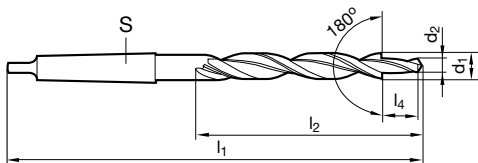
Artikel-Nr. 85616



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 9,400$  • Kegelmantelschliff • für Durchgangsbohrungen mit alten Senkungen Form H, J, K nach DIN 75 Teil 2 (Ausgabe 04.1968 zurückgezogen), Ausführung mittel und fein • für Schrauben nach DIN 84, 912, 6912 • f richtet sich nach kleinem Durchmesser • vc richtet sich nach großem Durchmesser



d1 h8 mm	d2 h9 mm	S	l1 mm	l2 mm	l4 mm	für Gewinde
9,400	5,300	MK-1	162,000	81,000	16,000	M 5
14,500	9,500	MK-2	212,000	114,000	22,000	M 8
19,000	13,000	MK-2	233,000	135,000	28,000	M12
20,000	14,000	MK-2	238,000	140,000	28,000	M12
23,000	15,000	MK-2	253,000	155,000	30,000	M14
25,000	17,000	MK-3	281,000	160,000	33,000	M16
28,000	19,000	MK-3	291,000	170,000	36,000	M18
29,000	20,000	MK-3	296,000	175,000	36,000	M18
31,000	21,000	MK-3	301,000	180,000	39,000	M20
33,000	23,000	MK-4	334,000	185,000	39,000	M20



## Zentrierbohrer ohne Fläche

### Artikel-Nr. 83100



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • ohne Schutzsenkung • für Zentrierbohrungen nach DIN 332 Teil 1, Form A •  $d1 \leq 0,8$  mm: einseitig mit Spitze

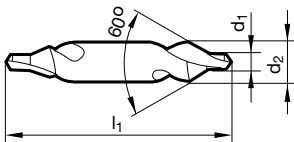
### Artikel-Nr. 84450



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • ohne Schutzsenkung • für Zentrierbohrungen nach DIN 332 Teil 1, Form A •  $d1 \leq 0,8$  mm: einseitig mit Spitze • höhere Verschleißfestigkeit



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
0,500	3,150	25,000	10,000	25,000	100,000
0,800	3,150	25,000	12,500	31,500	125,000
1,000	3,150	31,500			
1,250	3,150	31,500			
1,600	4,000	35,500			
2,000	5,000	40,000			
2,500	6,300	45,000			
3,150	8,000	50,000			
4,000	10,000	56,000			
5,000	12,500	63,000			
6,300	16,000	71,000			
8,000	20,000	80,000			

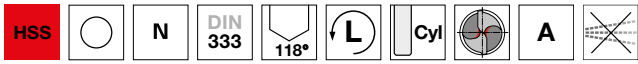


## Zentrierbohrer ohne Fläche

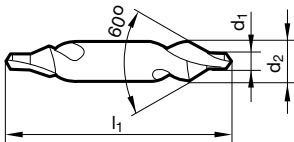
Artikel-Nr. 83105



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • ohne Schutzsenkung • für Zentrierbohrungen nach DIN 332 Teil 1, Form A •  $d1 \leq 0,8$  mm: einseitig mit Spitze



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
0,500	3,150	25,000	2,500	6,300	45,000
0,800	3,150	25,000	3,150	8,000	50,000
1,000	3,150	31,500	4,000	10,000	56,000
1,250	3,150	31,500			
1,600	4,000	35,500			
2,000	5,000	40,000			



## Zentrierbohrer ohne Fläche

### Artikel-Nr. 83000



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • korrekte Anlage zwischen Körnerspitzen • für Zentrierbohrungen nach DIN 332 Teil 1, Form R •  $d1 \leq 0,8$  mm: einseitig mit Spitze

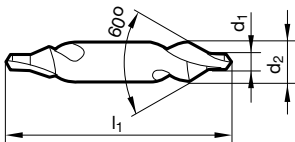
### Artikel-Nr. 84448



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • korrekte Anlage zwischen Körnerspitzen • für Zentrierbohrungen nach DIN 332 Teil 1, Form R •  $d1 \leq 0,8$  mm: einseitig mit Spitze • höhere Verschleißfestigkeit



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
0,500	3,150	25,000	10,000	25,000	100,000
0,800	3,150	25,000			
1,000	3,150	31,500			
1,250	3,150	31,500			
1,600	4,000	35,500			
2,000	5,000	40,000			
2,500	6,300	45,000			
3,150	8,000	50,000			
4,000	10,000	56,000			
5,000	12,500	63,000			
6,300	16,000	71,000			
8,000	20,000	80,000			





## Zentrierbohrer ohne Fläche

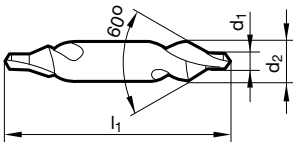
Artikel-Nr. 83300



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • mit Wulst für besonders hohe Bruchsicherheit • ohne Schutzsenkung • Vertiefung am Übergang Senkung/Bohrung für zusätzlichen Schmierstoffraum • für Zentrierbohrungen nach DIN 332 Teil 1, Form A



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
1,000	3,150	31,500	4,000	10,000	56,000
1,250	3,150	31,500	5,000	12,500	63,000
1,600	4,000	35,500	6,300	16,000	71,000
2,000	5,000	40,000	8,000	20,000	80,000
2,500	6,300	45,000	10,000	25,000	100,000
3,150	8,000	50,000			



## Zentrierbohrer ohne Fläche

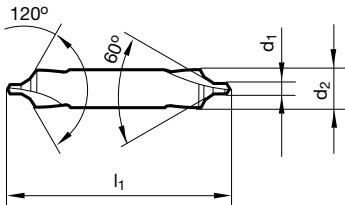
Artikel-Nr. 83200



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • für Zentrierbohrungen nach DIN 332 Teil 1, Form B • mit Schutzsenkung 120°



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
1,000	4,000	35,500	4,000	14,000	67,000
1,250	5,000	40,000	5,000	18,000	75,000
1,600	6,300	45,000	6,300	20,000	80,000
2,000	8,000	50,000	8,000	25,000	100,000
2,500	10,000	56,000	10,000	31,500	125,000
3,150	11,200	60,000			



## Zentrierbohrer ohne Fläche

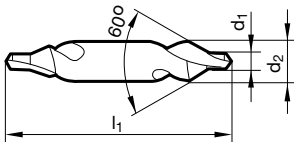
Artikel-Nr. 83005



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • korrekte Anlage zwischen Körnerspitzen • für Zentrierbohrungen nach DIN 332 Teil 1, Form R •  $d_1 \leq 0,8$  mm: einseitig mit Spitze



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
1,000	3,150	31,500			
1,250	3,150	31,500			
1,600	4,000	35,500			
2,000	5,000	40,000			
3,150	8,000	50,000			
4,000	10,000	56,000			



## Zentrierbohrer ohne Fläche

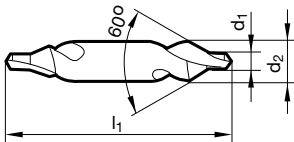
Artikel-Nr. 83110



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \text{Ø } 2,000$  • Kegelmantelschliff • überlanger Zentrierbohrer • ohne Schutzsenkung • für Zentrierbohrungen ähnlich DIN 332 Blatt 1, Form A • für vertieft liegende Zentrierstellen



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
1,000	4,000	120,000			
1,600	5,000	120,000			
2,000	6,000	120,000			
2,500	8,000	120,000			
3,150	10,000	120,000			



## Zentrierbohrer ohne Fläche

Artikel-Nr. 83101

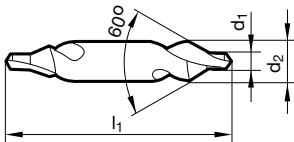


P	M	K	N	S	H
•	•	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • ohne Schutzsenkung • höhere Verschleißfestigkeit • für Zentrierbohrungen nach DIN 332 Teil 1, Form A

Werkstoffe über 800 N/mm<sup>2</sup> • rost-/säure-/hitzebeständige CrNi-Stähle



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
1,000	3,150	31,500			
1,600	4,000	35,500			
2,000	5,000	40,000			
2,500	6,300	45,000			
3,150	8,000	50,000			
4,000	10,000	56,000			



## Zentrierbohrer ohne Fläche

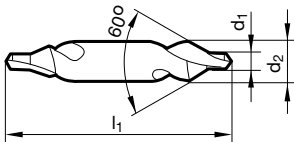
Artikel-Nr. 83102



P	M	K	N	S	H
•	•	•	○	•	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • ohne Schutzsenkung • für Zentrierbohrungen nach DIN 332 Teil 1, Form A •  $d1 \leq 0,8$  mm: einseitig mit Spitze



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
0,500	3,150	25,000	3,150	8,000	50,000
1,000	3,150	31,500	4,000	10,000	56,000
1,250	3,150	31,500			
1,600	4,000	35,500			
2,000	5,000	40,000			
2,500	6,300	45,000			



## Zentrierbohrer ohne Fläche

Artikel-Nr. 83370

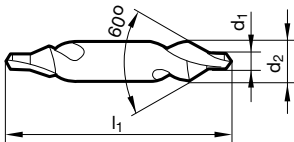


<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
○	○	○	○	○	○



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • ohne Schutzsenkung • für Zentrierbohrungen nach DIN 332 Teil 1, Form A •  $d1 \leq 0,8$  mm: einseitig mit Spitze

universelle Materialeignung



d1 mm	d2 h8 mm	l1 mm	d1 mm	d2 h8 mm	l1 mm
0,500	3,150	25,000	2,500	6,300	45,000
0,800	3,150	25,000	3,150	8,000	50,000
1,000	3,150	31,500	4,000	10,000	56,000
1,250	3,150	31,500	5,000	12,500	63,000
1,600	4,000	35,500	6,300	16,000	71,000
2,000	5,000	40,000			



## Zentrierbohrer mit Fläche

### Artikel-Nr. 83600



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • für Zentrierbohrungen nach DIN 332 Teil 1, Form A • ohne Schutzsenkung

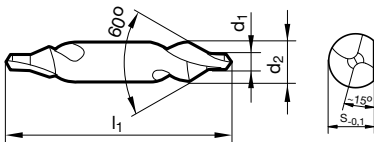
### Artikel-Nr. 83500



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • korrekte Anlage zwischen Körnerspitzen • für Zentrierbohrungen nach DIN 332 Teil 1, Form R



d1 mm	d2 h8 mm	l1 mm	S mm	d1 mm	d2 h8 mm	l1 mm	S mm
1,600	4,000	35,500	3,250	6,300	16,000	71,000	14,000
2,000	5,000	40,000	4,200	8,000	20,000	80,000	17,900
2,500	6,300	45,000	5,350	10,000	25,000	100,000	22,500
3,150	8,000	50,000	6,950				
4,000	10,000	56,000	8,400				
5,000	12,500	63,000	10,950				





## Zentrierbohrer mit Fläche

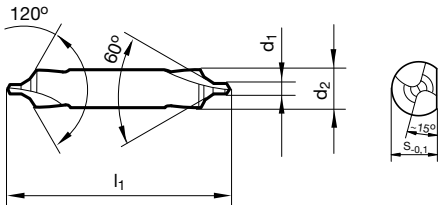
Artikel-Nr. 83700



P	M	K	N	S	H
•	○	•	•	○	



Ausspitzung  $\geq \varnothing 2,000$  • Kegelmantelschliff • für Zentrierbohrungen nach DIN 332 Teil 1, Form B • mit Schutzsenkung 120°



d1 mm	d2 h8 mm	l1 mm	S mm	d1 mm	d2 h8 mm	l1 mm	S mm
1,600	6,300	45,000	5,350	6,300	20,000	80,000	17,900
2,000	8,000	50,000	6,950	8,000	25,000	100,000	22,500
2,500	10,000	56,000	8,400				
3,150	11,200	60,000	10,000				
4,000	14,000	67,000	12,650				
5,000	18,000	75,000	16,400				





# HARTNER

Precision Cutting Tools

## SENK- UND ENTGRATWERKZEUGE

aus HSS, HSS-E, Vollhartmetall  
blank und beschichtet



Senk- & Entgrat-  
werkzeuge

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Senk- winkel/ Form	d1/mm	Artikel-Nr.	Progr. Seite
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## Kegelsenker 90°



•	○	•	•	○		DIN 335		<b>HSS</b>	○	rechts	zyl.	C	4,300 - 31,000	<b>88200</b>	382
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## Kegelsenker 90°, spiralisiert



•	•	•	○	○		DIN 335		<b>HSS-E</b>	Ⓜ	rechts	zyl.	C	6,300 - 31,000	<b>88201</b>	383
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## Kegelsenkersätze 90°



•	○	•	•	○		DIN 335		<b>HSS</b>	○	rechts	zyl.	C		<b>88021</b>	384
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## Kegelsenkersätze 90°, spiralisiert



•	•	•	○	○		DIN 335		<b>HSS-E</b>	Ⓜ	rechts	zyl.	C		<b>88022</b>	385
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P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Schaft- form	Senk- winkel/ Form	d1/mm	Artikel-Nr.	Progr. Seite
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## Entgratgabeln



•	•	•	○	•	○	Werksnorm	TS 100 EG	VHM	○	rechts	zyl.			84100	386
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•	•	•	○	•	○	Werksnorm	TS 100 EG	VHM	○	rechts	HA			84101	387
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## Vor- und Rückwärtsentgrater 90°



•	•	•	○	•	○	Werksnorm	TS 100 VR	VHM	Ⓜ	rechts	HA	3,000 - 12,000		80495	388
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# HARTNER

## Kegelsenker 90°

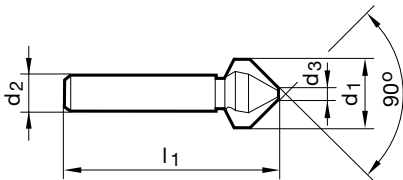
Artikel-Nr. 88200



P	M	K	N	S	H
•	○	•	•	○	



radial hinterschliffen • dreischneidig



d1 mm	d2 h9 mm	d3 mm	l1 mm	Z	Code-Nr.
4,300	4,000	1,300	40,000	3	4,300
5,000	4,000	1,500	40,000	3	5,000
5,300	4,000	1,500	40,000	3	5,300
5,800	5,000	1,500	45,000	3	5,800
6,000	5,000	1,500	45,000	3	6,000
6,300	5,000	1,500	45,000	3	6,300
7,000	6,000	1,800	50,000	3	7,000
7,300	6,000	1,800	50,000	3	7,300
8,000	6,000	2,000	50,000	3	8,000
8,300	6,000	2,000	50,000	3	8,300
9,400	6,000	2,200	50,000	3	9,400
10,000	6,000	2,500	50,000	3	10,000
10,400	6,000	2,500	50,000	3	10,400
11,500	8,000	2,800	56,000	3	11,500
12,400	8,000	2,800	56,000	3	12,400
13,400	8,000	2,900	56,000	3	13,400
15,000	10,000	3,200	60,000	3	15,000
16,500	10,000	3,200	60,000	3	16,500
19,000	10,000	3,500	63,000	3	19,000
20,500	10,000	3,500	63,000	3	20,500
23,000	10,000	3,800	67,000	3	23,000
25,000	10,000	3,800	67,000	3	25,000
26,000	10,000	3,800	67,000	3	26,000
28,000	12,000	4,000	71,000	3	28,000
30,000	12,000	4,200	71,000	3	30,000
31,000	12,000	4,200	71,000	3	31,000



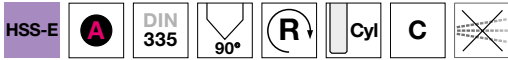
# HARTNER

## Kegelsenker 90°

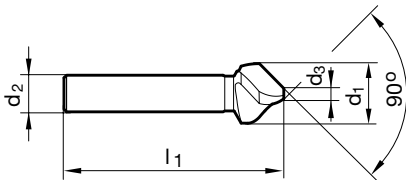
Artikel-Nr. 88201



P	M	K	N	S	H
•	•	•	○	○	



3 ungleiche, konvexe Schneiden • vibrationsarme Schneidverhältnisse • für runde und ratterfreie Senkungen • deutlich reduzierte Vorschubkraft notwendig • universell einsetzbar • kleinster senkbarer Ø siehe „Einsatzempfehlungen für Kegelsenker“



d1 mm	d2 h9 mm	d3 mm	l1 mm	Z	Code-Nr.
6,300	5,000	1,500	45,000	3	6,300
8,000	6,000	2,000	50,000	3	8,000
8,300	6,000	2,000	50,000	3	8,300
10,000	6,000	2,500	50,000	3	10,000
10,400	6,000	2,500	50,000	3	10,400
11,500	8,000	2,800	56,000	3	11,500
12,400	8,000	2,800	56,000	3	12,400
15,000	10,000	3,200	60,000	3	15,000
16,500	10,000	3,200	60,000	3	16,500
19,000	10,000	3,500	63,000	3	19,000
20,500	10,000	3,500	63,000	3	20,500
23,000	10,000	3,800	67,000	3	23,000
25,000	10,000	3,800	67,000	3	25,000
31,000	12,000	4,200	71,000	3	31,000



# HARTNER

## Kegelsenker 90°

Artikel-Nr. 88021

P	M	K	N	S	H
•	○	•	•	○	



Satz in Kassette, bestehend aus Artikel-Nr. 88200 • radial hinterschliffen • dreischneidig

d1 mm	mm	Stück/Satz	Code-Nr.
6,30-20,50	6,3/8,3/10,4/12,4/16,5/20,5	6	7,000





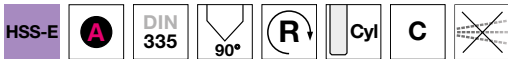
# HARTNER

## Kegelsenker 90°

Artikel-Nr. 88022



P	M	K	N	S	H
•	•	•	○	○	



Satz in Kassette, bestehend aus Artikel-Nr. 88201 • 3 ungleiche, konvexe Schneiden • vibrationsarme Schneidverhältnisse • für runde und ratterfreie Senkungen • deutlich reduzierte Vorschubkraft notwendig • universell einsetzbar • kleinster senkbarer Ø siehe „Einsatzempfehlungen für Kegelsenker“

d1 mm	mm	Stück/Satz	Code-Nr.
6,30-20,50	6,3/8,3/10,4/12,4/16,5/20,5	6	1,000



## Entgratgabeln

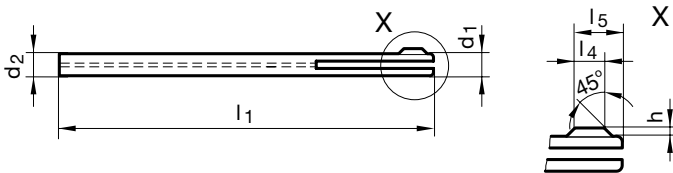
Artikel-Nr. 84100



P	M	K	N	S	H
•	•	•	○	•	○



mit Innenkühlung • mit durchgängig zylindrischem Schaft für die Aufnahme in Spannzangen  
 Innen- und Außenentgratung • universell einsetzbar auf Werkzeug-, Fräs- und Drehmaschinen sowie Robotern



Ø-Bereich	d1 mm	d2 mm	l1 mm	l4 mm	l5 mm	h mm	Code-Nr.
1,91-2,15	1,900	1,900	80,000	1,000	2,050	0,350	2,000
2,16-2,40	2,100	2,100	80,000	1,500	2,600	0,400	2,250
2,41-2,70	2,400	2,400	80,000	1,500	2,900	0,400	2,500
2,71 -2,90	2,600	2,600	90,000	1,500	2,950	0,450	2,750
2,91-3,25	2,900	2,900	90,000	2,000	3,650	0,450	3,000
3,26-3,60	3,200	3,200	90,000	2,000	3,800	0,600	3,500
3,61-4,25	3,600	3,600	90,000	2,000	4,100	0,700	4,000
4,26-4,75	4,200	4,200	90,000	2,500	4,600	0,700	4,500
4,76-5,30	4,700	4,700	100,000	2,500	4,850	0,750	5,000
5,31-5,80	5,200	5,200	100,000	2,500	4,850	0,750	5,500
5,81-6,20	5,600	5,600	110,000	3,000	5,800	0,800	6,000
6,21-6,70	6,000	6,000	110,000	3,000	5,900	0,900	6,500
6,71-7,10	6,500	6,500	110,000	3,000	5,850	0,850	7,000
7,11-7,60	6,900	6,900	110,000	3,500	6,950	0,950	7,500
7,61-8,05	7,300	7,300	110,000	3,500	7,000	1,000	8,000



# HARTNER

## Entgratgabeln

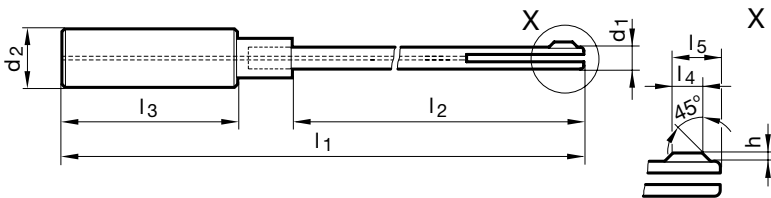
Artikel-Nr. 84101



P	M	K	N	S	H
•	•	•	○	•	○



für die Aufnahme in Hydraulik-Dehnspannfutter und Schrumpffutter • mit Schaft nach DIN 6535 • mit Innenkühlung  
 Innen- und Außenentgratung • universell einsetzbar auf Werkzeug-, Fräs- und Drehmaschinen sowie Robotern



Ø-Bereich	d1 mm	d2 mm	l1 mm	l2 mm	l3 mm	l4 mm	l5 mm	h mm	Code-Nr.
1,91 -2,15	1,900	6,000	120,000	69,000	36,000	1,000	2,050	0,350	2,000
2,16 -2,40	2,100	6,000	120,000	69,000	36,000	1,500	2,600	0,400	2,250
2,41 -2,70	2,400	6,000	120,000	69,000	36,000	1,500	2,900	0,400	2,500
2,71 -2,90	2,600	6,000	130,000	79,000	36,000	1,500	2,950	0,450	2,750
2,91 -3,25	2,900	6,000	130,000	79,000	36,000	2,000	3,650	0,450	3,000
3,26 -3,60	3,200	10,000	135,000	80,000	40,000	2,000	3,800	0,600	3,500
3,61 -4,25	3,600	10,000	135,000	80,000	40,000	2,000	4,100	0,700	4,000
4,26 -4,75	4,200	10,000	135,000	80,000	40,000	2,500	4,600	0,700	4,500
4,76 -5,30	4,700	10,000	145,000	80,000	40,000	2,500	4,850	0,750	5,000
5,31 -5,80	5,200	10,000	145,000	90,000	40,000	2,500	4,850	0,750	5,500
5,81 -6,20	5,600	10,000	155,000	90,000	40,000	3,000	5,800	0,800	6,000
6,21 -6,70	6,000	16,000	165,000	102,000	48,000	3,000	5,900	0,900	6,500
6,71 -7,10	6,500	16,000	165,000	102,000	48,000	3,000	5,850	0,850	7,000
7,11 -7,60	6,900	16,000	165,000	102,000	48,000	3,500	6,950	0,950	7,500
7,61 -8,05	7,300	16,000	165,000	102,000	48,000	3,500	7,000	1,000	8,000



## Vor- und Rückwärtsentgrater 90°

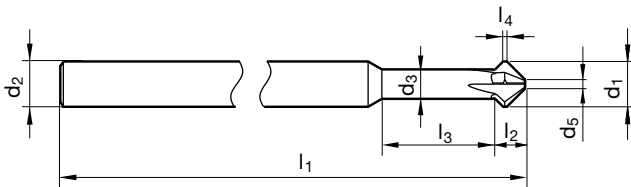
Artikel-Nr. 80495



P	M	K	N	S	H
•	•	•	○	•	○



mit Schaft nach DIN 6535 • für die Aufnahme in Hydraulik-Dehnspannfutter und Schrumpffutter  
 Innen- und Außenentgratung • Entgraten von Bohrungen und Konturen

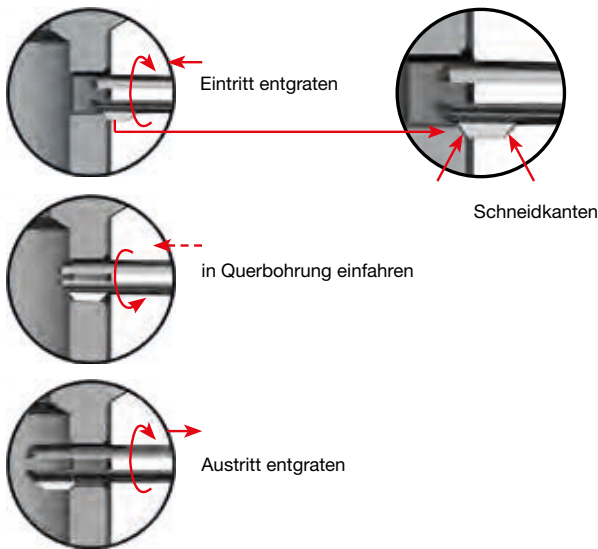


d1 mm	d2 h6 mm	d3 mm	d5 mm	l1 mm	l2 mm	l3 mm	l4 mm	Z	Code-Nr.
3,000	4,000	2,200	0,600	75,000	2,10	11,400	0,500	4	3,000
4,000	4,000	2,900	0,800	75,000	2,70	15,000	0,500	4	4,000
5,000	5,000	3,900	1,000	75,000	3,00	18,000	0,500	4	5,000
6,000	6,000	3,900	1,200	100,000	3,90	18,200	0,500	4	6,000
8,000	6,000	6,000	1,600	100,000	4,70	55,000	0,500	4	8,000
10,000	6,000	6,000	2,000	100,000	6,50	55,000	0,500	4	10,000
12,000	6,000	6,000	2,400	100,000	8,30	55,500	0,500	4	12,000



## Entgratgabel TS 100 EG

### Die Bearbeitung

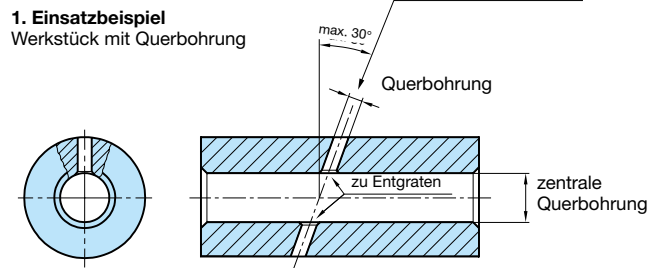


### Schritt für Schritt:

Die maschinelle Ein- und Austritts-Entgratung mit der Entgratgabel TS 100 EG ist eine einfache und kostengünstige Alternative zur bisherigen, aufwändigen Nachbearbeitung per Hand. Dabei kommt ein einziges Werkzeug für alle Arbeitsschritte zum Einsatz.

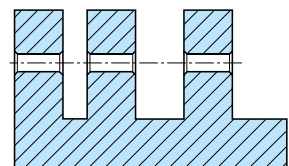
Ø-Bereich (mm)	v <sub>c</sub> m/min	f <sub>u</sub> (mm)
< Ø 4	8 - 10	0,1 - 0,2
Ø 4 - < Ø 6	10 - 14	0,1 - 0,2
6 - Ø 8	14 - 20	0,1 - 0,2

### Einsatzbeispiele



Bei Werkstücken mit Querbohrung muss:  
 - der Durchmesser der Querbohrung maximal 35% des Durchmessers der zentralen Bohrung betragen  
 - der Durchmesser der Querbohrung 40% größer sein als die Schneidlänge l<sub>4</sub>

**2. Einsatzbeispiel**  
 Werkstück mit mehrfach unterbrochener Bohrung



### Universell einsetzbar:

Mit der Standard-Entgratgabel können sowohl Werkstücke mit Querbohrung als auch Werkstücke mit mehrfach unterbrochenem Schnitt bearbeitet werden. Resultat sind in jedem Fall sauber entgratete Bohrungsein- und -austritte.

### Wichtig:

Bitte beachten Sie, dass die Schnittwerte nur Richtwerte sind. Sie können nach oben wie nach unten hin angepasst werden.

## Vor-/Rückwärtsentgrater TS 100 VR

### Schnittwerte Vor-/Rückwärtsentgrater TS 100 VR

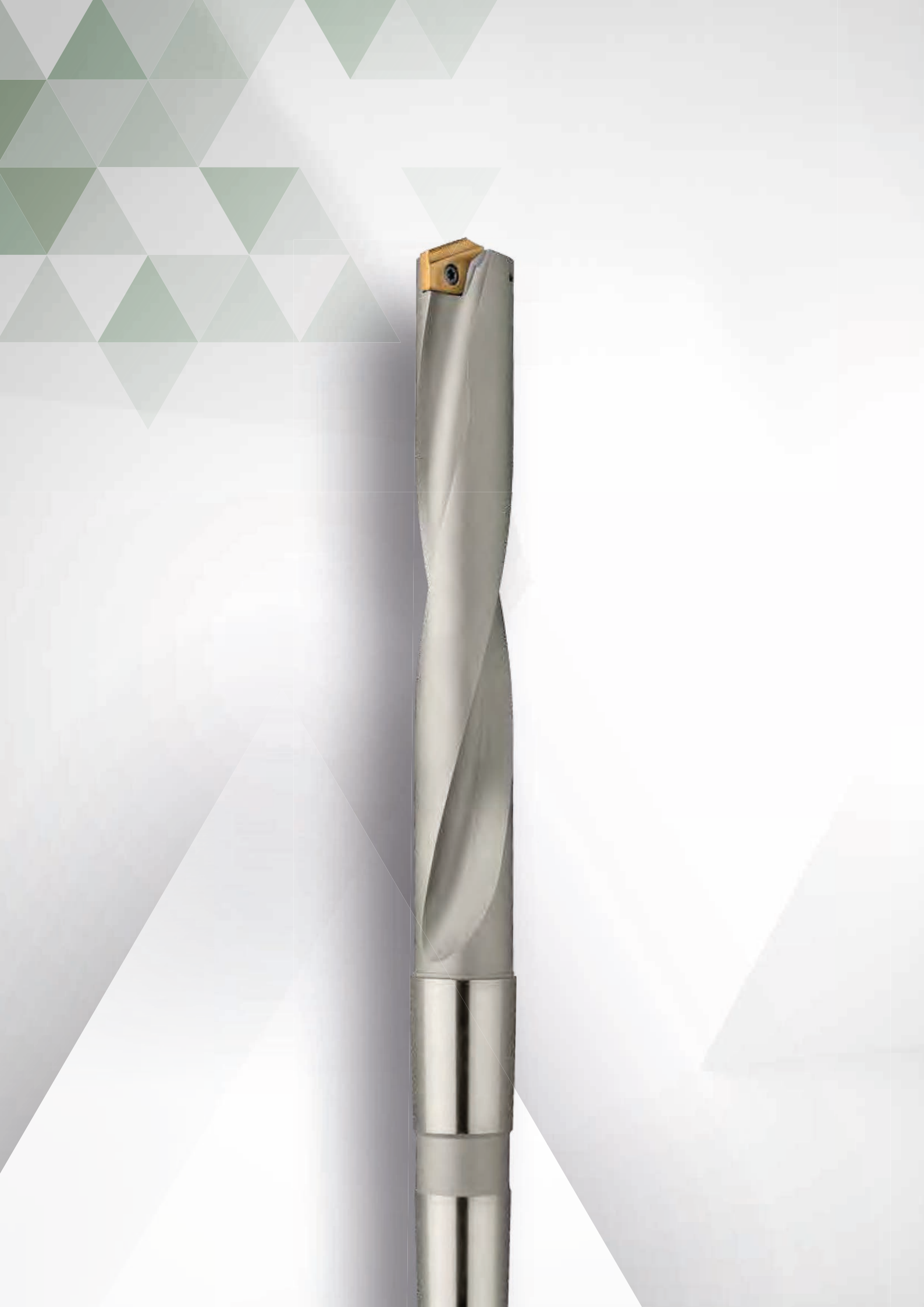
Werkstoffgruppe	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	v <sub>c</sub> (m/min)	VR-Code
Stähle	< 850		120 - 200	71
	850-1200		100 - 180	71
	> 1200		80 - 140	71
Gehärtete Stähle		< 54 HRC	60 - 120	71
		54-60 HRC	40 - 80	71
Rost- und säurebest. Stähle	< 850		80 - 120	71
Nickel-Basis-Legierungen	< 1300		30 - 60	71
Titan-Legierungen	< 1300		50 - 100	71
Guss		< 240 HB30	120 - 180	72
		> 240 HB30	100 - 160	72
Al Knetlegierungen < 3% Si			150 - 250	72
Al Gusslegierungen > 3% Si			100 - 200	72
Magnesium-Legierungen			150 - 250	72
Nichteisen-Legierungen	< 850		30 - 200	72

### Vorschubreihen-Code (mm/U)

Ø	71	72
≤ 3,00	0,060	0,080
4,00	0,100	0,125
5,00	0,100	0,125
6,30	0,125	0,160
8,00	0,160	0,200
10,00	0,200	0,250
12,50	0,200	0,250

### Wichtig:

Bitte beachten Sie, dass die Schnittwerte nur Richtwerte sind. Sie können nach oben wie nach unten hin angepasst werden.





# HARTNER

Precision Cutting Tools

## MULTIPLEX MULTIPLEX HPC

Wechselplatten-Spiralbohrer mit Innenkühlung  
Wechselplatten aus HSS-E, HSS-E-PM, Vollhartmetall  
beschichtet



Multiplex  
Multiplex HPC

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Innen- kühlung	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Multiplex-Halter mit Zylinderschaft



Werksnorm	Ni	rechts	mit	3xD	<b>86612</b>	399
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Werksnorm	Ni	rechts	mit	5xD	<b>86622</b>	400
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Werksnorm	Ni	rechts	mit	7xD	<b>86624</b>	401
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Werksnorm	Ni	rechts	mit		<b>86628</b>	402
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## Multiplex-Halter mit Morsekegel



Werksnorm	Ni	rechts	mit		<b>86630</b>	404
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Werksnorm	Ni	rechts	mit		<b>86650</b>	405
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Werksnorm	B	rechts	mit		<b>86670</b>	406
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Werksnorm	B	rechts	mit		<b>86680</b>	407
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Werksnorm	Ni	rechts	mit		<b>86678</b>	408
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P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Innen- kühlung	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Wechselplatten

	•	○	•	○		Werksnorm		<b>HSS-E-PM</b>		rechts		10,000 - 25,000	<b>86602</b>	411
	○	•	○	•	•	Werksnorm		<b>HSS-E</b>		rechts		25,000 - 102,000	<b>86605</b>	412
	•	○	•	○		Werksnorm		<b>HSS-E-PM</b>		rechts		10,000 - 25,000	<b>86608</b>	413
	•	○	•	○		Werksnorm		<b>HSS-E-PM</b>		rechts		25,000 - 210,000	<b>86609</b>	414
	•	○	•	○		Werksnorm		<b>HSS-E-PM</b>		rechts		10,000 - 65,000	<b>86611</b>	415
	•	○	•	○		Werksnorm		<b>VHM</b>		rechts		10,000 - 35,000	<b>86701</b>	417
	•	○	•	○		Werksnorm		<b>VHM</b>		rechts		10,000 - 35,000	<b>86702</b>	418
	•	○	•	○		Werksnorm		<b>VHM</b>		rechts		10,000 - 35,000	<b>86708</b>	419
	•	○	•	○		Werksnorm		<b>VHM</b>		rechts		9,920 - 35,000	<b>86709</b>	420
			•			Werksnorm		<b>VHM</b>	○	rechts		10,000 - 65,000	<b>86711</b>	421

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Innen- kühlung	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Kühlmittelzuführringe



Werksnorm

**86690**

422

## Kühlmittelzuführrohre



Werksnorm



**82571**

423

## Schnellverschlusskupplung



Werksnorm

**82578**

424

## Torx-Schraubendreher



Werksnorm

**86842**

425

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Innen- kühlung	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Kühlmittelzuführfutter für Multiplex



Werksnorm

Ⓑ

86691

426



Werksnorm

Ⓑ

86692

427



Werksnorm

Ⓑ

86693

428



Werksnorm

Ⓑ

86694

429

## Reduzierhülsen für Kühlmittelzuführfutter



Werksnorm

Ⓑ

86699

430

P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Innen- kühlung	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Multiplex HPC-Halter



						Werksnorm	HPC		Ⓝ	rechts	mit	1xD	11,000 - 36,005	<b>86681</b>	432
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						Werksnorm	HPC		Ⓝ	rechts	mit	1,5xD	11,000 - 39,005	<b>86682</b>	433
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						Werksnorm	HPC		Ⓝ	rechts	mit	3xD	11,000 - 39,005	<b>86683</b>	435
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						Werksnorm	HPC		Ⓝ	rechts	mit	5xD	11,000 - 39,000	<b>86684</b>	437
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						Werksnorm	HPC		Ⓝ	rechts	mit	7xD	11,000 - 31,505	<b>86685</b>	439
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						Werksnorm	HPC		Ⓝ	rechts	mit	10xD	11,000 - 31,505	<b>86686</b>	441
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## Multiplex HPC-Wechselplatten



○	○	○	○	○	○	Werksnorm	HPC	VHM	Ⓝ	rechts			11,000 - 40,000	<b>86721</b>	443
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●	○	○	○	○	○	Werksnorm	HPC	VHM	Ⓝ	rechts			11,000 - 40,000	<b>86722</b>	446
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○	○	●	○	○	○	Werksnorm	HPC	VHM	Ⓝ	rechts			11,000 - 40,000	<b>86723</b>	449
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P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Innen- kühlung	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Multiplex HPC-Wechselplatten



			•			Werksnorm	HPC	VHM	○	rechts		11,000 - 40,000	86724	452
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○	•			○	○	Werksnorm	HPC	VHM	ⓐ	rechts		11,000 - 40,000	86725	455
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•						Werksnorm		VHM	ⓑ	rechts		12,000 - 40,000	86729	458
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## Multiplex HPC-Senkplatten



○		•				Werksnorm		VHM	ⓐ	neutral		52,020 - 93,080	86726	459
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		•				Werksnorm		VHM	○	rechts		52,020 - 93,080	86727	459
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•	○	○		○	○	Werksnorm		VHM	ⓓ	rechts		52,020 - 93,080	86728	460
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## Spannschrauben für Multiplex HPC-Halter 1,5-10xD



						Werksnorm							86843	461
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## Drehmomentschlüssel



						Werksnorm							86844	462
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P	M	K	N	S	H	Norm	Typ	Schneidstoff	Oberfläche	Schneid- richtung	Innen- kühlung	Bohrtiefe	d1/mm	Artikel-Nr.	Progr. Seite
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## Torx-Einsätze



Werksnorm

**86845**

463

## Spannschrauben für Multiplex HPC-Senkhalter



Werksnorm

**86846**

464

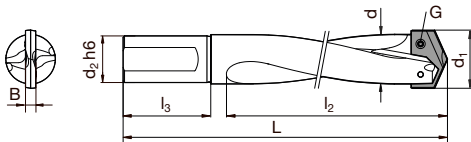


## Multiplex-Halter mit Zylinderschaft

Artikel-Nr. 86612



vernickelt • Halter für Wechselplatten. Der Halter mit Zylinderschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einjustieren der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet. Spannschrauben Artikel-Nr. 86807 enthalten.



d1 mm	d mm	d2 h6 mm	L mm	l2 mm	l3 mm	B mm	G	Code-Nr.
10,00-11,7	9,500	20,000	108,000	50,000	40,000	2,500	86807 2.000	<b>9,500</b>
11,71-13,4	11,500	20,000	109,000	53,000	40,000	2,500	86807 2.000	<b>11,500</b>
13,41-16,4	13,000	20,000	116,000	60,000	40,000	3,500	86807 2.500	<b>13,000</b>
16,41-18,9	16,000	20,000	118,000	65,000	40,000	3,500	86807 2.501	<b>16,000</b>
18,91-22,4	18,500	20,000	124,000	73,000	40,000	4,000	86807 3.000	<b>18,500</b>
22,41-25,4	22,000	20,000	127,000	78,000	40,000	4,000	86807 3.001	<b>22,000</b>
25,41-29,0	24,000	32,000	178,000	105,000	60,000	5,000	86807 3.500	<b>24,000</b>
29,01-35,0	28,000	32,000	178,000	108,000	60,000	5,000	86807 3.500	<b>28,000</b>
35,01-45,0	34,000	32,000	223,000	152,000	60,000	7,000	86807 4.001	<b>34,000</b>
45,01-55,0	44,000	40,000	233,000	152,000	70,000	7,000	86807 4.001	<b>44,000</b>
55,01-65,0	54,000	40,000	233,000	152,000	70,000	7,000	86807 4.001	<b>54,000</b>

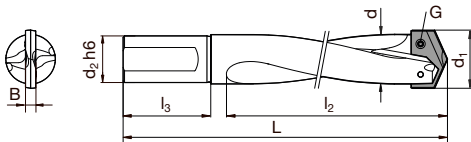


## Multiplex-Halter mit Zylinderschaft

Artikel-Nr. 86622



vernickelt • Halter für Wechselplatten. Der Halter mit Zylinderschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einjustieren der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet. Spannschrauben Artikel-Nr. 86807 enthalten.



d1 mm	d mm	d2 h6 mm	L mm	l2 mm	l3 mm	B mm	G	Code-Nr.
10,00-11,7	9,500	20,000	140,000	83,000	40,000	2,500	86807 2.000	<b>9,500</b>
11,71-13,4	11,500	20,000	150,000	94,000	40,000	2,500	86807 2.000	<b>11,500</b>
13,41-16,4	13,000	20,000	160,000	104,000	40,000	3,500	86807 2.500	<b>13,000</b>
16,41-18,9	16,000	20,000	170,000	117,000	40,000	3,500	86807 2.501	<b>16,000</b>
18,91-22,4	18,500	20,000	180,000	129,000	40,000	4,000	86807 3.000	<b>18,500</b>
22,41-25,4	22,000	20,000	180,000	131,000	40,000	4,000	86807 3.001	<b>22,000</b>
25,41-29,0	24,000	32,000	240,000	166,000	60,000	5,000	86807 3.500	<b>24,000</b>
29,01-35,0	28,000	32,000	240,000	170,000	60,000	5,000	86807 3.500	<b>28,000</b>
35,01-45,0	34,000	32,000	280,000	210,000	60,000	7,000	86807 4.001	<b>34,000</b>
45,01-55,0	44,000	40,000	290,000	210,000	70,000	7,000	86807 4.001	<b>44,000</b>
55,01-65,0	54,000	40,000	290,000	210,000	70,000	7,000	86807 4.001	<b>54,000</b>



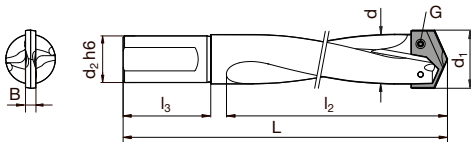


## Multiplex-Halter mit Zylinderschaft

Artikel-Nr. 86624



vernickelt • Halter für Wechselplatten. Der Halter mit Zylinderschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einjustieren der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet. Spannschrauben Artikel-Nr. 86807 enthalten.



d1 mm	d mm	d2 h6 mm	L mm	l2 mm	l3 mm	B mm	G	Code-Nr.
10,00-11,7	9,500	20,000	180,000	123,000	40,000	2,500	86807 2.000	<b>9,500</b>
11,71-13,4	11,500	20,000	190,000	134,000	40,000	2,500	86807 2.000	<b>11,500</b>
13,41-16,4	13,000	20,000	210,000	155,000	40,000	3,500	86807 2.500	<b>13,000</b>
16,41-18,9	16,000	20,000	220,000	168,000	40,000	3,500	86807 2.501	<b>16,000</b>
18,91-22,4	18,500	20,000	250,000	199,000	40,000	4,000	86807 3.000	<b>18,500</b>
22,41-25,4	22,000	20,000	250,000	201,000	40,000	4,000	86807 3.001	<b>22,000</b>
25,41-29,0	24,000	32,000	320,000	246,000	60,000	5,000	86807 3.500	<b>24,000</b>
29,01-35,0	28,000	32,000	320,000	250,000	60,000	5,000	86807 3.500	<b>28,000</b>
35,01-45,0	34,000	32,000	380,000	310,000	60,000	7,000	86807 4.001	<b>34,000</b>
45,01-55,0	44,000	40,000	390,000	310,000	70,000	7,000	86807 4.001	<b>44,000</b>
55,01-65,0	54,000	40,000	390,000	310,000	70,000	7,000	86807 4.001	<b>54,000</b>

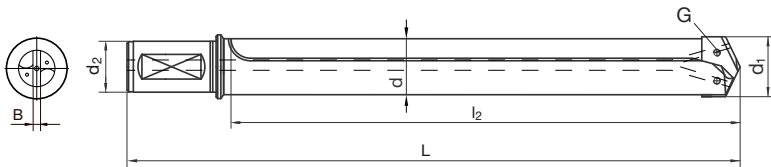


## Multiplex-Halter mit Zylinderschaft

Artikel-Nr. 86628



vernickelt • Halter für Wechselplatten. Der überlange Halter mit Zylinderschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einstützen der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet. Spannschrauben Artikel-Nr. 86807 enthalten



d1 mm	d mm	d2 h6 mm	L mm	l2 mm	B mm	G	Code-Nr.
13,41-16,4	13,000	20,000	198,500	156,500	3,500	86807 2.500	13,157
13,41-16,4	13,000	20,000	238,500	196,500	3,500	86807 2.500	13,197
13,41-16,4	13,000	20,000	318,500	276,500	3,500	86807 2.500	13,277
15,00-16,4	14,500	20,000	95,000	52,000	3,500	86807 2.500	14,052
15,00-16,4	14,500	20,000	125,000	82,000	3,500	86807 2.500	14,082
15,00-16,4	14,500	20,000	178,500	136,500	3,500	86807 2.500	14,137
15,00-16,4	14,500	20,000	198,500	156,500	3,500	86807 2.500	14,157
15,00-16,4	14,500	20,000	238,500	196,500	3,500	86807 2.500	14,197
15,00-16,4	14,500	20,000	268,500	226,500	3,500	86807 2.500	14,227
15,00-16,4	14,500	20,000	398,500	356,500	3,500	86807 2.500	14,357
16,41-18,9	16,000	20,000	260,500	218,500	3,500	86807 2.500	16,219
16,41-18,9	16,000	20,000	295,500	253,500	3,500	86807 2.500	16,254
16,41-18,9	16,000	20,000	410,500	368,500	3,500	86807 2.501	16,369
18,91-22,4	18,500	20,000	304,000	262,000	4,000	86807 3.000	18,262
18,91-22,4	18,500	20,000	344,000	302,000	4,000	86807 3.000	18,302
18,91-22,4	18,500	20,000	464,000	422,000	4,000	86807 3.000	18,422
22,41-25,4	22,000	20,000	285,000	243,000	4,000	86807 3.001	22,243
22,41-25,4	22,000	20,000	345,000	303,000	4,000	86807 3.001	22,303
22,41-25,4	22,000	20,000	385,000	343,000	4,000	86807 3.001	22,343
22,41-25,4	22,000	20,000	535,000	493,000	4,000	86807 3.001	22,493
25,41-29,0	23,000	32,000	138,000	63,000	5,000	86807 3.500	23,063
25,41-29,0	23,000	32,000	173,000	98,000	5,000	86807 3.500	23,098
25,41-29,0	23,000	32,000	225,000	150,000	5,000	86807 3.500	23,150
25,41-29,0	23,000	32,000	273,000	198,000	5,000	86807 3.500	23,198
25,41-29,0	23,000	32,000	343,000	268,000	5,000	86807 3.500	23,268
25,41-29,0	23,000	32,000	433,000	358,000	5,000	86807 3.500	23,358
25,41-29,0	23,000	32,000	503,000	428,000	5,000	86807 3.500	23,428
25,41-29,0	23,000	32,000	683,000	608,000	5,000	86807 3.500	23,608
29,01-35,0	28,000	32,000	393,000	321,500	5,000	86807 3.500	28,322
29,01-35,0	28,000	32,000	473,000	401,500	5,000	86807 3.500	28,402
29,01-35,0	28,000	32,000	553,000	481,500	5,000	86807 3.500	28,482
29,01-35,0	28,000	32,000	763,000	691,500	5,000	86807 3.500	28,692
33,20-36,0	33,000	32,000	148,000	80,500	5,000	86807 3.500	33,081
33,20-36,0	33,000	32,000	173,000	105,500	5,000	86807 3.500	33,106
33,20-36,0	33,000	32,000	223,000	155,500	5,000	86807 3.500	33,156
33,20-36,0	33,000	32,000	273,000	205,500	5,000	86807 3.500	33,206
33,20-36,0	33,000	32,000	393,000	325,500	5,000	86807 3.500	33,326
33,20-36,0	33,000	32,000	503,000	435,500	5,000	86807 3.500	33,436
33,20-36,0	33,000	32,000	603,000	535,500	5,000	86807 3.500	33,536
33,20-36,0	33,000	32,000	823,000	755,500	5,000	86807 3.500	33,756
35,01-45,0	34,000	32,000	457,000	388,000	7,000	86807 4.001	34,388
35,01-45,0	34,000	32,000	607,000	538,000	7,000	86807 4.001	34,538



## Multiplex-Halter mit Zylinderschaft

<b>d1 mm</b>	<b>d mm</b>	<b>d2 h6 mm</b>	<b>L mm</b>	<b>l2 mm</b>	<b>B mm</b>	<b>G</b>	<b>Code-Nr.</b>
<b>35,01-45,0</b>	34,000	32,000	907,000	838,000	7,000	86807 4.001	<b>34,838</b>
<b>45,01-55,0</b>	44,000	40,000	467,000	394,000	7,000	86807 4.001	<b>44,394</b>
<b>45,01-55,0</b>	44,000	40,000	617,000	544,000	7,000	86807 4.001	<b>44,544</b>
<b>45,01-55,0</b>	44,000	40,000	917,000	844,000	7,000	86807 4.001	<b>44,844</b>
<b>55,01-65,0</b>	54,000	40,000	467,000	393,000	7,000	86807 4.001	<b>54,393</b>
<b>55,01-65,0</b>	54,000	40,000	617,000	543,000	7,000	86807 4.001	<b>54,543</b>
<b>55,01-65,0</b>	54,000	40,000	917,000	843,000	7,000	86807 4.001	<b>54,843</b>
<b>65,01-78,0</b>	63,000	40,000	230,000	155,000	9,000	86807 5.000	<b>63,155</b>
<b>65,01-78,0</b>	63,000	40,000	340,000	265,000	9,000	86807 5.000	<b>63,265</b>
<b>65,01-78,0</b>	63,000	40,000	470,000	395,000	9,000	86807 5.000	<b>63,395</b>
<b>65,01-78,0</b>	63,000	40,000	620,000	545,000	9,000	86807 5.000	<b>63,545</b>
<b>65,01-78,0</b>	63,000	40,000	920,000	845,000	9,000	86807 5.000	<b>63,845</b>
<b>78,01-90,0</b>	77,000	50,000	240,000	155,000	9,000	86807 5.000	<b>77,155</b>
<b>78,01-90,0</b>	77,000	50,000	350,000	265,000	9,000	86807 5.000	<b>77,265</b>
<b>78,01-90,0</b>	77,000	50,000	480,000	395,000	9,000	86807 5.000	<b>77,395</b>
<b>78,01-90,0</b>	77,000	50,000	630,000	545,000	9,000	86807 5.000	<b>77,545</b>
<b>78,01-90,0</b>	77,000	50,000	930,000	845,000	9,000	86807 5.000	<b>77,845</b>
<b>90,01-102,0</b>	89,000	50,000	240,000	155,000	9,000	86807 5.000	<b>89,155</b>
<b>90,01-102,0</b>	89,000	50,000	350,000	265,000	9,000	86807 5.000	<b>89,265</b>
<b>90,01-102,0</b>	89,000	50,000	480,000	395,000	9,000	86807 5.000	<b>89,395</b>
<b>90,01-102,0</b>	89,000	50,000	630,000	545,000	9,000	86807 5.000	<b>89,545</b>
<b>90,01-102,0</b>	89,000	50,000	930,000	845,000	9,000	86807 5.000	<b>89,845</b>



## Multiplex-Halter mit Morsekegel

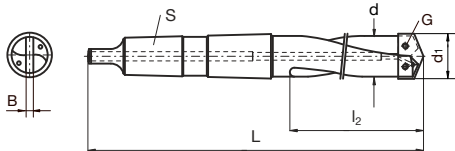
Artikel-Nr. 86630



vernickelt • Halter für Wechselplatten in kurzer Ausführung. Der Halter mit Kegelschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einstellen der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet.

Kühlmittelzuführung: axial (radial auf Anfrage)

Spannschrauben Artikel-Nr. 86807 enthalten



d1 mm	d mm	S	L mm	l <sub>2</sub> mm	B mm	G	Code-Nr.
10,00-11,7	9,500	MK-2	139,000	56,000	2,500	86807 2.000	<b>9,500</b>
11,71-13,4	11,500	MK-2	141,000	58,000	2,500	86807 2.000	<b>11,500</b>
13,41-16,4	13,000	MK-2	148,000	63,000	3,500	86807 2.500	<b>13,000</b>
16,41-18,9	16,000	MK-2	150,000	67,000	3,500	86807 2.501	<b>16,000</b>
18,91-22,4	18,500	MK-3	178,000	76,000	4,000	86807 3.000	<b>18,500</b>
22,41-25,4	22,000	MK-3	181,000	80,000	4,000	86807 3.001	<b>22,000</b>



## Multiplex-Halter mit Morsekegel

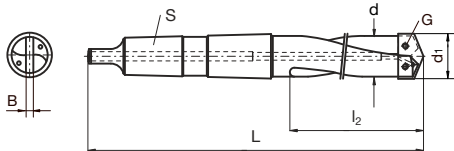
Artikel-Nr. 86650



vernickelt • Halter für Wechselplatten in langer Ausführung. Der Halter mit Kegelschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einstützen der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet.

Kühlmittelzuführung: axial (radial auf Anfrage)

Spannschrauben Artikel-Nr. 86807 enthalten



d1 mm	d mm	S	L mm	l <sub>2</sub> mm	B mm	G	Code-Nr.
10,00-11,7	9,500	MK-2	186,000	103,000	2,500	86807 2.000	<b>9,500</b>
11,71-13,4	11,500	MK-2	191,000	108,000	2,500	86807 2.000	<b>11,500</b>
13,41-16,4	13,000	MK-2	210,000	125,000	3,500	86807 2.500	<b>13,000</b>
16,41-18,9	16,000	MK-2	218,000	135,000	3,500	86807 2.501	<b>16,000</b>
18,91-22,4	18,500	MK-3	258,000	156,000	4,000	86807 3.000	<b>18,500</b>
22,41-25,4	22,000	MK-3	266,000	166,000	4,000	86807 3.001	<b>22,000</b>



## Multiplex-Halter mit Morsekegel

Artikel-Nr. 86670



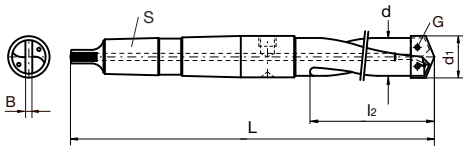
≤ Ø 28 mm: vernickelt, > Ø 28 mm: brüniert • Halter für Wechselplatten in kurzer Ausführung mit Ringlauffläche für Kühlmittelzuführung. Der Halter mit Kegelschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einjustieren der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet.

Kühlmittelzuführung: radial (axial auf Anfrage)

Ab Halter-Ø 63,0 mm: gerade genutet

Schaftgröße MK 5: mit Querkeilnut

Spannschrauben Artikel-Nr. 86807 enthalten



d1 mm	d mm	S	L mm	l2 mm	B mm	G	Code-Nr.
<b>25.01-29.0</b>	24,000	MK-4	279,000	108,000	5,000	86807 3.500	<b>24,000</b>
<b>29.01-35.0</b>	28,000	MK-4	279,000	108,000	5,000	86807 3.500	<b>28,000</b>
<b>35.01-45.0</b>	34,000	MK-4	324,000	152,000	7,000	86807 4.001	<b>34,000</b>
<b>45.01-55.0</b>	44,000	MK-4	324,000	152,000	7,000	86807 4.001	<b>44,000</b>
<b>55.01-65.0</b>	54,000	MK-4	324,000	152,000	7,000	86807 4.001	<b>54,000</b>
<b>65.01-78.0</b>	63,000	MK-5	436,000	216,000	9,000	86807 5.000	<b>63,000</b>
<b>78.01-90.0</b>	77,000	MK-5	436,000	216,000	9,000	86807 5.000	<b>77,000</b>
<b>90.01-102.0</b>	89,000	MK-5	436,000	216,000	9,000	86807 5.000	<b>89,000</b>



## Multiplex-Halter mit Morsekegel

Artikel-Nr. 86680



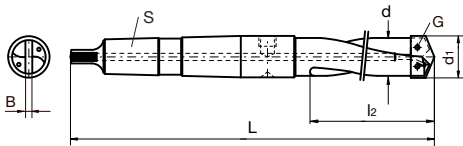
≤ Ø 28 mm: vernickelt, > Ø 28 mm: brüniert • Halter für Wechselplatten in langer Ausführung mit Ringlauffläche für Kühlmittelzuführung. Der Halter mit Kegelschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einstellen der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet.

Kühlmittelzuführung: radial (axial auf Anfrage)

Ab Halter-Ø 63,0 mm: gerade genutet

Schaftgröße MK 5: mit Querkeilnut

Spannschrauben Artikel-Nr. 86807 enthalten



d1 mm	d mm	S	L mm	l2 mm	B mm	G	Code-Nr.
<b>25.01-29.0</b>	24,000	MK-4	379,000	208,000	5,000	86807 3.500	<b>24,000</b>
<b>29.01-35.0</b>	28,000	MK-4	379,000	208,000	5,000	86807 3.500	<b>28,000</b>
<b>35.01-45.0</b>	34,000	MK-4	429,000	257,000	7,000	86807 4.001	<b>34,000</b>
<b>45.01-55.0</b>	44,000	MK-4	429,000	257,000	7,000	86807 4.001	<b>44,000</b>
<b>55.01-65.0</b>	54,000	MK-4	429,000	257,000	7,000	86807 4.001	<b>54,000</b>
<b>65.01-78.0</b>	63,000	MK-5	536,000	316,000	9,000	86807 5.000	<b>63,000</b>
<b>78.01-90.0</b>	77,000	MK-5	536,000	316,000	9,000	86807 5.000	<b>77,000</b>
<b>90.01-102.0</b>	89,000	MK-5	536,000	316,000	9,000	86807 5.000	<b>89,000</b>



## Multiplex-Halter mit Morsekegel

Artikel-Nr. 86678



Oberfläche  $\leq 1000$  mm Gesamtlänge vernickelt,  $> 1000$  mm Gesamtlänge brüniert • Halter für Wechselplatten in überlanger Ausführung. Der Halter mit Kegelschaft besitzt eine innere Kühlmittelzufuhr. Weite Spannuten gewährleisten einen optimalen Spantransport. Einfaches Wechseln der Schneidplatten durch Klemmschrauben. Kein Einjustieren der Wechselplatten nötig. Mit dem Wechselplatten-Spiralbohrer soll grundsätzlich ins volle Material gebohrt werden. Zum Aufbohren vorgegossener oder vorgebohrter Löcher ist dieses Werkzeug nicht geeignet.

Kühlmittelzuführung: radial (axial auf Anfrage)

Spannschrauben Artikel-Nr. 86807 enthalten



d1 mm	d mm	S	L mm	l2 mm	B mm	G	Code-Nr.
35,01-45,0	34,000	MK-4	566,000	393,000	7,000	86807 4.001	<b>34,393</b>
35,01-45,0	34,000	MK-4	716,000	543,000	7,000	86807 4.001	<b>34,543</b>
35,01-45,0	34,000	MK-4	1016,000	843,000	7,000	86807 4.001	<b>34,843</b>
45,01-55,0	44,000	MK-4	566,000	394,500	7,000	86807 4.001	<b>44,395</b>
45,01-55,0	44,000	MK-4	716,000	544,500	7,000	86807 4.001	<b>44,545</b>
45,01-55,0	44,000	MK-4	1016,000	844,500	7,000	86807 4.001	<b>44,845</b>
55,01-65,0	54,000	MK-4	560,000	387,000	7,000	86807 4.001	<b>54,387</b>
55,01-65,0	54,000	MK-4	716,000	543,000	7,000	86807 4.001	<b>54,543</b>
55,01-65,0	54,000	MK-4	1016,000	843,000	7,000	86807 4.001	<b>54,843</b>
65,01-78,0	63,000	MK-5	766,000	547,000	9,000	86807 5.000	<b>63,547</b>
65,01-78,0	63,000	MK-5	1066,000	847,000	9,000	86807 5.000	<b>63,847</b>
78,01-90,0	77,000	MK-5	766,000	544,000	9,000	86807 5.000	<b>77,544</b>
78,01-90,0	77,000	MK-5	1066,000	844,000	9,000	86807 5.000	<b>77,844</b>
90,01-102,0	89,000	MK-5	766,000	544,000	9,000	86807 5.000	<b>89,544</b>
90,01-102,0	89,000	MK-5	1066,000	844,000	9,000	86807 5.000	<b>89,844</b>





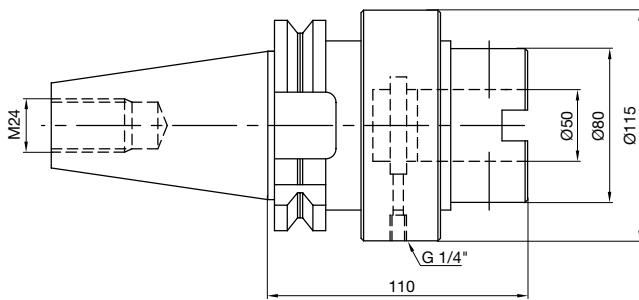
## Sonderprogramm Multiplex Modular-System Ø 97 mm bis 210 mm



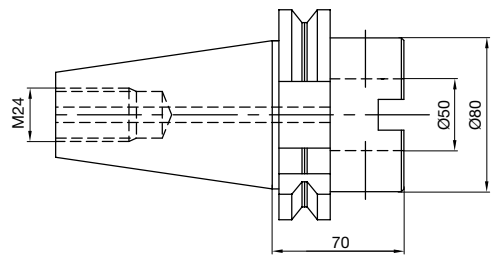
### Aufnahmen

Folgende Versionen sind auf Anfrage lieferbar:

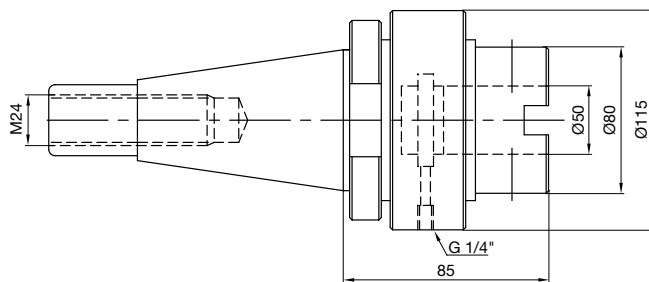
- SK50 DIN ISO 7388-1 mit Kühlmittelring



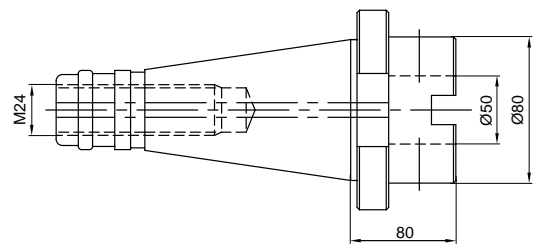
- SK50 DIN ISO 7388-1 ohne Kühlmittelring



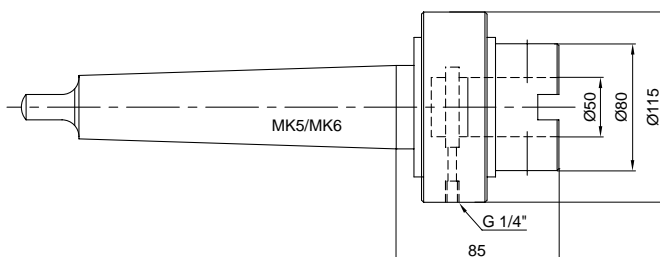
- SK50 DIN 2080 mit Kühlmittelring



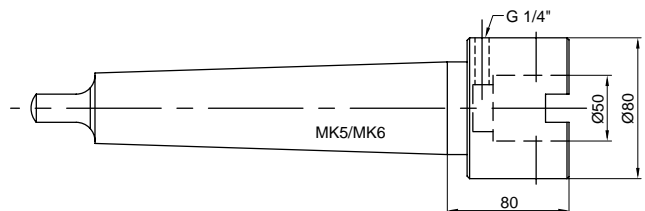
- SK50 DIN 2080 ohne Kühlmittelring



- MK 5/MK 6 mit Kühlmittelring



- MK 5/MK 6 ohne Kühlmittelring



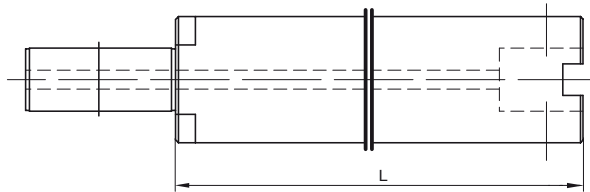


## Sonderprogramm Multiplex Modular-System Ø 97 mm bis 210 mm

### Verlängerungen für Bohrkopf



Verlängerungen für Bohrkopf  
 Ø 97 mm - Ø 130 mm  
 L = 186 mm  
 L = 300 mm



Verlängerungen für Bohrkopf  
 Ø 131 mm - Ø 165 mm und Ø 164 mm - Ø 210 mm  
 L = 204 mm  
 L = 300 mm  
 L = 500 mm

### Mitnehmer



klein, für Bohrkopf Ø 97 mm - Ø 130 mm,  
 Breite 14 mm

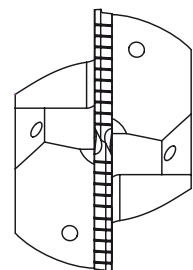
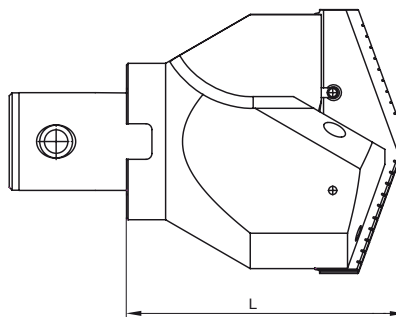


groß, für Bohrkopf Ø 131 mm - Ø 165 mm  
 und Ø 164 mm - Ø 210 mm, Breite 16 mm

### Bohrköpfe



Folgende Größen sind auf Anfrage lieferbar:  
 - Ø 97 mm bis Ø 130 mm, L = 118,5 mm  
 - Ø 131 mm bis Ø 165 mm, L = 142,5 mm  
 - Ø 164 mm bis Ø 210 mm, L = 142,5 mm





## Wechselplatten

Artikel-Nr. 86602



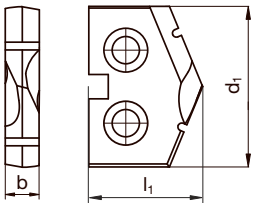
P	M	K	N	S	H
•	○	•	○		

HSS-E-PM



0/+0,05

Ausspitzung  $\geq \varnothing 9,800$  • Wechselplatte mit Spanteilernuten. Spitzenwinkel 135°. Für universelle Anwendung.



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
10,000	8,700	2,500	<b>10,000</b>	17,500	11,700	3,500	<b>17,500</b>
10,200	8,700	2,500	<b>10,200</b>	17,750	11,700	3,500	<b>17,750</b>
10,500	8,700	2,500	<b>10,500</b>	18,000	11,700	3,500	<b>18,000</b>
11,000	8,700	2,500	<b>11,000</b>	18,250	11,700	3,500	<b>18,250</b>
11,110	8,700	2,500	<b>11,110</b>	18,500	11,700	3,500	<b>18,500</b>
11,500	8,700	2,500	<b>11,500</b>	18,750	11,700	3,500	<b>18,750</b>
11,750	8,700	2,500	<b>11,750</b>	19,000	13,700	4,000	<b>19,000</b>
12,000	8,700	2,500	<b>12,000</b>	19,500	13,700	4,000	<b>19,500</b>
12,250	8,700	2,500	<b>12,250</b>	19,750	13,700	4,000	<b>19,750</b>
12,400	8,700	2,500	<b>12,400</b>	20,000	13,700	4,000	<b>20,000</b>
12,500	8,700	2,500	<b>12,500</b>	20,250	13,700	4,000	<b>20,250</b>
12,750	8,700	2,500	<b>12,750</b>	20,500	13,700	4,000	<b>20,500</b>
13,000	8,700	2,500	<b>13,000</b>	21,000	13,700	4,000	<b>21,000</b>
13,250	8,700	2,500	<b>13,250</b>	21,250	13,700	4,000	<b>21,250</b>
13,500	11,700	3,500	<b>13,500</b>	21,500	13,700	4,000	<b>21,500</b>
13,750	11,700	3,500	<b>13,750</b>	21,750	13,700	4,000	<b>21,750</b>
14,000	11,700	3,500	<b>14,000</b>	22,000	13,700	4,000	<b>22,000</b>
14,250	11,700	3,500	<b>14,250</b>	22,500	13,700	4,000	<b>22,500</b>
14,500	11,700	3,500	<b>14,500</b>	23,000	13,700	4,000	<b>23,000</b>
14,750	11,700	3,500	<b>14,750</b>	23,500	13,700	4,000	<b>23,500</b>
15,000	11,700	3,500	<b>15,000</b>	24,000	13,700	4,000	<b>24,000</b>
15,250	11,700	3,500	<b>15,250</b>	24,500	13,700	4,000	<b>24,500</b>
15,300	11,700	3,500	<b>15,300</b>	25,000	13,700	4,000	<b>25,000</b>
15,500	11,700	3,500	<b>15,500</b>				
15,750	11,700	3,500	<b>15,750</b>				
16,000	11,700	3,500	<b>16,000</b>				
16,500	11,700	3,500	<b>16,500</b>				
16,750	11,700	3,500	<b>16,750</b>				
17,000	11,700	3,500	<b>17,000</b>				
17,250	11,700	3,500	<b>17,250</b>				

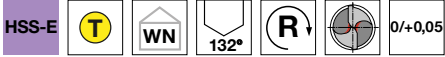


## Wechselplatten

Artikel-Nr. 86605



P	M	K	N	S	H
○	●	○	●	●	

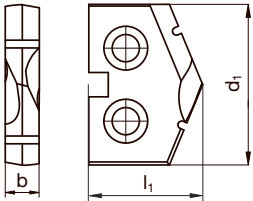


Ausspitzung  $\geq \text{Ø } 25,000$  • Wechselplatte mit Spanteilemuten. VA-Geometrie für rostfreie Stähle, Aluminium-Legierungen und Nichteisenmetalle.

Spitzenwinkel:

$\geq \text{Ø } 25,0 \text{ mm} = 132^\circ$

$> \text{Ø } 66,0 \text{ mm} = 140^\circ$



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
25,000	17,300	5,000	<b>25,000</b>	56,000	24,000	7,000	<b>56,000</b>
25,500	17,300	5,000	<b>25,500</b>	57,000	24,000	7,000	<b>57,000</b>
26,000	17,300	5,000	<b>26,000</b>	58,000	24,000	7,000	<b>58,000</b>
26,500	17,300	5,000	<b>26,500</b>	59,000	24,000	7,000	<b>59,000</b>
27,000	17,300	5,000	<b>27,000</b>	60,000	24,000	7,000	<b>60,000</b>
28,000	17,300	5,000	<b>28,000</b>	62,000	24,000	7,000	<b>62,000</b>
29,000	17,300	5,000	<b>29,000</b>	64,000	24,000	7,000	<b>64,000</b>
29,500	17,300	5,000	<b>29,500</b>	65,000	24,000	7,000	<b>65,000</b>
30,000	17,300	5,000	<b>30,000</b>	66,000	37,000	9,000	<b>66,000</b>
31,000	17,300	5,000	<b>31,000</b>	68,000	37,000	9,000	<b>68,000</b>
32,000	17,300	5,000	<b>32,000</b>	70,000	37,000	9,000	<b>70,000</b>
33,000	17,300	5,000	<b>33,000</b>	74,000	37,000	9,000	<b>74,000</b>
34,000	17,300	5,000	<b>34,000</b>	75,000	37,000	9,000	<b>75,000</b>
35,000	17,300	5,000	<b>35,000</b>	78,000	37,000	9,000	<b>78,000</b>
36,000	24,000	7,000	<b>36,000</b>	80,000	37,000	9,000	<b>80,000</b>
37,000	24,000	7,000	<b>37,000</b>	82,000	37,000	9,000	<b>82,000</b>
37,500	24,000	7,000	<b>37,500</b>	84,000	37,000	9,000	<b>84,000</b>
38,000	24,000	7,000	<b>38,000</b>	85,000	37,000	9,000	<b>85,000</b>
39,000	24,000	7,000	<b>39,000</b>	88,000	37,000	9,000	<b>88,000</b>
40,000	24,000	7,000	<b>40,000</b>	90,000	37,000	9,000	<b>90,000</b>
41,000	24,000	7,000	<b>41,000</b>	94,000	37,000	9,000	<b>94,000</b>
42,000	24,000	7,000	<b>42,000</b>	95,000	37,000	9,000	<b>95,000</b>
43,000	24,000	7,000	<b>43,000</b>	96,000	37,000	9,000	<b>96,000</b>
44,000	24,000	7,000	<b>44,000</b>	98,000	37,000	9,000	<b>98,000</b>
45,000	24,000	7,000	<b>45,000</b>	100,000	37,000	9,000	<b>100,000</b>
46,000	24,000	7,000	<b>46,000</b>	102,000	37,000	9,000	<b>102,000</b>
47,000	24,000	7,000	<b>47,000</b>				
48,000	24,000	7,000	<b>48,000</b>				
49,000	24,000	7,000	<b>49,000</b>				
50,000	24,000	7,000	<b>50,000</b>				
50,500	24,000	7,000	<b>50,500</b>				
51,000	24,000	7,000	<b>51,000</b>				
52,000	24,000	7,000	<b>52,000</b>				
53,000	24,000	7,000	<b>53,000</b>				
54,000	24,000	7,000	<b>54,000</b>				
55,000	24,000	7,000	<b>55,000</b>				



## Wechselplatten

Artikel-Nr. 86608



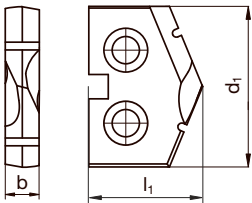
P	M	K	N	S	H
•	○	•	○		

HSS-E-PM



0/+0,05

Ausspitzung  $\geq \varnothing 10,000$  • Wechselplatte mit Spanteilemuten. Spitzenwinkel 135°. Für universelle Anwendung.



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
10,000	8,700	2,500	<b>10,000</b>	17,500	11,700	3,500	<b>17,500</b>
10,200	8,700	2,500	<b>10,200</b>	17,750	11,700	3,500	<b>17,750</b>
10,500	8,700	2,500	<b>10,500</b>	18,000	11,700	3,500	<b>18,000</b>
11,000	8,700	2,500	<b>11,000</b>	18,250	11,700	3,500	<b>18,250</b>
11,500	8,700	2,500	<b>11,500</b>	18,500	11,700	3,500	<b>18,500</b>
11,750	8,700	2,500	<b>11,750</b>	18,750	11,700	3,500	<b>18,750</b>
12,000	8,700	2,500	<b>12,000</b>	19,000	13,700	4,000	<b>19,000</b>
12,500	8,700	2,500	<b>12,500</b>	19,500	13,700	4,000	<b>19,500</b>
12,750	8,700	2,500	<b>12,750</b>	19,750	13,700	4,000	<b>19,750</b>
13,000	8,700	2,500	<b>13,000</b>	20,000	13,700	4,000	<b>20,000</b>
13,250	8,700	2,500	<b>13,250</b>	20,500	13,700	4,000	<b>20,500</b>
13,500	11,700	3,500	<b>13,500</b>	21,000	13,700	4,000	<b>21,000</b>
13,750	11,700	3,500	<b>13,750</b>	21,500	13,700	4,000	<b>21,500</b>
14,000	11,700	3,500	<b>14,000</b>	21,750	13,700	4,000	<b>21,750</b>
14,250	11,700	3,500	<b>14,250</b>	22,000	13,700	4,000	<b>22,000</b>
14,500	11,700	3,500	<b>14,500</b>	22,500	13,700	4,000	<b>22,500</b>
14,750	11,700	3,500	<b>14,750</b>	23,000	13,700	4,000	<b>23,000</b>
15,000	11,700	3,500	<b>15,000</b>	23,500	13,700	4,000	<b>23,500</b>
15,250	11,700	3,500	<b>15,250</b>	24,000	13,700	4,000	<b>24,000</b>
15,500	11,700	3,500	<b>15,500</b>	24,500	13,700	4,000	<b>24,500</b>
15,750	11,700	3,500	<b>15,750</b>	24,750	13,700	4,000	<b>24,750</b>
16,000	11,700	3,500	<b>16,000</b>	25,000	13,700	4,000	<b>25,000</b>
16,500	11,700	3,500	<b>16,500</b>				
17,000	11,700	3,500	<b>17,000</b>				

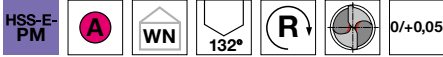


## Wechselplatten

Artikel-Nr. 86609



P	M	K	N	S	H
•	○	•	○		



Ausspitzung  $\geq \varnothing 25,000$  • Wechselplatte mit Spanteilemuten. Für universelle Anwendung.

Spitzenwinkel:

$\geq \varnothing 25,0$  mm = 132°

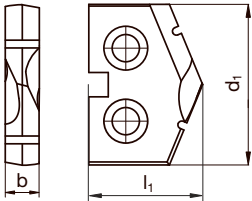
$> \varnothing 66,0$  mm = 140°

$> \varnothing 190,0$  mm = 150°

Schneidstoff:

$\leq \varnothing 66,0$  mm HSS-E-PM

$> \varnothing 66,0$  mm HSS-E



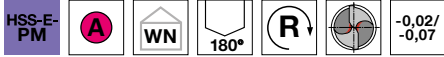
d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
25,000	17,300	5,000	<b>25,000</b>	66,000	37,000	9,000	<b>66,000</b>
25,500	17,300	5,000	<b>25,500</b>	68,000	37,000	9,000	<b>68,000</b>
26,000	17,300	5,000	<b>26,000</b>	70,000	37,000	9,000	<b>70,000</b>
26,500	17,300	5,000	<b>26,500</b>	74,000	37,000	9,000	<b>74,000</b>
27,000	17,300	5,000	<b>27,000</b>	75,000	37,000	9,000	<b>75,000</b>
28,000	17,300	5,000	<b>28,000</b>	78,000	37,000	9,000	<b>78,000</b>
29,000	17,300	5,000	<b>29,000</b>	80,000	37,000	9,000	<b>80,000</b>
29,500	17,300	5,000	<b>29,500</b>	82,000	37,000	9,000	<b>82,000</b>
30,000	17,300	5,000	<b>30,000</b>	84,000	37,000	9,000	<b>84,000</b>
31,000	17,300	5,000	<b>31,000</b>	85,000	37,000	9,000	<b>85,000</b>
32,000	17,300	5,000	<b>32,000</b>	88,000	37,000	9,000	<b>88,000</b>
33,000	17,300	5,000	<b>33,000</b>	90,000	37,000	9,000	<b>90,000</b>
34,000	17,300	5,000	<b>34,000</b>	93,000	37,000	9,000	<b>93,000</b>
35,000	17,300	5,000	<b>35,000</b>	95,000	37,000	9,000	<b>95,000</b>
36,000	24,000	7,000	<b>36,000</b>	96,000	37,000	9,000	<b>96,000</b>
37,000	24,000	7,000	<b>37,000</b>	98,000	37,000	9,000	<b>98,000</b>
38,000	24,000	7,000	<b>38,000</b>	100,000	37,000	9,000	<b>100,000</b>
39,000	24,000	7,000	<b>39,000</b>	102,000	37,000	9,000	<b>102,000</b>
40,000	24,000	7,000	<b>40,000</b>	103,000	37,000	9,000	<b>103,000</b>
41,000	24,000	7,000	<b>41,000</b>	105,000	37,000	9,000	<b>105,000</b>
42,000	24,000	7,000	<b>42,000</b>	110,000	37,000	9,000	<b>110,000</b>
43,000	24,000	7,000	<b>43,000</b>	115,000	37,000	9,000	<b>115,000</b>
44,000	24,000	7,000	<b>44,000</b>	120,000	37,000	9,000	<b>120,000</b>
45,000	24,000	7,000	<b>45,000</b>	125,000	37,000	9,000	<b>125,000</b>
46,000	24,000	7,000	<b>46,000</b>	130,000	37,000	9,000	<b>130,000</b>
47,000	24,000	7,000	<b>47,000</b>	135,000	47,000	9,000	<b>135,000</b>
48,000	24,000	7,000	<b>48,000</b>	140,000	47,000	9,000	<b>140,000</b>
49,000	24,000	7,000	<b>49,000</b>	145,000	47,000	9,000	<b>145,000</b>
50,000	24,000	7,000	<b>50,000</b>	150,000	47,000	9,000	<b>150,000</b>
51,000	24,000	7,000	<b>51,000</b>	155,000	47,000	9,000	<b>155,000</b>
52,000	24,000	7,000	<b>52,000</b>	160,000	47,000	9,000	<b>160,000</b>
53,000	24,000	7,000	<b>53,000</b>	165,000	47,000	9,000	<b>165,000</b>
54,000	24,000	7,000	<b>54,000</b>	170,000	47,000	9,000	<b>170,000</b>
55,000	24,000	7,000	<b>55,000</b>	175,000	47,000	9,000	<b>175,000</b>
56,000	24,000	7,000	<b>56,000</b>	180,000	47,000	9,000	<b>180,000</b>
57,000	24,000	7,000	<b>57,000</b>	185,000	47,000	9,000	<b>185,000</b>
58,000	24,000	7,000	<b>58,000</b>	190,000	47,000	9,000	<b>190,000</b>
59,000	24,000	7,000	<b>59,000</b>	195,000	47,000	9,000	<b>195,000</b>
60,000	24,000	7,000	<b>60,000</b>	200,000	47,000	9,000	<b>200,000</b>
62,000	24,000	7,000	<b>62,000</b>	205,000	47,000	9,000	<b>205,000</b>
64,000	24,000	7,000	<b>64,000</b>	210,000	47,000	9,000	<b>210,000</b>
65,000	24,000	7,000	<b>65,000</b>				



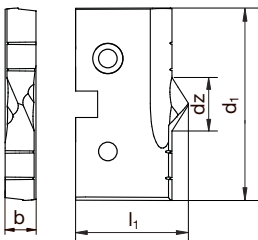
## Wechselplatten

Artikel-Nr. 86611

P	M	K	N	S	H
●	○	●	○		



Ausspitzung  $\geq \varnothing 10,000$  • Wechselplatte mit Spanteilemuten. Für universelle Anwendung.  
 Spitzenwinkel der Zentrierspitze:  
 $\leq \varnothing 35,0 \text{ mm} = 120^\circ$   
 $> \varnothing 35,0 \text{ mm} = 140^\circ$



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
10,000	10,000	2,500	<b>10,000</b>	23,000	15,000	4,000	<b>23,000</b>
10,500	10,000	2,500	<b>10,500</b>	23,500	15,000	4,000	<b>23,500</b>
11,000	10,000	2,500	<b>11,000</b>	24,000	15,000	4,000	<b>24,000</b>
11,500	10,000	2,500	<b>11,500</b>	24,500	15,000	4,000	<b>24,500</b>
11,750	10,000	2,500	<b>11,750</b>	24,750	15,000	4,000	<b>24,750</b>
12,000	10,000	2,500	<b>12,000</b>	25,000	15,000	4,000	<b>25,000</b>
12,500	10,000	2,500	<b>12,500</b>	25,000	18,500	5,000	<b>25,001</b>
12,700	10,000	2,500	<b>12,700</b>	25,400	18,500	5,000	<b>25,400</b>
12,750	10,000	2,500	<b>12,750</b>	25,500	18,500	5,000	<b>25,500</b>
13,000	10,000	2,500	<b>13,000</b>	26,000	18,500	5,000	<b>26,000</b>
13,250	10,000	2,500	<b>13,250</b>	26,500	18,500	5,000	<b>26,500</b>
13,500	13,000	3,500	<b>13,500</b>	27,000	18,500	5,000	<b>27,000</b>
13,750	13,000	3,500	<b>13,750</b>	28,000	18,500	5,000	<b>28,000</b>
14,000	13,000	3,500	<b>14,000</b>	29,000	18,500	5,000	<b>29,000</b>
14,250	13,000	3,500	<b>14,250</b>	29,500	18,500	5,000	<b>29,500</b>
14,500	13,000	3,500	<b>14,500</b>	30,000	18,500	5,000	<b>30,000</b>
14,750	13,000	3,500	<b>14,750</b>	31,000	18,500	5,000	<b>31,000</b>
15,000	13,000	3,500	<b>15,000</b>	32,000	18,500	5,000	<b>32,000</b>
15,250	13,000	3,500	<b>15,250</b>	33,000	18,500	5,000	<b>33,000</b>
15,500	13,000	3,500	<b>15,500</b>	34,000	18,500	5,000	<b>34,000</b>
15,750	13,000	3,500	<b>15,750</b>	35,000	18,500	5,000	<b>35,000</b>
16,000	13,000	3,500	<b>16,000</b>	36,000	25,500	7,000	<b>36,000</b>
16,500	13,000	3,500	<b>16,500</b>	37,000	25,500	7,000	<b>37,000</b>
17,000	13,000	3,500	<b>17,000</b>	38,000	25,500	7,000	<b>38,000</b>
17,500	13,000	3,500	<b>17,500</b>	39,000	25,500	7,000	<b>39,000</b>
17,750	13,000	3,500	<b>17,750</b>	40,000	25,500	7,000	<b>40,000</b>
18,000	13,000	3,500	<b>18,000</b>	41,000	25,500	7,000	<b>41,000</b>
18,250	13,000	3,500	<b>18,250</b>	42,000	25,500	7,000	<b>42,000</b>
18,500	13,000	3,500	<b>18,500</b>	43,000	25,500	7,000	<b>43,000</b>
18,750	13,000	3,500	<b>18,750</b>	44,000	25,500	7,000	<b>44,000</b>
19,000	15,000	4,000	<b>19,000</b>	45,000	25,500	7,000	<b>45,000</b>
19,500	15,000	4,000	<b>19,500</b>	46,000	25,500	7,000	<b>46,000</b>
19,750	15,000	4,000	<b>19,750</b>	47,000	25,500	7,000	<b>47,000</b>
20,000	15,000	4,000	<b>20,000</b>	48,000	25,500	7,000	<b>48,000</b>
20,250	15,000	4,000	<b>20,250</b>	49,000	25,500	7,000	<b>49,000</b>
20,500	15,000	4,000	<b>20,500</b>	50,000	25,500	7,000	<b>50,000</b>
21,000	15,000	4,000	<b>21,000</b>	51,000	25,500	7,000	<b>51,000</b>
21,250	15,000	4,000	<b>21,250</b>	52,000	25,500	7,000	<b>52,000</b>
21,500	15,000	4,000	<b>21,500</b>	53,000	25,500	7,000	<b>53,000</b>
21,750	15,000	4,000	<b>21,750</b>	54,000	25,500	7,000	<b>54,000</b>
22,000	15,000	4,000	<b>22,000</b>	55,000	25,500	7,000	<b>55,000</b>
22,500	15,000	4,000	<b>22,500</b>	56,000	25,500	7,000	<b>56,000</b>



## Wechselplatten

d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
57,000	25,500	7,000	<b>57,000</b>	65,000	25,500	7,000	<b>65,000</b>
58,000	25,500	7,000	<b>58,000</b>				
59,000	25,500	7,000	<b>59,000</b>				
60,000	25,500	7,000	<b>60,000</b>				
62,000	25,500	7,000	<b>62,000</b>				
64,000	25,500	7,000	<b>64,000</b>				



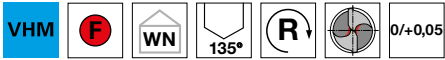


## Wechselplatten

Artikel-Nr. 86701



P	M	K	N	S	H
•	○	•	○		

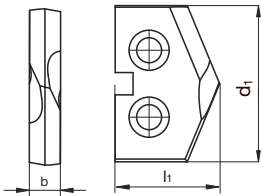


Ausspitzung  $\geq \varnothing 10,000$  • Wechselplatte ohne Spanteilernuten. Für Werkstoffe bis 600 N/mm<sup>2</sup>. Für universelle Anwendung.  
Spitzenwinkel:

$\leq \varnothing 25,4 \text{ mm} = 135^\circ$

$> \varnothing 25,4 \text{ mm} = 132^\circ$

Ohne Fase (siehe „Einsatzempfehlungen Multiplex“/ Technischer Teil)



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
10,000	8,700	2,500	<b>10,000</b>	18,000	11,700	3,500	<b>18,000</b>
10,200	8,700	2,500	<b>10,200</b>	18,250	11,700	3,500	<b>18,250</b>
10,500	8,700	2,500	<b>10,500</b>	18,500	11,700	3,500	<b>18,500</b>
11,000	8,700	2,500	<b>11,000</b>	19,000	13,700	4,000	<b>19,000</b>
11,500	8,700	2,500	<b>11,500</b>	19,500	13,700	4,000	<b>19,500</b>
12,000	8,700	2,500	<b>12,000</b>	20,000	13,700	4,000	<b>20,000</b>
12,500	8,700	2,500	<b>12,500</b>	20,500	13,700	4,000	<b>20,500</b>
12,750	8,700	2,500	<b>12,750</b>	21,000	13,700	4,000	<b>21,000</b>
13,000	8,700	2,500	<b>13,000</b>	21,500	13,700	4,000	<b>21,500</b>
13,500	11,700	3,500	<b>13,500</b>	22,000	13,700	4,000	<b>22,000</b>
13,750	11,700	3,500	<b>13,750</b>	23,000	13,700	4,000	<b>23,000</b>
14,000	11,700	3,500	<b>14,000</b>	24,000	13,700	4,000	<b>24,000</b>
14,500	11,700	3,500	<b>14,500</b>	24,500	13,700	4,000	<b>24,500</b>
14,750	11,700	3,500	<b>14,750</b>	25,000	13,700	4,000	<b>25,000</b>
15,000	11,700	3,500	<b>15,000</b>	26,000	17,300	5,000	<b>26,000</b>
15,500	11,700	3,500	<b>15,500</b>	27,000	17,300	5,000	<b>27,000</b>
15,750	11,700	3,500	<b>15,750</b>	28,000	17,300	5,000	<b>28,000</b>
16,000	11,700	3,500	<b>16,000</b>	29,000	17,300	5,000	<b>29,000</b>
16,250	11,700	3,500	<b>16,250</b>	30,000	17,300	5,000	<b>30,000</b>
16,500	11,700	3,500	<b>16,500</b>	31,000	17,300	5,000	<b>31,000</b>
16,750	11,700	3,500	<b>16,750</b>	32,000	17,300	5,000	<b>32,000</b>
17,000	11,700	3,500	<b>17,000</b>	33,000	17,300	5,000	<b>33,000</b>
17,500	11,700	3,500	<b>17,500</b>	34,000	17,300	5,000	<b>34,000</b>
17,750	11,700	3,500	<b>17,750</b>	35,000	17,300	5,000	<b>35,000</b>

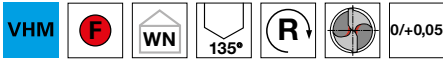


## Wechselplatten

Artikel-Nr. 86702



P	M	K	N	S	H
●	○	●	○		

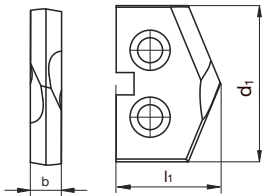


Ausspitzung  $\geq \varnothing 10,000$  • Wechselplatte ohne Spanteilernuten. Für Werkstoffe über 600 N/mm<sup>2</sup>. Für universelle Anwendung.  
Spitzenwinkel:

$\leq \varnothing 25,4$  mm = 135°

$> \varnothing 25,4$  mm = 132°

Mit Fase (siehe „Einsatzempfehlungen Multiplex“/ Technischer Teil)



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
10,000	8,700	2,500	<b>10,000</b>	21,000	13,700	4,000	<b>21,000</b>
10,200	8,700	2,500	<b>10,200</b>	21,500	13,700	4,000	<b>21,500</b>
10,500	8,700	2,500	<b>10,500</b>	22,000	13,700	4,000	<b>22,000</b>
11,000	8,700	2,500	<b>11,000</b>	22,300	13,700	4,000	<b>22,300</b>
12,000	8,700	2,500	<b>12,000</b>	22,750	13,700	4,000	<b>22,750</b>
12,500	8,700	2,500	<b>12,500</b>	23,000	13,700	4,000	<b>23,000</b>
12,750	8,700	2,500	<b>12,750</b>	24,250	13,700	4,000	<b>24,250</b>
13,000	8,700	2,500	<b>13,000</b>	24,500	13,700	4,000	<b>24,500</b>
13,500	11,700	3,500	<b>13,500</b>	25,000	13,700	4,000	<b>25,000</b>
13,750	11,700	3,500	<b>13,750</b>	26,000	17,300	5,000	<b>26,000</b>
14,000	11,700	3,500	<b>14,000</b>	26,500	17,300	5,000	<b>26,500</b>
14,100	11,700	3,500	<b>14,100</b>	27,000	17,300	5,000	<b>27,000</b>
14,500	11,700	3,500	<b>14,500</b>	28,000	17,300	5,000	<b>28,000</b>
14,750	11,700	3,500	<b>14,750</b>	29,000	17,300	5,000	<b>29,000</b>
15,000	11,700	3,500	<b>15,000</b>	29,800	17,300	5,000	<b>29,800</b>
15,500	11,700	3,500	<b>15,500</b>	30,000	17,300	5,000	<b>30,000</b>
16,000	11,700	3,500	<b>16,000</b>	32,000	17,300	5,000	<b>32,000</b>
16,250	11,700	3,500	<b>16,250</b>	33,000	17,300	5,000	<b>33,000</b>
16,500	11,700	3,500	<b>16,500</b>	34,000	17,300	5,000	<b>34,000</b>
17,000	11,700	3,500	<b>17,000</b>	35,000	17,300	5,000	<b>35,000</b>
17,500	11,700	3,500	<b>17,500</b>				
17,750	11,700	3,500	<b>17,750</b>				
18,000	11,700	3,500	<b>18,000</b>				
18,250	11,700	3,500	<b>18,250</b>				
18,500	11,700	3,500	<b>18,500</b>				
19,000	13,700	4,000	<b>19,000</b>				
19,500	13,700	4,000	<b>19,500</b>				
19,750	13,700	4,000	<b>19,750</b>				
20,000	13,700	4,000	<b>20,000</b>				
20,500	13,700	4,000	<b>20,500</b>				

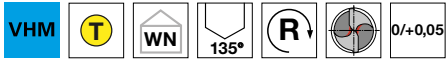


## Wechselplatten

Artikel-Nr. 86708



P	M	K	N	S	H
•	○	•	○		

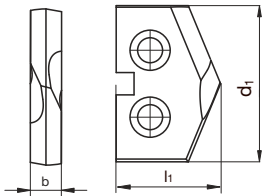


Ausspitzung  $\geq \varnothing 9,800$  • Wechselplatte ohne Spanteilernuten. Für Werkstoffe über 600 N/mm<sup>2</sup>. Für universelle Anwendung.  
Spitzenwinkel:

$\leq \varnothing 25,4$  mm = 135°

$> \varnothing 25,4$  mm = 132°

Mit Fase (siehe „Einsatzempfehlungen Multiplex“/ Technischer Teil)



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
10,000	8,700	2,500	<b>10,000</b>	20,500	13,700	4,000	<b>20,500</b>
10,200	8,700	2,500	<b>10,200</b>	21,000	13,700	4,000	<b>21,000</b>
10,500	8,700	2,500	<b>10,500</b>	21,500	13,700	4,000	<b>21,500</b>
11,000	8,700	2,500	<b>11,000</b>	22,000	13,700	4,000	<b>22,000</b>
11,500	8,700	2,500	<b>11,500</b>	22,500	13,700	4,000	<b>22,500</b>
12,500	8,700	2,500	<b>12,500</b>	22,750	13,700	4,000	<b>22,750</b>
12,750	8,700	2,500	<b>12,750</b>	23,000	13,700	4,000	<b>23,000</b>
13,000	8,700	2,500	<b>13,000</b>	23,500	13,700	4,000	<b>23,500</b>
13,500	11,700	3,500	<b>13,500</b>	24,000	13,700	4,000	<b>24,000</b>
13,750	11,700	3,500	<b>13,750</b>	24,250	13,700	4,000	<b>24,250</b>
14,000	11,700	3,500	<b>14,000</b>	24,500	13,700	4,000	<b>24,500</b>
14,500	11,700	3,500	<b>14,500</b>	25,000	13,700	4,000	<b>25,000</b>
14,750	11,700	3,500	<b>14,750</b>	26,000	17,300	5,000	<b>26,000</b>
15,000	11,700	3,500	<b>15,000</b>	27,000	17,300	5,000	<b>27,000</b>
15,500	11,700	3,500	<b>15,500</b>	28,000	17,300	5,000	<b>28,000</b>
15,750	11,700	3,500	<b>15,750</b>	29,000	17,300	5,000	<b>29,000</b>
16,000	11,700	3,500	<b>16,000</b>	30,000	17,300	5,000	<b>30,000</b>
16,250	11,700	3,500	<b>16,250</b>	31,000	17,300	5,000	<b>31,000</b>
16,500	11,700	3,500	<b>16,500</b>	32,000	17,300	5,000	<b>32,000</b>
16,750	11,700	3,500	<b>16,750</b>	34,000	17,300	5,000	<b>34,000</b>
17,000	11,700	3,500	<b>17,000</b>	35,000	17,300	5,000	<b>35,000</b>
17,500	11,700	3,500	<b>17,500</b>				
17,750	11,700	3,500	<b>17,750</b>				
18,000	11,700	3,500	<b>18,000</b>				
18,250	11,700	3,500	<b>18,250</b>				
18,500	11,700	3,500	<b>18,500</b>				
19,000	13,700	4,000	<b>19,000</b>				
19,500	13,700	4,000	<b>19,500</b>				
19,750	13,700	4,000	<b>19,750</b>				
20,000	13,700	4,000	<b>20,000</b>				

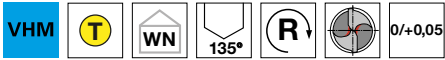


## Wechselplatten

Artikel-Nr. 86709



P	M	K	N	S	H
•	○	•	○		

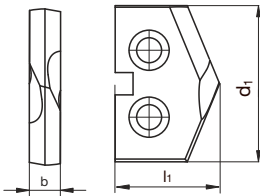


Ausspitzung  $\geq \varnothing 9,800$  • Wechselplatte ohne Spanteilernuten. Für Werkstoffe bis  $600 \text{ N/mm}^2$ . Für universelle Anwendung.  
Spitzenwinkel:

$\leq \varnothing 25,4 \text{ mm} = 135^\circ$

$> \varnothing 25,4 \text{ mm} = 132^\circ$

Ohne Fase (siehe „Einsatzempfehlungen Multiplex“/ Technischer Teil)



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
9,920	8,700	2,500	<b>9,920</b>	18,250	11,700	3,500	<b>18,250</b>
10,000	8,700	2,500	<b>10,000</b>	18,500	11,700	3,500	<b>18,500</b>
10,200	8,700	2,500	<b>10,200</b>	19,000	13,700	4,000	<b>19,000</b>
10,500	8,700	2,500	<b>10,500</b>	19,500	13,700	4,000	<b>19,500</b>
11,000	8,700	2,500	<b>11,000</b>	20,000	13,700	4,000	<b>20,000</b>
11,110	8,700	2,500	<b>11,110</b>	20,500	13,700	4,000	<b>20,500</b>
12,000	8,700	2,500	<b>12,000</b>	21,000	13,700	4,000	<b>21,000</b>
12,500	8,700	2,500	<b>12,500</b>	21,500	13,700	4,000	<b>21,500</b>
12,700	8,700	2,500	<b>12,700</b>	22,000	13,700	4,000	<b>22,000</b>
12,750	8,700	2,500	<b>12,750</b>	23,000	13,700	4,000	<b>23,000</b>
13,000	8,700	2,500	<b>13,000</b>	23,250	13,700	4,000	<b>23,250</b>
13,500	11,700	3,500	<b>13,500</b>	24,500	13,700	4,000	<b>24,500</b>
14,000	11,700	3,500	<b>14,000</b>	25,000	13,700	4,000	<b>25,000</b>
14,500	11,700	3,500	<b>14,500</b>	26,000	17,300	5,000	<b>26,000</b>
15,000	11,700	3,500	<b>15,000</b>	27,000	17,300	5,000	<b>27,000</b>
15,880	11,700	3,500	<b>15,880</b>	28,000	17,300	5,000	<b>28,000</b>
16,250	11,700	3,500	<b>16,250</b>	29,000	17,300	5,000	<b>29,000</b>
16,500	11,700	3,500	<b>16,500</b>	30,000	17,300	5,000	<b>30,000</b>
16,670	11,700	3,500	<b>16,670</b>	33,000	17,300	5,000	<b>33,000</b>
16,750	11,700	3,500	<b>16,750</b>	34,000	17,300	5,000	<b>34,000</b>
17,000	11,700	3,500	<b>17,000</b>	35,000	17,300	5,000	<b>35,000</b>
17,500	11,700	3,500	<b>17,500</b>				
17,750	11,700	3,500	<b>17,750</b>				
18,000	11,700	3,500	<b>18,000</b>				

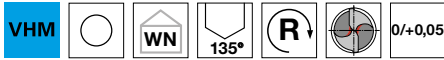


## Wechselplatten

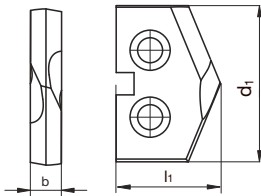
Artikel-Nr. 86711



P	M	K	N	S	H
			•		



Ausspitzung  $\geq \varnothing 10,000$  • Wechselplatte mit Spanteilernuten. Aluminium-Geometrie für .  
 Aluminium-Legierungen, Nichteisenmetalle und Kunststoffe:  
 $\leq \varnothing 25,4 \text{ mm} = 135^\circ$   
 $> \varnothing 25,4 \text{ mm} = 132^\circ$



d1 mm	l1 mm	b mm	Code-Nr.	d1 mm	l1 mm	b mm	Code-Nr.
10,000	8,700	2,500	<b>10,000</b>	24,000	13,700	4,000	<b>24,000</b>
10,200	8,700	2,500	<b>10,200</b>	24,250	13,700	4,000	<b>24,250</b>
10,500	8,700	2,500	<b>10,500</b>	24,500	13,700	4,000	<b>24,500</b>
11,000	8,700	2,500	<b>11,000</b>	25,000	13,700	4,000	<b>25,000</b>
11,500	8,700	2,500	<b>11,500</b>	25,400	17,300	5,000	<b>25,400</b>
12,000	8,700	2,500	<b>12,000</b>	26,000	17,300	5,000	<b>26,000</b>
12,250	8,700	2,500	<b>12,250</b>	27,000	17,300	5,000	<b>27,000</b>
12,500	8,700	2,500	<b>12,500</b>	28,000	17,300	5,000	<b>28,000</b>
12,700	8,700	2,500	<b>12,700</b>	29,000	17,300	5,000	<b>29,000</b>
12,750	8,700	2,500	<b>12,750</b>	30,000	17,300	5,000	<b>30,000</b>
13,000	8,700	2,500	<b>13,000</b>	31,000	17,300	5,000	<b>31,000</b>
13,500	11,700	3,500	<b>13,500</b>	32,000	17,300	5,000	<b>32,000</b>
13,750	11,700	3,500	<b>13,750</b>	34,000	17,300	5,000	<b>34,000</b>
14,000	11,700	3,500	<b>14,000</b>	35,000	17,300	5,000	<b>35,000</b>
14,250	11,700	3,500	<b>14,250</b>	36,000	24,000	7,000	<b>36,000</b>
14,500	11,700	3,500	<b>14,500</b>	37,000	24,000	7,000	<b>37,000</b>
14,750	11,700	3,500	<b>14,750</b>	38,000	24,000	7,000	<b>38,000</b>
15,000	11,700	3,500	<b>15,000</b>	39,000	24,000	7,000	<b>39,000</b>
15,500	11,700	3,500	<b>15,500</b>	40,000	24,000	7,000	<b>40,000</b>
15,750	11,700	3,500	<b>15,750</b>	41,000	24,000	7,000	<b>41,000</b>
16,000	11,700	3,500	<b>16,000</b>	42,000	24,000	7,000	<b>42,000</b>
16,250	11,700	3,500	<b>16,250</b>	43,000	24,000	7,000	<b>43,000</b>
16,500	11,700	3,500	<b>16,500</b>	44,000	24,000	7,000	<b>44,000</b>
16,750	11,700	3,500	<b>16,750</b>	45,000	24,000	7,000	<b>45,000</b>
17,000	11,700	3,500	<b>17,000</b>	46,000	24,000	7,000	<b>46,000</b>
17,500	11,700	3,500	<b>17,500</b>	47,000	24,000	7,000	<b>47,000</b>
17,750	11,700	3,500	<b>17,750</b>	48,000	24,000	7,000	<b>48,000</b>
18,000	11,700	3,500	<b>18,000</b>	49,000	24,000	7,000	<b>49,000</b>
18,250	11,700	3,500	<b>18,250</b>	50,000	24,000	7,000	<b>50,000</b>
18,500	11,700	3,500	<b>18,500</b>	51,000	24,000	7,000	<b>51,000</b>
19,000	13,700	4,000	<b>19,000</b>	52,000	24,000	7,000	<b>52,000</b>
19,500	13,700	4,000	<b>19,500</b>	53,000	24,000	7,000	<b>53,000</b>
19,750	13,700	4,000	<b>19,750</b>	54,000	24,000	7,000	<b>54,000</b>
20,000	13,700	4,000	<b>20,000</b>	55,000	24,000	7,000	<b>55,000</b>
20,500	13,700	4,000	<b>20,500</b>	56,000	24,000	7,000	<b>56,000</b>
21,000	13,700	4,000	<b>21,000</b>	57,000	24,000	7,000	<b>57,000</b>
21,500	13,700	4,000	<b>21,500</b>	58,000	24,000	7,000	<b>58,000</b>
22,000	13,700	4,000	<b>22,000</b>	59,000	24,000	7,000	<b>59,000</b>
22,500	13,700	4,000	<b>22,500</b>	60,000	24,000	7,000	<b>60,000</b>
22,750	13,700	4,000	<b>22,750</b>	62,000	24,000	7,000	<b>62,000</b>
23,000	13,700	4,000	<b>23,000</b>	64,000	24,000	7,000	<b>64,000</b>
23,500	13,700	4,000	<b>23,500</b>	65,000	24,000	7,000	<b>65,000</b>



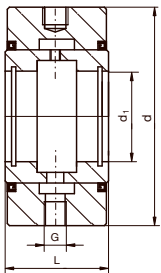
# HARTNER

## Kühlmittelzuführringe

Artikel-Nr. 86690



Kühlmittelzuführung für Halter mit MK und Ringlauffläche 86670 und 86680 (ohne Verschraubungsset).



für	d1 mm	d mm	G	L mm	Code-Nr.
MK 4	31,750	80,000	G1/4	45,000	<b>31,750</b>
MK 5	63,500	127,000	G1/2	60,000	<b>63,500</b>



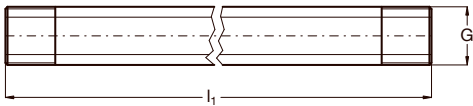
HARTNER

## Kühlmittelzuführrohre

Artikel-Nr. 82571



Kühlmittelzuführrohr für Kühlmittelzuführringe Artikel-Nr. 86690.



G	l1 mm	Code-Nr.
G1/4	200,000	13,160
G1/2	200,000	20,960



## Schnellverschlusskupplung

Artikel-Nr. 82578



Schnellverschlusskupplung für Kühlmittelzuführrohre Artikel-Nr. 82571

G	d mm	l1 mm	Code-Nr.
G1/4	9,000	118,000	<b>9,000</b>
G1/2	13,000	118,000	<b>13,000</b>



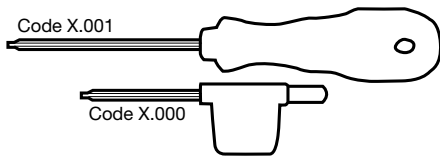


## Torx-Schraubendreher

Artikel-Nr. 86842



Torx-Schraubendreher



Torx	l1 mm	Code-Nr.
T5	130,000	5,001
T6	69,000	6,000
T6	150,000	6,001
T7	74,000	7,000
T7	150,000	7,001
T8	150,000	8,001
T9	150,000	9,001
T10	170,000	10,001
T15	80,000	15,000
T15	190,000	15,001
T20	205,000	20,001
T25	207,000	25,001

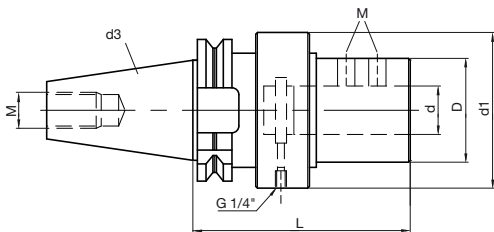


## Kühlmittelzuführfutter für Multiplex

Artikel-Nr. 86691



Kühlmittelzuführfutter mit SK nach DIN ISO 7388-1 und zylindrischer Aufbohrung. Bei kleineren Schaft-Ø Verwendung mit Reduzierhülse.



d3	d mm	D mm	D1 mm	L mm	M	kg	Code-Nr.
<b>SK 40</b>	32,000	65,000	88,000	130,000	M16	4,000	<b>32,040</b>
<b>SK 50</b>	40,000	65,000	98,000	135,000	M24	5,400	<b>40,050</b>
<b>SK 50</b>	50,000	90,000	123,000	165,000	M24	9,520	<b>50,050</b>

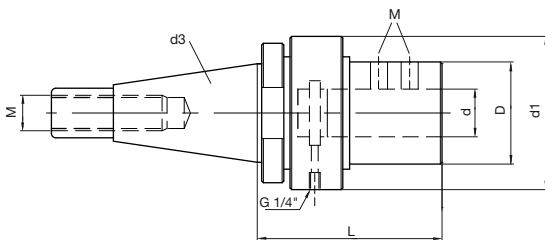


## Kühlmittelzuführfutter für Multiplex

Artikel-Nr. 86692



Kühlmittelzuführfutter mit SK nach DIN 2080 und zylindrischer Aufbohrung. Bei kleineren Schaft-Ø Verwendung mit Reduzierhülse.



d3	d mm	D mm	D1 mm	L mm	M	kg	Code-Nr.
<b>SK 40</b>	32,000	65,000	88,000	110,000	M16	0,931	<b>32,040</b>
<b>SK 50</b>	40,000	65,000	98,000	120,000	M24	5,825	<b>40,050</b>
<b>SK 50</b>	50,000	90,000	123,000	145,000	M24	9,116	<b>50,050</b>

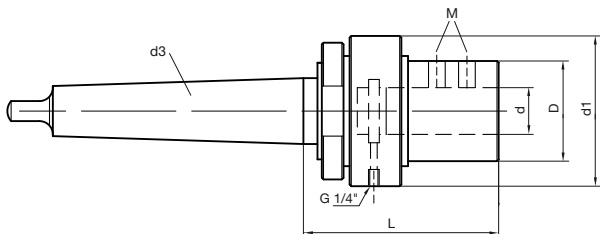


## Kühlmittelzuführfutter für Multiplex

Artikel-Nr. 86693



Kühlmittelzuführfutter mit MK nach DIN 228 B und zylindrischer Aufbohrung. Bei kleineren Schaft-Ø Verwendung mit Reduzierhülse.



d3	d mm	D mm	D1 mm	L mm	M	kg	Code-Nr.
<b>MK-4</b>	32,000	65,000	88,000	100,000	M14	3,498	<b>32,400</b>
<b>MK-5</b>	40,000	75,000	98,000	110,000	M16	7,325	<b>40,500</b>
<b>MK-6</b>	40,000	75,000	98,000	120,000	M16	8,000	<b>40,600</b>
<b>MK-5</b>	50,000	90,000	123,000	140,000	M20	7,278	<b>50,500</b>
<b>MK-6</b>	50,000	90,000	123,000	140,000	M20	3,997	<b>50,600</b>

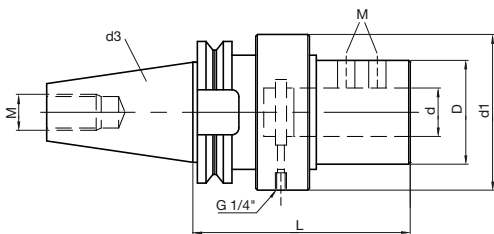


## Kühlmittelzuführfutter für Multiplex

Artikel-Nr. 86694



Kühlmittelzuführfutter mit MAS BT nach DIN ISO 7388-2 und zylindrischer Aufbohrung. Bei kleineren Schaft-Ø Verwendung mit Reduzierhülse.



d3	d mm	D mm	D1 mm	L mm	M	kg	Code-Nr.
<b>BT 40</b>	32,000	65,000	88,000	125,000	M16	0,872	<b>32,040</b>
<b>BT 50</b>	40,000	65,000	98,000	145,000	M24	6,800	<b>40,050</b>
<b>BT 50</b>	50,000	90,000	123,000	170,000	M24	10,183	<b>50,050</b>

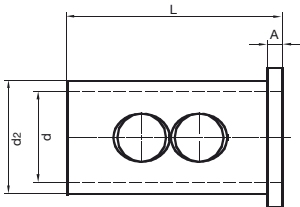


## Reduzierhülsen für Kühlmittelzuführfutter

Artikel-Nr. 86699



Reduzierhülse für Kühlmittelzuführfutter mit zylindrischer Aufnahmebohrung



d mm	d2 mm	L mm	A mm	Code-Nr.
20,000	32,000	65,000	5,000	<b>20,032</b>
20,000	40,000	75,000	5,000	<b>20,040</b>
25,000	32,000	65,000	5,000	<b>25,032</b>
25,000	40,000	75,000	5,000	<b>25,040</b>
32,000	40,000	75,000	5,000	<b>32,040</b>



# HARTNER

Precision Cutting Tools



**MULTIPLY HPC**

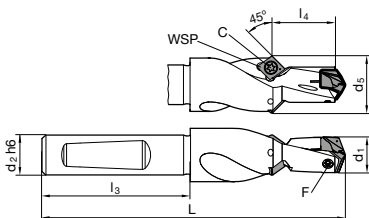


## Multiplex HPC-Halter

Artikel-Nr. 86681



besonders hohe Verschleißfestigkeit • optimierter Nutquerschnitt • optimierter Kühlkanalaustritt • Spannschrauben Art.-Nr. 86843 und 86846 enthalten • Schraubendreher Art.-Nr. 86842 enthalten zum Pilotieren und Senken 45°



Größe mm	d1	d2 h6 mm	d5 mm	L mm	l3 mm	l4 mm	F	C	Code-Nr.
110	11,00-11,99	12,000	17,000	81,000	45,000	12,000	86843 2.200	86846 2.000	11,000
110	11,00-11,99	12,700	17,000	81,000	45,000	12,000	86843 2.200	86846 2.000	11,005
120	12,00-12,99	12,000	18,000	84,000	45,000	13,000	86843 2.201	86846 2.000	12,000
120	12,00-12,99	12,700	18,000	84,000	45,000	13,000	86843 2.201	86846 2.000	12,005
130	13,00-13,99	14,000	18,000	86,000	45,000	14,000	86843 2.500	86846 2.000	13,000
130	13,00-13,99	15,875	18,000	86,000	45,000	14,000	86843 2.500	86846 2.000	13,005
140	14,00-15,99	16,000	18,000	93,000	48,000	16,000	86843 3.000	86846 2.000	14,000
140	14,00-15,99	15,875	18,000	93,000	48,000	16,000	86843 3.000	86846 2.000	14,005
160	16,00-17,99	18,000	20,000	99,000	48,000	18,000	86843 3.500	86846 2.500	16,000
160	16,00-17,99	19,050	20,000	99,000	48,000	18,000	86843 3.500	86846 2.500	16,005
180	18,00-19,99	20,000	22,000	106,000	50,000	20,000	86843 4.000	86846 2.500	18,000
180	18,00-19,99	19,050	22,000	106,000	50,000	20,000	86843 4.000	86846 2.500	18,005
200	20,00-21,99	25,000	25,000	117,000	56,000	22,000	86843 4.500	86846 2.500	20,000
200	20,00-21,99	25,400	25,400	117,000	56,000	22,000	86843 4.500	86846 2.500	20,005
220	22,00-23,99	25,000	26,000	122,000	56,000	24,000	86843 5.000	86846 2.500	22,000
220	22,00-23,99	25,400	26,000	122,000	56,000	24,000	86843 5.000	86846 2.500	22,005
240	24,00-25,99	25,000	28,000	128,000	56,000	26,000	86843 5.001	86846 2.500	24,000
240	24,00-25,99	25,400	28,000	128,000	56,000	26,000	86843 5.001	86846 2.500	24,005
260	26,00-27,99	32,000	32,000	142,000	60,000	28,000	86843 5.003	86846 2.500	26,000
260	26,00-27,99	31,750	32,000	142,000	60,000	28,000	86843 5.003	86846 2.500	26,005
280	28,00-29,99	32,000	34,000	147,000	60,000	30,000	86843 5.003	86846 2.500	28,000
280	28,00-29,99	31,750	34,000	147,000	60,000	30,000	86843 5.003	86846 2.500	28,005
300	30,00-31,99	32,000	38,000	152,000	60,000	32,000	86843 6.000	86846 4.006	30,000
300	30,00-31,99	31,750	38,000	152,000	60,000	32,000	86843 6.000	86846 4.006	30,005
320	32,00-35,99	32,000	42,000	163,000	60,000	36,000	86843 6.001	86846 4.006	32,000
320	32,00-35,99	31,750	42,000	163,000	60,000	36,000	86843 6.001	86846 4.006	32,005
360	36,00-40,00	32,000	46,000	173,000	60,000	40,000	86843 6.002	86846 4.006	36,000
360	36,00-40,00	31,750	46,000	173,000	60,000	40,000	86843 6.002	86846 4.006	36,005



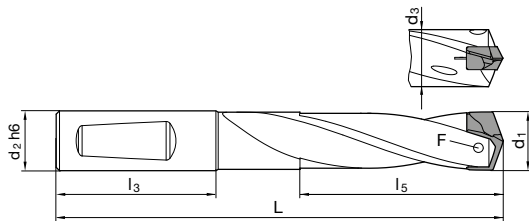


## Multiplex HPC-Halter

Artikel-Nr. 86682



besonders hohe Verschleißfestigkeit • optimierter Nutquerschnitt • optimierter Kühlkanalaustritt • Spannschrauben Art.-Nr. 86843 enthalten • Schraubendreher Art.-Nr. 86842 enthalten



Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
110	11,00-11,49	12,000	10,700	84,000	45,000	19,300	86843 2.200	11,000
110	11,00-11,49	12,700	10,700	84,000	45,000	19,300	86843 2.200	11,005
115	11,50-11,99	12,000	11,200	85,000	45,000	20,100	86843 2.200	11,500
115	11,50-11,99	12,700	11,200	85,000	45,000	20,100	86843 2.200	11,505
120	12,00-12,49	12,000	11,700	87,000	45,000	21,000	86843 2.201	12,000
120	12,00-12,49	12,700	11,700	87,000	45,000	21,000	86843 2.201	12,005
125	12,50-12,99	14,000	12,200	89,000	45,000	21,900	86843 2.201	12,500
125	12,50-12,99	15,875	12,200	89,000	45,000	21,900	86843 2.201	12,505
130	13,00-13,49	14,000	12,700	90,000	45,000	22,600	86843 2.500	13,000
130	13,00-13,49	15,875	12,700	90,000	45,000	22,600	86843 2.500	13,005
135	13,50-13,99	14,000	13,200	92,000	45,000	23,600	86843 2.500	13,500
135	13,50-13,99	15,875	13,200	92,000	45,000	23,600	86843 2.500	13,505
140	14,00-14,49	14,000	13,700	93,000	45,000	24,500	86843 3.000	14,000
140	14,00-14,49	15,875	13,700	93,000	45,000	24,500	86843 3.000	14,005
145	14,50-14,99	16,000	14,200	98,000	48,000	25,300	86843 3.000	14,500
145	14,50-14,99	15,875	14,200	98,000	48,000	25,300	86843 3.000	14,505
150	15,00-15,49	16,000	14,700	100,000	48,000	26,100	86843 3.001	15,000
150	15,00-15,49	15,875	14,700	100,000	48,000	26,100	86843 3.001	15,005
155	15,50-15,99	16,000	15,200	101,000	48,000	27,000	86843 3.001	15,500
155	15,50-15,99	15,875	15,200	101,000	48,000	27,000	86843 3.001	15,505
160	16,00-16,49	16,000	15,700	102,000	48,000	27,800	86843 3.500	16,000
160	16,00-16,49	15,875	15,700	102,000	48,000	27,800	86843 3.500	16,005
165	16,50-16,99	18,000	16,200	105,000	48,000	28,700	86843 3.500	16,500
165	16,50-16,99	19,050	16,200	105,000	48,000	28,700	86843 3.500	16,505
170	17,00-17,49	18,000	16,700	106,000	48,000	29,600	86843 3.500	17,000
170	17,00-17,49	19,050	16,700	106,000	48,000	29,600	86843 3.500	17,005
175	17,50-17,99	18,000	17,200	107,000	48,000	30,400	86843 3.500	17,500
175	17,50-17,99	19,050	17,200	107,000	48,000	30,400	86843 3.500	17,505
180	18,00-18,49	18,000	17,700	109,000	48,000	31,200	86843 4.000	18,000
180	18,00-18,49	19,050	17,700	109,000	48,000	31,200	86843 4.000	18,005
185	18,50-18,99	20,000	18,200	113,000	50,000	32,100	86843 4.000	18,500
185	18,50-18,99	19,050	18,200	113,000	50,000	32,100	86843 4.000	18,505
190	19,00-19,49	20,000	18,700	114,000	50,000	32,900	86843 4.000	19,000
190	19,00-19,49	19,050	18,700	114,000	50,000	32,900	86843 4.000	19,005
195	19,50-19,99	20,000	19,200	116,000	50,000	33,700	86843 4.000	19,500
195	19,50-19,99	19,050	19,200	116,000	50,000	33,700	86843 4.000	19,505
200	20,00-20,49	20,000	19,700	117,000	50,000	34,600	86843 4.500	20,000
200	20,00-20,49	19,050	19,700	117,000	50,000	34,600	86843 4.500	20,005
205	20,50-20,99	25,000	20,200	128,000	56,000	35,500	86843 4.500	20,500
205	20,50-20,99	25,400	20,200	128,000	56,000	35,500	86843 4.500	20,505
210	21,00-21,49	25,000	20,700	129,000	56,000	36,400	86843 4.500	21,000
210	21,00-21,49	25,400	20,700	129,000	56,000	36,400	86843 4.500	21,005



## Multiplex HPC-Halter

Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
<b>215</b>	21,50-21,99	25,000	21,200	130,000	56,000	37,200	86843 4.500	<b>21,500</b>
<b>215</b>	21,50-21,99	25,400	21,200	130,000	56,000	37,200	86843 4.500	<b>21,505</b>
<b>220</b>	22,00-22,49	25,000	21,700	131,000	56,000	38,000	86843 5.000	<b>22,000</b>
<b>220</b>	22,00-22,49	25,400	21,700	131,000	56,000	38,000	86843 5.000	<b>22,005</b>
<b>225</b>	22,50-22,99	25,000	22,200	134,000	56,000	38,900	86843 5.000	<b>22,500</b>
<b>225</b>	22,50-22,99	25,400	22,200	134,000	56,000	38,900	86843 5.000	<b>22,505</b>
<b>230</b>	23,00-23,49	25,000	22,700	135,000	56,000	39,800	86843 5.000	<b>23,000</b>
<b>230</b>	23,00-23,49	25,400	22,700	135,000	56,000	39,800	86843 5.000	<b>23,005</b>
<b>235</b>	23,50-23,99	25,000	23,200	137,000	56,000	40,600	86843 5.000	<b>23,500</b>
<b>235</b>	23,50-23,99	25,400	23,200	137,000	56,000	40,600	86843 5.000	<b>23,505</b>
<b>240</b>	24,00-24,49	25,000	23,700	138,000	56,000	41,500	86843 5.001	<b>24,000</b>
<b>240</b>	24,00-24,49	25,400	23,700	138,000	56,000	41,500	86843 5.001	<b>24,005</b>
<b>245</b>	24,50-24,99	25,000	24,200	140,000	56,000	42,300	86843 5.001	<b>24,500</b>
<b>245</b>	24,50-24,99	25,400	24,200	140,000	56,000	42,300	86843 5.001	<b>24,505</b>
<b>250</b>	25,00-25,49	25,000	24,700	142,000	56,000	43,200	86843 5.001	<b>25,000</b>
<b>250</b>	25,00-25,49	25,400	24,700	142,000	56,000	43,200	86843 5.001	<b>25,005</b>
<b>255</b>	25,50-25,99	32,000	25,200	148,000	60,000	44,000	86843 5.001	<b>25,500</b>
<b>255</b>	25,50-25,99	31,750	25,200	148,000	60,000	44,000	86843 5.001	<b>25,505</b>
<b>260</b>	26,00-26,49	32,000	25,700	151,000	60,000	44,300	86843 5.003	<b>26,000</b>
<b>260</b>	26,00-26,49	31,750	25,700	151,000	60,000	44,300	86843 5.003	<b>26,005</b>
<b>265</b>	26,50-26,99	32,000	26,200	153,000	60,000	45,100	86843 5.003	<b>26,500</b>
<b>265</b>	26,50-26,99	31,750	26,200	153,000	60,000	45,100	86843 5.003	<b>26,505</b>
<b>270</b>	27,00-27,49	32,000	26,700	155,000	60,000	46,000	86843 5.003	<b>27,000</b>
<b>270</b>	27,00-27,49	31,750	26,700	155,000	60,000	46,000	86843 5.003	<b>27,005</b>
<b>275</b>	27,50-27,99	32,000	27,200	156,000	60,000	46,800	86843 5.003	<b>27,500</b>
<b>275</b>	27,50-27,99	31,750	27,200	156,000	60,000	46,800	86843 5.003	<b>27,505</b>
<b>280</b>	28,00-28,49	32,000	27,700	157,000	60,000	47,700	86843 5.003	<b>28,000</b>
<b>280</b>	28,00-28,49	31,750	27,700	157,000	60,000	47,700	86843 5.003	<b>28,005</b>
<b>285</b>	28,50-28,99	32,000	28,200	159,000	60,000	48,500	86843 5.003	<b>28,500</b>
<b>285</b>	28,50-28,99	31,750	28,200	159,000	60,000	48,500	86843 5.003	<b>28,505</b>
<b>290</b>	29,00-29,49	32,000	28,700	161,000	60,000	49,400	86843 5.003	<b>29,000</b>
<b>290</b>	29,00-29,49	31,750	28,700	161,000	60,000	49,400	86843 5.003	<b>29,005</b>
<b>295</b>	29,50-29,99	32,000	29,200	162,000	60,000	50,200	86843 5.003	<b>29,500</b>
<b>295</b>	29,50-29,99	31,750	29,200	162,000	60,000	50,200	86843 5.003	<b>29,505</b>
<b>300</b>	30,00-30,49	32,000	29,700	164,000	60,000	50,900	86843 6.000	<b>30,000</b>
<b>300</b>	30,00-30,49	31,750	29,700	164,000	60,000	50,900	86843 6.000	<b>30,005</b>
<b>305</b>	30,50-30,99	32,000	30,200	166,000	60,000	51,700	86843 6.000	<b>30,500</b>
<b>305</b>	30,50-30,99	31,750	30,200	166,000	60,000	51,700	86843 6.000	<b>30,505</b>
<b>310</b>	31,00-31,49	32,000	30,700	167,000	60,000	52,600	86843 6.000	<b>31,000</b>
<b>310</b>	31,00-31,49	31,750	30,700	167,000	60,000	52,600	86843 6.000	<b>31,005</b>
<b>315</b>	31,50-31,99	32,000	31,200	168,000	60,000	53,400	86843 6.000	<b>31,500</b>
<b>315</b>	31,50-31,99	31,750	31,200	168,000	60,000	53,400	86843 6.000	<b>31,505</b>
<b>320</b>	32,00-32,99	32,000	31,700	172,000	60,000	55,100	86843 6.001	<b>32,000</b>
<b>320</b>	32,00-32,99	31,750	31,700	172,000	60,000	55,100	86843 6.001	<b>32,005</b>
<b>330</b>	33,00-33,99	32,000	32,700	175,000	60,000	56,800	86843 6.001	<b>33,000</b>
<b>330</b>	33,00-33,99	31,750	32,700	175,000	60,000	56,800	86843 6.001	<b>33,005</b>
<b>340</b>	34,00-34,99	32,000	33,700	178,000	60,000	58,500	86843 6.001	<b>34,000</b>
<b>340</b>	34,00-34,99	31,750	33,700	178,000	60,000	58,500	86843 6.001	<b>34,005</b>
<b>350</b>	35,00-35,99	32,000	34,700	181,000	60,000	60,200	86843 6.001	<b>35,000</b>
<b>350</b>	35,00-35,99	31,750	34,700	181,000	60,000	60,200	86843 6.001	<b>35,005</b>
<b>360</b>	36,00-36,99	32,000	35,700	184,000	60,000	61,800	86843 6.002	<b>36,000</b>
<b>360</b>	36,00-36,99	31,750	35,700	184,000	60,000	61,800	86843 6.002	<b>36,005</b>
<b>370</b>	37,00-37,99	32,000	36,700	188,000	60,000	63,500	86843 6.002	<b>37,000</b>
<b>370</b>	37,00-37,99	31,750	36,700	188,000	60,000	63,500	86843 6.002	<b>37,005</b>
<b>380</b>	38,00-38,99	32,000	37,700	191,000	60,000	65,200	86843 6.002	<b>38,000</b>
<b>380</b>	38,00-38,99	31,750	37,700	191,000	60,000	65,200	86843 6.002	<b>38,005</b>
<b>390</b>	39,00-40,00	32,000	38,700	194,000	60,000	66,900	86843 6.002	<b>39,000</b>
<b>390</b>	39,00-40,00	31,750	38,700	194,000	60,000	66,900	86843 6.002	<b>39,005</b>

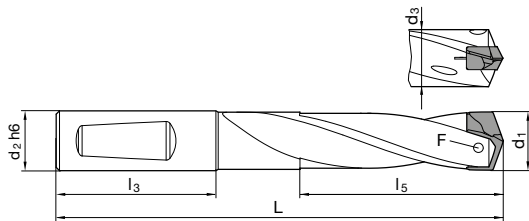


## Multiplex HPC-Halter

Artikel-Nr. 86683



besonders hohe Verschleißfestigkeit • optimierter Nutquerschnitt • besonders hohe Stabilität • Spanschrauben Art.-Nr. 86843 enthalten  
• Schraubendreher Art.-Nr. 86842 enthalten



Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
110	11,00-11,49	12,000	10,700	101,000	45,000	36,600	86843 2.200	11,000
110	11,00-11,49	12,700	10,700	101,000	45,000	36,600	86843 2.200	11,005
115	11,50-11,99	12,000	11,200	103,000	45,000	38,100	86843 2.200	11,500
115	11,50-11,99	12,700	11,200	103,000	45,000	38,100	86843 2.200	11,505
120	12,00-12,49	12,000	11,700	106,000	45,000	39,700	86843 2.201	12,000
120	12,00-12,49	12,700	11,700	106,000	45,000	39,700	86843 2.201	12,005
125	12,50-12,99	14,000	12,200	108,000	45,000	41,300	86843 2.201	12,500
125	12,50-12,99	15,875	12,200	108,000	45,000	41,300	86843 2.201	12,505
130	13,00-13,49	14,000	12,700	110,000	45,000	42,900	86843 2.500	13,000
130	13,00-13,49	15,875	12,700	110,000	45,000	42,900	86843 2.500	13,005
135	13,50-13,99	14,000	13,200	113,000	45,000	44,600	86843 2.500	13,500
135	13,50-13,99	15,875	13,200	113,000	45,000	44,600	86843 2.500	13,505
140	14,00-14,49	14,000	13,700	115,000	45,000	46,200	86843 3.000	14,000
140	14,00-14,49	15,875	13,700	115,000	45,000	46,200	86843 3.000	14,005
145	14,50-14,99	16,000	14,200	120,000	48,000	47,800	86843 3.000	14,500
145	14,50-14,99	15,875	14,200	120,000	48,000	47,800	86843 3.000	14,505
150	15,00-15,49	16,000	14,700	123,000	48,000	49,300	86843 3.001	15,000
150	15,00-15,49	15,875	14,700	123,000	48,000	49,300	86843 3.001	15,005
155	15,50-15,99	16,000	15,200	125,000	48,000	50,900	86843 3.001	15,500
155	15,50-15,99	15,875	15,200	125,000	48,000	50,900	86843 3.001	15,505
160	16,00-16,49	16,000	15,700	127,000	48,000	52,900	86843 3.500	16,000
160	16,00-16,49	15,875	15,700	127,000	48,000	52,900	86843 3.500	16,005
165	16,50-16,99	18,000	16,200	130,000	48,000	54,100	86843 3.500	16,500
165	16,50-16,99	19,050	16,200	130,000	48,000	54,100	86843 3.500	16,505
170	17,00-17,49	18,000	16,700	132,000	48,000	55,800	86843 3.500	17,000
170	17,00-17,49	19,050	16,700	132,000	48,000	55,800	86843 3.500	17,005
175	17,50-17,99	18,000	17,200	134,000	48,000	57,400	86843 3.500	17,500
175	17,50-17,99	19,050	17,200	134,000	48,000	57,400	86843 3.500	17,505
180	18,00-18,49	18,000	17,700	137,000	48,000	58,900	86843 4.000	18,000
180	18,00-18,49	19,050	17,700	137,000	48,000	58,900	86843 4.000	18,005
185	18,50-18,99	20,000	18,200	141,000	50,000	60,500	86843 4.000	18,500
185	18,50-18,99	19,050	18,200	141,000	50,000	60,500	86843 4.000	18,505
190	19,00-19,49	20,000	18,700	143,000	50,000	62,100	86843 4.000	19,000
190	19,00-19,49	19,050	18,700	143,000	50,000	62,100	86843 4.000	19,005
195	19,50-19,99	20,000	19,200	146,000	50,000	63,700	86843 4.000	19,500
195	19,50-19,99	19,050	19,200	146,000	50,000	63,700	86843 4.000	19,505
200	20,00-20,49	20,000	19,700	148,000	50,000	65,300	86843 4.500	20,000
200	20,00-20,49	19,050	19,700	148,000	50,000	65,300	86843 4.500	20,005
205	20,50-20,99	25,000	20,200	159,000	56,000	67,000	86843 4.500	20,500
205	20,50-20,99	25,400	20,200	159,000	56,000	67,000	86843 4.500	20,505
210	21,00-21,49	25,000	20,700	161,000	56,000	68,600	86843 4.500	21,000
210	21,00-21,49	25,400	20,700	161,000	56,000	68,600	86843 4.500	21,005



## Multiplex HPC-Halter

Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
<b>215</b>	21,50-21,99	25,000	21,200	163,000	56,000	70,100	86843 4.500	<b>21,500</b>
<b>215</b>	21,50-21,99	25,400	21,200	163,000	56,000	70,100	86843 4.500	<b>21,505</b>
<b>220</b>	22,00-22,49	25,000	21,700	165,000	56,000	71,700	86843 5.000	<b>22,000</b>
<b>220</b>	22,00-22,49	25,400	21,700	165,000	56,000	71,700	86843 5.000	<b>22,005</b>
<b>225</b>	22,50-22,99	25,000	22,200	168,000	56,000	73,300	86843 5.000	<b>22,500</b>
<b>225</b>	22,50-22,99	25,400	22,200	168,000	56,000	73,300	86843 5.000	<b>22,505</b>
<b>230</b>	23,00-23,49	25,000	22,700	170,000	56,000	74,900	86843 5.000	<b>23,000</b>
<b>230</b>	23,00-23,49	25,400	22,700	170,000	56,000	74,900	86843 5.000	<b>23,005</b>
<b>235</b>	23,50-23,99	25,000	23,200	173,000	56,000	76,500	86843 5.000	<b>23,500</b>
<b>235</b>	23,50-23,99	25,400	23,200	173,000	56,000	76,500	86843 5.000	<b>23,505</b>
<b>240</b>	24,00-24,49	25,000	23,700	175,000	56,000	78,100	86843 5.001	<b>24,000</b>
<b>240</b>	24,00-24,49	25,400	23,700	175,000	56,000	78,100	86843 5.001	<b>24,005</b>
<b>245</b>	24,50-24,99	25,000	24,200	177,000	56,000	79,700	86843 5.001	<b>24,500</b>
<b>245</b>	24,50-24,99	25,400	24,200	177,000	56,000	79,700	86843 5.001	<b>24,505</b>
<b>250</b>	25,00-25,49	25,000	24,700	180,000	56,000	81,300	86843 5.001	<b>25,000</b>
<b>250</b>	25,00-25,49	25,400	24,700	180,000	56,000	81,300	86843 5.001	<b>25,005</b>
<b>255</b>	25,50-25,99	32,000	25,200	187,000	60,000	82,900	86843 5.001	<b>25,500</b>
<b>255</b>	25,50-25,99	31,750	25,200	187,000	60,000	82,900	86843 5.001	<b>25,505</b>
<b>260</b>	26,00-26,49	32,000	25,700	191,000	60,000	84,000	86843 5.003	<b>26,000</b>
<b>260</b>	26,00-26,49	31,750	25,700	191,000	60,000	84,000	86843 5.003	<b>26,005</b>
<b>265</b>	26,50-26,99	32,000	26,200	193,000	60,000	86,100	86843 5.003	<b>26,500</b>
<b>265</b>	26,50-26,99	31,750	26,200	193,000	60,000	86,100	86843 5.003	<b>26,505</b>
<b>270</b>	27,00-27,49	32,000	26,700	196,000	60,000	87,200	86843 5.003	<b>27,000</b>
<b>270</b>	27,00-27,49	31,750	26,700	196,000	60,000	87,200	86843 5.003	<b>27,005</b>
<b>275</b>	27,50-27,99	32,000	27,200	198,000	60,000	88,900	86843 5.003	<b>27,500</b>
<b>275</b>	27,50-27,99	31,750	27,200	198,000	60,000	88,900	86843 5.003	<b>27,505</b>
<b>280</b>	28,00-28,49	32,000	27,700	200,000	60,000	90,400	86843 5.003	<b>28,000</b>
<b>280</b>	28,00-28,49	31,750	27,700	200,000	60,000	90,400	86843 5.003	<b>28,005</b>
<b>285</b>	28,50-28,99	32,000	28,200	202,000	60,000	92,500	86843 5.003	<b>28,500</b>
<b>285</b>	28,50-28,99	31,750	28,200	202,000	60,000	92,500	86843 5.003	<b>28,505</b>
<b>290</b>	29,00-29,49	32,000	28,700	205,000	60,000	94,600	86843 5.003	<b>29,000</b>
<b>290</b>	29,00-29,49	31,750	28,700	205,000	60,000	94,600	86843 5.003	<b>29,005</b>
<b>295</b>	29,50-29,99	32,000	29,200	207,000	60,000	95,100	86843 5.003	<b>29,500</b>
<b>295</b>	29,50-29,99	31,750	29,200	207,000	60,000	95,100	86843 5.003	<b>29,505</b>
<b>300</b>	30,00-30,49	32,000	29,700	210,000	60,000	96,700	86843 6.000	<b>30,000</b>
<b>300</b>	30,00-30,49	31,750	29,700	210,000	60,000	96,700	86843 6.000	<b>30,005</b>
<b>305</b>	30,50-30,99	32,000	30,200	212,000	60,000	98,300	86843 6.000	<b>30,500</b>
<b>305</b>	30,50-30,99	31,750	30,200	212,000	60,000	98,300	86843 6.000	<b>30,505</b>
<b>310</b>	31,00-31,49	32,000	30,700	214,000	60,000	99,800	86843 6.000	<b>31,000</b>
<b>310</b>	31,00-31,49	31,750	30,700	214,000	60,000	99,800	86843 6.000	<b>31,005</b>
<b>315</b>	31,50-31,99	32,000	31,200	216,000	60,000	101,400	86843 6.000	<b>31,500</b>
<b>315</b>	31,50-31,99	31,750	31,200	216,000	60,000	101,400	86843 6.000	<b>31,505</b>
<b>320</b>	32,00-32,99	32,000	31,700	221,000	60,000	104,600	86843 6.001	<b>32,000</b>
<b>320</b>	32,00-32,99	31,750	31,700	221,000	60,000	104,600	86843 6.001	<b>32,005</b>
<b>330</b>	33,00-33,99	32,000	32,700	226,000	60,000	107,800	86843 6.001	<b>33,000</b>
<b>330</b>	33,00-33,99	31,750	32,700	226,000	60,000	107,800	86843 6.001	<b>33,005</b>
<b>340</b>	34,00-34,99	32,000	33,700	230,000	60,000	111,000	86843 6.001	<b>34,000</b>
<b>340</b>	34,00-34,99	31,750	33,700	230,000	60,000	111,000	86843 6.001	<b>34,005</b>
<b>350</b>	35,00-35,99	32,000	34,700	235,000	60,000	114,200	86843 6.001	<b>35,000</b>
<b>350</b>	35,00-35,99	31,750	34,700	235,000	60,000	114,200	86843 6.001	<b>35,005</b>
<b>360</b>	36,00-36,99	32,000	35,700	240,000	60,000	117,300	86843 6.002	<b>36,000</b>
<b>360</b>	36,00-36,99	31,750	35,700	240,000	60,000	117,300	86843 6.002	<b>36,005</b>
<b>370</b>	37,00-37,99	32,000	36,700	245,000	60,000	120,500	86843 6.002	<b>37,000</b>
<b>370</b>	37,00-37,99	31,750	36,700	245,000	60,000	120,500	86843 6.002	<b>37,005</b>
<b>380</b>	38,00-38,99	32,000	37,700	249,000	60,000	123,700	86843 6.002	<b>38,000</b>
<b>380</b>	38,00-38,99	31,750	37,700	249,000	60,000	123,700	86843 6.002	<b>38,005</b>
<b>390</b>	39,00-40,00	32,000	38,700	254,000	60,000	126,900	86843 6.002	<b>39,000</b>
<b>390</b>	39,00-40,00	31,750	38,700	254,000	60,000	126,900	86843 6.002	<b>39,005</b>

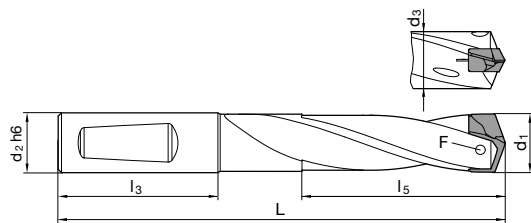


## Multiplex HPC-Halter

Artikel-Nr. 86684



besonders hohe Verschleißfestigkeit • optimierter Nutquerschnitt • besonders hohe Stabilität • Spanschrauben Art.-Nr. 86843 enthalten  
• Schraubendreher Art.-Nr. 86842 enthalten



Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
110	11,00-11,49	12,000	10,700	124,000	45,000	59,600	86843 2.200	11,000
110	11,00-11,49	12,700	10,700	124,000	45,000	59,600	86843 2.200	11,005
115	11,50-11,99	12,000	11,200	127,000	45,000	62,100	86843 2.200	11,500
115	11,50-11,99	12,700	11,200	127,000	45,000	62,100	86843 2.200	11,505
120	12,00-12,49	12,000	11,700	131,000	45,000	64,700	86843 2.201	12,000
120	12,00-12,49	12,700	11,700	131,000	45,000	64,700	86843 2.201	12,005
125	12,50-12,99	14,000	12,200	134,000	45,000	67,300	86843 2.201	12,500
125	12,50-12,99	15,875	12,200	134,000	45,000	67,300	86843 2.201	12,505
130	13,00-13,49	14,000	12,700	137,000	45,000	69,900	86843 2.500	13,000
130	13,00-13,49	15,875	12,700	137,000	45,000	69,900	86843 2.500	13,005
135	13,50-13,99	14,000	13,200	141,000	45,000	72,600	86843 2.500	13,500
135	13,50-13,99	15,875	13,200	141,000	45,000	72,600	86843 2.500	13,505
140	14,00-14,49	14,000	13,700	144,000	45,000	75,200	86843 3.000	14,000
140	14,00-14,49	15,875	13,700	144,000	45,000	75,200	86843 3.000	14,005
145	14,50-14,99	16,000	14,200	150,000	48,000	77,800	86843 3.000	14,500
145	14,50-14,99	15,875	14,200	150,000	48,000	77,800	86843 3.000	14,505
150	15,00-15,49	16,000	14,700	154,000	48,000	80,300	86843 3.001	15,000
150	15,00-15,49	15,875	14,700	154,000	48,000	80,300	86843 3.001	15,005
155	15,50-15,99	16,000	15,200	157,000	48,000	82,900	86843 3.001	15,500
155	15,50-15,99	15,875	15,200	157,000	48,000	82,900	86843 3.001	15,505
160	16,00-16,49	16,000	15,700	160,000	48,000	85,900	86843 3.500	16,000
160	16,00-16,49	15,875	15,700	160,000	48,000	85,900	86843 3.500	16,005
165	16,50-16,99	18,000	16,200	164,000	48,000	88,100	86843 3.500	16,500
165	16,50-16,99	19,050	16,200	164,000	48,000	88,100	86843 3.500	16,505
170	17,00-17,49	18,000	16,700	167,000	48,000	90,800	86843 3.500	17,000
170	17,00-17,49	19,050	16,700	167,000	48,000	90,800	86843 3.500	17,005
175	17,50-17,99	18,000	17,200	170,000	48,000	93,400	86843 3.500	17,500
175	17,50-17,99	19,050	17,200	170,000	48,000	93,400	86843 3.500	17,505
180	18,00-18,49	18,000	17,700	174,000	48,000	95,900	86843 4.000	18,000
180	18,00-18,49	19,050	17,700	174,000	48,000	95,900	86843 4.000	18,005
185	18,50-18,99	20,000	18,200	179,000	50,000	98,500	86843 4.000	18,500
185	18,50-18,99	19,050	18,200	179,000	50,000	98,500	86843 4.000	18,505
190	19,00-19,49	20,000	18,700	182,000	50,000	101,100	86843 4.000	19,000
190	19,00-19,49	19,050	18,700	182,000	50,000	101,100	86843 4.000	19,005
195	19,50-19,99	20,000	19,200	186,000	50,000	103,700	86843 4.000	19,500
195	19,50-19,99	19,050	19,200	186,000	50,000	103,700	86843 4.000	19,505
200	20,00-20,49	20,000	19,700	189,000	50,000	106,300	86843 4.500	20,000
200	20,00-20,49	19,050	19,700	189,000	50,000	106,300	86843 4.500	20,005
205	20,50-20,99	25,000	20,200	201,000	56,000	109,000	86843 4.500	20,500
205	20,50-20,99	25,400	20,200	201,000	56,000	109,000	86843 4.500	20,505
210	21,00-21,49	25,000	20,700	204,000	56,000	111,600	86843 4.500	21,000
210	21,00-21,49	25,400	20,700	204,000	56,000	111,600	86843 4.500	21,005



## Multiplex HPC-Halter

Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
<b>215</b>	21,50-21,99	25,000	21,200	207,000	56,000	114,100	86843 4.500	<b>21,500</b>
<b>215</b>	21,50-21,99	25,400	21,200	207,000	56,000	114,100	86843 4.500	<b>21,505</b>
<b>220</b>	22,00-22,49	25,000	21,700	210,000	56,000	116,700	86843 5.000	<b>22,000</b>
<b>220</b>	22,00-22,49	25,400	21,700	210,000	56,000	116,700	86843 5.000	<b>22,005</b>
<b>225</b>	22,50-22,99	25,000	22,200	214,000	56,000	119,300	86843 5.000	<b>22,500</b>
<b>225</b>	22,50-22,99	25,400	22,200	214,000	56,000	119,300	86843 5.000	<b>22,505</b>
<b>230</b>	23,00-23,49	25,000	22,700	217,000	56,000	121,900	86843 5.000	<b>23,000</b>
<b>230</b>	23,00-23,49	25,400	22,700	217,000	56,000	121,900	86843 5.000	<b>23,005</b>
<b>235</b>	23,50-23,99	25,000	23,200	221,000	56,000	124,500	86843 5.000	<b>23,500</b>
<b>235</b>	23,50-23,99	25,400	23,200	221,000	56,000	124,500	86843 5.000	<b>23,505</b>
<b>240</b>	24,00-24,49	25,000	23,700	224,000	56,000	127,100	86843 5.001	<b>24,000</b>
<b>240</b>	24,00-24,49	25,400	23,700	224,000	56,000	127,100	86843 5.001	<b>24,005</b>
<b>245</b>	24,50-24,99	25,000	24,200	227,000	56,000	129,700	86843 5.001	<b>24,500</b>
<b>245</b>	24,50-24,99	25,400	24,200	227,000	56,000	129,700	86843 5.001	<b>24,505</b>
<b>250</b>	25,00-25,49	25,000	24,700	231,000	56,000	132,300	86843 5.001	<b>25,000</b>
<b>250</b>	25,00-25,49	25,400	24,700	231,000	56,000	132,300	86843 5.001	<b>25,005</b>
<b>255</b>	25,50-25,99	32,000	25,200	239,000	60,000	134,900	86843 5.001	<b>25,500</b>
<b>255</b>	25,50-25,99	31,750	25,200	239,000	60,000	134,900	86843 5.001	<b>25,505</b>
<b>260</b>	26,00-26,49	32,000	25,700	244,000	60,000	137,000	86843 5.003	<b>26,000</b>
<b>265</b>	26,50-26,99	32,000	26,200	247,000	60,000	140,000	86843 5.003	<b>26,500</b>
<b>270</b>	27,00-27,49	32,000	26,700	251,000	60,000	142,200	86843 5.003	<b>27,000</b>
<b>275</b>	27,50-27,99	32,000	27,200	254,000	60,000	144,800	86843 5.003	<b>27,500</b>
<b>280</b>	28,00-28,49	32,000	27,700	257,000	60,000	147,400	86843 5.003	<b>28,000</b>
<b>285</b>	28,50-28,99	32,000	28,200	260,000	60,000	150,400	86843 5.003	<b>28,500</b>
<b>290</b>	29,00-29,49	32,000	28,700	264,000	60,000	153,500	86843 5.003	<b>29,000</b>
<b>295</b>	29,50-29,99	32,000	29,200	267,000	60,000	155,100	86843 5.003	<b>29,500</b>
<b>300</b>	30,00-30,49	32,000	29,700	271,000	60,000	157,600	86843 6.000	<b>30,000</b>
<b>305</b>	30,50-30,99	32,000	30,200	274,000	60,000	160,200	86843 6.000	<b>30,500</b>
<b>310</b>	31,00-31,49	32,000	30,700	277,000	60,000	162,800	86843 6.000	<b>31,000</b>
<b>315</b>	31,50-31,99	32,000	31,200	280,000	60,000	165,400	86843 6.000	<b>31,500</b>
<b>320</b>	32,00-32,99	32,000	31,700	287,000	60,000	170,600	86843 6.001	<b>32,000</b>
<b>330</b>	33,00-33,99	32,000	32,700	294,000	60,000	175,800	86843 6.001	<b>33,000</b>
<b>340</b>	34,00-34,99	32,000	33,700	300,000	60,000	181,000	86843 6.001	<b>34,000</b>
<b>350</b>	35,00-35,99	32,000	34,700	307,000	60,000	186,200	86843 6.001	<b>35,000</b>
<b>360</b>	36,00-36,99	32,000	35,700	314,000	60,000	191,300	86843 6.002	<b>36,000</b>
<b>370</b>	37,00-37,99	32,000	36,700	321,000	60,000	196,500	86843 6.002	<b>37,000</b>
<b>380</b>	38,00-38,99	32,000	37,700	327,000	60,000	201,700	86843 6.002	<b>38,000</b>
<b>390</b>	39,00-40,00	32,000	38,700	334,000	60,000	206,900	86843 6.002	<b>39,000</b>

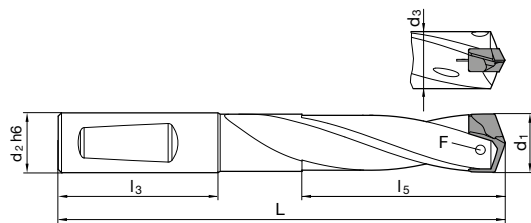


## Multiplex HPC-Halter

Artikel-Nr. 86685



besonders hohe Verschleißfestigkeit • optimierter Nutquerschnitt • besonders hohe Stabilität • Spanschrauben Art.-Nr. 86843 enthalten  
• Schraubendreher Art.-Nr. 86842 enthalten



Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
110	11,00-11,49	12,000	10,700	147,000	45,000	82,600	86843 2.200	11,000
110	11,00-11,49	12,700	10,700	147,000	45,000	82,600	86843 2.200	11,005
115	11,50-11,99	12,000	11,200	151,000	45,000	86,100	86843 2.200	11,500
115	11,50-11,99	12,700	11,200	151,000	45,000	86,100	86843 2.200	11,505
120	12,00-12,49	12,000	11,700	156,000	45,000	89,700	86843 2.201	12,000
120	12,00-12,49	12,700	11,700	156,000	45,000	89,700	86843 2.201	12,005
125	12,50-12,99	14,000	12,200	160,000	45,000	93,300	86843 2.201	12,500
125	12,50-12,99	15,875	12,200	160,000	45,000	93,300	86843 2.201	12,505
130	13,00-13,49	14,000	12,700	164,000	45,000	96,900	86843 2.500	13,000
130	13,00-13,49	15,875	12,700	164,000	45,000	96,900	86843 2.500	13,005
135	13,50-13,99	14,000	13,200	169,000	45,000	100,600	86843 2.500	13,500
135	13,50-13,99	15,875	13,200	169,000	45,000	100,600	86843 2.500	13,505
140	14,00-14,49	14,000	13,700	173,000	45,000	104,200	86843 3.000	14,000
140	14,00-14,49	15,875	13,700	173,000	45,000	104,200	86843 3.000	14,005
145	14,50-14,99	16,000	14,200	180,000	48,000	107,800	86843 3.000	14,500
145	14,50-14,99	15,875	14,200	180,000	48,000	107,800	86843 3.000	14,505
150	15,00-15,49	16,000	14,700	185,000	48,000	111,300	86843 3.001	15,000
150	15,00-15,49	15,875	14,700	185,000	48,000	111,300	86843 3.001	15,005
155	15,50-15,99	16,000	15,200	189,000	48,000	114,900	86843 3.001	15,500
155	15,50-15,99	15,875	15,200	189,000	48,000	114,900	86843 3.001	15,505
160	16,00-16,49	16,000	15,700	193,000	48,000	118,900	86843 3.500	16,000
160	16,00-16,49	15,875	15,700	193,000	48,000	118,900	86843 3.500	16,005
165	16,50-16,99	18,000	16,200	198,000	48,000	122,100	86843 3.500	16,500
165	16,50-16,99	19,050	16,200	198,000	48,000	122,100	86843 3.500	16,505
170	17,00-17,49	18,000	16,700	202,000	48,000	125,800	86843 3.500	17,000
170	17,00-17,49	19,050	16,700	202,000	48,000	125,800	86843 3.500	17,005
175	17,50-17,99	18,000	17,200	206,000	48,000	129,400	86843 3.500	17,500
175	17,50-17,99	19,050	17,200	206,000	48,000	129,400	86843 3.500	17,505
180	18,00-18,49	18,000	17,700	211,000	48,000	132,900	86843 4.000	18,000
180	18,00-18,49	19,050	17,700	211,000	48,000	132,900	86843 4.000	18,005
185	18,50-18,99	20,000	18,200	217,000	50,000	136,500	86843 4.000	18,500
185	18,50-18,99	19,050	18,200	217,000	50,000	136,500	86843 4.000	18,505
190	19,00-19,49	20,000	18,700	221,000	50,000	140,100	86843 4.000	19,000
190	19,00-19,49	19,050	18,700	221,000	50,000	140,100	86843 4.000	19,005
195	19,50-19,99	20,000	19,200	226,000	50,000	143,700	86843 4.000	19,500
195	19,50-19,99	19,050	19,200	226,000	50,000	143,700	86843 4.000	19,505
200	20,00-20,49	20,000	19,700	230,000	50,000	147,300	86843 4.500	20,000
200	20,00-20,49	19,050	19,700	230,000	50,000	147,300	86843 4.500	20,005
205	20,50-20,99	25,000	20,200	243,000	56,000	151,000	86843 4.500	20,500
205	20,50-20,99	25,400	20,200	243,000	56,000	151,000	86843 4.500	20,505
210	21,00-21,49	25,000	20,700	247,000	56,000	154,600	86843 4.500	21,000
210	21,00-21,49	25,400	20,700	247,000	56,000	154,600	86843 4.500	21,005



## Multiplex HPC-Halter

Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
<b>215</b>	21,50-21,99	25,000	21,200	251,000	56,000	158,100	86843 4.500	<b>21,500</b>
<b>215</b>	21,50-21,99	25,400	21,200	251,000	56,000	158,100	86843 4.500	<b>21,505</b>
<b>220</b>	22,00-22,49	25,000	21,700	255,000	56,000	161,700	86843 5.000	<b>22,000</b>
<b>220</b>	22,00-22,49	25,400	21,700	255,000	56,000	161,700	86843 5.000	<b>22,005</b>
<b>225</b>	22,50-22,99	25,000	22,200	260,000	56,000	165,300	86843 5.000	<b>22,500</b>
<b>225</b>	22,50-22,99	25,400	22,200	260,000	56,000	165,300	86843 5.000	<b>22,505</b>
<b>230</b>	23,00-23,49	25,000	22,700	264,000	56,000	168,900	86843 5.000	<b>23,000</b>
<b>230</b>	23,00-23,49	25,400	22,700	264,000	56,000	168,900	86843 5.000	<b>23,005</b>
<b>235</b>	23,50-23,99	25,000	23,200	269,000	56,000	172,500	86843 5.000	<b>23,500</b>
<b>235</b>	23,50-23,99	25,400	23,200	269,000	56,000	172,500	86843 5.000	<b>23,505</b>
<b>240</b>	24,00-24,49	25,000	23,700	273,000	56,000	176,100	86843 5.001	<b>24,000</b>
<b>240</b>	24,00-24,49	25,400	23,700	273,000	56,000	176,100	86843 5.001	<b>24,005</b>
<b>245</b>	24,50-24,99	25,000	24,200	277,000	56,000	179,700	86843 5.001	<b>24,500</b>
<b>245</b>	24,50-24,99	25,400	24,200	277,000	56,000	179,700	86843 5.001	<b>24,505</b>
<b>250</b>	25,00-25,49	25,000	24,700	282,000	56,000	183,300	86843 5.001	<b>25,000</b>
<b>250</b>	25,00-25,49	25,400	24,700	282,000	56,000	183,300	86843 5.001	<b>25,005</b>
<b>255</b>	25,50-25,99	32,000	25,200	291,000	60,000	186,900	86843 5.001	<b>25,500</b>
<b>255</b>	25,50-25,99	31,750	25,200	291,000	60,000	186,900	86843 5.001	<b>25,505</b>
<b>260</b>	26,00-26,49	32,000	25,700	297,000	60,000	190,000	86843 5.003	<b>26,000</b>
<b>260</b>	26,00-26,49	31,750	25,700	297,000	60,000	190,000	86843 5.003	<b>26,005</b>
<b>265</b>	26,50-26,99	32,000	26,200	301,000	60,000	194,000	86843 5.003	<b>26,500</b>
<b>265</b>	26,50-26,99	31,750	26,200	301,000	60,000	194,000	86843 5.003	<b>26,505</b>
<b>270</b>	27,00-27,49	32,000	26,700	306,000	60,000	197,200	86843 5.003	<b>27,000</b>
<b>270</b>	27,00-27,49	31,750	26,700	306,000	60,000	197,200	86843 5.003	<b>27,005</b>
<b>275</b>	27,50-27,99	32,000	27,200	310,000	60,000	200,800	86843 5.003	<b>27,500</b>
<b>275</b>	27,50-27,99	31,750	27,200	310,000	60,000	200,800	86843 5.003	<b>27,505</b>
<b>280</b>	28,00-28,49	32,000	27,700	314,000	60,000	204,400	86843 5.003	<b>28,000</b>
<b>280</b>	28,00-28,49	31,750	27,700	314,000	60,000	204,400	86843 5.003	<b>28,005</b>
<b>285</b>	28,50-28,99	32,000	28,200	318,000	60,000	208,400	86843 5.003	<b>28,500</b>
<b>285</b>	28,50-28,99	31,750	28,200	318,000	60,000	208,400	86843 5.003	<b>28,505</b>
<b>290</b>	29,00-29,49	32,000	28,700	323,000	60,000	212,500	86843 5.003	<b>29,000</b>
<b>290</b>	29,00-29,49	31,750	28,700	323,000	60,000	212,500	86843 5.003	<b>29,005</b>
<b>295</b>	29,50-29,99	32,000	29,200	327,000	60,000	215,100	86843 5.003	<b>29,500</b>
<b>295</b>	29,50-29,99	31,750	29,200	327,000	60,000	215,100	86843 5.003	<b>29,505</b>
<b>300</b>	30,00-30,49	32,000	29,700	332,000	60,000	218,600	86843 6.000	<b>30,000</b>
<b>300</b>	30,00-30,49	31,750	29,700	332,000	60,000	218,600	86843 6.000	<b>30,005</b>
<b>305</b>	30,50-30,99	32,000	30,200	336,000	60,000	222,200	86843 6.000	<b>30,500</b>
<b>305</b>	30,50-30,99	31,750	30,200	336,000	60,000	222,200	86843 6.000	<b>30,505</b>
<b>310</b>	31,00-31,49	32,000	30,700	340,000	60,000	225,800	86843 6.000	<b>31,000</b>
<b>310</b>	31,00-31,49	31,750	30,700	340,000	60,000	225,800	86843 6.000	<b>31,005</b>
<b>315</b>	31,50-31,99	32,000	31,200	344,000	60,000	229,400	86843 6.000	<b>31,500</b>
<b>315</b>	31,50-31,99	31,750	31,200	344,000	60,000	229,400	86843 6.000	<b>31,505</b>



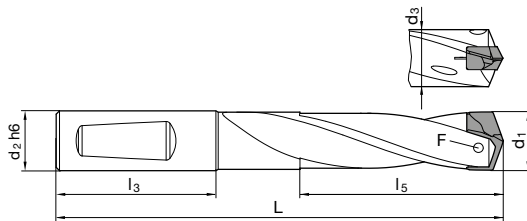


## Multiplex HPC-Halter

Artikel-Nr. 86686



besonders hohe Verschleißfestigkeit • optimierter Nutquerschnitt • besonders hohe Stabilität • Spanschrauben Art.-Nr. 86843 enthalten  
• Schraubendreher Art.-Nr. 86842 enthalten



Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
110	11,00-11,49	12,000	10,700	182,000	45,000	117,100	86843 2.200	11,000
110	11,00-11,49	12,700	10,700	182,000	45,000	117,100	86843 2.200	11,005
115	11,50-11,99	12,000	11,200	187,000	45,000	122,100	86843 2.200	11,500
115	11,50-11,99	12,700	11,200	187,000	45,000	122,100	86843 2.200	11,505
120	12,00-12,49	12,000	11,700	194,000	45,000	127,200	86843 2.201	12,000
120	12,00-12,49	12,700	11,700	194,000	45,000	127,200	86843 2.201	12,005
125	12,50-12,99	14,000	12,200	199,000	45,000	132,300	86843 2.201	12,500
125	12,50-12,99	15,875	12,200	199,000	45,000	132,300	86843 2.201	12,505
130	13,00-13,49	14,000	12,700	205,000	45,000	137,500	86843 2.500	13,000
130	13,00-13,49	15,875	12,700	205,000	45,000	137,500	86843 2.500	13,005
135	13,50-13,99	14,000	13,200	211,000	45,000	142,500	86843 2.500	13,500
135	13,50-13,99	15,875	13,200	211,000	45,000	142,500	86843 2.500	13,505
140	14,00-14,49	14,000	13,700	217,000	45,000	147,700	86843 3.000	14,000
140	14,00-14,49	15,875	13,700	217,000	45,000	147,700	86843 3.000	14,005
145	14,50-14,99	16,000	14,200	225,000	48,000	152,800	86843 3.000	14,500
145	14,50-14,99	15,875	14,200	225,000	48,000	152,800	86843 3.000	14,505
150	15,00-15,49	16,000	14,700	232,000	48,000	157,800	86843 3.001	15,000
150	15,00-15,49	15,875	14,700	232,000	48,000	157,800	86843 3.001	15,005
155	15,50-15,99	16,000	15,200	237,000	48,000	162,900	86843 3.001	15,500
155	15,50-15,99	15,875	15,200	237,000	48,000	162,900	86843 3.001	15,505
160	16,00-16,49	16,000	15,700	243,000	48,000	168,000	86843 3.500	16,000
160	16,00-16,49	15,875	15,700	243,000	48,000	168,000	86843 3.500	16,005
165	16,50-16,99	18,000	16,200	249,000	48,000	170,000	86843 3.500	16,500
165	16,50-16,99	19,050	16,200	249,000	48,000	170,000	86843 3.500	16,505
170	17,00-17,49	18,000	16,700	255,000	48,000	178,300	86843 3.500	17,000
170	17,00-17,49	19,050	16,700	255,000	48,000	178,300	86843 3.500	17,005
175	17,50-17,99	18,000	17,200	260,000	48,000	183,500	86843 3.500	17,500
175	17,50-17,99	19,050	17,200	260,000	48,000	183,500	86843 3.500	17,505
180	18,00-18,49	18,000	17,700	267,000	48,000	188,400	86843 4.000	18,000
180	18,00-18,49	19,050	17,700	267,000	48,000	188,400	86843 4.000	18,005
185	18,50-18,99	20,000	18,200	274,000	50,000	193,500	86843 4.000	18,500
185	18,50-18,99	19,050	18,200	274,000	50,000	193,500	86843 4.000	18,505
190	19,00-19,49	20,000	18,700	280,000	50,000	198,700	86843 4.000	19,000
190	19,00-19,49	19,050	18,700	280,000	50,000	198,700	86843 4.000	19,005
195	19,50-19,99	20,000	19,200	286,000	50,000	203,700	86843 4.000	19,500
195	19,50-19,99	19,050	19,200	286,000	50,000	203,700	86843 4.000	19,505
200	20,00-20,49	20,000	19,700	292,000	50,000	208,900	86843 4.500	20,000
200	20,00-20,49	19,050	19,700	292,000	50,000	208,900	86843 4.500	20,005
205	20,50-20,99	25,000	20,200	306,000	56,000	214,000	86843 4.500	20,500
205	20,50-20,99	25,400	20,200	306,000	56,000	214,000	86843 4.500	20,505
210	21,00-21,49	25,000	20,700	312,000	56,000	219,100	86843 4.500	21,000
210	21,00-21,49	25,400	20,700	312,000	56,000	219,100	86843 4.500	21,005



## Multiplex HPC-Halter

Größe mm	d1	d2 h6 mm	d3 mm	L mm	l3 mm	l5 mm	F	Code-Nr.
<b>215</b>	21,50-21,99	25,000	21,200	317,000	56,000	224,200	86843 4.500	<b>21,500</b>
<b>215</b>	21,50-21,99	25,400	21,200	317,000	56,000	224,200	86843 4.500	<b>21,505</b>
<b>220</b>	22,00-22,49	25,000	21,700	323,000	56,000	229,300	86843 5.000	<b>22,000</b>
<b>220</b>	22,00-22,49	25,400	21,700	323,000	56,000	229,300	86843 5.000	<b>22,005</b>
<b>225</b>	22,50-22,99	25,000	22,200	329,000	56,000	234,400	86843 5.000	<b>22,500</b>
<b>225</b>	22,50-22,99	25,400	22,200	329,000	56,000	234,400	86843 5.000	<b>22,505</b>
<b>230</b>	23,00-23,49	25,000	22,700	335,000	56,000	239,500	86843 5.000	<b>23,000</b>
<b>230</b>	23,00-23,49	25,400	22,700	335,000	56,000	239,500	86843 5.000	<b>23,005</b>
<b>235</b>	23,50-23,99	25,000	23,200	341,000	56,000	244,600	86843 5.000	<b>23,500</b>
<b>235</b>	23,50-23,99	25,400	23,200	341,000	56,000	244,600	86843 5.000	<b>23,505</b>
<b>240</b>	24,00-24,49	25,000	23,700	347,000	56,000	249,700	86843 5.001	<b>24,000</b>
<b>240</b>	24,00-24,49	25,400	23,700	347,000	56,000	249,700	86843 5.001	<b>24,005</b>
<b>245</b>	24,50-24,99	25,000	24,200	352,000	56,000	254,800	86843 5.001	<b>24,500</b>
<b>245</b>	24,50-24,99	25,400	24,200	352,000	56,000	254,800	86843 5.001	<b>24,505</b>
<b>250</b>	25,00-25,49	25,000	24,700	359,000	56,000	259,900	86843 5.001	<b>25,000</b>
<b>250</b>	25,00-25,49	25,400	24,700	359,000	56,000	259,900	86843 5.001	<b>25,005</b>
<b>255</b>	25,50-25,99	32,000	25,200	369,000	60,000	265,000	86843 5.001	<b>25,500</b>
<b>255</b>	25,50-25,99	31,750	25,200	369,000	60,000	265,000	86843 5.001	<b>25,505</b>
<b>260</b>	26,00-26,49	32,000	25,700	377,000	60,000	270,000	86843 5.003	<b>26,000</b>
<b>260</b>	26,00-26,49	31,750	25,700	377,000	60,000	270,000	86843 5.003	<b>26,005</b>
<b>265</b>	26,50-26,99	32,000	26,200	382,000	60,000	275,000	86843 5.003	<b>26,500</b>
<b>265</b>	26,50-26,99	31,750	26,200	382,000	60,000	275,000	86843 5.003	<b>26,505</b>
<b>270</b>	27,00-27,49	32,000	26,700	388,000	60,000	280,100	86843 5.003	<b>27,000</b>
<b>270</b>	27,00-27,49	31,750	26,700	388,000	60,000	280,100	86843 5.003	<b>27,005</b>
<b>275</b>	27,50-27,99	32,000	27,200	394,000	60,000	285,200	86843 5.003	<b>27,500</b>
<b>275</b>	27,50-27,99	31,750	27,200	394,000	60,000	285,200	86843 5.003	<b>27,505</b>
<b>280</b>	28,00-28,49	32,000	27,700	400,000	60,000	290,300	86843 5.003	<b>28,000</b>
<b>280</b>	28,00-28,49	31,750	27,700	400,000	60,000	290,300	86843 5.003	<b>28,005</b>
<b>285</b>	28,50-28,99	32,000	28,200	405,000	60,000	295,400	86843 5.003	<b>28,500</b>
<b>285</b>	28,50-28,99	31,750	28,200	405,000	60,000	295,400	86843 5.003	<b>28,505</b>
<b>290</b>	29,00-29,49	32,000	28,700	412,000	60,000	300,500	86843 5.003	<b>29,000</b>
<b>290</b>	29,00-29,49	31,750	28,700	412,000	60,000	300,500	86843 5.003	<b>29,005</b>
<b>295</b>	29,50-29,99	32,000	29,200	418,000	60,000	305,600	86843 5.003	<b>29,500</b>
<b>295</b>	29,50-29,99	31,750	29,200	418,000	60,000	305,600	86843 5.003	<b>29,505</b>
<b>300</b>	30,00-30,49	32,000	29,700	424,000	60,000	310,600	86843 6.000	<b>30,000</b>
<b>300</b>	30,00-30,49	31,750	29,700	424,000	60,000	310,600	86843 6.000	<b>30,005</b>
<b>305</b>	30,50-30,99	32,000	30,200	429,000	60,000	315,700	86843 6.000	<b>30,500</b>
<b>305</b>	30,50-30,99	31,750	30,200	429,000	60,000	315,700	86843 6.000	<b>30,505</b>
<b>310</b>	31,00-31,49	32,000	30,700	435,000	60,000	320,800	86843 6.000	<b>31,000</b>
<b>310</b>	31,00-31,49	31,750	30,700	435,000	60,000	320,800	86843 6.000	<b>31,005</b>
<b>315</b>	31,50-31,99	32,000	31,200	441,000	60,000	325,900	86843 6.000	<b>31,500</b>
<b>315</b>	31,50-31,99	31,750	31,200	441,000	60,000	325,900	86843 6.000	<b>31,505</b>



## Multiplex HPC-Wechselplatten

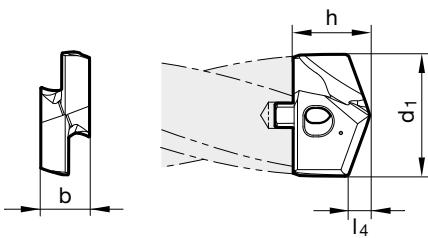
Artikel-Nr. 86721



<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
○	○	○	○	○	○



Ausspitzung  $\geq \varnothing 11,000$  • Flächenanschliff • Hauptschneidenform gerade (durch Korrektur) • Spanschrauben Art.-Nr. 86843 enthalten  
 Pilotieren in allen Werkstoffen



Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
110	11,000		1,800	4,500	7,200	11,000
110	11,200		1,800	4,500	7,200	11,200
110	11,500		1,900	4,500	7,200	11,500
110	11,510	29/64	1,900	4,500	7,200	11,510
110	11,700		1,900	4,500	7,200	11,700
110	11,800		1,900	4,500	7,200	11,800
110	11,910	15/32	1,900	4,500	7,200	11,910
120	12,000		1,900	5,000	7,400	12,000
120	12,100		2,000	5,000	7,400	12,100
120	12,200		2,000	5,000	7,400	12,200
120	12,300	31/64	2,000	5,000	7,400	12,300
120	12,500		2,000	5,000	7,400	12,500
120	12,600		2,000	5,000	7,400	12,600
120	12,700	1/2	2,100	5,000	7,400	12,700
120	12,800		2,100	5,000	7,400	12,800
120	12,900		2,100	5,000	7,400	12,900
130	13,000		2,100	5,500	8,200	13,000
130	13,100	33/64	2,100	5,500	8,200	13,100
130	13,490	17/32	2,200	5,500	8,200	13,490
130	13,500		2,200	5,500	8,200	13,500
130	13,600		2,200	5,500	8,200	13,600
130	13,700		2,200	5,500	8,200	13,700
130	13,800		2,200	5,500	8,200	13,800
130	13,890	35/64	2,200	5,500	8,200	13,890
140	14,000		2,300	6,000	9,400	14,000
140	14,100		2,300	6,000	9,400	14,100
140	14,290	9/16	2,300	6,000	9,400	14,290
140	14,400		2,300	6,000	9,400	14,400
140	14,500		2,300	6,000	9,400	14,500
140	14,600		2,400	6,000	9,400	14,600
140	14,680	37/64	2,400	6,000	9,400	14,680
140	14,700		2,400	6,000	9,400	14,700
140	14,800		2,400	6,000	9,400	14,800
140	15,000		2,400	6,000	9,400	15,000
140	15,080	19/32	2,400	6,000	9,400	15,080
140	15,100		2,400	6,000	9,400	15,100
140	15,200		2,400	6,000	9,400	15,200
140	15,300		2,500	6,000	9,400	15,300
140	15,480	39/64	2,500	6,000	9,400	15,480
140	15,500		2,500	6,000	9,400	15,500
140	15,600		2,500	6,000	9,400	15,600
140	15,700		2,500	6,000	9,400	15,700



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
140	15,800		2,500	6,000	9,400	15,800
140	15,870	5/8	2,600	6,000	9,400	15,870
160	16,000		2,600	7,000	10,600	16,000
160	16,270	41/64	2,600	7,000	10,600	16,270
160	16,500		2,700	7,000	10,600	16,500
160	16,670	21/32	2,700	7,000	10,600	16,670
160	17,000		2,700	7,000	10,600	17,000
160	17,070	43/64	2,700	7,000	10,600	17,070
160	17,460	11/16	2,800	7,000	10,600	17,460
160	17,500		2,800	7,000	10,600	17,500
160	17,600		2,800	7,000	10,600	17,600
160	17,860	45/64	2,900	7,000	10,600	17,860
180	18,000		2,900	8,000	12,100	18,000
180	18,260	23/32	2,900	8,000	12,100	18,260
180	18,500		3,000	8,000	12,100	18,500
180	18,650	47/64	3,000	8,000	12,100	18,650
180	19,000		3,000	8,000	12,100	19,000
180	19,050	3/4	3,100	8,000	12,100	19,050
180	19,450	49/64	3,100	8,000	12,100	19,450
180	19,500		3,100	8,000	12,100	19,500
180	19,600		3,100	8,000	12,100	19,600
180	19,840	25/32	3,200	8,000	12,100	19,840
200	20,000		3,200	9,000	13,300	20,000
200	20,240	51/64	3,200	9,000	13,300	20,240
200	20,500		3,300	9,000	13,300	20,500
200	20,640	13/16	3,300	9,000	13,300	20,640
200	21,000		3,400	9,000	13,300	21,000
200	21,030	53/64	3,400	9,000	13,300	21,030
200	21,100		3,400	9,000	13,300	21,100
200	21,430	27/32	3,400	9,000	13,300	21,430
200	21,500		3,400	9,000	13,300	21,500
200	21,830	55/64	3,500	9,000	13,300	21,830
220	22,000		3,500	10,000	14,800	22,000
220	22,220	7/8	3,600	10,000	14,800	22,220
220	22,500		3,600	10,000	14,800	22,500
220	22,620	57/64	3,600	10,000	14,800	22,620
220	23,000		3,700	10,000	14,800	23,000
220	23,020	29/32	3,700	10,000	14,800	23,020
220	23,420	59/64	3,700	10,000	14,800	23,420
220	23,500		3,800	10,000	14,800	23,500
220	23,810	15/16	3,800	10,000	14,800	23,810
240	24,000		3,800	11,000	15,300	24,000
240	24,100		3,800	11,000	15,300	24,100
240	24,210	61/64	3,900	11,000	15,300	24,210
240	24,500		3,900	11,000	15,300	24,500
240	24,610	31/32	3,900	11,000	15,300	24,610
240	25,000	63/64	4,000	11,000	15,300	25,000
240	25,400	1	4,100	11,000	15,300	25,400
240	25,500		4,100	11,000	15,300	25,500
240	25,700		4,100	11,000	15,300	25,700
260	26,000		4,100	12,000	19,400	26,000
260	26,190	1 1/32	4,200	12,000	19,400	26,190
260	26,500		4,200	12,000	19,400	26,500
260	26,590	1 3/64	4,200	12,000	19,400	26,590
260	27,000		4,300	12,000	19,400	27,000
260	27,500		4,400	12,000	19,400	27,500
260	27,700		4,400	12,000	19,400	27,700
260	27,780	1 3/32	4,400	12,000	19,400	27,780
280	28,000		4,500	13,000	20,100	28,000
280	28,180	1 7/64	4,500	13,000	20,100	28,180
280	28,500		4,500	13,000	20,100	28,500
280	28,580		4,600	13,000	20,100	28,580
280	29,000		4,600	13,000	20,100	29,000
280	29,370	1 5/32	4,700	13,000	20,100	29,370
280	29,500		4,700	13,000	20,100	29,500
300	30,000		4,800	14,000	21,700	30,000
300	30,160	1 3/16	4,800	14,000	21,700	30,160
300	30,500		4,900	14,000	21,700	30,500
300	30,960	1 7/32	4,900	14,000	21,700	30,960
300	31,000		4,900	14,000	21,700	31,000
300	31,500		5,000	14,000	21,700	31,500
300	31,750	1 1/4	5,100	14,000	21,700	31,750



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
<b>320</b>	32,000		5,100	15,000	22,400	<b>32,000</b>
<b>320</b>	32,500		5,200	15,000	22,400	<b>32,500</b>
<b>320</b>	32,540	1 9/32	5,200	15,000	22,400	<b>32,540</b>
<b>320</b>	33,000		5,300	15,000	22,400	<b>33,000</b>
<b>320</b>	33,340	1 5/16	5,300	15,000	22,400	<b>33,340</b>
<b>320</b>	33,500		5,300	15,000	22,400	<b>33,500</b>
<b>320</b>	34,000		5,400	15,000	22,400	<b>34,000</b>
<b>320</b>	34,130	1 11/32	5,400	15,000	22,400	<b>34,130</b>
<b>320</b>	34,500		5,500	15,000	22,400	<b>34,500</b>
<b>320</b>	34,930		5,600	15,000	22,400	<b>34,930</b>
<b>320</b>	35,000		5,600	15,000	22,400	<b>35,000</b>
<b>320</b>	35,500		5,600	15,000	22,400	<b>35,500</b>
<b>320</b>	35,720	1 13/32	5,700	15,000	22,400	<b>35,720</b>
<b>360</b>	36,000		5,700	16,000	23,200	<b>36,000</b>
<b>360</b>	36,500		5,800	16,000	23,200	<b>36,500</b>
<b>360</b>	36,510	1 7/16	5,800	16,000	23,200	<b>36,510</b>
<b>360</b>	37,000		5,900	16,000	23,200	<b>37,000</b>
<b>360</b>	37,310	1 15/32	5,900	16,000	23,200	<b>37,310</b>
<b>360</b>	37,500		6,000	16,000	23,200	<b>37,500</b>
<b>360</b>	38,000		6,000	16,000	23,200	<b>38,000</b>
<b>360</b>	38,100	1 1/2	6,100	16,000	23,200	<b>38,100</b>
<b>360</b>	38,500	1 33/64	6,100	16,000	23,200	<b>38,500</b>
<b>360</b>	39,000		6,200	16,000	23,200	<b>39,000</b>
<b>360</b>	39,500		6,300	16,000	23,200	<b>39,500</b>
<b>360</b>	40,000		6,400	16,000	23,200	<b>40,000</b>



## Multiplex HPC-Wechselplatten

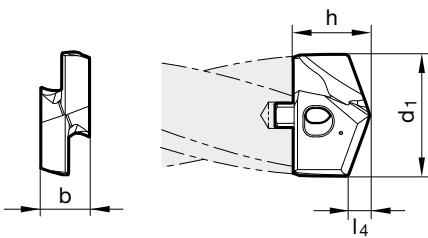
Artikel-Nr. 86722



P	M	K	N	S	H
●	○	○			



Ausspitzung  $\geq \text{Ø } 11,000$  • Flächenanschliff • Hauptschneidenform gerade (durch Korrektur) • Spanschrauben Art.-Nr. 86843 enthalten  
 Bau- und Einsatzstähle • Automatenstähle, Vergütungsstähle • legierte Stähle bis 1200 N/mm<sup>2</sup>



Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
110	11,000		2,100	4,500	7,500	11,000
110	11,200		2,100	4,500	7,500	11,200
115	11,500		2,100	4,500	7,500	11,500
115	11,510	29/64	2,100	4,500	7,500	11,510
115	11,700		2,200	4,500	7,500	11,700
115	11,800		2,200	4,500	7,500	11,800
115	11,910	15/32	2,200	4,500	7,500	11,910
120	12,000		2,200	5,000	7,700	12,000
120	12,100		2,300	5,000	7,700	12,100
120	12,200		2,300	5,000	7,700	12,200
120	12,300	31/64	2,300	5,000	7,700	12,300
125	12,500		2,300	5,000	7,700	12,500
125	12,600		2,300	5,000	7,700	12,600
125	12,700	1/2	2,400	5,000	7,700	12,700
125	12,800		2,400	5,000	7,700	12,800
125	12,900		2,400	5,000	7,700	12,900
130	13,000		2,400	5,500	8,500	13,000
130	13,100	33/64	2,400	5,500	8,500	13,100
130	13,490	17/32	2,500	5,500	8,500	13,490
135	13,500		2,500	5,500	8,500	13,500
135	13,600		2,500	5,500	8,500	13,600
135	13,700		2,500	5,500	8,500	13,700
135	13,800		2,600	5,500	8,500	13,800
135	13,890	35/64	2,600	5,500	8,500	13,890
140	14,000		2,600	6,000	9,600	14,000
140	14,100		2,600	6,000	9,600	14,100
140	14,290	9/16	2,700	6,000	9,600	14,290
140	14,400		2,700	6,000	9,600	14,400
145	14,500		2,700	6,000	9,600	14,500
145	14,600		2,700	6,000	9,600	14,600
145	14,680	37/64	2,700	6,000	9,600	14,680
145	14,700		2,700	6,000	9,600	14,700
145	14,800		2,700	6,000	9,600	14,800
150	15,000		2,800	6,000	9,800	15,000
150	15,080	19/32	2,800	6,000	9,800	15,080
150	15,100		2,800	6,000	9,800	15,100
150	15,200		2,800	6,000	9,800	15,200
150	15,300		2,800	6,000	9,800	15,300
150	15,480	39/64	2,900	6,000	9,800	15,480
155	15,500		2,900	6,000	9,800	15,500
155	15,600		2,900	6,000	9,800	15,600
155	15,700		2,900	6,000	9,800	15,700



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
155	15,800		2,900	6,000	9,800	15,800
155	15,870	5/8	2,900	6,000	9,800	15,870
160	16,000		3,000	7,000	11,000	16,000
160	16,270	41/64	3,000	7,000	11,000	16,270
165	16,500		3,100	7,000	11,000	16,500
165	16,670	21/32	3,100	7,000	11,000	16,670
170	17,000		3,100	7,000	11,000	17,000
170	17,070	43/64	3,200	7,000	11,000	17,070
170	17,460	11/16	3,200	7,000	11,000	17,460
175	17,500		3,200	7,000	11,000	17,500
175	17,600		3,300	7,000	11,000	17,600
175	17,860	45/64	3,300	7,000	11,000	17,860
180	18,000		3,300	8,000	12,600	18,000
180	18,260	23/32	3,400	8,000	12,600	18,260
185	18,500		3,400	8,000	12,600	18,500
185	18,650	47/64	3,400	8,000	12,600	18,650
185	18,900		3,500	8,000	12,600	18,900
190	19,000		3,500	8,000	12,600	19,000
190	19,050	3/4	3,500	8,000	12,600	19,050
190	19,250		3,600	8,000	12,600	19,250
190	19,450	49/64	3,600	8,000	12,600	19,450
195	19,500		3,600	8,000	12,600	19,500
195	19,600		3,600	8,000	12,600	19,600
195	19,840	25/32	3,700	8,000	12,600	19,840
200	20,000		3,700	9,000	13,900	20,000
200	20,240	51/64	3,700	9,000	13,900	20,240
205	20,500		3,800	9,000	13,900	20,500
205	20,640	13/16	3,800	9,000	13,900	20,640
210	21,000		3,900	9,000	13,900	21,000
210	21,030	53/64	3,900	9,000	13,900	21,030
210	21,100		3,900	9,000	13,900	21,100
210	21,430	27/32	3,900	9,000	13,900	21,430
215	21,500		4,000	9,000	13,900	21,500
215	21,830	55/64	4,000	9,000	13,900	21,830
220	22,000		4,100	10,000	15,300	22,000
220	22,220	7/8	4,100	10,000	15,300	22,220
225	22,500		4,100	10,000	15,300	22,500
225	22,620	57/64	4,200	10,000	15,300	22,620
230	23,000		4,200	10,000	15,300	23,000
230	23,020	29/32	4,200	10,000	15,300	23,020
230	23,420	59/64	4,300	10,000	15,300	23,420
235	23,500		4,300	10,000	15,300	23,500
235	23,810	15/16	4,400	10,000	15,300	23,810
240	24,000		4,400	11,000	15,800	24,000
240	24,100		4,400	11,000	15,800	24,100
240	24,210	61/64	4,500	11,000	15,800	24,210
245	24,500		4,500	11,000	15,800	24,500
245	24,610	31/32	4,500	11,000	15,800	24,610
250	25,000	63/64	4,600	11,000	15,800	25,000
250	25,400	1	4,700	11,000	15,800	25,400
255	25,500		4,700	11,000	15,800	25,500
255	25,670		4,700	11,000	15,800	25,670
255	25,700		4,700	11,000	15,800	25,700
255	25,810		4,700	11,000	15,800	25,810
260	26,000		4,800	12,000	20,000	26,000
260	26,190	1 1/32	4,800	12,000	20,000	26,190
265	26,500		4,900	12,000	20,000	26,500
265	26,590	1 3/64	4,900	12,000	20,000	26,590
270	27,000		5,000	12,000	20,000	27,000
275	27,500		5,100	12,000	20,000	27,500
275	27,700		5,100	12,000	20,000	27,700
275	27,780	1 3/32	5,100	12,000	20,000	27,780
280	28,000		5,100	13,000	20,700	28,000
280	28,180	1 7/64	5,200	13,000	20,700	28,180
285	28,500		5,200	13,000	20,700	28,500
285	28,580		5,300	13,000	20,700	28,580
290	29,000		5,300	13,000	20,700	29,000
290	29,370	1 5/32	5,400	13,000	20,700	29,370
295	29,500		5,400	13,000	20,700	29,500
295	29,770	1 11/64	5,500	13,000	20,700	29,770
300	30,000		5,500	14,000	22,300	30,000
300	30,160	1 3/16	5,500	14,000	22,300	30,160



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
305	30,500		5,600	14,000	22,300	30,500
305	30,960	1 7/32	5,700	14,000	22,300	30,960
310	31,000		5,700	14,000	22,300	31,000
315	31,500		5,800	14,000	22,300	31,500
315	31,750	1 1/4	5,800	14,000	22,300	31,750
320	32,000		5,900	15,000	23,100	32,000
320	32,500		6,000	15,000	23,100	32,500
320	32,540	1 9/32	6,000	15,000	23,100	32,540
320	32,940	1 19/64	6,000	15,000	23,100	32,940
330	33,000		6,100	15,000	23,100	33,000
330	33,340	1 5/16	6,100	15,000	23,100	33,340
330	33,500		6,100	15,000	23,100	33,500
340	34,000		6,200	15,000	23,100	34,000
340	34,130	1 11/32	6,300	15,000	23,100	34,130
340	34,500		6,300	15,000	23,100	34,500
340	34,930		6,400	15,000	23,100	34,930
350	35,000		6,400	15,000	23,100	35,000
350	35,500		6,500	15,000	23,100	35,500
350	35,720	1 13/32	6,600	15,000	23,100	35,720
360	36,000		6,600	16,000	23,900	36,000
360	36,500		6,700	16,000	23,900	36,500
360	36,510	1 7/16	6,700	16,000	23,900	36,510
370	37,000		6,800	16,000	23,900	37,000
370	37,310	1 15/32	6,800	16,000	23,900	37,310
370	37,500		6,900	16,000	23,900	37,500
380	38,000		7,000	16,000	23,900	38,000
380	38,100	1 1/2	7,000	16,000	23,900	38,100
380	38,500	1 33/64	7,100	16,000	23,900	38,500
390	39,000		7,100	16,000	23,900	39,000
390	39,500		7,200	16,000	23,900	39,500
400	40,000		7,300	16,000	23,900	40,000





## Multiplex HPC-Wechselplatten

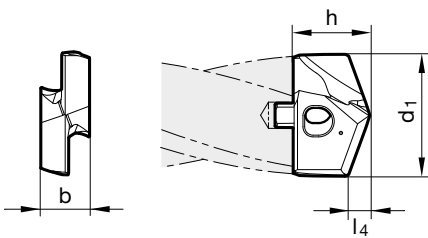
Artikel-Nr. 86723



P	M	K	N	S	H
○		●			



Ausspitzung  $\geq \varnothing 11,000$  • Flächenanschliff • Hauptschneidenform gerade (durch Korrektur) • Spanschrauben Art.-Nr. 86843 enthalten  
 Vermikularguss GGK • Grauguss, Temperguss, Sphäroguss



Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
110	11,000		2,600	4,500	7,500	11,000
110	11,200		2,600	4,500	7,500	11,200
115	11,500		2,700	4,500	7,500	11,500
115	11,510	29/64	2,700	4,500	7,500	11,510
115	11,700		2,700	4,500	7,500	11,700
115	11,800		2,700	4,500	7,500	11,800
115	11,910	15/32	2,700	4,500	7,500	11,910
120	12,000		2,900	5,000	7,700	12,000
120	12,100		2,900	5,000	7,700	12,100
120	12,200		2,900	5,000	7,700	12,200
120	12,300	31/64	2,900	5,000	7,700	12,300
125	12,500		3,000	5,000	7,700	12,500
125	12,600		3,000	5,000	7,700	12,600
125	12,700	1/2	3,000	5,000	7,700	12,700
125	12,800		3,000	5,000	7,700	12,800
125	12,900		3,000	5,000	7,700	12,900
130	13,000		3,100	5,500	8,500	13,000
130	13,100	33/64	3,100	5,500	8,500	13,100
130	13,490	17/32	3,100	5,500	8,500	13,490
135	13,500		3,300	5,500	8,500	13,500
135	13,600		3,300	5,500	8,500	13,600
135	13,700		3,300	5,500	8,500	13,700
135	13,800		3,300	5,500	8,500	13,800
135	13,890	35/64	3,300	5,500	8,500	13,890
140	14,000		3,400	6,000	9,600	14,000
140	14,100		3,400	6,000	9,600	14,100
140	14,290	9/16	3,400	6,000	9,600	14,290
140	14,400		3,400	6,000	9,600	14,400
145	14,500		3,500	6,000	9,600	14,500
145	14,600		3,500	6,000	9,600	14,600
145	14,680	37/64	3,500	6,000	9,600	14,680
145	14,700		3,500	6,000	9,600	14,700
145	14,800		3,500	6,000	9,600	14,800
150	15,000		3,600	6,000	9,800	15,000
150	15,080	19/32	3,600	6,000	9,800	15,080
150	15,100		3,600	6,000	9,800	15,100
150	15,200		3,600	6,000	9,800	15,200
150	15,300		3,600	6,000	9,800	15,300
150	15,480	39/64	3,600	6,000	9,800	15,480
155	15,500		3,800	6,000	9,800	15,500
155	15,600		3,800	6,000	9,800	15,600
155	15,700		3,800	6,000	9,800	15,700



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
155	15,800		3,800	6,000	9,800	15,800
155	15,870	5/8	3,800	6,000	9,800	15,870
160	16,000		3,800	7,000	11,000	16,000
160	16,270	41/64	3,800	7,000	11,000	16,270
165	16,500		4,000	7,000	11,000	16,500
165	16,670	21/32	4,000	7,000	11,000	16,670
170	17,000		4,100	7,000	11,000	17,000
170	17,070	43/64	4,100	7,000	11,000	17,070
170	17,460	11/16	4,100	7,000	11,000	17,460
175	17,500		4,200	7,000	11,000	17,500
175	17,600		4,200	7,000	11,000	17,600
175	17,860	45/64	4,200	7,000	11,000	17,860
180	18,000		4,300	8,000	12,600	18,000
180	18,260	23/32	4,300	8,000	12,600	18,260
185	18,500		4,400	8,000	12,600	18,500
185	18,650	47/64	4,400	8,000	12,600	18,650
190	19,000		4,600	8,000	12,600	19,000
190	19,050	3/4	4,600	8,000	12,600	19,050
190	19,250		4,600	8,000	12,600	19,250
190	19,450	49/64	4,600	8,000	12,600	19,450
195	19,500		4,700	8,000	12,600	19,500
195	19,600		4,700	8,000	12,600	19,600
195	19,840	25/32	4,700	8,000	12,600	19,840
200	20,000		4,800	9,000	13,900	20,000
200	20,240	51/64	4,800	9,000	13,900	20,240
205	20,500		5,000	9,000	13,900	20,500
205	20,640	13/16	5,000	9,000	13,900	20,640
210	21,000		5,100	9,000	13,900	21,000
210	21,030	53/64	5,100	9,000	13,900	21,030
210	21,100		5,100	9,000	13,900	21,100
210	21,430	27/32	5,100	9,000	13,900	21,430
215	21,500		5,200	9,000	13,900	21,500
215	21,830	55/64	5,200	9,000	13,900	21,830
220	22,000		5,300	10,000	15,300	22,000
220	22,220	7/8	5,300	10,000	15,300	22,220
225	22,500		5,400	10,000	15,300	22,500
225	22,620	57/64	5,400	10,000	15,300	22,620
230	23,000		5,600	10,000	15,300	23,000
230	23,020	29/32	5,600	10,000	15,300	23,020
230	23,420	59/64	5,600	10,000	15,300	23,420
235	23,500		5,700	10,000	15,300	23,500
235	23,810	15/16	5,700	10,000	15,300	23,810
240	24,000		5,800	11,000	15,800	24,000
240	24,100		5,800	11,000	15,800	24,100
240	24,210	61/64	5,800	11,000	15,800	24,210
245	24,500		6,000	11,000	15,800	24,500
245	24,610	31/32	6,000	11,000	15,800	24,610
250	25,000	63/64	6,100	11,000	15,800	25,000
250	25,400	1	6,100	11,000	15,800	25,400
255	25,500		6,200	11,000	15,800	25,500
255	25,670		6,200	11,000	15,800	25,670
255	25,700		6,200	11,000	15,800	25,700
255	25,810		6,200	11,000	15,800	25,810
260	26,000		6,000	12,000	20,000	26,000
260	26,190	1 1/32	6,000	12,000	20,000	26,190
265	26,500		6,100	12,000	20,000	26,500
265	26,590	1 3/64	6,100	12,000	20,000	26,590
270	27,000		6,300	12,000	20,000	27,000
275	27,500		6,400	12,000	20,000	27,500
275	27,700		6,400	12,000	20,000	27,700
275	27,780	1 3/32	6,400	12,000	20,000	27,780
280	28,000		6,600	13,000	20,700	28,000
280	28,180	1 7/64	6,600	13,000	20,700	28,180
285	28,500		6,700	13,000	20,700	28,500
285	28,580		6,700	13,000	20,700	28,580
290	29,000		6,900	13,000	20,700	29,000
290	29,370	1 5/32	6,900	13,000	20,700	29,370
295	29,500		7,000	13,000	20,700	29,500
295	29,770	1 11/64	7,000	13,000	20,700	29,770
300	30,000		6,900	14,000	22,300	30,000
300	30,160	1 3/16	6,900	14,000	22,300	30,160
305	30,500		7,000	14,000	22,300	30,500



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
<b>305</b>	30,960	1 7/32	7,000	14,000	22,300	<b>30,960</b>
<b>310</b>	31,000		7,200	14,000	22,300	<b>31,000</b>
<b>315</b>	31,500		7,300	14,000	22,300	<b>31,500</b>
<b>315</b>	31,750	1 1/4	7,300	14,000	22,300	<b>31,750</b>
<b>320</b>	32,000		7,500	15,000	23,100	<b>32,000</b>
<b>320</b>	32,500		7,600	15,000	23,100	<b>32,500</b>
<b>320</b>	32,540	1 9/32	7,600	15,000	23,100	<b>32,540</b>
<b>320</b>	32,940	1 19/64	7,600	15,000	23,100	<b>32,940</b>
<b>330</b>	33,000		7,800	15,000	23,100	<b>33,000</b>
<b>330</b>	33,340	1 5/16	7,800	15,000	23,100	<b>33,340</b>
<b>330</b>	33,500		7,900	15,000	23,100	<b>33,500</b>
<b>340</b>	34,000		8,100	15,000	23,100	<b>34,000</b>
<b>340</b>	34,130	1 11/32	8,100	15,000	23,100	<b>34,130</b>
<b>340</b>	34,500		8,200	15,000	23,100	<b>34,500</b>
<b>340</b>	34,930		8,200	15,000	23,100	<b>34,930</b>
<b>350</b>	35,000		8,300	15,000	23,100	<b>35,000</b>
<b>350</b>	35,500		8,400	15,000	23,100	<b>35,500</b>
<b>350</b>	35,720	1 13/32	8,400	15,000	23,100	<b>35,720</b>
<b>360</b>	36,000		8,500	16,000	23,900	<b>36,000</b>
<b>360</b>	36,500		8,600	16,000	23,900	<b>36,500</b>
<b>360</b>	36,510	1 7/16	8,600	16,000	23,900	<b>36,510</b>
<b>370</b>	37,000		8,800	16,000	23,900	<b>37,000</b>
<b>370</b>	37,310	1 15/32	8,800	16,000	23,900	<b>37,310</b>
<b>370</b>	37,500		8,900	16,000	23,900	<b>37,500</b>
<b>380</b>	38,000		9,000	16,000	23,900	<b>38,000</b>
<b>380</b>	38,100	1 1/2	9,000	16,000	23,900	<b>38,100</b>
<b>380</b>	38,500	1 33/64	9,100	16,000	23,900	<b>38,500</b>
<b>390</b>	39,000		9,300	16,000	23,900	<b>39,000</b>
<b>390</b>	39,500		9,400	16,000	23,900	<b>39,500</b>
<b>400</b>	40,000		9,400	16,000	23,900	<b>40,000</b>



## Multiplex HPC-Wechselplatten

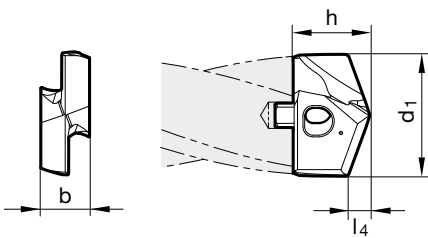
Artikel-Nr. 86724



P	M	K	N	S	H
			•		



Ausspitzung  $\geq \varnothing 11,000$  • Kegelmantelschliff • Spannschrauben Art.-Nr. 86843 enthalten • Hauptschneidenform konkav  
 Aluminium und Al-Legierungen • NE-Metalle



Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
110	11,000		2,100	4,500	7,500	11,000
110	11,200		2,100	4,500	7,500	11,200
115	11,500		2,100	4,500	7,500	11,500
115	11,510	29/64	2,100	4,500	7,500	11,510
115	11,700		2,200	4,500	7,500	11,700
115	11,800		2,200	4,500	7,500	11,800
115	11,910	15/32	2,200	4,500	7,500	11,910
120	12,000		2,200	5,000	7,700	12,000
120	12,100		2,300	5,000	7,700	12,100
120	12,200		2,300	5,000	7,700	12,200
120	12,300	31/64	2,300	5,000	7,700	12,300
125	12,500		2,300	5,000	7,700	12,500
125	12,600		2,300	5,000	7,700	12,600
125	12,700	1/2	2,400	5,000	7,700	12,700
125	12,800		2,400	5,000	7,700	12,800
125	12,900		2,400	5,000	7,700	12,900
130	13,000		2,400	5,500	8,500	13,000
130	13,100	33/64	2,400	5,500	8,500	13,100
130	13,490	17/32	2,500	5,500	8,500	13,490
135	13,500		2,500	5,500	8,500	13,500
135	13,600		2,500	5,500	8,500	13,600
135	13,700		2,500	5,500	8,500	13,700
135	13,800		2,600	5,500	8,500	13,800
135	13,890	35/64	2,600	5,500	8,500	13,890
140	14,000		2,600	6,000	9,600	14,000
140	14,100		2,600	6,000	9,600	14,100
140	14,290	9/16	2,700	6,000	9,600	14,290
140	14,400		2,700	6,000	9,600	14,400
145	14,500		2,700	6,000	9,600	14,500
145	14,600		2,700	6,000	9,600	14,600
145	14,680	37/64	2,700	6,000	9,600	14,680
145	14,700		2,700	6,000	9,600	14,700
145	14,800		2,700	6,000	9,600	14,800
150	15,000		2,800	6,000	9,800	15,000
150	15,080	19/32	2,800	6,000	9,800	15,080
150	15,100		2,800	6,000	9,800	15,100
150	15,200		2,800	6,000	9,800	15,200
150	15,300		2,800	6,000	9,800	15,300
150	15,480	39/64	2,900	6,000	9,800	15,480
155	15,500		2,900	6,000	9,800	15,500
155	15,600		2,900	6,000	9,800	15,600
155	15,700		2,900	6,000	9,800	15,700



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
155	15,800		2,900	6,000	9,800	15,800
155	15,870	5/8	2,900	6,000	9,800	15,870
160	16,000		3,000	7,000	11,000	16,000
160	16,270	41/64	3,000	7,000	11,000	16,270
165	16,500		3,100	7,000	11,000	16,500
165	16,670	21/32	3,100	7,000	11,000	16,670
170	17,000		3,100	7,000	11,000	17,000
170	17,070	43/64	3,200	7,000	11,000	17,070
170	17,460	11/16	3,200	7,000	11,000	17,460
175	17,500		3,200	7,000	11,000	17,500
175	17,600		3,300	7,000	11,000	17,600
175	17,860	45/64	3,300	7,000	11,000	17,860
180	18,000		3,300	8,000	12,600	18,000
180	18,260	23/32	3,400	8,000	12,600	18,260
185	18,500		3,400	8,000	12,600	18,500
185	18,650	47/64	3,400	8,000	12,600	18,650
190	19,000		3,500	8,000	12,600	19,000
190	19,050	3/4	3,500	8,000	12,600	19,050
190	19,250		3,600	8,000	12,600	19,250
190	19,450	49/64	3,600	8,000	12,600	19,450
195	19,500		3,600	8,000	12,600	19,500
195	19,600		3,600	8,000	12,600	19,600
195	19,840	25/32	3,700	8,000	12,600	19,840
200	20,000		3,700	9,000	13,900	20,000
200	20,240	51/64	3,700	9,000	13,900	20,240
205	20,500		3,800	9,000	13,900	20,500
205	20,640	13/16	3,800	9,000	13,900	20,640
210	21,000		3,900	9,000	13,900	21,000
210	21,030	53/64	3,900	9,000	13,900	21,030
210	21,100		3,900	9,000	13,900	21,100
210	21,430	27/32	3,900	9,000	13,900	21,430
215	21,500		4,000	9,000	13,900	21,500
215	21,830	55/64	4,000	9,000	13,900	21,830
220	22,000		4,100	10,000	15,300	22,000
220	22,220	7/8	4,100	10,000	15,300	22,220
225	22,500		4,100	10,000	15,300	22,500
225	22,620	57/64	4,200	10,000	15,300	22,620
230	23,000		4,200	10,000	15,300	23,000
230	23,020	29/32	4,200	10,000	15,300	23,020
230	23,420	59/64	4,300	10,000	15,300	23,420
235	23,500		4,300	10,000	15,300	23,500
235	23,810	15/16	4,400	10,000	15,300	23,810
240	24,000		4,400	11,000	15,800	24,000
240	24,100		4,400	11,000	15,800	24,100
240	24,210	61/64	4,500	11,000	15,800	24,210
245	24,500		4,500	11,000	15,800	24,500
245	24,610	31/32	4,500	11,000	15,800	24,610
250	25,000	63/64	4,600	11,000	15,800	25,000
250	25,400	1	4,700	11,000	15,800	25,400
255	25,500		4,700	11,000	15,800	25,500
255	25,670		4,700	11,000	15,800	25,670
255	25,700		4,700	11,000	15,800	25,700
255	25,810		4,700	11,000	15,800	25,810
260	26,000		4,800	12,000	20,000	26,000
260	26,190	1 1/32	4,800	12,000	20,000	26,190
265	26,500		4,900	12,000	20,000	26,500
265	26,590	1 3/64	4,900	12,000	20,000	26,590
270	27,000		5,000	12,000	20,000	27,000
275	27,500		5,100	12,000	20,000	27,500
275	27,700		5,100	12,000	20,000	27,700
275	27,780	1 3/32	5,100	12,000	20,000	27,780
280	28,000		5,100	13,000	20,700	28,000
280	28,180	1 7/64	5,200	13,000	20,700	28,180
285	28,500		5,200	13,000	20,700	28,500
285	28,580		5,300	13,000	20,700	28,580
290	29,000		5,300	13,000	20,700	29,000
290	29,370	1 5/32	5,400	13,000	20,700	29,370
295	29,500		5,400	13,000	20,700	29,500
295	29,770	1 11/64	5,500	13,000	20,700	29,770
300	30,000		5,500	14,000	22,300	30,000
300	30,160	1 3/16	5,500	14,000	22,300	30,160
305	30,500		5,600	14,000	22,300	30,500



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
<b>305</b>	30,960	1 7/32	5,700	14,000	22,300	<b>30,960</b>
<b>310</b>	31,000		5,700	14,000	22,300	<b>31,000</b>
<b>315</b>	31,500		5,800	14,000	22,300	<b>31,500</b>
<b>315</b>	31,750	1 1/4	5,800	14,000	22,300	<b>31,750</b>
<b>320</b>	32,000		5,900	15,000	23,100	<b>32,000</b>
<b>320</b>	32,500		6,000	15,000	23,100	<b>32,500</b>
<b>320</b>	32,540	1 9/32	6,000	15,000	23,100	<b>32,540</b>
<b>320</b>	32,940	1 19/64	6,000	15,000	23,100	<b>32,940</b>
<b>330</b>	33,000		6,100	15,000	23,100	<b>33,000</b>
<b>330</b>	33,340	1 5/16	6,100	15,000	23,100	<b>33,340</b>
<b>330</b>	33,500		6,100	15,000	23,100	<b>33,500</b>
<b>340</b>	34,000		6,200	15,000	23,100	<b>34,000</b>
<b>340</b>	34,130	1 11/32	6,300	15,000	23,100	<b>34,130</b>
<b>340</b>	34,500		6,300	15,000	23,100	<b>34,500</b>
<b>340</b>	34,930		6,400	15,000	23,100	<b>34,930</b>
<b>350</b>	35,000		6,400	15,000	23,100	<b>35,000</b>
<b>350</b>	35,500		6,500	15,000	23,100	<b>35,500</b>
<b>350</b>	35,720	1 13/32	6,600	15,000	23,100	<b>35,720</b>
<b>360</b>	36,000		6,600	16,000	23,900	<b>36,000</b>
<b>360</b>	36,500		6,700	16,000	23,900	<b>36,500</b>
<b>360</b>	36,510	1 7/16	6,700	16,000	23,900	<b>36,510</b>
<b>370</b>	37,000		6,800	16,000	23,900	<b>37,000</b>
<b>370</b>	37,310	1 15/32	6,800	16,000	23,900	<b>37,310</b>
<b>370</b>	37,500		6,900	16,000	23,900	<b>37,500</b>
<b>380</b>	38,000		7,000	16,000	23,900	<b>38,000</b>
<b>380</b>	38,100	1 1/2	7,000	16,000	23,900	<b>38,100</b>
<b>380</b>	38,500	1 33/64	7,100	16,000	23,900	<b>38,500</b>
<b>390</b>	39,000		7,100	16,000	23,900	<b>39,000</b>
<b>390</b>	39,500		7,200	16,000	23,900	<b>39,500</b>
<b>400</b>	40,000		7,300	16,000	23,900	<b>40,000</b>



## Multiplex HPC-Wechselplatten

Artikel-Nr. 86725

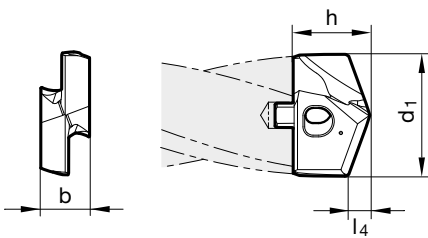


P	M	K	N	S	H
○	●			○	○



Ausspitzung  $\geq \varnothing 11,000$  • Kegelmantelanschiff • Hauptschneidenform gerade (durch Korrektur) • Spannschrauben Art.-Nr. 86843 enthalten

rostfreie Stähle



Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
110	11,000		2,100	4,500	7,500	11,000
110	11,200		2,100	4,500	7,500	11,200
115	11,500		2,100	4,500	7,500	11,500
115	11,510	29/64	2,100	4,500	7,500	11,510
115	11,700		2,200	4,500	7,500	11,700
115	11,800		2,200	4,500	7,500	11,800
115	11,910	15/32	2,200	4,500	7,500	11,910
120	12,000		2,200	5,000	7,700	12,000
120	12,100		2,300	5,000	7,700	12,100
120	12,200		2,300	5,000	7,700	12,200
120	12,300	31/64	2,300	5,000	7,700	12,300
125	12,500		2,300	5,000	7,700	12,500
125	12,600		2,300	5,000	7,700	12,600
125	12,700	1/2	2,400	5,000	7,700	12,700
125	12,800		2,400	5,000	7,700	12,800
125	12,900		2,400	5,000	7,700	12,900
130	13,000		2,400	5,500	8,500	13,000
130	13,100	33/64	2,400	5,500	8,500	13,100
130	13,490	17/32	2,500	5,500	8,500	13,490
135	13,500		2,500	5,500	8,500	13,500
135	13,600		2,500	5,500	8,500	13,600
135	13,700		2,500	5,500	8,500	13,700
135	13,800		2,600	5,500	8,500	13,800
135	13,890	35/64	2,600	5,500	8,500	13,890
140	14,000		2,600	6,000	9,600	14,000
140	14,100		2,600	6,000	9,600	14,100
140	14,290	9/16	2,700	6,000	9,600	14,290
140	14,400		2,700	6,000	9,600	14,400
145	14,500		2,700	6,000	9,600	14,500
145	14,600		2,700	6,000	9,600	14,600
145	14,700		2,700	6,000	9,600	14,700
145	14,800		2,700	6,000	9,600	14,800
150	15,000		2,800	6,000	9,800	15,000
150	15,080	19/32	2,800	6,000	9,800	15,080
150	15,100		2,800	6,000	9,800	15,100
150	15,200		2,800	6,000	9,800	15,200
150	15,300		2,800	6,000	9,800	15,300
155	15,500		2,900	6,000	9,800	15,500
155	15,600		2,900	6,000	9,800	15,600
155	15,700		2,900	6,000	9,800	15,700
155	15,800		2,900	6,000	9,800	15,800
155	15,870	5/8	2,900	6,000	9,800	15,870



## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
160	16,000		3,000	7,000	11,000	16,000
160	16,270	41/64	3,000	7,000	11,000	16,270
165	16,500		3,100	7,000	11,000	16,500
165	16,670	21/32	3,100	7,000	11,000	16,670
170	17,000		3,100	7,000	11,000	17,000
170	17,070	43/64	3,200	7,000	11,000	17,070
170	17,460	11/16	3,200	7,000	11,000	17,460
175	17,500		3,200	7,000	11,000	17,500
175	17,600		3,300	7,000	11,000	17,600
175	17,860	45/64	3,300	7,000	11,000	17,860
180	18,000		3,300	8,000	12,600	18,000
180	18,260	23/32	3,400	8,000	12,600	18,260
185	18,500		3,400	8,000	12,600	18,500
185	18,650	47/64	3,400	8,000	12,600	18,650
190	19,000		3,500	8,000	12,600	19,000
190	19,050	3/4	3,500	8,000	12,600	19,050
190	19,450	49/64	3,600	8,000	12,600	19,450
195	19,500		3,600	8,000	12,600	19,500
195	19,600		3,600	8,000	12,600	19,600
195	19,840	25/32	3,700	8,000	12,600	19,840
200	20,000		3,700	9,000	13,900	20,000
200	20,240	51/64	3,700	9,000	13,900	20,240
205	20,500		3,800	9,000	13,900	20,500
205	20,640	13/16	3,800	9,000	13,900	20,640
210	21,000		3,900	9,000	13,900	21,000
210	21,030	53/64	3,900	9,000	13,900	21,030
210	21,100		3,900	9,000	13,900	21,100
210	21,430	27/32	3,900	9,000	13,900	21,430
215	21,500		4,000	9,000	13,900	21,500
215	21,830	55/64	4,000	9,000	13,900	21,830
220	22,000		4,100	10,000	15,300	22,000
220	22,220	7/8	4,100	10,000	15,300	22,220
225	22,500		4,100	10,000	15,300	22,500
225	22,620	57/64	4,200	10,000	15,300	22,620
230	23,000		4,200	10,000	15,300	23,000
230	23,020	29/32	4,200	10,000	15,300	23,020
230	23,420	59/64	4,300	10,000	15,300	23,420
235	23,500		4,300	10,000	15,300	23,500
235	23,810	15/16	4,400	10,000	15,300	23,810
240	24,000		4,400	11,000	15,800	24,000
240	24,100		4,400	11,000	15,800	24,100
240	24,210	61/64	4,500	11,000	15,800	24,210
245	24,500		4,500	11,000	15,800	24,500
245	24,610	31/32	4,500	11,000	15,800	24,610
250	25,000	63/64	4,600	11,000	15,800	25,000
250	25,400	1	4,700	11,000	15,800	25,400
255	25,500		4,700	11,000	15,800	25,500
255	25,670		4,700	11,000	15,800	25,670
255	25,700		4,700	11,000	15,800	25,700
260	26,000		4,800	12,000	20,000	26,000
260	26,190	1 1/32	4,800	12,000	20,000	26,190
265	26,500		4,900	12,000	20,000	26,500
265	26,590	1 3/64	4,900	12,000	20,000	26,590
270	27,000		5,000	12,000	20,000	27,000
275	27,500		5,100	12,000	20,000	27,500
275	27,700		5,100	12,000	20,000	27,700
275	27,780	1 3/32	5,100	12,000	20,000	27,780
280	28,000		5,100	13,000	20,700	28,000
280	28,180	1 7/64	5,200	13,000	20,700	28,180
285	28,500		5,200	13,000	20,700	28,500
285	28,580		5,300	13,000	20,700	28,580
290	29,000		5,300	13,000	20,700	29,000
290	29,370	1 5/32	5,400	13,000	20,700	29,370
295	29,500		5,400	13,000	20,700	29,500
295	29,600		5,400	13,000	20,700	29,600
295	29,770	1 11/64	5,500	13,000	20,700	29,770
300	30,000		5,500	14,000	22,300	30,000
300	30,160	1 3/16	5,500	14,000	22,300	30,160
305	30,500		5,600	14,000	22,300	30,500
305	30,960	1 7/32	5,700	14,000	22,300	30,960
310	31,000		5,700	14,000	22,300	31,000
315	31,500		5,800	14,000	22,300	31,500





## Multiplex HPC-Wechselplatten

Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
<b>315</b>	31,750	1 1/4	5,800	14,000	22,300	<b>31,750</b>
<b>320</b>	32,000		5,900	15,000	23,100	<b>32,000</b>
<b>320</b>	32,500		6,000	15,000	23,100	<b>32,500</b>
<b>320</b>	32,540	1 9/32	6,000	15,000	23,100	<b>32,540</b>
<b>320</b>	32,940	1 19/64	6,000	15,000	23,100	<b>32,940</b>
<b>330</b>	33,000		6,100	15,000	23,100	<b>33,000</b>
<b>330</b>	33,340	1 5/16	6,100	15,000	23,100	<b>33,340</b>
<b>330</b>	33,500		6,100	15,000	23,100	<b>33,500</b>
<b>340</b>	34,000		6,200	15,000	23,100	<b>34,000</b>
<b>340</b>	34,130	1 11/32	6,300	15,000	23,100	<b>34,130</b>
<b>340</b>	34,500		6,300	15,000	23,100	<b>34,500</b>
<b>340</b>	34,930		6,400	15,000	23,100	<b>34,930</b>
<b>350</b>	35,000		6,400	15,000	23,100	<b>35,000</b>
<b>350</b>	35,500		6,500	15,000	23,100	<b>35,500</b>
<b>350</b>	35,720	1 13/32	6,600	15,000	23,100	<b>35,720</b>
<b>360</b>	36,000		6,600	16,000	23,900	<b>36,000</b>
<b>360</b>	36,500		6,700	16,000	23,900	<b>36,500</b>
<b>360</b>	36,510	1 7/16	6,700	16,000	23,900	<b>36,510</b>
<b>370</b>	37,000		6,800	16,000	23,900	<b>37,000</b>
<b>370</b>	37,310	1 15/32	6,800	16,000	23,900	<b>37,310</b>
<b>370</b>	37,500		6,900	16,000	23,900	<b>37,500</b>
<b>380</b>	38,000		7,000	16,000	23,900	<b>38,000</b>
<b>380</b>	38,100	1 1/2	7,000	16,000	23,900	<b>38,100</b>
<b>380</b>	38,500	1 33/64	7,100	16,000	23,900	<b>38,500</b>
<b>390</b>	39,000		7,100	16,000	23,900	<b>39,000</b>
<b>390</b>	39,500		7,200	16,000	23,900	<b>39,500</b>
<b>400</b>	40,000		7,300	16,000	23,900	<b>40,000</b>

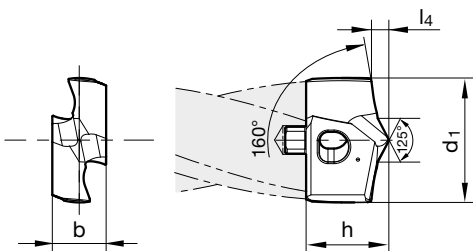


## Multiplex HPC-Wechselplatten

Artikel-Nr. 86729



Flächenanschliff • Hauptschneidenform konkav • spezieller Spitzenanschliff für Bohrsägeanlagen mit 160° Spitzenwinkel und 125° Zentrierspitze • Spannschrauben Art.-Nr. 86843 enthalten



Größe	d1 mm	inch	l4 mm	b mm	h mm	Code-Nr.
120	12,000		1,700	5,000	7,500	12,000
140	14,000		2,000	6,000	9,500	14,000
160	16,000		2,300	7,000	10,800	16,000
180	18,000		2,600	8,000	12,300	18,000
200	20,000		2,900	9,000	13,600	20,000
210	21,000		3,000	9,000	13,600	21,000
220	22,000		3,200	10,000	14,900	22,000
240	24,000		3,500	11,000	15,500	24,000
250	25,000	63/64	3,600	11,000	15,500	25,000
260	26,000		3,800	12,000	18,500	26,000
270	27,000		3,900	12,000	18,600	27,000
280	28,000		4,100	13,000	18,600	28,000
290	29,000		4,200	13,000	18,600	29,000
300	30,000		4,400	14,000	19,900	30,000
320	32,000		4,600	15,000	21,300	32,000
330	33,000		4,800	15,000	21,700	33,000
340	34,000		4,900	15,000	22,200	34,000
360	36,000		5,200	16,000	22,500	36,000
380	38,000		5,500	16,000	23,000	38,000
400	40,000		5,800	16,000	23,100	40,000



## Multiplex HPC-Senkplatten

### Artikel-Nr. 86726



P	M	K	N	S	H
○		●			



Grauguss, Temperguss, Sphäroguss

ISO	Halter-Größe	Code-Nr.
CPGW050202F N-K	110-140	52,020
CPGW050204F N-K	110-140	52,040
CPGW060202F N-K	160-280	62,020
CPGW060204F N-K	160-280	62,040
CPGW09T308F N-K	300-360	93,080

### Artikel-Nr. 86727



P	M	K	N	S	H
			●		



Aluminium und Al-Legierungen • NE-Metalle

ISO	Halter-Größe	Code-Nr.
CPGT050202F R-AL	110-140	52,020
CPGT050204F R-AL	110-140	52,040
CPGT060202F R-AL	160-280	62,020
CPGT060204F R-AL	160-280	62,040
CPGT09T308F R-AL	300-360	93,080



## Multiplex HPC-Senkplatten

Artikel-Nr. 86728



<b>P</b>	<b>M</b>	<b>K</b>	<b>N</b>	<b>S</b>	<b>H</b>
•	○	○		○	○



Stahl und Stahlguss (legiert und unleg.)

ISO	Halter-Größe	Code-Nr.
CPGT050202F R-P	110-140	<b>52,020</b>
CPGT050204F R-P	110-140	<b>52,040</b>
CPGT060202F R-P	160-280	<b>62,020</b>
CPGT060204F R-P	160-280	<b>62,040</b>
CPGT09T308F R-P	300-360	<b>93,080</b>

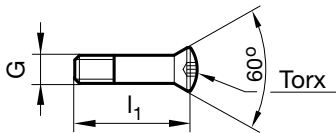


## Spannschrauben für Multiplex HPC-Halter 1,5-10xD

Artikel-Nr. 86843



Anzugsmomente Torxschrauben s. „Multiplex HPC - Technik und Vorteile“



G	l1 mm	Torx	Code-Nr.
M 2.2	9,500	T7	2,200
M 2.2	10,500	T7	2,201
M 2.5	11,400	T8	2,500
M 3	12,100	T9	3,000
M 3	13,100	T9	3,001
M 3.5	14,250	T10	3,500
M 4	16,000	T15	4,000
M 4.5	18,000	T15	4,500
M 5	19,750	T20	5,000
M 5	21,750	T20	5,001
M 5	23,400	T20	5,003
M 6	27,000	T25	6,000
M 6	28,500	T25	6,001
M 6	32,500	T25	6,002



HARTNER

## Drehmomentschlüssel

Artikel-Nr. 86844



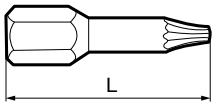
Antrieb	Drehmoment Nm	L mm	Typ	Code-Nr.
1/4"	0,4-1	100,000	A	1,001
1/4"	0,8-2	160,000	A	2,000
1/4"	0,8-5	160,000	A	5,001
1/4"	2-8	200,000	A	8,000
1/4"	5-14	200,000	E	14,000



HARTNER

## Torx-Einsätze

Artikel-Nr. 86845



Antrieb		Torx	L mm	Code-Nr.
1/4	6-kant	T5	25,000	5,000
1/4	6-kant	T7	25,000	7,000
1/4	6-kant	T8	25,000	8,000
1/4	6-kant	T9	25,000	9,000
1/4	6-kant	T10	25,000	10,000
1/4	6-kant	T15	25,000	15,000
1/4	6-kant	T20	25,000	20,000
1/4	6-kant	T25	25,000	25,001

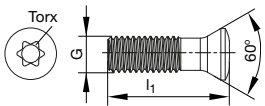


## Spannschrauben für Multiplex HPC-Senkhalter

Artikel-Nr. 86846



Anzugsmomente Torxschrauben s. „Multiplex HPC - Technik und Vorteile“



G	l1 mm	Torx	Code-Nr.
M2	5,500	T6	2,000
M2,5	5,300	T7	2,500
M4	9,500	T15	4,006



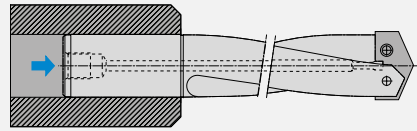


## Multiplex - Die Kühlmittel-Zuführung

Jeder Multiplex-Halter verfügt über eine innere Kühlmittel-Zufuhr. Sie gewährleistet sowohl beim horizontalen als auch beim vertikalen Bohren eine optimale Kühlmittel- sowie Schmiermittel-Versorgung der Schneiden und verlängert so die Standwege. Gleichzeitig sorgt das Kühlmittel für einen optimierten Spänetransport aus der Bohrung heraus. Die Kühlmittel-Zuführung erfolgt bei den verschiedenen Schaftausführungen unterschiedlich:

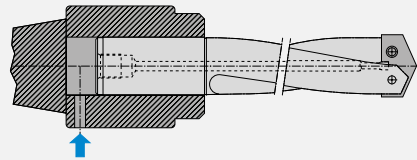
### Zuführbohrung an der Stirnseite des Schaftes

Für **stehende** und **drehende** Werkzeuge:  
Kühlmittelzufuhr axial durch die Werkzeugaufnahme.  
Für Halter mit Zylinderschaft und Bohr-Ø 10 bis 102 mm.  
Halter Art.-Nr. 86612/86622/86624/86730/86740/86750 und überlange Halter.



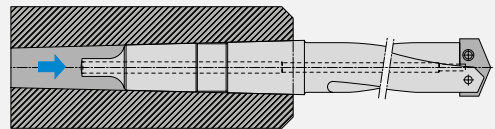
### Zuführbohrung an der Stirnseite des Schaftes mit Zuführfutter

Für **drehende** Werkzeuge:  
Kühlmittelzufuhr radial durch das Kühlmittelzuführfutter.  
Für Halter mit Zylinderschaft und Bohr-Ø 10 bis 102 mm.  
Halter Art.-Nr. 86612/86622/86624/86730/86740/86750 und überlange Halter.  
Kühlmittelzuführfutter SK40/50 auf zyl. und MK4/5/6 auf zyl.



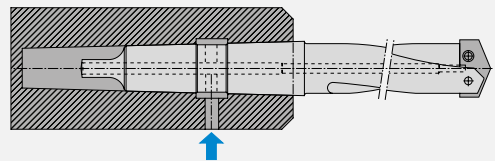
### Zuführbohrung am Austreibblappen

Für **stehende** und **drehende** Werkzeuge:  
Kühlmittelzufuhr axial durch die Werkzeugaufnahme.  
Für Halter mit Morsekegelschaft und Bohr-Ø 10 bis 25 mm.  
Halter Art.-Nr. 86630/86650.



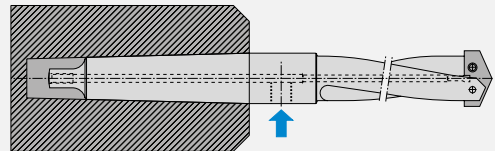
### Zuführbohrung seitlich am Morsekegel

Für **stehende** Werkzeuge:  
Kühlmittelzufuhr radial durch die Werkzeugaufnahme.  
Für Halter mit Morsekegelschaft und Bohr-Ø 10 bis 25 mm.  
Halter auf Anfrage.



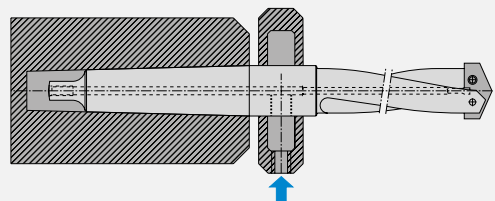
### Zuführbohrung seitlich am Sitz der Ringlauffläche

Für **stehende** Werkzeuge:  
Kühlmittelzufuhr über direkte Schlauch-/Rohrverbindung mit Gewinde R1/4" und R1/2". Für Halter mit Morsekegel und Sitz für Zuführring für Bohr-Ø 25 bis 102 mm.  
Halter Art.-Nr. 86670/86680 und überlange Halter.



### Zuführbohrung seitlich am Sitz der Ringlauffläche

Für **drehende** Werkzeuge:  
Kühlmittelzufuhr radial durch den Zuführring.  
Für Halter mit Morsekegel und Ringlauffläche ab Bohr-Ø 25 mm.  
Halter Art.-Nr. 86670/86680 und überlange Halter.

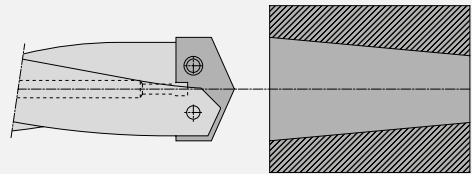




## Multiplex - Tipps und Tricks

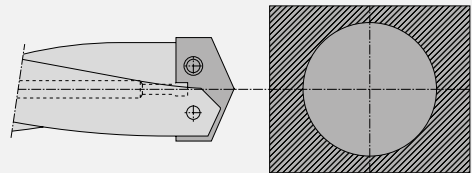
### Bohren vorgebohrter Bohrungen

Da das Multiplex System hauptsächlich durch die Querschneide geführt wird, ist es zum Aufbohren von vorgegessenen oder vorgebohrten Löchern nicht geeignet. Falls das System dennoch eingesetzt wird, sind die Einsatzparameter zu verringern.



### Bohren in unterbrochenem Schnitt

Zum Bohren in unterbrochenem Schnitt (z.B. Querbohrungen, die größer als der Bohrdurchmesser sind) ist das Multiplex System nicht geeignet.

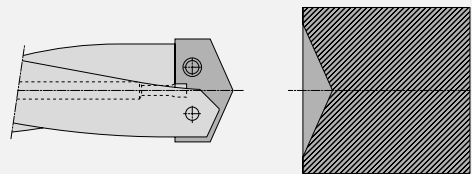


### Anzentrieren der Bohrung

Die Bohrplatten des Multiplex-Systems sind ausgespitzt. Ein Anzentrieren ist somit erst ab größeren Bohrtiefen notwendig. Falls das Anzentrieren aus technischen Gründen notwendig ist, muss der Spitzenwinkel der Zentrierung gleich oder größer wie der Spitzenwinkel der Schneidplatte sein.

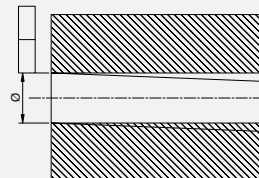
Dies entspricht: bis  $d = 25,4 \text{ mm} = 135^\circ$   
bis  $d = 66,0 \text{ mm} = 132^\circ$   
ab  $d = 66,0 \text{ mm} = 140^\circ$

Es kann auch ein kurzer Halter (3xD) zum Anbohren verwendet werden.



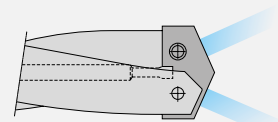
### Verlaufen des Bohrers

Ein Verlaufen des Bohrers hängt von verschiedenen Faktoren ab. Als Richtwert für Bohrtiefen bis  $7 \times D$  kann man einen Wert von ca.  $0,1-0,16 \text{ mm}$  annehmen. In diesem Fall sollte aber immer der kürzest mögliche und somit stabilste Haltertyp verwendet werden.



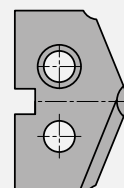
### Kühlmitteldruck

Das Kühlschmiermittel ist beim Multiplex System für die Spanabfuhr sehr wichtig. Es kann ab einem Druck von ca. 5 bar betrieben werden. Generell gilt aber: Je mehr Kühlmittel zur Verfügung steht, desto besser. Durch den Einsatz von Kühlmittelringen oder Kühlmittelzuführfuttern ist das Multiplex- System auch mit der an älteren Maschinen vorhandenen Außenkühlung einsetzbar. Der jeweilige Anwendungsfall kann jederzeit mit unseren Anwendungstechnikern abgeklärt werden.



### Starker Schneidenverschleiß

Wenn sich an den Schneidecken eine Stufe eingebraunt hat, ist die Schnittgeschwindigkeit zu hoch und muss reduziert werden. Messen Sie den Durchmesser, der abgebraunt ist, und berechnen Sie die Schnittgeschwindigkeit anhand dieses Durchmessers neu. Von dieser neuen Drehzahl ziehen Sie 10% ab und geben diesen Wert dann in die Maschine ein.

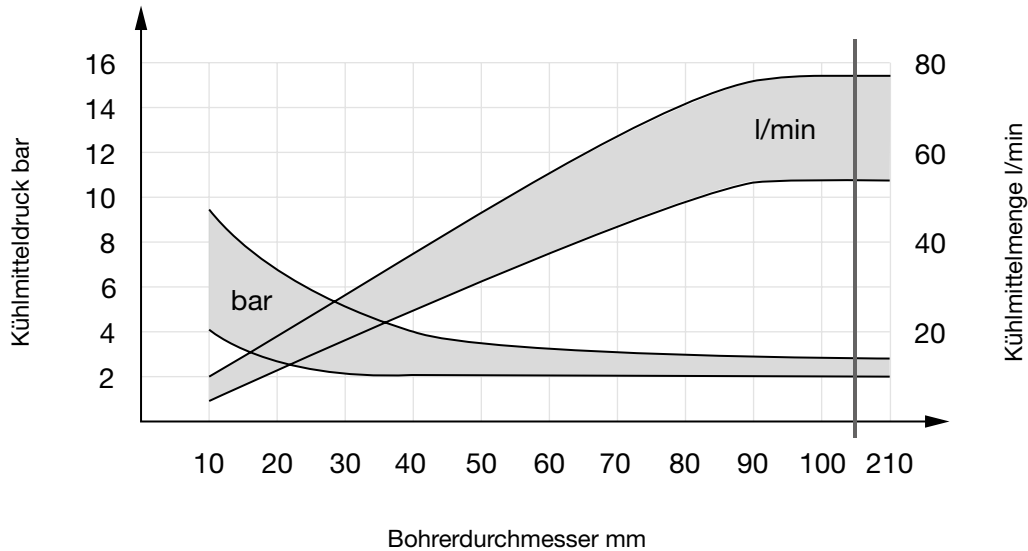




## Multiplex - Das Kühlmittelaggregat

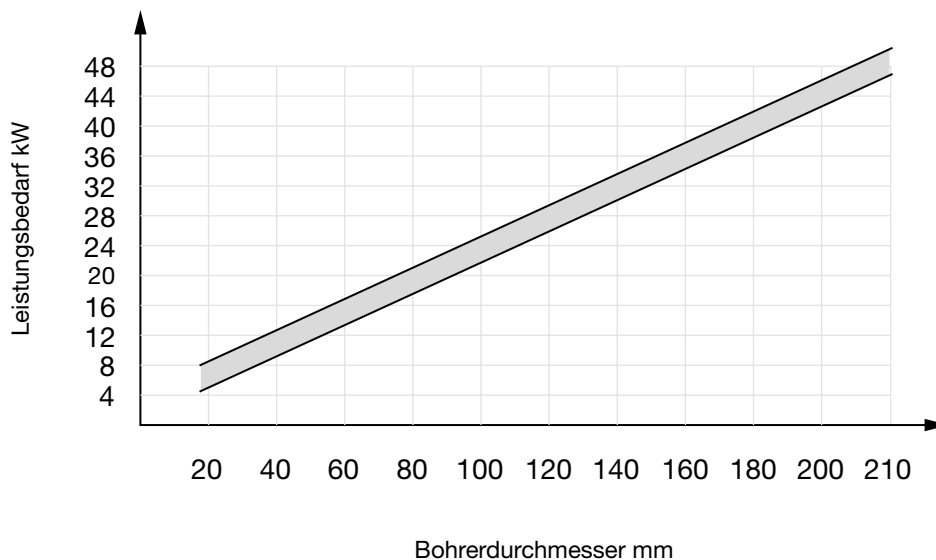
Von ganz entscheidender Bedeutung ist ein leistungsfähiges Kühlmittelaggregat. Sind Druck und Menge des Kühlmittels nicht ausreichend, so kann dies zu einer schlechten Bohrungsoberfläche oder zum Werkzeugbruch führen. Die Größe der Feststoffteilchen im Kühlmittel sollten 50 µm möglichst nicht überschreiten.

Als Kühlschmiermittel empfehlen wir beim Einsatz der Multiplex-Werkzeuge sowohl bei Schnellstahl- als auch bei Hartmetall-Wechselplatten Bohremulsion im üblichen Mischungsverhältnis 1 : 20. Wichtiger als die Zusammensetzung der Bohremulsion sind der Kühlmitteldruck und die Kühlmittelmenge. Ein leistungsfähiges Kühlmittelaggregat ist deshalb eine wichtige Voraussetzung für eine ausreichende Kühlung und Schmierung.



## Maschine und Werkstück

Erst die Stabilität von Maschine, Spindel, Werkstückaufspannung und Werkstück ermöglichen den Einsatz des Schneidstoffs Hartmetall. Ungenügende Steifigkeit führt zu Schwingungen oder Durchsacken des Bohrers bei Durchgangslöchern, wenn die Querschneide aus dem Werkstück austritt. Geringe Standwege oder Plattenbruch können die Folge sein.





## Multiplex - Sondergeometrien



**Formplatte\* nach Kundenzeichnung**  
(HSS-E/PM, HSS-E oder HM)



**NC-Platte (HSS-E/PM, HSS-E oder HM)**  
**mit 90° oder 120°**  
(Je nach  $\emptyset$  wird der 90°-Winkel im Spitzenbereich verzerrt)



**Platte mit Eckenradius**  
(HSS-E/PM, HSS-E oder HM)



**Stufenplatte**  
(HSS-E/PM, HSS-E oder HM)



**Messing-Geometrie (HM)**  
für den Einsatz in Messing und ähnlichen Werkstoffen



**Sacklochplatte\* (HSS-E/PM HSS-E)**  
ohne Zentrierspitze



**Anschliff für faserverstärkte Kunststoffe (HM)**



**Radiusplatte\* (HSS-E/PM, HSS-E)**

**\* Beim Einsatz von Formplatten bitte beachten:**

- nur mit kurzem Halter einsetzen
- die Bohrung sollte mit einer normalen Multiplex-Platte vorgebohrt werden (gleicher oder kleinerer  $\emptyset$ )
- nur bedingt zum Bohren ins Volle geeignet
- wenn möglich Zeichnungsausschnitt der Bohrung zuschicken

Sondergeometrien erhalten Sie auf Anfrage mit den unterschiedlichsten Beschichtungen aus unserem Programm.  
Sprechen Sie uns einfach an. **Lieferzeit ca. 3 Wochen.**

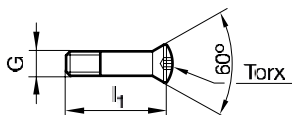


## Multiplex HPC – Technik und Vorteile

Mit dem neuen Wechselplatten-Bohrsystem Multiplex HPC bietet Hartner leistungsstarke und kostengünstige Halter und Wechselplatten für Bohrungen im Durchmesserbereich von 11,00 bis 40,00 mm an, die durch folgende Vorteile überzeugen:

- Hohe Standzeit**  
 Dank spezieller, mikro-bearbeiteter Schneiden und der anwendungsorientierten Oberfläche sind die Wechselplatten des Multiplex HPC-Bohrsystems besonders verschleißbeständig. Die Halter des Multiplex HPC-Bohrsystems verfügen ebenfalls über eine sehr hohe Verschleißbeständigkeit. Grundlage hierfür sind der optimierte Halterwerkstoff mit vernickelter Oberfläche ebenso wie die Abstufung der Haltergrößen in 0,5 mm-Schritten bis Durchmesser 31,99 mm bzw. in 1,0 mm Schritten ab Durchmesser 32,00 mm. Dies führt zu weniger Verschleiß am Halterrücken.
- Optimierter Spantransport**  
 Dank ihres Nutquerschnitts gewährleisten die Halter des Multiplex HPC-Bohrsystems auch bei größeren Bohrtiefen einen optimalen Spantransport aus der Bohrung.
- Perfekte Kühlschmierung**  
 Für eine perfekte Kühlschmierung sorgen die Kühlkanäle mit maximalem Querschnitt, die in der Spannutt austreten. Dadurch ermöglichen sie eine optimale Kühlschmierung der Schneiden und unterstützen zudem die Spanabfuhr aus der Bohrung.
- Hochpräziser und stabiler Plattensitz**  
 Der präzise Plattensitz ermöglicht den Plattenwechsel innerhalb der Maschine mit nur wenigen Handgriffen unter Verwendung eines herkömmlichen Torx-Schlüssels. Dank des optimierten Werkstoffs für die Halter des Multiplex HPC-Bohrsystems können die Platten häufiger als bei herkömmlichen Systemen gewechselt werden, bevor der Halter wegen Verschleiß des Plattensitzes ausgetauscht werden muss.  
 Die Spannschrauben mit Schraubensicherung sorgen auch bei stark vibrationsbelasteten Maschinen für einen sicheren Halt der Wechselplatte im Halter.
- Stabile Halter**  
 Die eng gestuften Durchmessersprünge bei den Haltergrößen reduzieren nicht nur den Verschleiß. Sie erhöhen durch die bessere Führung des Werkzeugs in der Bohrung auch die Stabilität des Bohrsystems Multiplex HPC. Daraus wiederum resultieren neben längerer Lebensdauer auch bessere Werkstückoberflächen.

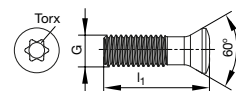
### Spannschraubenzuordnung für Halter 1,5 - 10 x D 86843



für Träger-Größe	Torx	Code-Nr.
110/115	T7	2,200
120/125	T7	2,201
130/135	T8	2,500
140/145	T9	3,000
150/155	T9	3,001
160 - 175	T10	3,500
180 - 195	T15	4,000
200 - 215	T15	4,500

für Träger-Größe	Torx	Code-Nr.
220 - 235	T20	5,000
240 - 255	T20	5,001
260 - 295	T20	5,003
300 - 315	T25	6,000
320 - 350	T25	6,001
360 - 390	T25	6,002

### für Senkhalter 86846



für Träger-Größe	Torx	Code-Nr.
110 - 140	T6	2,000
160 - 280	T7	2,500
300 - 360	T15	4,006

Wir empfehlen, bei jedem Plattenwechsel auch die Spannschraube zu wechseln!

Jeder Halter wird deshalb mit Spannschraube, Art.-Nr. 86843, und Schraubendreher, Artikel-Nr. 86842, ausgeliefert, jede Wechselplatte mit Spannschraube, Art.-Nr. 86843.

### Anzugsmomente für die Spannschraube:

Durchmesserbereich	11,0 - 12,99	13,0 - 13,99	14,0 - 15,99	16,0 - 17,99	18,0 - 19,99	20,0 - 21,99	22,0 - 29,99	30,0 - 40,00
Gewinde	M2,2	M2,5	M3	M3,5	M4	M4,5	M5	M6
Torx Größe	T7	T8	T9	T10	T15	T15	T20	T25
Anzugsmoment [Nm]	0,8	1,0	1,7	2,7	4,0	6,0	8,0	14,0





# HARTNER

Precision Cutting Tools

## TECHNISCHER TEIL

Baumaße, Begriffe, Einsatzempfehlungen



## Inhalt Baumaße, Bezeichnungen

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# HARTNER

## Längenmaße Spiralbohrer mit Zylinderschaft

Durchmesser bis (inkl.) mm	DIN 338		DIN 339		DIN 340		DIN 1897		DIN 1869 Überlange Spiralbohrer					
	Gesamtlänge	Spannutlänge	Gesamtlänge	Spannutlänge	Gesamtlänge	Spannutlänge	Gesamtlänge	Spannutlänge	Reihe 1		Reihe 2		Reihe 3	
									Gesamtlänge	Spannutlänge	Gesamtlänge	Spannutlänge	Gesamtlänge	Spannutlänge
≤ 0,24	19	2,5					19	1,5						
0,30	19	3					19	1,5						
0,38	19	4					19	2						
0,48	20	5			30*	10*	19	2,5						
0,53	22	6			32*	12*	20	3						
0,60	24	7	32*	15*	35*	15*	21	3,5						
0,67	26	8	36*	18*	38*	18*	22	4						
0,75	28	9	39*	20*	42*	21*	23	4,5						
0,85	30	10	42*	22*	46*	25*	24	5						
0,95	32	11	45*	24*	51*	29*	25	5,5						
1,06	34	12	48	26	56	33	26	6						
1,18	36	14	50	28	60	37	28	7						
1,32	38	16	52	30	65	41	30	8						
1,50	40	18	55	33	70	45	32	9						
1,70	43	20	58	35	76	50	34	10	115*	75*				
1,90	46	22	62	38	80	53	36	11	120*	80*				
2,12	49	24	66	41	85	56	38	12	125	85	160*	110*	205*	135*
2,36	53	27	70	44	90	59	40	13	135	90	170*	115*	215*	145*
2,65	57	30	74	47	95	62	43	14	140	95	180*	120*	225*	150*
3,00	61	33	79	51	100	66	46	16	150	100	190	130	240*	160*
3,35	65	36	84	55	106	69	49	18	155	105	200	135	250*	170*
3,75	70	39	91	60	112	73	52	20	165	115	210	145	265	180
4,25	75	43	96	64	119	78	55	22	175	120	220	150	280	190
4,75	80	47	102	69	126	82	58	24	185	125	235	160	295	200
5,30	86	52	108	74	132	87	62	26	195	135	245	170	315	210
6,00	93	57	116	80	139	91	66	28	205	140	260	180	330	225
6,70	101	63	124	86	148	97	70	31	215	150	275	190	350	235
7,50	109	69	133	93	156	102	74	34	225	155	290	200	370	250
8,50	117	75	142	100	165	109	79	37	240	165	305	210	390	265
9,50	125	81	151	107	175	115	84	40	250	175	320	220	410	280
10,60	133	87	162	116	184	121	89	43	265	185	340	235	430	295
11,80	142	94	173	125	195	128	95	47	280*	195*	365*	250*	455*	310*
13,20	151	101	184	134	205	134	102	51	295*	205*	375*	260*	480*	330*
14,00	160	108	194	142	214	140	107	54						
15,00	169	114	202	147	220	144	111	56						
16,00	178	120	211	153	227	149	115	58						
17,00	184	125	218	159	235	154	119	60						
18,00	191	130	226	165	241	158	123	62						
19,00	198	135	234	171	247	162	127	64						
20,00	205	140	242	177	254	166	131	66						
21,20					261	171	136	68						
22,40					268	176	141	70						
23,60					275	180	146	72						
25,00					282	185	151	75						
26,50					290	190	156	78						
28,00					298	195	162	81						
30,00					307	201	168	84						
31,50					316	207	174	87						
33,50							180	90						
35,50							186	93						
37,50							193	96						
40,00							200	100						
42,50							207	104						
45,00							214	108						
47,50							221	112						
50,00							228	116						

Nach Werksnorm liefert  
Hartner Spiralbohrer  
bis 1000 mm Gesamtlänge  
Art.-Nr. 81740, 81750, 81760

\* Werksnorm



**HARTNER**

**Längenmaße  
Spiralbohrer mit Morsekegel**

Durchmesser bis (inkl.)	DIN 345			DIN 346			DIN 341			Bohrbuchsenbohrer mit großem Morsekegel*			Typ V/IS-Bohrer* für schwer zu bearbeitende Werkstoffe			DIN 1870 Überlange Spiralbohrer					
	Gesamtlänge	Spannutlänge	Morsekegel	Gesamtlänge	Spannutlänge	Morsekegel	Gesamtlänge	Spannutlänge	Morsekegel	Gesamtlänge	Spannutlänge	Morsekegel	Gesamtlänge	Spannutlänge	Morsekegel	Reihe 1			Reihe 2		
																Gesamtlänge	Spannutlänge	Morsekegel	Gesamtlänge	Spannutlänge	Morsekegel
mm	mm			mm			mm			mm			mm			mm					
2,65	111*	30*	1*																		
3,00	114	33	1																		
3,35	117	36	1																		
3,75	120	39	1																		
4,25	124	43	1				145*	64*	1*												
4,75	128	47	1				150*	69*	1*												
5,30	133	52	1				155	74	1												
6,00	138	57	1				161	80	1												
6,70	144	63	1				167	86	1												
7,50	150	69	1				174	93	1												
8,50	156	75	1				181	100	1				130	49	1	265	165	1	330	210	1
9,50	162	81	1				188	107	1				134	53	1	275	175	1	345	220	1
10,60	168	87	1	185*	87*	2*	197	116	1	214	116	2	138	57	1	285	185	1	360	235	1
11,80	175	94	1	192*	94*	2*	206	125	1	223	125	2	142	61	1	300	195	1	375	250	1
13,20	182	101	1	199	101	2	215	134	1	232	134	2	147	66	1	310	205	1	395	260	1
14,00	189	108	1	206	108	2	223	142	1	240	142	2	168	70	2	325	220	1	410	275	1
15,00	212	114	2	235*	114*	3*	245	147	2	268	147	3	172	74	2	340	220	2	425	275	2
16,00	218	120	2	241*	120*	3*	251	153	2	274	153	3	176	78	2	355	230	2	445	295	2
17,00	223	125	2	246*	125*	3*	257	159	2	280	159	3	179	81	2	355	230	2	445	295	2
18,00	228	130	2	251*	130*	3*	263	165	2	286	165	3	183	85	2	370	245	2	465	310	2
19,00	233	135	2	256	135	3	269	171	2	292	171	3	186	88	2	370	245	2	465	310	2
20,00	238	140	2	261	140	3	275	177	2	298	177	3	212	91	3	385	260	2	490	325	2
21,20	243	145	2	266	145	3	282	184	2	305	184	3	216	95	3	385	260	3	490	325	3
22,40	248	150	2	271	150	3	289	191	2	312	191	3	219	98	3	405	270	3	515	345	3
23,02	253	155	2	276	155	3	296	198	2	319	198	3	222	101	3	405	270	3	515	345	3
23,60	276	155	3	304*	155*	4*	319	198	3	347	198	4	222	101	3	425	270	3	535	345	3
25,00	281	160	3	309*	160*	4*	327	206	3	355	206	4	225	104	3	440	290	3	555	365	3
26,50	286	165	3	314*	165*	4*	335	214	3	363	214	4	256	107	4	440	290	3	555	365	3
28,00	291	170	3	319	170	4	343	222	3	371	222	4	259	110	4	460	305	3	580	385	3
30,00	296	175	3	324	175	4	351	230	3	379	230	4	263	114	4	460	305	3	580	385	3
31,50	301	180	3	329	180	4	360	239	3	388	239	4	266	117	4	480	320	3	610	410	3
31,75	306	185	3	334	185	4	369	248	3	397	248	4	269	120	4	480	320	3	610	410	3
33,50	334	185	4	372*	185*	5*	397	248	4	435	248	5	269	120	4	505	320	4	635	410	4
35,50	339	190	4	377*	190*	5*	406	257	4				272	123	4	530	340	4	665	430	4
37,50	344	195	4	382*	195*	5*	416	267	4				276	127	4	530	340	4	665	430	4
40,00	349	200	4	387*	200*	5*	426	277	4				317	130	5	555	360	4	695	460	4
42,50	354	205	4	392	205	5	436	287	4				320	133	5	555	360	4	695	460	4
45,00	359	210	4	397	210	5	447	298	4				323	136	5	585	385	4	735	490	4
47,50	364	215	4	402	215	5	459	310	4							585	385	4	735	490	4
50,00	369	220	4	407	220	5	470	321	4							605	405	4	765	510	4
50,80	374	225	4	412	225	5	475*	326*	4*												
53,00	412	225	5	479*	225*	6*	513*	326*	5*												
56,00	417	230	5	484*	230*	6*	518*	331*	5*												
60,00	422	235	5	489*	235*	6*	523*	336*	5*												
63,00	427	240	5	494*	240*	6*															
67,00	432	245	5	499	245	6															
71,00	437	250	5	504	250	6															
75,00	442	255	5	509	255	6															
76,50	447	260	5	514	260	6															
80,00	514	260	6																		
85,00	519	265	6																		
90,00	524	270	6																		
95,00	529	275	6																		
100,00	534	280	6																		
106,00	539*	285*	6*																		

Nach Werksnorm liefert  
Hartner Spiralbohrer  
bis 1000 mm Gesamtlänge  
Art.-Nr. 82467, 82468, 82469,  
82466

\* Werksnorm



# HARTNER

## Schnellarbeitsstähle für Hartner Werkzeuge

Schnellstahl-Werkzeuge fertigen wir nur aus hochwertigen, sorgfältig ausgewählten Stahlsorten. Je nach Legierungsbestandteil erhalten die Werkzeuge spezifische, auf den Einsatzfall abgestimmte Eigenschaften:

Wolfram, Molybdän: erhöht die Anlassbeständigkeit und Verschleißfestigkeit.

Vanadium: erhöht die Verschleißfestigkeit

Kobalt: erhöht die Verschleißfestigkeit, steigert die Warmhärte.

Hartner-Bezeichnung	Typ	Anwendungsgebiet, Eigenschaften
<b>HSS</b>	Konventioneller Schnellarbeitsstahl	Standardschneidstoff für universelle Anwendungen
<b>HSS-E</b>	Kobaltlegierter Schnellarbeitsstahl	Schneidstoff mit hoher Warmhärte für erhöhte Beanspruchung, besonders geeignet bei hohen Schnitttemperaturen oder bei ungünstiger Kühlung
<b>M42</b>	8%-kobaltlegierter Schnellarbeitsstahl	Schneidstoff mit erhöhter Warmfestigkeit und Härte, geeignet für Arbeiten in schwer zerspanbarem Material
<b>HSS-E-PM</b>	Pulvermetallurgisch hergestellter kobaltlegierter Schnellarbeitsstahl	Schneidstoff mit sehr dichtem und gleichmäßigem Gefüge. Hohe Härte und Warmfestigkeit, große Verschleißbeständigkeit und Schneidkantenstabilität



## Die wichtigsten Hartmetall-Sorten für Hartner-Werkzeuge

Die folgende Tabelle stellt die wesentlichen, bei Hartner im Lagerprogramm erhältlichen Hartmetalle für allgemeine Bohranwendungen dar. Weitere Sorten sind auf Anfrage erhältlich.

Bei über 80% aller uns bekannten Anwendungen waren die Ergebnisse von Werkzeugen aus DK460UF in Verbindung mit einer angepassten Beschichtung durch andere, auch beschichtete Hartmetall-Sorten nicht zu überbieten. Dies und die hohe Lagerverfügbarkeit dieses Materials vereinfachen die Werkzeugauswahl stark. Unsere Anwendungstechniker beraten Sie gerne, wann ein Einsatz der anderen Sorten sinnvoll ist.

Sorte	Co-Gehalt [M-%]	WC-Einsatzkorn [ $\mu\text{m}$ ]	Härte [HV]	ISO-Klassifikation [ISO 513]	Charakterisierung
DK460UF K40UF	10	0,6	1620	K20-K40	Sehr breitbandig einsetzbare Sorte, die, meist beschichtet eingesetzt, Stähle, weiche Aluminium-Legierungen, Gusseisen, aber auch Superlegierungen wie Inconel 718 schneidet. Diese Sorte stellt das Rückgrat unserer Produktion dar.
DK500UF K44UF	12	0,5	1690	K20-K30	Speziell für die Hartbearbeitung wurde diese Sorte entwickelt. Sie zeichnet sich durch gegenüber DK460UF erhöhte Härte und größere Verformungstoleranz aus.
DK255F	8	0,7	1720	K20	Diese Sorte wird für die Hartbearbeitung, die Bearbeitung von hochfesten Graugussorten und harten AISi-Legierungen empfohlen. Trockenbearbeitung ist möglich.
DK120	6	1,3	1620	K15-K20	Insbesondere für den Einsatz mit Diamantbeschichtung ist diese Sorte geeignet.
DK120UF	7	0,7	1850	K05-K10	Feinkornsorte mit höchster Verschleißfestigkeit, geeignet für absolut stabile Maschinen, bevorzugt für Reibahlen
K55SF	9	0,2-0,4	1920	K05-K10	Für den Einsatz bei hochverschleißfesten Materialien, rostfreien Stählen, Verbundwerkstoffen wie Kevlar und GFK, Hochgeschwindigkeits- und Trockenbearbeitung
DK400N	10	0,7	1580	K20-K40	Hochzähe Sorte für die Bearbeitung hochtemperaturfester Metalle
DK256EH	10	0,6	1750	K20	Diese Sorte ist insbesondere für die Bearbeitung von Nickelbasislegierungen geeignet.
K6UF	6	0,6	1870	K05-K10	Ultrafeinkornsorte mit höchster Verschleißfestigkeit. Besonders geeignet zur Bearbeitung von hochverschleißfesten Materialien, Verbundwerkstoffe, CFK und Kevlar.
K5UF	5	0,5	2010	K05-K10	Neuentwickelte hochharte Sorte zum Bohren und Reiben. Besonders geeignet zur Bearbeitung von Verbundwerkstoffen und CFK.



### Blanke Oberfläche



Speziell für die Bearbeitung von Aluminiumguss- als auch auch Aluminiumknetlegierungen mit moderatem Siliziumgehalt, liefern unbeschichtete Bohrer sehr gute Zerspanungsleistungen. Um dem hier dominanten Adhäsionsverschleiß (Aufbauschnittenbildung) zu begegnen, sind diese Werkzeuge durch eine spezielle Geometrie, in Verbindung mit hohen Oberflächengüten im Bereich der Ausspitzung, Nut und Freiflächen, bestens an dieses Einsatzfeld angepasst.

### Dampfbehandelte/nitrierte Oberfläche



Dampfbehandelte Oberflächen zeigen durch gezielte Oxidation des Randbereiches (ca. 3 bis 10  $\mu\text{m}$ ) einen verbesserten Korrosionsschutz der Stahloberfläche sowie ein verbessertes tribologisches Verhalten der Werkzeuge. Für abrasivere Anwendungen empfiehlt sich eine Nitrierung der Oberfläche, wodurch die Randhärte der Oberfläche erhöht und damit die Verschleißbeständigkeit des Werkzeugs verbessert wird.

### TiN-Beschichtung



Max. Anwendungstemperatur: < 600°C  
Farbe: goldgelb  
Aufbau: einlagig  
Härte: 2300 HV0,05

Die schon Anfang der 1980er Jahre durch Hartner eingeführte TiN-Beschichtung findet beim Bohren als kostengünstige Breitbandschicht auf HSS wie auch auf Hartmetall Anwendung.

### FIRE/nanoFIRE-Beschichtung



Max. Anwendungstemperatur: < 800°C  
Farbe: violett  
Aufbau: mehrlagig  
Härte: 3300 HV0,05

Die Beschichtungen FIRE und nanoFIRE enthalten neben Titan und Stickstoff auch Aluminium. Diese Schichten wurden bereits Ende der 1990er Jahren eingeführt und stellen eine Weiterentwicklung der TiN-Schichten da. Sie zeichnen sich durch eine höhere Härte sowie eine gute thermochemische Beständigkeit aus und sind sowohl für HSS- als auch für Hartmetall geeignet.



### TiAlZrN-Beschichtung



Max. Anwendungstemperatur: < 800°C  
Farbe: blassgold  
Aufbau: mehrlagig  
Härte: 3300 HV0,05

Die TiN/ TiAlN-Mehrlagenstruktur der TiAlZrN ist verantwortlich für die gute Performance bei der Bearbeitung von Stählen. Durch eine zusätzliche reibungsmindernde Deckschicht, die auf Zirkon basiert, konnte die Leistungsfähigkeit nun auch für adhäsiv wirkende Stähle (z.B. ferritische, austenitische und Duplex-Stähle) weiter ausgebaut werden.

### TiAlN-Beschichtung



Max. Anwendungstemperatur: < 800°C  
Farbe: violett  
Aufbau: einlagig  
Härte: 3300 HV0,05

Die TiAlN-Beschichtung zeigt ähnliche Eigenschaften wie FIRE und nanoFIRE und findet mit ihrem einlagigen Aufbau meist Anwendung im Bereich der Kleinstbohrer.

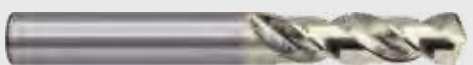
### AlTiN nano-Beschichtung



Max. Anwendungstemperatur: < 900°C  
Farbe: blauviolett  
Aufbau: mehrlagig, nanostrukturiert  
Härte: 3300 HV0,05

Die ebenfalls auf TiAlN basierende AlTiN nano hat sich besonders in der Bearbeitung rostfreier Stähle bewährt, findet aber teilweise auch Anwendung beim Bohren von Guss, Titan-, Nickelbasis- und Kobalt-Chrom-Legierungen. Durch ihren nanolagigen Aufbau wird das Risswachstum hinausgezögert. Des Weiteren verfügt sie aufgrund der angepassten Zusammensetzung über eine höhere thermochemische Beständigkeit als beispielsweise TiAlN.Siliziumgehalten.

### AlTiZrN-Beschichtung



Max. Anwendungstemperatur: < 900°C  
Farbe: blassgold  
Aufbau: mehrlagig, nanostrukturiert  
Härte: 3400 HV0,05

Die im Wesentlichen auf AlTiN basierende AlTiZrN eignet sich insbesondere für die Bearbeitung rostfreier Stähle. Durch den nanostrukturierenden Aufbau zeigt Sie eine gute Härte und Zähigkeit. Die zirkonhaltige Deckschicht soll chemische Reaktionen mit dem Werkstoff weitgehend unterbinden und damit den Spanfluss fördern.



# HARTNER

## Beschichtungen und Oberflächenbehandlung

### TiAlSiN-Beschichtung



Max. Anwendungstemperatur: < 800°C  
Farbe: bronze  
Aufbau: mehrlagiges Nanokomposit  
Härte: 5500 HV0,05

Die TiAlSiN zählt zur Gruppe der sogenannten Nanokomposite. Die Mikrostruktur zeichnet sich durch extrem feine TiAlN-Nanokristalle aus, die in eine glasartige, hochtemperaturfeste Siliziumnitridmatrix eingebettet sind. Daraus resultiert eine hohe Härte, die die TiAlSiN besonders für gehärtete Stähle und Gusswerkstoffe zur ersten Wahl macht.

### TiSiN-Beschichtung



Max. Anwendungstemperatur: < 800°C  
Farbe: kupfer  
Aufbau: mehrlagiges Nanokomposit  
Härte: 4000 HV0,05

Die TiSiN, ebenfalls eine Schicht aus der Familie der Nanokomposite, wurde durch Anpassung des Schichtaufbaus gezielt auf die Zerspanung von Kohlenstoff-, Automaten- und Mangan-legierter Stähle ausgelegt.

### ZrN-Beschichtung



Max. Anwendungstemperatur: < 700°C  
Farbe: blassgold  
Aufbau: mehrlagig, nanostrukturiert  
Härte: 2500 HV0,05

Die nanostrukturierte ZrN wurde gezielt für die Zerspanung von Titanlegierungen optimiert. Der spezielle Aufbau als auch die Zusammensetzung, tragen zur signifikanten Verringerung des tribochemischen Verschleißes bei und machen sie deshalb zum echten Spezialisten. Parallel liefert sie auch gute Ergebnisse beim Bohren von Aluminiumgusslegierungen mit moderaten Siliziumgehalten.

### CrN-Beschichtung



Max. Anwendungstemperatur: < 1000°C  
Farbe: metallisch grau  
Aufbau: mehrlagig  
Härte: 3500 HV0,05

Die auf Titan, Aluminium und Chrom basierende CrN ist spezialisiert auf die Zerspanung von Nichteisenmetallen, wie z.B. Kupferlegierungen sowie Bronze und Messing.



### DLC-Beschichtung



Max. Anwendungstemperatur: < 500°C  
Farbe: grau-schwarz  
Aufbau: einlagig  
Härte: 5000 HV0,05

Die DLC zählt zur Gruppe der DLC-Schichten (DLC – diamond-like carbon). Diese Kohlenstoffschichten besitzen diamantähnliche Eigenschaften. Die DLC zeigt aufgrund ihrer Zusammensetzung, nämlich 100 % Kohlenstoff, und Struktur (ta-C) eine sehr hohe Härte. Dadurch erklärt sich die herausragende Performance beim Bohren von Nichteisenmetallen wie z.B. Aluminiumknet- und Aluminiumgusslegierungen (< 12% Si), Kupfer, Messing und Bronze. Zusätzlich ist sie auch in unverstärkten Kunststoffen und Holz ein zuverlässiger Partner.

### Diamant-Beschichtung



Max. Anwendungstemperatur: < 600°C  
Farbe: grauschwarz  
Aufbau: einlagig  
Härte: 8000 HV0,05

Die Diamant, als reine kristalline Diamantschicht, steht dem natürlich vorkommenden Diamanten in nichts nach. Neben vielen interessanten physikalischen Eigenschaften besticht sie durch ihre außerordentliche Härte. Dadurch eignet sich die mikrokristalline Diamant ausgezeichnet für die Zerspanung hochabrasiver Werkstoffe wie z.B. faserverstärkten Kunststoffen, Keramik, Graphit und Aluminiumgusslegierungen mit hohen Siliziumanteilen (>12 %). Applizierbar ist diese Schicht aufgrund verfahrenstechnischer Gründe ausschließlich auf speziellen Hartmetallsorten.





## Anwendungsempfehlungen der Hartner-Schichten

	Bohren		
	Hartmetall		HSS
	konventionell	MQL	
<b>C-Stähle, Automatenstähle, Mn-Stähle</b>	TiSiN	TiSiN	Fire
	TiAlZrN	TiAlZrN	-
	Fire	Fire	-
<b>Stahl, niedrig legiert</b>	Fire	Fire	Fire
	TiSiN	TiSiN	TiN
	TiAlZrN	TiAlZrN	
<b>Stahl, legiert</b>	Fire	Fire	Fire
	TiAlSiN	TiAlSiN	TiN
	AlTiN nano	AlTiN nano	
<b>Stahl, gehärtet &lt;55 HRC</b>	TiAlSiN	TiAlSiN	-
	Fire	Fire	-
	TiAlN	TiAlN	-
<b>Stahl, gehärtet 55-65 HRC</b>	TiAlSiN	TiAlSiN	-
	Fire	Fire	-
	TiAlN	TiAlN	-
<b>Stahl, rost- und säurebeständig</b>	AlTiN nano	AlTiN nano	AlTiZrN
	AlTiZrN	AlTiZrN	Fire
	TiSiN	TiSiN	TiN
<b>Gusseisen</b>	TiAlSiN	TiAlSiN	Fire
	Fire	Fire	-
	AlTiN nano	AlTiN nano	-
<b>Aluminiumknetlegierung</b>	blank	blank	blank
	DLC	DLC	DLC
	Diamant	Diamant	-
<b>Aluminiumgusslegierung (&lt; 12% Silizium)</b>	blank	blank	blank
	ZrN	ZrN	ZrN
	DLC	DLC	DLC
<b>Aluminiumgusslegierung (≥ 12% Silizium)</b>	Diamant	Diamant	-
	-	-	-
	-	-	-
<b>Nickelbasislegierungen (z.B. Inconel)</b>	AlTiN nano	AlTiN nano	Fire
	TiAlSiN	TiAlSiN	-
	Fire	Fire	-
<b>Titan/Titanlegierungen</b>	ZrN	ZrN	Fire
	AlTiN nano	AlTiN nano	-
<b>Kupfer/Bronze/Messing</b>	CrN	CrN	TiN
	DLC	DLC	-
<b>Kobalt-Chrom Legierungen</b>	AlTiN nano	AlTiN nano	-
	TiAlSiN	TiAlSiN	-
	Fire	Fire	-
<b>Edelmetalle</b>	AlTiN nano	AlTiN nano	-
<b>Keramik</b>	Diamant	Diamant	-
<b>Kunststoffe, unverstärkt</b>	DLC	-	-
<b>Kunststoffe, faserverstärkt</b>	Diamant	Diamant	-
	TiAlSiN	TiAlSiN	-

**Hinweis:**

Die Übersicht zeigt die allgemeinen Anwendungsempfehlungen der Hartner-Schichten.  
Die Priorisierung erfolgt in der jeweiligen Zelle von oben nach unten.



# HARTNER

## Anwendung der Hartner-Schichten

		BOHREN			FRÄSEN		
		HARTMETALL		HSS	HARTMETALL		HSS
		konv.	MQL		konv.	MQL	
<b>C-Stähle, Automatenstähle, Mn-Stähle</b>		TiSiN TiAlZrN Fire	TiSiN TiAlZrN Fire	Fire - -	TiSiN Fire TiAlZrN	Fire TiSiN TiAlZrN	Fire - -
<b>Stahl, niedrig legiert</b>		Fire TiSiN TiAlZrN	Fire TiSiN TiAlZrN	Fire TiN -	Fire TiAlSiN AlTiN nano	Fire TiAlSiN AlTiN nano	Fire TiCN -
<b>Stahl, legiert</b>		Fire TiAlSiN AlTiN nano	Fire TiAlSiN AlTiN nano	Fire TiN -	Fire AlTiN nano TiAlSiN	Fire AlTiN nano TiAlSiN	Fire TiCN -
<b>Stahl, gehärtet, &lt;55 HRC</b>		TiAlSiN Fire TiAlN	TiAlSiN Fire TiAlN	- - -	TiAlSiN AlTiN nano TiAlN	TiAlSiN AlTiN nano TiAlN	- - -
<b>Stahl, gehärtet, 55 – 65 HRC</b>		TiAlSiN Fire TiAlN	TiAlSiN Fire TiAlN	- - -	TiAlSiN SuperA AlTiN nano	TiAlSiN SuperA AlTiN nano	- - -
<b>Stahl, rost- und säurebeständig</b>		AlTiN nano AlTiZrN TiSiN	AlTiN nano AlTiZrN TiSiN	AlTiZrN Fire TiN	AlTiN nano AlTiZrN Fire	AlTiN nano AlTiZrN Fire	Fire - -
<b>Gusseisen</b>		TiAlSiN Fire AlTiN nano	TiAlSiN Fire AlTiN nano	Fire - -	TiAlSiN Fire AlTiN nano	TiAlSiN Fire AlTiN nano	Fire TiCN -
<b>Nickelbasislegierungen (z.B. Inconel)</b>		AlTiN nano TiAlSiN Fire	AlTiN nano TiAlSiN Fire	Fire - -	AlTiN nano TiAlSiN ZrN	AlTiN nano TiAlSiN -	Fire - -
<b>Titan/Titanlegierungen</b>		ZrN AlTiN nano	ZrN AlTiN nano	Fire -	ZrN SuperA	ZrN SuperA	Fire -
<b>Kobalt-Chrom-Legierungen</b>		AlTiN nano TiAlSiN Fire	AlTiN nano TiAlSiN Fire	- - -	AlTiN nano TiAlSiN Fire	AlTiN nano TiAlSiN Fire	- - -
<b>Edelmetalle</b>		AlTiN nano	AlTiN nano	-	AlTiN nano	AlTiN nano	-
<b>Aluminiumknetlegierungen</b>		blank DLC Diamant	blank DLC Diamant	blank DLC -	blank DLC ZrN	blank DLC ZrN	blank DLC -
<b>Aluminiumgusslegierungen (&lt; 12% Silizium)</b>		blank ZrN DLC	blank ZrN DLC	blank ZrN DLC	ZrN DLC Diamant	ZrN DLC Diamant	blank DLC -
<b>Aluminiumgusslegierungen (≥ 12% Silizium)</b>		Diamant - -	Diamant - -	- - -	Diamant - -	Diamant - -	- - -
<b>Kupfer/Bronze/Messing</b>		CrN DLC	CrN DLC	TiN -	CrN DLC	CrN DLC	TiN -
<b>Keramik</b>		Diamant	Diamant	-	Diamant	Diamant	-
<b>Kunststoffe, unverstärkt</b>		DLC	-	-	DLC	-	-
<b>Kunststoffe, faserverstärkt</b>		Diamant TiAlSiN	Diamant TiAlSiN	- -	Diamant TiAlSiN	Diamant TiAlSiN	- -
<b>Graphit</b>		-	Diamant	-	-	Diamant	-

**Hinweis:** Die Übersicht zeigt die allgemeinen Anwendungsempfehlungen der Hartner-Schichten.  
Die Priorisierung erfolgt jeweils von oben nach unten.



# HARTNER

## Anwendung der Hartner-Schichten

GEWINDEBOHREN			GEWINDEFRÄSEN		GEWINDEFORMEN			REIBEN			
HARTMETALL	HSS		HARTMETALL		HARTMETALL	HSS		HARTMETALL	HSS		
konv.	MQL		konv.	MQL	konv.	MQL		konv.	MQL		
-	-	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiSiN	TiSiN	TiN
-	-	TiAlN	-	-	-	-	-	-	AlTiN nano	AlTiN nano	-
-	-	TiN	-	-	-	-	-	-	-	-	-
-	-	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	AlTiN nano	AlTiN nano	TiN
-	-	TiAlN	-	-	-	-	-	-	TiSiN	TiSiN	-
-	-	TiN	-	-	-	-	-	-	-	-	-
-	-	TiCN	TiAlN	TiAlN	-	-	-	-	AlTiN nano	AlTiN nano	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
TiCN	-	-	TiAlN	TiAlN	-	-	-	-	TiAlSiN	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	AlTiZrN <sup>1</sup> /TiAlN <sup>2</sup>	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	AlTiN nano	AlTiN nano	TiN
-	-	TiN	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
TiAlN	TiAlN	TiAlN	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiAlSiN	TiAlSiN	TiN
TiCN	-	TiCN	-	-	-	-	-	-	-	-	-
-	-	TiN	-	-	-	-	-	-	-	-	-
-	-	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	AlTiN nano	-	TiN
-	-	TiAlN	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	ZrN	-	TiN
-	-	TiAlN	-	-	-	-	-	-	AlTiN nano	-	-
blank	-	blank	TiCN	TiCN	-	-	-	-	AlTiN nano	-	TiN
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	AlTiN nano	AlTiN nano	TiN
blank	blank	blank	blank	blank	DLC	DLC	DLC	DLC	DLC	-	-
DLC	DLC	DLC	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	TiCN	DLC	DLC	-
DLC	DLC	DLC	blank	blank	DLC	DLC	DLC	DLC	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
TiCN	TiCN	TiCN	TiCN	TiCN	-	-	-	-	-	-	-
Diamant	-	-	Diamant	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
blank	blank	blank	blank	-	DLC	DLC	DLC	DLC	blank	-	-
DLC	DLC	DLC	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
blank	-	blank	blank	blank	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
TiCN	TiCN	-	TiCN	TiCN	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

<sup>1</sup> bei Durchgangsloch, <sup>2</sup> bei Sackloch

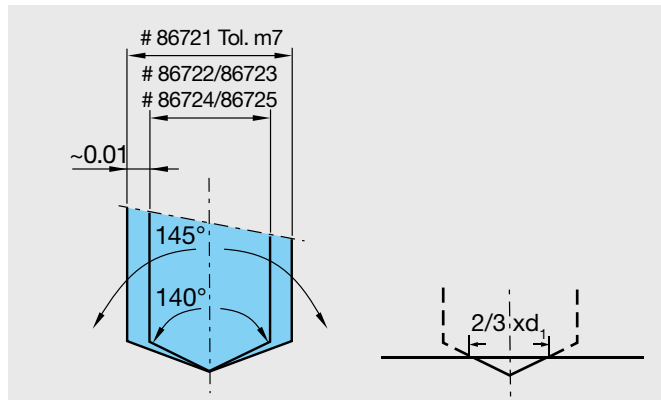


### Anzentrieren und Pilotieren bei Multiplex HPC-Bohrsystemen

Generell empfehlen wir für die Multiplex HPC-Bohrsysteme bei Bohrtiefen größer  $5xD$  zu zentrieren bzw. zu pilotieren.

Beim reinen Anzentrieren sollte der Anbohrdurchmesser etwa  $2/3$  des zu erstellenden Bohrungsdurchmessers betragen. Beim Pilotieren empfehlen wir eine Bohrtiefe von  $1xD$ . Außerdem sollten der Spitzenwinkel sowie der Durchmesser des Pilotierwerkzeugs größer sein als der Spitzenwinkel und Durchmesser des nachfolgenden Bohrers.

Um dies sicherzustellen empfehlen wir den Einsatz der dafür optimal abgestimmten Pilotierplatten Art.-Nr. 86721 mit  $145^\circ$  Spitzenwinkel und  $m7$  Durchmesser-toleranz im extra kurzen, steifen Halter Art.-Nr. 86681.



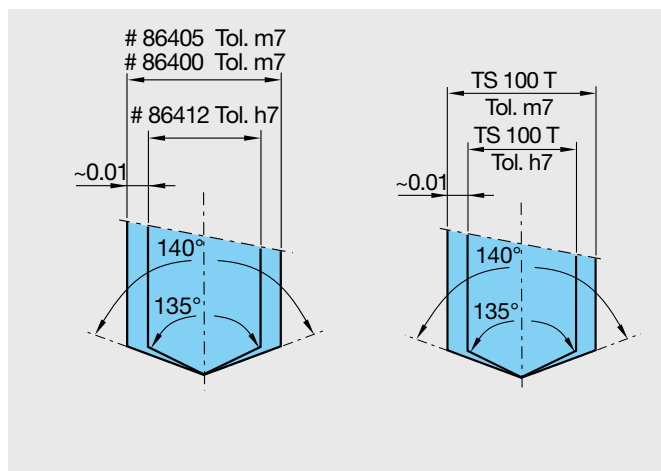
### Anzentrieren und Pilotieren bei VHM-Bohrwerkzeugen

Beim Einsatz von VHM-Bohrern für Bohrtiefen von  $7xD$  bis  $12xD$  empfehlen wir das Anzentrieren oder die Herstellung einer Pilotbohrung mit  $1xD$  bis  $2xD$  Tiefe.

Bei Bohrtiefen größer  $12xD$  ist eine Pilotbohrung mit  $1xD$  bis  $2xD$  Tiefe zwingend erforderlich.

Zum Pilotieren der Kleinbohrer mit  $15xD$  (Artikel-Nr. 86412) empfehlen wir die Verwendung der Kleinbohrer  $4xD$  ohne Innenkühlung (Artikel-Nr. 86400) oder  $5xD$  mit Innenkühlung (Artikel-Nr. 86405), da sie bezüglich Spitzenwinkel sowie Durchmesser-toleranz optimal dafür ausgelegt sind.

Zum Pilotieren der spiralisierten Tieflochbohrer TS 100 T kann z.B. der TS-Drills TS 100 U mit Innenkühlung,  $3xD$  (Artikel-Nr. 86410) verwendet werden, da er bezüglich Spitzenwinkel sowie Durchmesser-toleranz optimal dafür geeignet ist.



### Anzentrieren und Pilotieren bei HSS-Bohrwerkzeugen

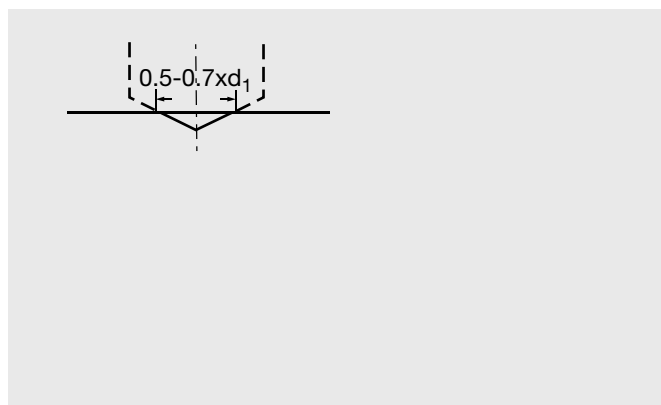
#### Anzentrieren bei Bohrerlängen nach DIN 340

Beim Einsatz der HSS/HSS-E-Bohrer nach DIN 340 empfehlen wir das Anzentrieren mit einem Anbohrdurchmesser von  $0,5-0,7$ -mal des Bohrer-durchmessers. Die HSS/HSS-E-NC-Anbohrer sind optimal für diese Zentrierbohrung geeignet. Detaillierte Angaben zu den NC-Anbohrern finden Sie im Abschnitt NC-Anbohrer.

#### Pilotieren bei Bohrerlängen nach DIN 1869

Beim Einsatz der überlangen und extra langen HSS/HSS-E-Bohrer nach DIN 1869 empfehlen wir die Herstellung einer Pilotbohrung mit  $1xD$  bis  $2xD$  Tiefe.

Die extra kurzen Bohrer, Typ V, nach DIN 1897 sind hierfür optimal geeignet.



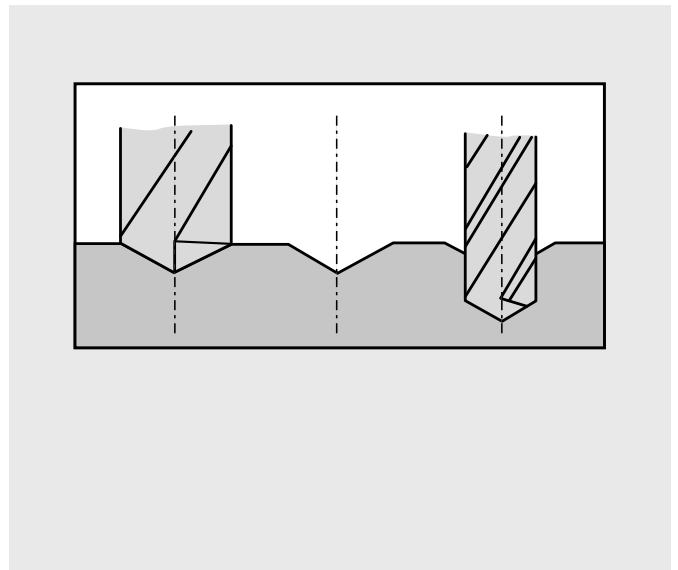


### NC-Anbohrer

Für die Herstellung besonders positionsgenauer Bohrungen, Bohrungen mit engen Durchmesser-toleranzen, Tieflochbohrungen oder allgemein bei ungünstigen Werkstückformen (rund, rau) empfiehlt es sich, vor dem eigentlichen Bohrprozess mit einem NC-Anbohrer anzubohren. Das gewährleistet, dass der nachfolgende Bohrer positionsgenau bohrt, ein eventuelles Verlaufen des Bohrers wird vermieden.

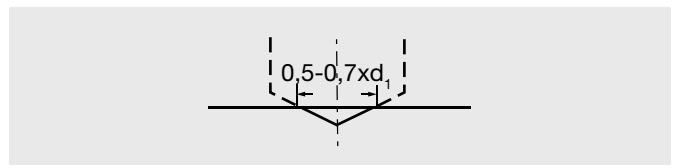
Auch zum Herstellen von Fasen bzw. Senkungen und der Zentrierung in einem Arbeitsgang können NC-Anbohrer verwendet werden, wenn der Anbohrdurchmesser des NC-Anbohrers größer als der eigentliche Bohrungsdurchmesser gewählt wird.

NC-Anbohrer sind mit einer sehr kurzen Spann-länge und ohne Führungsfasenhinterschliff ausgeführt, um eine sehr stabile Ausführung und damit ein sehr positionsgenau-tes Anbohren zu gewährleisten. Durch diese Ausführung eignen sich NC-Anbohrer ausschließlich zum Anbohren und nicht für die Herstellung von Bohrtiefen, die größer als die Länge des Spitzenanschliffes sind.



### Auswahl des NC-Anbohrers

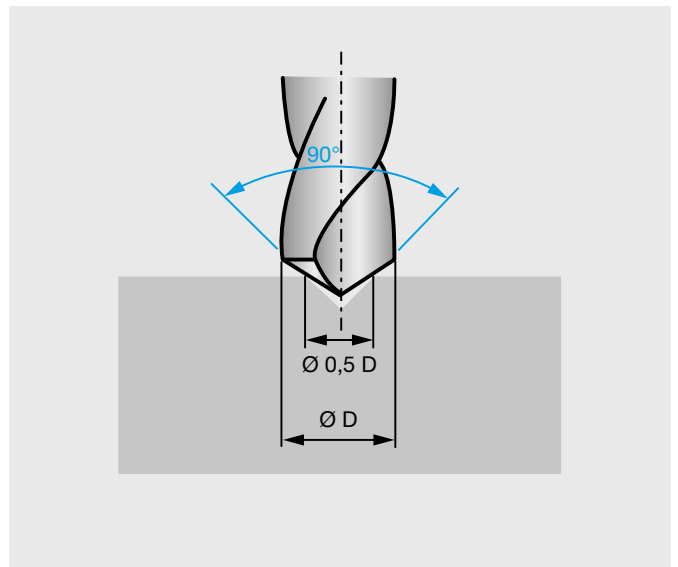
Idealerweise sollte der Anbohrdurchmesser 0,5-0,7 mal Bohrerdurchmesser gewählt werden.



### 90°-NC-Anbohrer

NC-Anbohrer mit 90°-Spitzenwinkel sind speziell zum Anbohren geeignet, wenn anschließend die eigentlichen Bohrungen mit HSS-/HSS-E-Bohrern, die eine relativ große Querschneide haben, erzeugt werden. Dadurch wird gewährleistet, dass der nachfolgende HSS-/HSS-E-Bohrer zuerst mit den Hauptschneiden bohrt und an den stabilsten Stellen der Schneidkanten geführt wird.

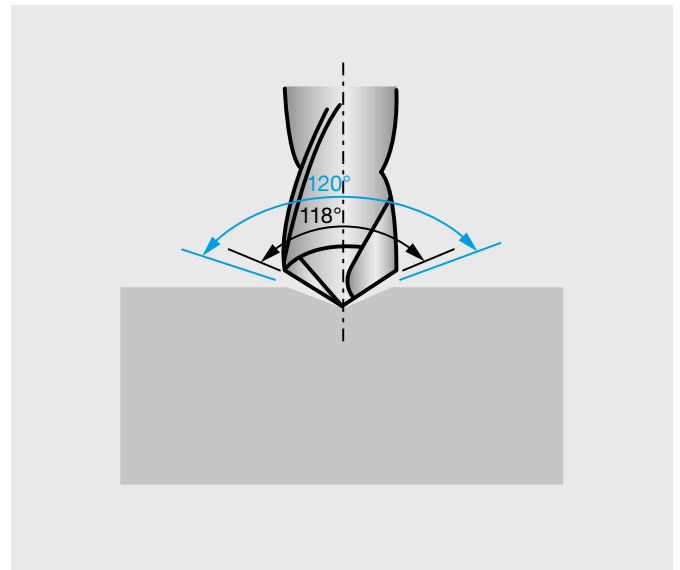
Außerdem sind NC-Anbohrer mit 90°-Spitzenwinkel zur Herstellung der Zentrierung und einer 90°-Senkung in einem Arbeitsgang geeignet, wenn der Anbohrdurchmesser des NC-Anbohrers größer als der eigentliche Bohrungsdurchmesser gewählt wird.





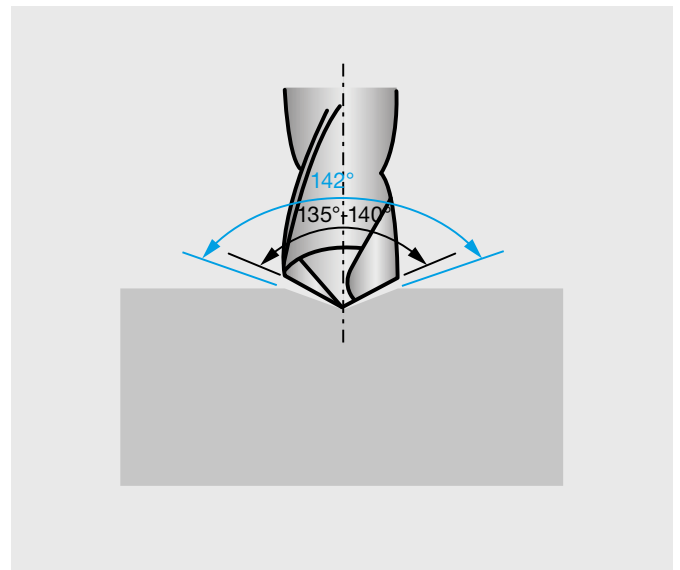
### 120°-NC-Anbohrer

NC-Anbohrer mit 120°-Spitzenwinkel sind speziell zum Anbohren geeignet, wenn die eigentliche Bohrung anschließend mit HSS-/HSS-E-Bohrern mit 118°-Spitzenwinkel erzeugt wird. Dadurch wird gewährleistet, dass der nachfolgende HSS-/HSS-E-Bohrer zuerst mit der Spitze anbohrt und satt geführt wird.



### 142°-NC-Anbohrer

NC-Anbohrer mit 142°-Spitzenwinkel sind speziell zum Anbohren geeignet, wenn anschließend die eigentliche Bohrung mit Hartmetallbohrern mit 135°-140°-Spitzenwinkel erzeugt wird. Dadurch wird gewährleistet, dass der nachfolgende Hartmetallbohrer zuerst mit der Spitze anbohrt, zentriert und geführt wird. Treffen die Schneidecken des Hartmetallbohrers vor der Spitze auf dem zu bearbeitenden Werkstoff auf, besteht bei Hartmetallbohrern die Gefahr von Schneid-eckenausbrüchen.



### NC-Anbohrer

90°



120°



142°





## Umrechnungstafel inch-Millimeter von 1/64 bis 11 63/64

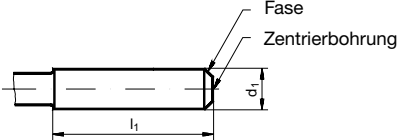
Größe (Inch)	mm	Teile des Inch (Dezimal)	Größe (Inch)	mm	Teile des Inch (Dezimal)	Größe (Inch)	mm	Teile des Inch (Dezimal)	Größe (Inch)	mm	Teile des Inch (Dezimal)
-	0,10	0,0039	51	1,70	0,0670	4	5,31	0,2090	-	14,00	0,5512
97	0,15	0,0059		1,75	0,0689	3	5,41	0,213	9/16	14,29	0,5625
96	0,16	0,0063	50	1,78	0,0700		5,50	0,2165		14,50	0,5709
95	0,17	0,0067		1,80	0,0709	7/32	5,56	0,2188	37/64	14,68	0,5781
94	0,18	0,0071	49	1,85	0,0730	2	5,61	0,221	-	15,00	0,5906
93	0,19	0,0075		1,90	0,0748	1	5,79	0,228	19/32	15,08	0,5938
92	0,20	0,0079	48	1,93	0,0760	A	5,94	0,234	39/64	15,48	0,6094
91	0,21	0,0083		1,95	0,0768	15/64	5,95	0,2344		15,50	0,6102
90	0,22	0,0087	5/64	1,98	0,0781	-	6,00	0,2362	5/8	15,88	0,625
89	0,23	0,0091	47	1,99	0,0785	B	6,05	0,238	-	16,00	0,6299
88	0,24	0,0095	-	2,00	0,0787	C	6,15	0,242	41/64	16,27	0,6406
-	0,25	0,0098		2,05	0,0807	D	6,25	0,246		16,50	0,6496
87	0,25	0,0100	46	2,06	0,0810	1/4	6,35	0,25	21/32	16,67	0,6562
	0,26	0,0102	45	2,08	0,0820	E	6,35	0,25	-	17,00	0,6693
86	0,27	0,0105		2,15	0,0846		6,50	0,2559	43/64	17,07	0,6719
	0,27	0,0106	44	2,18	0,0860	F	6,53	0,257	11/16	17,46	0,6875
85	0,28	0,0110	43	2,26	0,0890	G	6,63	0,261		17,50	0,689
	0,29	0,0114	42	2,37	0,0935	17/64	6,75	0,2656	45/64	17,86	0,7031
84	0,29	0,0115	3/32	2,38	0,0938		6,75	0,2657	-	18,00	0,7087
-	0,30	0,0118	41	2,44	0,0960	H	6,76	0,266	23/32	18,26	0,7188
83	0,30	0,0120	40	2,50	0,0980	I	6,91	0,272		18,50	0,7283
82	0,32	0,0125	39	2,53	0,0995	-	7,00	0,2756	47/64	18,65	0,7344
	0,32	0,0126	38	2,58	0,1015	J	7,04	0,2772	-	19,00	0,748
81	0,33	0,0130	37	2,64	0,1040	K	7,14	0,281	3/4	19,05	0,75
80	0,34	0,0135	36	2,71	0,1065	9/32	7,14	0,2812	49/64	19,45	0,7656
79	0,37	0,0145	7/64	2,78	0,1094	L	7,37	0,29		19,50	0,7677
1/64	0,40	0,0156	35	2,79	0,11	M	7,49	0,2949	25/32	19,84	0,7812
78	0,41	0,0160	34	2,82	0,111		7,50	0,2953	-	20,00	0,7874
77	0,46	0,0180	33	2,87	0,113	19/64	7,54	0,2969	51/64	20,24	0,7969
-	0,50	0,0197		2,90	0,1142	N	7,67	0,3020		20,50	0,8071
76	0,51	0,0200	32	2,95	0,116		7,75	0,3051	13/16	20,64	0,8125
75	0,53	0,0210	-	3,00	0,1181	5/16	7,94	0,3125	-	21,00	0,8268
74	0,57	0,0225	31	3,05	0,12	-	8,00	0,315	53/64	21,03	0,8281
-	0,60	0,0236	1/8	3,18	0,125	O	8,03	0,316	27/32	21,43	0,8438
73	0,61	0,0240	30	3,26	0,1285	P	8,20	0,323		21,50	0,8465
72	0,64	0,0250		3,30	0,1299	21/64	8,33	0,3281	55/64	21,84	0,8594
71	0,66	0,0260	29	3,45	0,136	Q	8,43	0,332	-	22,00	0,8661
-	0,70	0,0276		3,50	0,1378		8,50	0,3346	7/8	22,23	0,875
70	0,71	0,0280	28	3,57	0,1405	R	8,61	0,339		22,50	0,8858
69	0,74	0,0292	9/64	3,57	0,1406	11/32	8,73	0,3438	57/64	22,62	0,8906
-	0,75	0,0295	27	3,66	0,144		8,75	0,3445	-	23,00	0,9055
68	0,79	0,0310	26	3,73	0,147	S	8,84	0,348	29/32	23,02	0,9062
1/32	0,79	0,0313		3,75	0,1476	-	9,00	0,3543	59/64	23,42	0,9219
-	0,80	0,0315	25	3,80	0,1495	T	9,09	0,358		23,50	0,9252
67	0,81	0,0320	24	3,86	0,152	23/64	9,13	0,3594	15/16	23,81	0,9375
66	0,84	0,0330	23	3,91	0,154	U	9,35	0,368	-	24,00	0,9449
65	0,89	0,0350	5/32	3,97	0,1562		9,50	0,374	61/64	24,21	0,9531
-	0,90	0,0354	22	3,99	0,157	3/8	9,53	0,375		24,50	0,9646
64	0,91	0,0360	-	4,00	0,1575	V	9,56	0,377	31/32	24,61	0,9688
63	0,94	0,0370	21	4,04	0,159	W	9,80	0,386	-	25,00	0,9843
62	0,97	0,0380	20	4,09	0,161	25/64	9,92	0,3906	63/64	25,00	0,9844
61	0,99	0,0390		4,20	0,1654	-	10,00	0,3937	1	25,40	1,00
-	1,00	0,0394	19	4,22	0,166	X	10,08	0,397			
60	1,02	0,0400	18	4,31	0,1695	Y	10,26	0,4040			
59	1,04	0,0410	11/64	4,37	0,1719	13/32	10,32	0,4062			
58	1,07	0,0420	17	4,39	0,173	Z	10,49	0,413			
57	1,09	0,0430	16	4,50	0,177		10,50	0,4134			
56	1,18	0,0465	15	4,57	0,18	27/64	10,72	0,4219			
3/64	1,19	0,0469	14	4,62	0,182	-	11,00	0,4331			
	1,20	0,0472	13	4,70	0,185	7/16	11,11	0,4375			
	1,25	0,0492	3/16	4,76	0,1875		11,50	0,4528			
	1,30	0,0512	12	4,80	0,189	29/64	11,51	0,4531			
55	1,32	0,0520	11	4,85	0,191	15/32	11,91	0,4688			
54	1,40	0,0550	10	4,91	0,1935	-	12,00	0,4724			
	1,45	0,0571	9	4,98	0,196	31/64	12,30	0,4844			
	1,50	0,0591	-	5,00	0,1968		12,50	0,4921			
53	1,51	0,0595	8	5,05	0,199	1/2	12,70	0,50			
	1,55	0,0610	7	5,11	0,2010	-	13,00	0,5118			
1/16	1,59	0,0625	13/64	5,16	0,2031	33/64	13,10	0,5156			
	1,60	0,0630	6	5,18	0,2040	17/32	13,49	0,5312			
52	1,61	0,0635	5	5,22	0,2055		13,50	0,5315			
	1,65	0,0650		5,25	0,2067	35/64	13,89	0,5469			

1 inch = 25,400 mm, siehe DIN 4890 (Ausgabe 2/75)

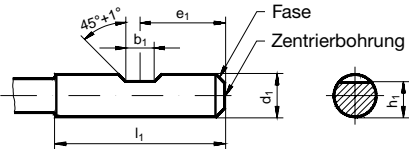
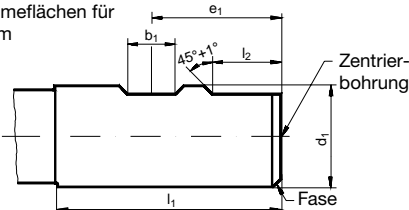


## Maße für Zylinderschäfte aus Schnellstahl nach DIN 1835 (Auszug)

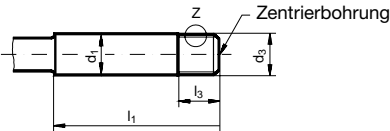
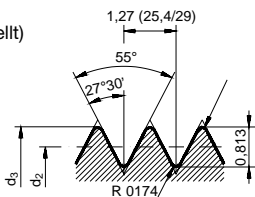
### Form A, glatt

Maße in mm	d <sub>1</sub>	l <sub>1</sub>	d <sub>1</sub>	l <sub>1</sub>	d <sub>1</sub>	l <sub>1</sub>
	h8	+2 0	h8	+2 0	h8	+2 0
	3	28	10	40	32	60
	4	28	12	45	40	70
	5	28	16	48	50	80
	6	36	20	50	63	90
	8	36	25	56		

### Form B, mit seitlicher Mitnahmefläche

Maße in mm	d <sub>1</sub>	b <sub>1</sub>	e <sub>1</sub>	h <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>	Zentrierbohrung Form R DIN 332 Teil 1
	h6	+0,05 0	0 -1	h13	+2 0	+1 0	
mit <b>einer</b> Mitnahmefläche für d <sub>1</sub> = 6 ... 20 mm  	6	4,2	18	4,8	36	-	1,6x2,5
	8	5,5	18	6,6	36	-	1,6x3,35
	10	7	20	8,4	40	-	1,6x3,35
	12	8	22,5	10,4	45	-	1,6x3,35
	16	10	24	14,2	48	-	2,0x4,25
mit <b>zwei</b> Mitnahmeflächen für d <sub>1</sub> = 25 ... 63 mm  	20	11	25	18,2	50	-	2,5x5,3
	25	12	32	23	56	17	2,5x5,3
	32	14	36	30	60	19	3,15x6,7
	40	14	40	38	70	19	3,15x6,7
	50	18	45	47,8	80	23	3,15x6,7
63	18	50	60,8	90	23	3,15x6,7	

### Form D, mit Anzugsgewinde

Maße in mm	d <sub>1</sub>	d <sub>3</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>3</sub>	Zentrierbohrung Form R DIN 332 Teil 1
	h8	Grenz- abmaße	Grenz- abmaße	+2 0	+2 0	
  <b>Einzelheit Z</b> (im Schnitt dargestellt) Gewindeprofil nach DIN ISO 228 Teil 1  	6	5,9 0 -0,1	5,087 0 -0,1	36	10	1,6 x 2,5
	10	9,9 0 -0,1	9,087 0 -0,1	40	10	1,6 x 3,35
	12	11,9 0 -0,1	11,087 0 -0,1	45	10	1,6 x 3,35
	16	15,9 0 -0,1	15,087 0 -0,1	48	10	2,0 x 4,25
	20	19,9 0 -0,15	19,087 0 -0,15	50	15	2,5 x 5,3
	25	24,9 0 -0,15	24,087 0 -0,15	56	15	2,5 x 5,3
	32	31,9 0 -0,15	31,087 0 -0,15	60	15	3,15 x 6,7





## Maße für Zylinderschäfte aus Hartmetall nach DIN 6535 (Auszug)

### Form HA, glatt

Maße in mm	d <sub>1</sub>	l <sub>1</sub>	d <sub>1</sub>	l <sub>1</sub>	d <sub>1</sub>	l <sub>1</sub>
	h6	+2 0	h6	+2 0	h6	+2 0
	2	28	8	36	18	48
	3	28	10	40	20	50
	4	28	12	45	25	56
	5	28	14	45	32	60
	6	36	16	48		

### Form HB, mit seitlicher Mitnahmefläche

Maße in mm	d <sub>1</sub>	b <sub>1</sub>	e <sub>1</sub>	h <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>
	h6	+0,05 0	0 -1	h11	+2 0	+1 0
<p>mit <b>einer</b> Mitnahmefläche für d<sub>1</sub> = 6 bis 20 mm</p>	6	4,2	18	5,1	36	-
	8	5,5	18	6,9	36	-
	10	7	20	8,5	40	-
	12	8	22,5	10,4	45	-
	14	8	22,5	12,7	45	-
	16	10	24	14,2	48	-
	18	10	24	16,2	48	-
	20	11	25	18,2	50	-
<p>mit <b>zwei</b> Mitnahmeflächen für d<sub>1</sub> = 25 und 32 mm</p>	25	12	32	23	56	17
	32	14	36	30	60	19

### Form HE, mit geneigter Spannfläche ohne Kühlkanäle\*

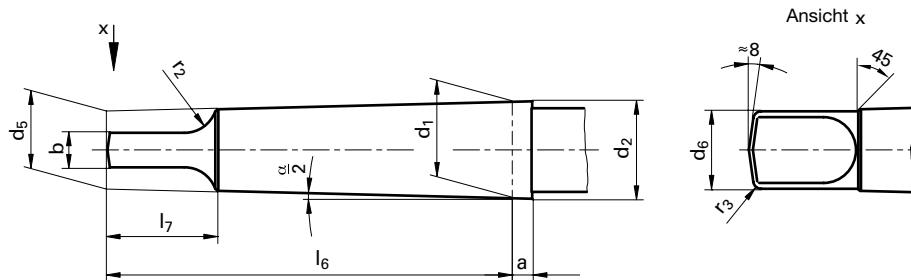
\* Ausführung: Zylinderschäfte nach DIN 6535 werden ohne oder mit Kühlkanälen ausgeführt. Anwendung der Ausführung für unterschiedliche Werkzeuge sowie Maßangaben und Bezeichnung für die Lage der Kühlkanäle sind in den entsprechenden Maßnormen enthalten.

Maße in mm	d <sub>1</sub>	(b <sub>2</sub> )	(b <sub>3</sub> )	h <sub>2</sub>	(h <sub>3</sub> )	l <sub>1</sub>	l <sub>4</sub>	l <sub>5</sub>	r <sub>2</sub>
	h6	≈		h13		+2 0	0 -1	Nenn- maß	min.
<p>für d<sub>1</sub> = 6 bis 20 mm</p>	6	4,3	-	5,1	-	36	25	18	1,2
	8	5,5	-	6,9	-	36	25	18	1,2
	10	7,1	-	8,5	-	40	28	20	1,2
	12	8,2	-	10,4	-	45	33	22,5	1,2
	14	8,1	-	12,7	-	45	33	22,5	1,2
	16	10,1	-	14,2	-	48	36	24	1,6
	18	10,8	-	16,2	-	48	36	24	1,6
	20	11,4	-	18,2	-	50	38	25	1,6
<p>für d<sub>1</sub> = 25 und 32 mm</p>	25	13,6	9,3	23,0	24,1	56	44	32	1,6
	32	15,5	9,9	30,0	31,2	60	48	35	1,6



## Maße für Kegelschäfte DIN 228 Teil 1 (Auszug)

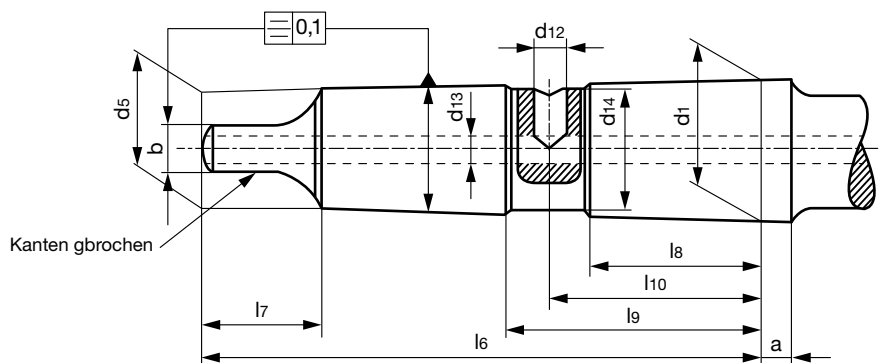
### Form B, Morsekegel mit Austreibblappen



Maße in mm

Schaft nach DIN 228 Form B Größe	a	Grenz- abmaße	b h13	d <sub>1</sub>	d <sub>2</sub> ≈	d <sub>5</sub> ≈	d <sub>6</sub> max.	l <sub>6</sub> 0 -1	l <sub>7</sub> max.	r <sub>2</sub> max.	r <sub>3</sub> ≈	$\frac{\alpha}{2}$
<b>MK 1</b>	3,5	$\begin{smallmatrix} +1,4 \\ 0 \end{smallmatrix}$	5,2	12,065	12,2	9,0	8,7	62	13,5	5	1,2	1°25'43''
<b>MK 2</b>	5,0	$\begin{smallmatrix} +1,4 \\ 0 \end{smallmatrix}$	6,3	17,780	18,0	14,0	13,5	75	16	6	1,6	1°25'50''
<b>MK 3</b>	5,0	$\begin{smallmatrix} +1,7 \\ 0 \end{smallmatrix}$	7,9	23,825	24,1	19,1	18,5	94	20	7	2	1°26'16''
<b>MK 4</b>	6,5	$\begin{smallmatrix} +1,9 \\ 0 \end{smallmatrix}$	11,9	31,267	31,6	25,2	24,5	117,5	24	8	2,5	1°29'15''
<b>MK 5</b>	6,5	$\begin{smallmatrix} +1,9 \\ 0 \end{smallmatrix}$	15,9	44,399	44,7	36,5	35,7	149,5	29	10	3	1°30'26''

### Form BK, Morsekegel mit Austreibblappen und Kühlmittelschmierstoffzuführung



Maße in mm

Schaft nach DIN 228 Form BK Größe	a	Grenz- abmaße	b h13	d <sub>1</sub>	d <sub>5</sub> ≈	d <sub>12</sub>	d <sub>13</sub>	d <sub>14</sub> 0 -0,01	l <sub>6</sub> 0 -1	l <sub>7</sub> max.	l <sub>8</sub>	l <sub>9</sub>	l <sub>10</sub>
<b>MK 1</b>	±0,1	$\begin{smallmatrix} +1,4 \\ 0 \end{smallmatrix}$	5,2	12,065	9,0	-	-	-	62	13,5	-	-	-
<b>MK 2</b>	5	$\begin{smallmatrix} +1,4 \\ 0 \end{smallmatrix}$	6,3	17,780	14,0	4,2	4,2	15,0	75	16	20	34	27
<b>MK 3</b>	5	$\begin{smallmatrix} +1,7 \\ 0 \end{smallmatrix}$	7,9	23,825	19,1	5,0	5,0	21,0	94	20	29	43	36
<b>MK 4</b>	6,5	$\begin{smallmatrix} +1,9 \\ 0 \end{smallmatrix}$	11,9	31,267	25,2	6,8	6,8	28,0	117,5	24	39	55	47
<b>MK 5</b>	6,5	$\begin{smallmatrix} +1,9 \\ 0 \end{smallmatrix}$	15,9	44,399	36,5	8,5	8,5	40,0	149,5	29	51	69	60



## Kernlochdurchmesser für das Gewindeschneiden

Metrische ISO-Regelgewinde DIN 13					Metrische ISO-Feingewinde DIN 13					UNC-Gewinde ASME B1.1									
Nenn- Ø	Steig- ung P	Kern- loch (Bohr-) Ø DIN 336	Kernloch-Ø Muttergewinde 6H*		Nenn- Ø	Steig- ung P	Kern- loch (Bohr-) Ø DIN 336	Kernloch-Ø Muttergewinde 6H		Nenn- Ø	Steig- ung P	Kern- loch (Bohr-) Ø DIN 336	Kernloch-Ø Muttergewinde 6H		Nenn- Ø	Gang pro inch	Kern- loch (Bohr-) Ø DIN 336	Kernloch-Ø Muttergewinde 2B	
			min.	max.				min.	max.				min.	max.				min.	max.
M 1	0,25	<b>0,75</b>	0,729	0,785	M 2,5 x	0,35	<b>2,15</b>	2,121	2,221	M 22 x	1,00	<b>21,00</b>	20,917	21,153	Nr. 1 -	64	<b>1,55</b>	1,425	1,580
M 1,1	0,25	<b>0,85</b>	0,829	0,885	M 3,0 x	0,35	<b>2,65</b>	2,621	2,721	M 22 x	1,50	<b>20,50</b>	20,376	20,676	Nr. 2 -	56	<b>1,85</b>	1,694	1,872
M 1,2	0,25	<b>0,95</b>	0,929	0,985	M 3,5 x	0,35	<b>3,15</b>	3,121	3,221	M 22 x	2,00	<b>20,00</b>	19,835	20,210	Nr. 3 -	48	<b>2,10</b>	1,941	2,146
M 1,4	0,30	<b>1,10</b>	1,075	1,142	M 4,0 x	0,50	<b>3,50</b>	3,459	3,599	M 24 x	1,00	<b>23,00</b>	22,917	23,153	Nr. 4 -	40	<b>2,35</b>	2,157	2,385
M 1,6	0,35	<b>1,25</b>	1,221	1,321	M 4,5 x	0,50	<b>4,00</b>	3,959	4,099	M 24 x	1,50	<b>22,50</b>	22,376	22,676	Nr. 5 -	40	<b>2,65</b>	2,487	2,698
M 1,8	0,35	<b>1,45</b>	1,421	1,521	M 5,0 x	0,50	<b>4,50</b>	4,459	4,599	M 24 x	2,00	<b>22,00</b>	21,835	22,210	Nr. 6 -	32	<b>2,85</b>	2,642	2,896
M 2	0,40	<b>1,60</b>	1,567	1,679	M 5,5 x	0,50	<b>5,00</b>	4,959	5,099	M 25 x	1,00	<b>24,00</b>	23,917	24,153	Nr. 8 -	32	<b>3,50</b>	3,302	3,531
M 2,2	0,45	<b>1,75</b>	1,713	1,838	M 6,0 x	0,75	<b>5,20</b>	5,188	5,378	M 25 x	1,50	<b>23,50</b>	23,376	23,676	Nr. 10 -	24	<b>3,90</b>	3,683	3,937
M 2,5	0,45	<b>2,05</b>	2,013	2,138	M 7,0 x	0,75	<b>6,20</b>	6,188	6,378	M 25 x	2,00	<b>23,00</b>	22,835	23,210	Nr. 12 -	24	<b>4,50</b>	4,343	4,597
M 3	0,50	<b>2,50</b>	2,459	2,599	M 8,0 x	0,50	<b>7,50</b>	7,459	7,599	M 27 x	1,00	<b>26,00</b>	25,917	26,153	1/4 -	20	<b>5,10</b>	4,978	5,258
M 3,5	0,60	<b>2,90</b>	2,850	3,010	M 8,0 x	0,75	<b>7,20</b>	7,188	7,378	M 27 x	1,50	<b>25,50</b>	25,376	25,676	5/16 -	18	<b>6,60</b>	6,401	6,731
M 4	0,70	<b>3,30</b>	3,242	3,422	M 8,0 x	1,00	<b>7,00</b>	6,917	7,153	M 27 x	2,00	<b>25,00</b>	24,835	25,210	3/8 -	16	<b>8,00</b>	7,798	8,153
M 4,5	0,75	<b>3,70</b>	3,688	3,878	M 9,0 x	0,75	<b>8,20</b>	8,188	8,378	M 28 x	1,00	<b>27,00</b>	26,917	27,153	7/16 -	14	<b>9,40</b>	9,144	9,550
M 5	0,80	<b>4,20</b>	4,134	4,334	M 9,0 x	1,00	<b>8,00</b>	7,917	8,153	M 28 x	1,50	<b>26,50</b>	26,376	26,676	1/2 -	13	<b>10,80</b>	10,592	11,024
M 6	1,00	<b>5,00</b>	4,917	5,153	M 10 x	0,75	<b>9,20</b>	9,188	9,378	M 28 x	2,00	<b>26,00</b>	25,835	26,210	9/16 -	12	<b>12,20</b>	11,989	12,446
M 7	1,00	<b>6,00</b>	5,917	6,153	M 10 x	1,00	<b>9,00</b>	8,917	9,153	M 30 x	1,00	<b>29,00</b>	28,917	29,153	5/8 -	11	<b>13,50</b>	13,386	13,868
M 8	1,25	<b>6,80</b>	6,647	6,912	M 10 x	1,25	<b>8,80</b>	8,647	8,912	M 30 x	1,50	<b>28,50</b>	28,376	28,676	3/4 -	10	<b>16,50</b>	16,307	16,840
M 9	1,25	<b>7,80</b>	7,647	7,912	M 11 x	0,75	<b>10,20</b>	10,188	10,378	M 30 x	2,00	<b>28,00</b>	27,835	28,210	7/8 -	9	<b>19,50</b>	19,177	19,761
M 10	1,50	<b>8,50</b>	8,376	8,676	M 11 x	1,00	<b>10,00</b>	9,917	10,153	M 30 x	3,00	<b>27,00</b>	26,752	27,252	1 -	8	<b>22,25</b>	21,971	22,606
M 11	1,50	<b>9,50</b>	9,376	9,676	M 12 x	1,00	<b>11,00</b>	10,917	11,153	M 32 x	1,50	<b>30,50</b>	30,376	30,676	1 1/8 -	7	<b>25,00</b>	24,638	25,349
M 12	1,75	<b>10,20</b>	10,106	10,441	M 12 x	1,25	<b>10,80</b>	10,647	10,912	M 32 x	2,00	<b>30,00</b>	29,835	30,210	1 1/4 -	7	<b>28,00</b>	27,813	28,524
M 14	2,00	<b>12,00</b>	11,835	12,210	M 12 x	1,50	<b>10,50</b>	10,376	10,676	M 33 x	1,50	<b>31,50</b>	31,376	31,676	1 3/8 -	6	<b>30,75</b>	30,353	31,115
M 16	2,00	<b>14,00</b>	13,835	14,210	M 14 x	1,00	<b>13,00</b>	12,917	13,153	M 33 x	2,00	<b>31,00</b>	30,835	31,210	1 1/2 -	6	<b>34,00</b>	33,528	34,290
M 18	2,50	<b>15,50</b>	15,294	15,744	M 14 x	1,25	<b>12,80</b>	12,647	12,912	M 33 x	3,00	<b>30,00</b>	29,752	30,252	1 3/4 -	5	<b>39,50</b>	38,938	39,802
M 20	2,50	<b>17,50</b>	17,294	17,744	M 14 x	1,50	<b>12,50</b>	12,376	12,676	M 35 x	1,50	<b>33,50</b>	33,376	33,676	2 -	4,5	<b>45,00</b>	44,679	45,593
M 22	2,50	<b>19,50</b>	19,294	19,744	M 15 x	1,00	<b>14,00</b>	13,917	14,153	M 36 x	1,50	<b>34,50</b>	34,376	34,676					
M 24	3,00	<b>21,00</b>	20,752	21,252	M 15 x	1,50	<b>13,50</b>	13,376	13,676										
M 27	3,00	<b>24,00</b>	23,752	24,252	M 16 x	1,00	<b>15,00</b>	14,917	15,153										
M 30	3,50	<b>26,50</b>	26,211	26,771	M 16 x	1,25	<b>14,80</b>	14,647	14,912										
M 33	3,50	<b>29,50</b>	29,211	29,771	M 16 x	1,50	<b>14,50</b>	14,376	14,676										
M 36	4,00	<b>32,00</b>	31,670	32,270	M 17 x	1,00	<b>16,00</b>	15,917	16,153										
M 39	4,00	<b>35,00</b>	34,670	35,270	M 17 x	1,50	<b>15,50</b>	15,376	15,676										
M 42	4,50	<b>37,50</b>	37,129	37,799	M 18 x	1,00	<b>17,00</b>	16,917	17,153										
M 45	4,50	<b>40,50</b>	40,129	40,799	M 18 x	1,50	<b>16,50</b>	16,376	16,676										
M 48	5,00	<b>43,00</b>	42,587	43,297	M 20 x	1,00	<b>19,00</b>	18,917	19,153										
M 52	5,00	<b>47,00</b>	46,587	47,297	M 20 x	1,50	<b>18,50</b>	18,376	18,676										
M 56	5,50	<b>50,50</b>	50,046	50,796	M 20 x	2,00	<b>18,00</b>	17,835	18,210										

\* M 1,1 bis M 1,4 Kern-Ø Muttergewinde 5H

MJ-Gewinde DIN ISO 5855					UNJC-Gewinde ISO 3161					UNJF-Gewinde ISO 3161					
Nenn- Ø	x	Steig- ung P	Kernloch (Bohr-) Ø DIN 336	Kernloch-Ø Muttergewinde 5H*		Nenn- Ø	Gang pro inch	Kernloch (Bohr-) Ø DIN 336	Kernloch-Ø Muttergewinde 3B		Nenn- Ø	Gang pro inch	Kernloch (Bohr-) Ø DIN 336	Kernloch-Ø Muttergewinde 3B	
				min.	max.				min.	max.				min.	max.
MJ 3	x	0,50	<b>2,60</b>	2,513	2,653	Nr. 6 -	32	<b>2,85</b>	2,733	2,939	Nr. 6 -	40	<b>3,00</b>	2,888	3,053
MJ 4	x	0,70	<b>3,40</b>	3,318	3,498	Nr. 8 -	32	<b>3,55</b>	3,393	3,599	Nr. 8 -	36	<b>3,60</b>	3,480	3,663
MJ 5	x	0,80	<b>4,30</b>	4,221	4,421	Nr. 10 -	24	<b>4,00</b>	3,795	4,064	Nr. 10 -	32	<b>4,20</b>	4,054	4,255
MJ 6	x	0,50	<b>5,55</b>	5,513	5,625	Nr. 12 -	24	<b>4,60</b>	4,455	4,704	Nr. 12 -	28	<b>4,75</b>	4,602	4,816
MJ 6	x	0,75	<b>5,35</b>	5,269	5,419	1/4 -	20	<b>5,30</b>	5,113	5,387	1/4 -	28	<b>5,60</b>	5,466	5,662
MJ 6	x	1,00	<b>5,10</b>	5,026	5,216	5/16 -	18	<b>6,75</b>	6,563	6,833	5/16 -	24	<b>7,00</b>	6,906	7,109
MJ 8	x	0,50	<b>7,55</b>	7,513	7,625	3/8 -	16	<b>8,20</b>	7,978	8,255	3/8 -	24	<b>8,60</b>	8,494	8,679
MJ 8	x	0,75	<b>7,35</b>	7,269	7,419	7/16 -	14	<b>9,60</b>	9,346	9,639	7/16 -	20	<b>10,00</b>	9,876	10,084
MJ 8	x	1,00	<b>7,10</b>	7,026	7,216	1/2 -	13	<b>11,00</b>	10,798	11,095	1/2 -	20	<b>11,60</b>	11,463	11,661
MJ 8	x	1,25	<b>6,90</b>	6,782	6,994	9/16 -	12	<b>12,40</b>	12,228	12,482	9/16 -	18	<b>13,00</b>	12,913	13,122
MJ 10	x	1,00	<b>9,10</b>	9,026	9,216	5/8 -	11	<b>13,80</b>	13,627	13,904	5/8 -	18	<b>14,60</b>	14,501	14,702
MJ 10	x	1,25	<b>8,90</b>	8,782	8,994										
MJ 10	x	1,50	<b>8,60</b>	8,539	8,775										
MJ 12	x	1,75	<b>10,40</b>	10,295	10,560										
MJ 16	x	2,00	<b>14,20</b>	14,051	14,351										

\* MJ 3 x 0,50 bis MJ 5 x 0,80 Kern-Ø Muttergewinde 6H



## Kernlochdurchmesser für das Gewindeschneiden

UNF-Gewinde ASME B1.1					BSW-(Whitworth)-Gewinde BS84					(Whitworth-) Rohrgewinde (nach DIN-ISO 228-1)					Stahlpanzerrohr-Gewinde nach DIN 40430				
Nenn-Ø	Gang	Kernloch	Kern-Ø		Nenn-Ø	Gang	Kernloch	Kern-Ø		Nenn-Ø	Gang	Kernloch	Kern-Ø		Nenn-Ø	Gang	Kernloch	Kern-Ø	
		(Bohr-) Ø DIN 336	Muttergewinde 2B	(Bohr-) Ø DIN 336			min.	max.	(Bohr-) Ø DIN 336			Muttergewinde	(Bohr-) Ø DIN 336	min.			max.	(Bohr-) Ø	Muttergewinde
	pro inch	mm	min. mm	max. mm		pro inch	mm	min. mm	max. mm		pro inch	mm	min. mm	max. mm		pro inch	mm	min. mm	max. mm
Nr. 1 - 72		<b>1,55</b>	1,473	1,610	W 1/16	60	<b>1,20</b>	1,045	1,230	G 1/16	28	<b>6,80</b>	6,561	6,843	Pg 7	20	<b>11,40</b>	11,280	11,430
Nr. 2 - 64		<b>1,85</b>	1,755	1,910	W 3/32	48	<b>1,80</b>	1,704	1,912	G 1/8	28	<b>8,80</b>	8,566	8,848	Pg 9	18	<b>14,00</b>	13,860	14,010
Nr. 3 - 56		<b>2,15</b>	2,024	2,197	W 1/8	40	<b>2,50</b>	2,362	2,591	G 1/4	19	<b>11,80</b>	11,445	11,890	Pg 11	18	<b>17,30</b>	17,260	17,410
Nr. 4 - 48		<b>2,40</b>	2,271	2,459	W 5/32	32	<b>3,20</b>	2,952	3,214	G 3/8	19	<b>15,25</b>	14,950	15,395	Pg 13,5	18	<b>19,00</b>	19,060	19,210
Nr. 5 - 44		<b>2,70</b>	2,550	2,741	W 3/16	24	<b>3,60</b>	3,407	3,745	G 1/2	14	<b>19,00</b>	18,631	19,172	Pg 16	18	<b>21,30</b>	21,160	21,310
Nr. 6 - 40		<b>2,95</b>	2,819	3,023	W 7/32	24	<b>4,50</b>	4,201	4,539	G 5/8	14	<b>21,00</b>	20,587	21,128	Pg 21	16	<b>26,90</b>	26,780	27,030
Nr. 8 - 36		<b>3,50</b>	3,404	3,607	W 1/4	20	<b>5,10</b>	4,724	5,156	G 3/4	14	<b>24,50</b>	24,117	24,658	Pg 29	16	<b>35,50</b>	35,480	35,730
Nr. 10 - 32		<b>4,10</b>	3,962	4,166	W 5/16	18	<b>6,50</b>	6,130	6,590	G 7/8	14	<b>28,25</b>	27,877	28,418	Pg 36	16	<b>45,50</b>	45,480	45,730
Nr. 12 - 28		<b>4,60</b>	4,496	4,724	W 3/8	16	<b>7,90</b>	7,492	7,987	G 1	11	<b>30,75</b>	30,291	30,931	Pg 42	16	<b>52,50</b>	52,480	52,730
1/4 - 28		<b>5,50</b>	5,359	5,588	W 7/16	14	<b>9,20</b>	8,789	9,330	G 1 1/8	11	<b>35,50</b>	34,939	35,579	Pg 48	16	<b>57,80</b>	57,780	58,030
5/16 - 24		<b>6,90</b>	6,782	7,036	W 1/2	12	<b>10,50</b>	9,989	10,591	G 1 1/4	11	<b>39,50</b>	38,952	39,592					
3/8 - 24		<b>8,50</b>	8,382	8,636	W 9/16	12	<b>12,00</b>	11,577	12,179	G 1 1/2	11	<b>45,25</b>	44,845	45,485					
7/16 - 20		<b>9,90</b>	9,728	10,033	W 5/8	11	<b>13,50</b>	12,918	13,558	G 1 3/4	11	<b>51,00</b>	50,788	51,428					
1/2 - 20		<b>11,50</b>	11,328	11,608	W 3/4	10	<b>16,25</b>	15,797	16,483	G 2	11	<b>57,00</b>	56,656	57,296					
9/16 - 18		<b>12,90</b>	12,751	13,081	W 7/8	9	<b>19,25</b>	18,611	19,353										
5/8 - 18		<b>14,50</b>	14,351	14,681	W 1	8	<b>22,00</b>	21,334	22,147										
3/4 - 16		<b>17,50</b>	17,323	17,678	W 1 1/8	7	<b>24,50</b>	23,928	24,832										
7/8 - 14		<b>20,40</b>	20,269	20,650	W 1 1/4	7	<b>27,75</b>	27,103	28,007										
1 - 12		<b>23,25</b>	23,114	23,571	W 1 3/8	6	<b>30,50</b>	29,504	30,528										
1 1/8 - 12		<b>26,50</b>	26,289	26,746	W 1 1/2	6	<b>33,50</b>	32,679	33,703										
1 1/4 - 12		<b>29,50</b>	29,464	29,921	W 1 5/8	5	<b>35,50</b>	34,769	35,963										
1 3/8 - 12		<b>32,75</b>	32,639	33,096	W 1 3/4	5	<b>39,00</b>	37,944	39,138										
1 1/2 - 12		<b>36,00</b>	35,814	36,271	W 2	4,5	<b>44,50</b>	43,571	44,877										

### NPT ANSI B 2.1 Amerik. kegeliges Rohrgewinde Kegel 1:16

Ausführung A (möglichst vermeiden)		Ausführung B		Nenn-Ø	Gang	Kernloch-Ø zylindrisch (A) d <sub>1</sub>	Kernloch-Ø konisch (B) D <sub>1</sub>	Einschneidtiefe ET mm	Bohrtiefe BT (min) mm
				1/16 - 27		<b>6,15</b>	6,39	9,29	10,7
				1/8 - 27		<b>8,40</b>	8,74	9,32	10,8
				1/4 - 18		<b>11,10</b>	<b>11,36</b>	13,52	15,6
				3/8 - 18		<b>14,30</b>	<b>14,80</b>	13,83	16,0
				1/2 - 14		<b>17,90</b>	<b>18,32</b>	18,07	20,8
				3/4 - 14		<b>23,30</b>	<b>23,67</b>	18,55	21,3
				1 - 11,5		<b>29,00</b>	<b>29,69</b>	22,29	25,6
				1 1/4 - 11,5		<b>37,70</b>	<b>38,45</b>	22,80	26,1
				1 1/2 - 11,5		<b>43,70</b>	<b>44,52</b>	22,80	26,1
				2 - 11,5		<b>55,60</b>	<b>56,56</b>	23,20	26,5
				2 1/2 - 8		<b>66,30</b>	<b>67,62</b>	31,75	36,3
				3 - 8		<b>82,30</b>	<b>83,52</b>	33,74	38,5

EG-Gewinde Metr./Metr. Fein (EG M 14 x 1,25) für Gewindedrahteinsätze DIN 8140					EG UNC (UNC-STI) Gewinde für Gewindedrahteinsätze ASME B18.29.1					EG UNF (UNF-STI) Gewinde für Gewindedrahteinsätze ASME B18.29.1				
Nenn-Ø	x Steigung P	Kernloch (Bohr-) Ø DIN 336	Kern-Ø Muttergewinde		Nenn-Ø	Gang	Kernloch (Bohr-) Ø	Kern-Ø Muttergewinde		Nenn-Ø	Gang	Kernloch (Bohr-) Ø	Kern-Ø Muttergewinde	
			min. mm	max. mm				min. mm	max. mm				min. mm	max. mm
EG M 4 x 0,70		<b>4,20</b>	4,152	4,292	EG Nr. 6 - 32		<b>3,80</b>	3,678	3,879	EG Nr. 6 - 40		<b>3,70</b>	3,644	3,818
EG M 5 x 0,80		<b>5,25</b>	5,174	5,334	EG Nr. 8 - 32		<b>4,40</b>	4,338	4,524	EG Nr. 8 - 36		<b>4,40</b>	4,321	4,498
EG M 6 x 1,00		<b>6,30</b>	6,217	6,407	EG Nr. 10 - 24		<b>5,20</b>	5,055	5,283	EG Nr. 10 - 32		<b>5,10</b>	4,999	5,184
EG M 8 x 1,25		<b>8,40</b>	8,271	8,483	EG Nr. 12 - 24		<b>5,80</b>	5,715	5,944	EG Nr. 12 - 28		<b>5,70</b>	5,682	5,809
EG M10 x 1,50		<b>10,50</b>	10,324	10,560	EG 1/4 - 20		<b>6,70</b>	6,624	6,868	EG 1/4 - 28		<b>6,60</b>	6,546	6,721
EG M12 x 1,75		<b>12,50</b>	12,379	12,644	EG 5/16 - 18		<b>8,40</b>	8,242	8,489	EG 5/16 - 24		<b>8,25</b>	8,166	8,352
EG M14 x 1,25		<b>14,40</b>	14,271	14,483	EG 3/8 - 16		<b>10,00</b>	9,868	10,127	EG 3/8 - 24		<b>9,80</b>	9,754	9,931
EG M16 x 2,00		<b>16,50</b>	16,433	16,733	EG 7/16 - 14		<b>11,60</b>	11,506	11,783	EG 7/16 - 20		<b>11,50</b>	11,389	11,585
					EG 1/2 - 13		<b>13,30</b>	13,122	13,393	EG 1/2 - 20		<b>13,10</b>	12,974	13,172
					EG 9/16 - 12		<b>14,90</b>	14,747	15,032	EG 9/16 - 18		<b>14,70</b>	14,592	14,798
					EG 5/8 - 11		<b>16,50</b>	16,375	16,673	EG 5/8 - 18		<b>16,25</b>	16,180	16,386



## Empfohlene Bohrdurchmesser für das Gewindeformen

Metrische ISO-Gewinde DIN 13						
Nenn-Ø	Steigung P	Bohr-Ø	Bohr-Ø		Kern-Ø Muttergewinde 7H*	
			min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	mm
M 2	0,40	<b>1,85</b>	1,84	1,88	1,567	1,679
M 2,2	0,45	<b>2,00</b>	2,01	2,05	1,713	1,838
M 2,5	0,45	<b>2,30</b>	2,28	2,32	2,013	2,138
M 3	0,50	<b>2,80</b>	2,78	2,85	2,459	2,639
M 3,5	0,60	<b>3,25</b>	3,23	3,30	2,850	3,050
M 4	0,70	<b>3,70</b>	3,68	3,76	3,242	3,466
M 4,5	0,75	<b>4,20</b>				
M 5	0,80	<b>4,65</b>	4,62	4,71	4,134	4,384
M 6	1,00	<b>5,55</b>	5,52	5,62	4,917	5,217
M 7	1,00	<b>6,55</b>	6,52	6,62	5,917	6,217
M 8	1,25	<b>7,40</b>	7,36	7,47	6,647	6,982
M 9	1,25	<b>8,40</b>	8,36	8,47	7,647	7,982
M 10	1,50	<b>9,30</b>	9,26	9,38	8,376	8,751
M 11	1,50	<b>10,30</b>	10,26	10,38	9,376	9,751
M 12	1,75	<b>11,20</b>	11,15	11,29	10,106	10,531
M 14	2,00	<b>13,10</b>	13,05	13,20	11,835	12,310
M 16	2,00	<b>15,10</b>	15,05	15,20	13,835	14,310
M 18	2,50	<b>16,90</b>	16,83	17,02	15,294	15,854
M 20	2,50	<b>18,90</b>	18,83	19,02	17,294	17,854
M 22	2,50	<b>20,90</b>	20,83	21,02	19,294	19,854
M 24	3,00	<b>22,70</b>	22,62	22,80	20,752	21,382
M 27	3,00	<b>25,70</b>	25,62	25,80	23,752	24,382
M 30	3,50	<b>28,50</b>	28,40	28,60	26,211	26,921
M 33	3,50	<b>31,50</b>	31,40	31,60	29,211	29,921
M 36	4,00	<b>34,30</b>	34,17	34,40	31,670	32,420
M 39	4,00	<b>37,30</b>	37,17	37,40	34,670	35,420
M 42	4,50	<b>40,10</b>	39,95	40,20	37,129	37,979

\* M 2 bis M 2,5 Kern-Ø Muttergewinde 6H

Metrische ISO-Feingewinde DIN 13															
Nenn-Ø	x	Steigung P	Bohr-Ø	Bohr-Ø		Kern-Ø Muttergewinde 7H*		Nenn-Ø	x	Steigung P	Bohr-Ø	Bohr-Ø		Kern-Ø Muttergewinde 7H*	
				min.	max.	min.	max.					min.	max.	min.	max.
mm		mm	mm	mm	mm	mm	mm	mm		mm	mm	mm	mm	mm	mm
M 2,5	x	0,35	<b>2,35</b>	2,35	2,38	2,121	2,221	M 17	x	1,50	<b>16,30</b>	16,26	16,38	15,376	15,751
M 3	x	0,35	<b>2,85</b>	2,85	2,88	2,621	2,721	M 18	x	1,00	<b>17,55</b>	17,52	17,62	16,917	17,217
M 4	x	0,35	<b>3,85</b>	3,85	3,88	3,621	3,721	M 18	x	1,50	<b>17,30</b>	17,26	17,38	16,376	16,751
M 4	x	0,50	<b>3,80</b>	3,78	3,83	3,459	3,639	M 18	x	2,00	<b>17,10</b>	17,05	17,20	15,835	16,310
M 5	x	0,50	<b>4,80</b>	4,78	4,83	4,459	4,639	M 20	x	1,00	<b>19,55</b>	19,52	19,62	18,917	19,217
M 5,5	x	0,50	<b>5,30</b>	5,28	5,33	4,959	5,139	M 20	x	1,50	<b>19,30</b>	19,26	19,38	18,376	19,751
M 6	x	0,75	<b>5,65</b>	5,62	5,70	5,188	5,424	M 24	x	1,00	<b>23,55</b>	23,52	23,62	22,917	23,217
M 7	x	0,75	<b>6,65</b>	6,62	6,70	6,188	6,424	M 24	x	1,50	<b>23,30</b>	23,26	23,38	22,376	22,751
M 8	x	0,75	<b>7,65</b>	7,62	7,70	7,188	7,424	M 24	x	2,00	<b>23,10</b>	23,05	23,20	21,835	22,310
M 8	x	1,00	<b>7,55</b>	7,52	7,62	6,917	7,217	M 27	x	1,50	<b>26,30</b>	26,26	26,38	25,376	25,751
M 9	x	0,75	<b>8,65</b>	8,62	8,70	8,188	8,424	M 30	x	1,50	<b>29,30</b>	29,26	29,38	28,376	28,751
M 9	x	1,00	<b>8,55</b>	8,52	8,62	7,917	8,217	M 33	x	1,50	<b>32,30</b>	32,26	32,38	31,376	31,751
M 10	x	0,75	<b>9,65</b>	9,62	9,70	9,188	9,424	M 36	x	1,50	<b>35,30</b>	35,26	35,38	34,376	34,751
M 10	x	1,00	<b>9,55</b>	9,52	9,62	8,917	9,217	M 39	x	1,50	<b>38,30</b>	38,26	38,38	37,376	37,751
M 10	x	1,25	<b>9,40</b>	9,36	9,47	8,647	8,982	M 42	x	1,50	<b>41,30</b>	41,26	41,38	42,376	42,751
M 11	x	0,75	<b>10,65</b>	10,62	10,70	10,188	10,424								
M 11	x	1,00	<b>10,55</b>	10,52	10,62	9,917	10,217								
M 12	x	1,00	<b>11,55</b>	11,52	11,62	10,917	11,217								
M 12	x	1,25	<b>11,40</b>	11,36	11,47	10,647	10,982								
M 12	x	1,50	<b>11,30</b>	11,26	11,38	10,376	10,751								
M 14	x	1,00	<b>13,55</b>	13,52	13,62	12,917	13,217								
M 14	x	1,25	<b>13,40</b>	13,36	13,47	12,647	12,982								
M 14	x	1,50	<b>13,30</b>	13,26	13,38	12,376	12,751								
M 15	x	1,00	<b>14,55</b>	14,52	14,62	13,917	14,217								
M 15	x	1,50	<b>14,30</b>	14,26	14,38	13,376	13,751								
M 16	x	1,00	<b>15,55</b>	15,52	15,62	14,917	15,217								
M 16	x	1,50	<b>15,30</b>	15,26	15,38	14,376	14,751								
M 17	x	1,00	<b>16,55</b>	16,52	16,62	15,917	16,217								

\* M 2,5 x 0,35 bis M 4 x 0,35 Kern-Ø Muttergewinde 6H

### Kerndurchmesser-Toleranzfeld beim Gewindeformen (nach DIN 13, Teil 50)

Aus Festigkeitsgründen ist es nicht erforderlich, die Kerndurchmessertoleranzen der Toleranzklasse 6H einzuhalten; die Toleranzklasse 7H genügt dem Anspruch, dass die Flankenüberdeckung von Bolzen- und Muttergewinde 0,32 x P nicht unterschreiten soll. Außerdem haben geformte Gewinde wegen des nicht unterbrochenen Faserverlaufs und der erfolgten Kaltverfestigung im Regelfall eine höhere Festigkeit als geschnittene Gewinde.

UNC-Gewinde ASME B1.1						
Nenn-Ø	Gang	Bohr-Ø	Bohr-Ø		Kern-Ø Muttergewinde 2B	
			min.	max.	min.	max.
	pro inch	mm	mm	mm	mm	mm
Nr. 1	- 64	<b>1,68</b>	1,67	1,70	1,425	1,580
Nr. 2	- 56	<b>1,98</b>	1,97	2,01	1,694	1,872
Nr. 3	- 48	<b>2,28</b>	2,27	2,32	1,941	2,146
Nr. 4	- 40	<b>2,55</b>	2,54	2,59	2,157	2,385
Nr. 5	- 40	<b>2,90</b>	2,89	2,94	2,487	2,698
Nr. 6	- 32	<b>3,15</b>	3,14	3,19	2,642	2,896
Nr. 8	- 32	<b>3,80</b>	3,78	3,82	3,302	3,531
Nr. 10	- 24	<b>4,35</b>	4,33	4,39	3,683	3,937
Nr. 12	- 24	<b>5,00</b>	4,97	5,03	4,343	4,597
1/4	- 20	<b>5,75</b>	5,72	5,80	4,978	5,258
5/16	- 18	<b>7,30</b>	7,26	7,37	6,401	6,731
3/8	- 16	<b>8,80</b>	8,77	8,88	7,798	8,153
7/16	- 14	<b>10,30</b>	10,27	10,37	9,144	9,550
1/2	- 13	<b>11,80</b>	11,77	11,88	10,592	11,024
9/16	- 12	<b>13,30</b>	13,28	13,39	11,989	12,446
5/8	- 11	<b>14,80</b>	14,78	14,90	13,386	13,868
3/4	- 10	<b>17,90</b>	17,85	17,97	16,307	16,840
7/8	- 9	<b>21,00</b>	20,95	21,10	19,177	19,761
1	- 8	<b>24,00</b>	23,95	24,12	21,971	22,606

UNF-Gewinde ASME B1.1						
Nenn-Ø	Gang	Bohr-Ø	Bohr-Ø		Kern-Ø Muttergewinde 2B	
			min.	max.	min.	max.
	pro inch	mm	mm	mm	mm	mm
Nr. 1	- 72	<b>1,70</b>	1,69	1,72	1,473	1,610
Nr. 2	- 64	<b>2,00</b>	1,99	2,03	1,755	1,910
Nr. 3	- 56	<b>2,30</b>	2,29	2,34	2,024	2,197
Nr. 4	- 48	<b>2,60</b>	2,59	2,63	2,271	2,459
Nr. 5	- 44	<b>2,90</b>	2,89	2,93	2,550	2,741
Nr. 6	- 40	<b>3,20</b>	3,19	3,24	2,819	3,023
Nr. 8	- 36	<b>3,85</b>	3,83	3,88	3,404	3,607
Nr. 10	- 32	<b>4,45</b>	4,43	4,49	3,962	4,166
Nr. 12	- 28	<b>5,10</b>	5,07	5,13	4,496	4,724
1/4	- 28	<b>5,95</b>	5,92	5,99	5,359	5,588
5/16	- 24	<b>7,45</b>	7,42	7,50	6,782	7,036
3/8	- 24	<b>9,05</b>	9,02	9,10	8,838	9,636
7/16	- 20	<b>10,55</b>	10,48	10,58	9,728	10,033
1/2	- 20	<b>12,10</b>	12,08	12,18	11,328	11,608
9/16	- 18	<b>13,65</b>	13,61	13,72	12,751	13,081
5/8	- 18	<b>15,25</b>	15,21	15,32	14,351	14,681
3/4	- 16	<b>18,35</b>	18,30	18,41	17,323	17,678
7/8	- 14	<b>21,40</b>	21,35	21,49	20,269	20,650
1	- 12	<b>24,45</b>	24,40	24,54	23,114	23,571

(Whitworth-) Rohrgewinde G DIN EN ISO 228-1						
Nenn-Ø	Gang	Bohr-Ø	Bohr-Ø		Kern-Ø Muttergewinde 2B	
			min.	max.	min.	max.
	pro inch	mm	mm	mm	mm	mm
G 1/16	28	<b>7,30</b>	7,28	7,35	6,561	6,843
G 1/8	28	<b>9,30</b>	9,28	9,35	8,566	8,848
G 1/4	19	<b>12,50</b>	12,48	12,55	11,445	11,890
G 3/8	19	<b>16,00</b>	15,98	16,05	14,950	15,395
G 1/2	14	<b>20,00</b>	19,98	20,12	18,631	19,172
G 5/8	14	<b>22,00</b>	21,98	22,12	20,587	21,128
G 3/4	14	<b>25,50</b>	25,48	25,62	24,117	24,658
G 7/8	14	<b>29,25</b>	29,23	29,37	27,877	28,418
G 1	11	<b>32,00</b>	31,98	32,15	30,291	30,931
G 1 1/4	11	<b>40,75</b>	40,70	40,85	38,952	39,592



# HARTNER

## Internationaler Werkstoffvergleich

Mat.-Nr.	Deutschland	Groß-britannien		Japan	USA
	DIN	BS	EN	JIS	AISI/SAE/ASTM
1.0711	9 S 20	220 M 07	-	SUM 21	1212
1.0715	9 SMn 28	230 M 07	-	SUM 22	1213
1.0718	9 SMnPb 28	-	-	SUM 22 L	12 L 13
1.0721	10 S 20	210 M 15	-	-	1108
1.0722	10 SPb 20	-	-	-	11 L 08
1.0723	15 S 20	210 A 15	-	SUM 32	-
1.0736	9 SMn 36	240 M 07	1B	-	1215
1.0737	9 SMnPb 36	-	-	-	12 L 14
1.0726	35 S 20	212 M 36	8M	-	1140
1.0727	45 S 20	212 M 44	-	-	1146
1.0728	60 S 20	-	-	-	-
1.0037	St 37-2	-	-	STKM 12 C	-
1.0044	St 44-2	4360-43 B	-	SM 41 B	A 570 Gr. 40
1.0116	St 37-3	4360-40 C	-	-	A 573 Gr. 58
1.0144	St 44-3	4360-43 C	-	SM 41 C	A 573 Gr. 70
1.0050	St 50-2	4360-50 B	-	SS 50	A 570 Gr. 50
1.0570	St 52-3	4360-50 B	-	SM 50 YA	-
1.0060	St 60-2	4360-SSE; SS	-	SM 58	-
1.5415	15 Mo 3	1501-240	-	-	A 204 Gr. A
1.5423	16 Mo 5	1503-245-420	-	-	4520
1.5622	14 Ni 6	-	-	-	A 350-LF 5
1.5680	12 Ni 19	-	-	-	2515
1.7335	13 CrMo 4 4	1501-620 Gr.	-	-	A 182-F11; F12
1.7337	16 CrMo 4 4	1501-620 Gr.	-	-	A 387 Gr. 12 C
1.7380	10 CrMo 9 10	1501-622 Gr.	-	-	A 182-F22
1.7709	21 CrMoV 5 7	-	-	-	-
1.7715	14 MoV 6 3	1503-660-440	-	-	-
1.7735	14 CrMoV 6 9	-	-	-	-
1.0904	55 Si 7	250 A 53	45	-	9255
1.0961	60 SiCr 7	-	-	SUP 7	9262
1.1231	CK 67	060 A 67	-	-	1070
1.1248	CK 75	060 A 78	-	-	1078; 1080
1.1274	CK 101	060 A 96	-	SUP 4	1095
1.7103	67 SiCr 5	-	-	-	-
1.7176	55 Cr 3	527 A 60	48	SUP 9 (A)	5155
1.8159	50 CrV 4	735 A 50	47	SUP 10	6150
1.0301	C 10	045 M 10	-	S 10 C	1010
1.0401	C 15	080 M 15	-	-	1015
1.1121	CK 10	045 M 10	-	S 10 C; S 9 CK	1010
1.1141	CK 15	080 M 15	32C	S 15 C; S 15 CK	1015
1.7012	13 Cr 2	-	-	-	-
1.7015	15 Cr 3	523 M 15	-	SCR 415 (H)	5015
1.5732	14 NiCr 10	-	-	SNC 415 (H)	3415
1.5752	14 NiCr 14	655 M 13	36A	SNC 815 (H)	3310; 9314
1.5860	14 NiCr 18	-	-	-	-
1.5919	15 CrNi 6	S 107	-	-	-
1.5920	18 NiCr 8	-	-	-	-
1.6523	21 NiCrMo 2	805 M 20	362	SNCM 220 (H)	8620
1.6587	17 CrNiMo 6	820 A 16	-	-	-
1.7131	16 MnCr 5	527 M 17	-	SCR 415	5115
1.7139	16 MnCrS 5	-	-	-	-
1.7147	20 MnCr 5	-	-	SMnC 420 (H)	5120
1.7149	20 MnCrS 5	-	-	-	-
1.7262	15 CrMo 5	-	-	SCM 415 (H)	-
1.7264	20 CrMo 5	-	-	SCM 421	-
1.7271	23 CrMoB 3 3	-	-	-	-
1.7311	20 CrMo 2	-	-	-	-
1.7321	20 MoCr 4	-	-	-	-
1.7323	20 MoCrS 4	-	-	-	-
1.7325	25 MoCr 4	-	-	-	-
1.7326	25 MoCrS 4	-	-	-	-
1.8504	34 CrAl 6	-	-	-	-
1.8506	34 CrAlS 5	-	-	-	-
1.8507	34 CrAlMo 5	905 M 31	-	-	A 355 Cl. D
1.0038	RSt37-2	4360 40C	1A	STKM 12A;C	A570.36



## Internationaler Werkstoffvergleich

Mat.-Nr.	Deutschland		Groß-britannien		Japan	USA
	DIN	BS	EN	JIS	AISI/SAE/ASTM	
1.0402	C22	050 A 20	2C	-	1020	
1.5026	55 Si 7	250 A 53	-	-	9255	
1.8509	41 CrAlMo 7	905 M 39	41B	SACM 645	A 355 Cl. A	
1.8515	31 CrMo 12	722 M 24	-	-	-	
1.8519	31 CrMoV 9	-	-	-	-	
1.8521	15 CrMoV 5 9	-	-	-	-	
1.8523	39 CrMoV 13 9	897 M 39	40C	-	-	
1.8550	34 CrAlNi 7	-	-	-	-	
1.0402	C 22	050 A 20	2D	-	1020	
1.0406	C 25	070 M 26	-	-	1025	
1.0501	C 35	060 A 35	-	-	1035	
1.0503	C 45	080 M 46	-	-	1045	
1.0511	C 40	-	-	-	1040	
1.0528	C 30	-	-	-	-	
1.1151	Ck 22	050 A 20	-	S 20 C; S 20 CK	1023	
1.1158	Ck 25	070 M 26	-	S 25 C	1025	
1.1178	Ck 30	-	-	-	-	
1.1181	Ck 35	080 M 36	-	S 35 C	1035	
1.1186	Ck 40	080 M 40	-	S 40 C	1040	
1.1191	Ck 45	080 M 46	-	S 45 C	1045	
1.0535	C 55	070 M 55	-	-	1055	
1.0540	C 50	-	-	-	-	
1.0601	C 60	080 A 62	43D	-	1060	
1.1203	Ck 55	070 M 55	-	S 55 C	1055	
1.1206	Ck 50	080 M 50	-	-	1050	
1.1221	Ck 60	080 A 62	43D	S 58 C	1060	
1.1133	20 Mn 5	120 M 19	-	-	1022; 1518	
1.3505	100 Cr 6	534 A 99	31	SUJ 2	52100	
1.5120	38 MnSi 4	-	-	-	-	
1.5121	46 MnSi 4	-	-	-	-	
1.5141	53 MnSi 4	-	-	-	-	
1.5710	36 NiCr 6	640 A 35	111A	SNC 236	3135	
1.6546	40 NiCrMo	311-Type7	-	SNCM 240	8740	
1.6565	40 NiCrMo	311-Type6	-	SNCM 439	4340	
1.7003	38 Cr 2	-	-	-	-	
1.7006	46 Cr 2	-	-	-	5045	
1.7020	32 Cr 2	-	-	-	-	
1.7030	28 Cr 4	530 A 30	-	-	5130	
1.7033	34 Cr 4	530 A 32	18B	SCr 430 (H)	5132	
1.7218	25 CrMo 4	1717 CDS 110	-	SCM 420; SCM	4130	
1.7220	34 CrMo 4	708 A 37	19B	SCM 432; SCCrM	4135; 4137	
1.7223	41 CrMo 4	708 M 40	19A	SCM 440	4142; 4140	
1.7225	42 CrMo 4	708 M 40	19A	SCM 440	4142; 4140	
1.7228	50 CrMo 4	708 A 47	-	SCM 445 (H)	4150	
1.1157	40 Mn 4	150 M 36	15	-	1039	
1.1165	30 Mn 5	120 M 36	-	SMn 433 H; SCMn	1330	
1.1167	36 Mn 5	150 M 36	-	SMn 438 H; SCMn	1335	
1.1170	28 Mn 5	150 M 28	14A	SCMn 1	1330	
1.3561	44 Cr 2	-	-	-	-	
1.3563	43 CrMo 4	-	-	-	-	
1.3565	48 CrMo 4	817 M 40	-	SNC 836	-	
1.5120	38 MnSi 4	-	-	-	-	
1.5121	46 MnSi 4	-	-	-	-	
1.5122	37 MnSi 4	-	-	-	-	
1.5131	50 MnSi4	-	-	-	-	
1.5141	53 MnSi 4	-	-	-	-	
1.5223	42 MnV 7	-	-	-	-	
1.5710	36 NiCr 6	640 A 35	111A	SNC 236	3135	
1.5736	36 NiCr 10	-	-	SNC 631 (H)	3435	
1.5755	31 NiCr 14	653 M 31	-	SNC 836	-	
1.6511	36 CrNiMo	816 M 40	110	SNC 836	9840	
1.6513	28 NiCrMo	-	-	-	-	
1.7003	38 Cr 2	-	-	-	-	
1.7006	46 Cr 2	-	-	-	5045	
1.7030	28 Cr 4	530 A 30	-	-	5130	



## Internationaler Werkstoffvergleich

Mat.-Nr.	Deutschland		Groß-britannien		Japan	USA
	DIN	BS	EN	JIS	AISI/SAE/ASTM	
1.7033	34 Cr 4	530 A 32	18B	SCr 430 (H)	5132	
1.7034	37 Cr 4	530 A 36	-	SCr 435 (H)	5135	
1.7035	41 Cr 4	530 M 40	18	SCr 440 (H)	5140	
1.7218	25 CrMo 4	1717 CDS 110	-	SCM 420; SCM 430	4130	
1.7220	34 CrMo 4	708 A 37	19B	SCM 432; SCCrM 3	4135; 4137	
1.7223	41 CrMo 4	708 M 40	19A	SCM 440	4142; 4140	
1.7225	42 CrMo 4	708 M 40	19A	SCM 440	4142; 4140	
1.7228	50 CrMo 4	708 A 47	-	SCM 445 (H)	4150	
1.7561	42 CrV 6	-	-	-	-	
1.7735	14 CrMoV 6 9	-	-	-	-	
1.8159	50 CrV 4	735 A 50	47	SUP 10	6150	
1.3563	43 CrMo 4	-	-	-	-	
1.3565	48 CrMo 4	817 M 40	-	SNC 836	-	
1.5120	38 MnSi 4	-	-	-	-	
1.5121	46 MnSi 4	-	-	-	-	
1.5122	37 MnSi 4	-	-	-	-	
1.5223	42 MnV 7	-	-	-	-	
1.5710	36 NiCr 6	640 A 35	111A	SNC 236	3135	
1.5736	36 NiCr 10	-	-	SNC 631 (H)	3435	
1.5864	35 NiCr 18	-	-	-	-	
1.6511	36 CrNiMo 4	816 M 40	110	SNC 836	9840	
1.6580	30 CrNiMo 8	823 M 30	-	SNM 431	-	
1.6582	34 CrNiMo 6	817 M 40	24	SNM 447	4340	
1.7033	34 Cr 4	530 A 32	18B	SCr 430 (H)	5132	
1.7034	37 Cr 4	530 A 36	-	SCr 435 (H)	5135	
1.7035	41 Cr 4	530 M 40	18	-	5140	
1.7045	42 Cr 4	530 A 40	-	2245	5140	
1.7218	25 CrMo 4	1717 CDS 110	-	2225	4130	
1.7220	34 CrMo 4	708 A 37	19B	2234	4135; 4137	
1.7223	41 CrMo 4	708 M 40	19A	2244	4142; 4140	
1.7225	42 CrMo 4	708 M 40	19A	2244	4142; 4140	
1.7228	50 CrMo 4	708 A 47	-	-	4150	
1.7361	32 CrMo 12	722 M 24	40B	2240	-	
1.7561	42 CrV 6	-	-	-	-	
1.7707	30 CrMoV 9	-	-	-	-	
1.7735	14 CrMoV 6 9	-	-	-	-	
1.8159	50 CrV 4	735 A 50	47	2230	6150	
1.8161	58 CrV 4	-	-	-	-	
1.1520	C 70 W1	-	-	-	-	
1.1525	C 80 W1	-	-	-	W 108	
1.1545	C 105 W1	-	-	-	W 110	
1.1620	C 70 W2	-	-	-	-	
1.1625	C 80 W2	BW 1B	-	-	W 1	
1.1645	C105 W2	-	-	-	-	
1.1654	C 110 W	-	-	-	-	
1.1663	C 125 W	-	-	-	W 112	
1.1673	C 135 W	-	-	-	-	
1.1730	C 45 W	-	-	-	-	
1.1740	C 60 W	-	-	-	-	
1.1744	C 67 W	-	-	-	-	
1.1750	C 75 W	BW 1A	-	-	W 1	
1.1820	C 55 W	-	-	-	-	
1.1830	C 85 W	-	-	-	-	
1.2067	100 Cr 6	BL 3	-	-	L 3	
1.2101	62 SiMnCr 4	-	-	-	-	
1.2103	58 SiCr 8	-	-	-	-	
1.2108	90 CrSi 5	-	-	-	-	
1.2162	21 MnCr 5	-	-	-	-	
1.2210	115 CRV 3	-	-	-	L 2	
1.2330	35 CrMo 4	708 A 37	-	2234	4135	
1.2332	47 CrMo 4	709 M 40	-	2244	4142	
1.2419	105 WCr 6	-	-	-	-	
1.2510	100 MnCrW 4	BO 1	-	2140	O 1	
1.2516	120 W 4	BF 1	-	-	-	
1.2542	45 WCrV 7	BS 1	-	2710	S 1	





## Internationaler Werkstoffvergleich

Mat.-Nr.	Deutschland	Groß-britannien		Japan	USA
	DIN	BS	EN	JIS	AISI/SAE/ASTM
1.2550	60 WCrV 7	-	-	-	-
1.2721	50 NiCr 13	-	-	-	-
1.2735	15 NiCr 14	-	-	SNC 22	-
1.2762	75 CrMoNiW 6 7	-	-	-	-
1.2826	60 MnSiCr 4	-	-	-	-
1.2833	100 V 1	BW 2	-	SKS 43	W 210
1.2842	90 MnCrV 8	BO 2	-	-	O 2
1.2080	X 210 Cr 12	BD 3	-	SKD 1	D 3
1.2341	X 6 CrMo 4	-	-	-	-
1.2363	X 100 CrMoV 5 1	BA 2	-	SKD 12	A 2
1.2379	X 155 CrVMo12 1	BD 2	-	SKD 11	D 2
1.2436	X 210 CrW 12	-	-	SKD 2	-
1.2601	X 165 CrMoV 12	-	-	-	-
1.2311	40 CrMnMo 7	-	-	-	-
1.2312	40 CrMnMoS 8 6	-	-	-	-
1.2711	54 NiCrMoV 6	-	-	-	-
1.2713	55 NiCrMoV 6	-	-	SKT 4	L 6
1.2738	40 CrMnNiMo 8	-	-	-	-
1.2744	57 NiCrMoV 77	-	-	-	-
1.2764	X 19 NiCrMo 4	-	-	-	-
1.2767	X 45 NiCrMo 4	-	-	-	-
1.2083	X 42 Cr 13	-	-	SUS 420 J 2	-
1.2343	X 38 CrMoV 5 1	BH 11	-	SKD 6	H 11
1.2344	X 40 CrMoV 5 1	BH 13	-	SKD 61	H 13
1.2365	X 32 CrMoV 3 3	BH 10	-	SKD 7	H 10
1.2567	X 30 WCrV 5 3	-	-	SKD 4	-
1.2581	X 30 WCrV 9 3	BH 21	-	SKD 5	H 21
1.2885	X 32 CrMoV 3 3 3	-	-	-	-
1.2316	X 36 CrMo 17	-	-	-	-
1.0420	GS-38	-	-	-	-
1.1118	GS-24 Mn 6	-	-	-	-
1.1120	GS-20 Mn 5	-	-	-	-
1.5419	GS-22 Mo 4	-	-	-	-
1.5633	GS-24 Ni 8	-	-	-	-
1.5681	GS-10 Ni 19	-	-	-	-
1.6309	GS-20 Mn MoNi 5 5	-	-	-	-
1.6582	GS-34 CrNiMo 6	-	24	-	-
1.6748	GS-40 NiCrMo 6 5 6	-	-	-	-
1.4311	X 2 CrNiN 18 10	304 S 62	-	SUS 304 LN	304 LN
1.4401	X 5 CrNiMo 18 10	316 S 16	58J	SUS 316	316
1.4404	X 2 CrNiMo 17 13 2	316 S 11	-	SUS 316 L	316 L
1.4406	X 2 CrNiMoN 17 12 2	316 S 61	58C	SUS 316 LN	316 LN
1.4429	X 2 CrNiMoN 17 13 3	316 S 62	-	SUS 316 LN	316 LN
1.4435	X 2 CrNiMo 18 14 3	317 S 12	-	SCS 16; SUS 316	316 L
1.4436	X 5 CrNiMo 17 13 3	316 S 16	-	SUS 316	316
1.4438	X 2 CrNiMo 18 16 4	317 S 12	-	SUS 317 L	317 L
1.4460	X 8 CrNiMo 27 5	-	-	SUS 329 J 1	329
1.4462	X 2 CrNiMoN 22 5	-	-	-	-
1.4541	X 6 CrNiTi 18 10	321 S 12	58B	SUS 321	321
1.4542	X 5 CrNiCuNb 17 14	-	-	SCS 124; SUS 630	630
1.4546	X 5 CrNiNb 18 10	347 S 18	-	-	348
1.4550	X 6 CrNiNb 18 10	347 S 17	58F	SUS 347	347
1.4571	X 6 CrNiMoTi 17 12 2	320 S 31	58J	-	316 Ti
1.4580	X 6 CrNiMoNb 17 12 2	318 S 17	-	-	316 Cb
1.4301	X 5 CrNi 18 9	304 S 15	58E	SUS 304	304; 304 H
1.4303	X 5 CrNi 18 12	305 S 19	-	SUS 305	308; 305
1.4305	X 10 CrNiS 18 9	303 S 21	58M	SUS 303	303
1.4306	X 2 CrNi 19 11	304 S 12	-	SCS 19	304 L
1.4310	X 12 CrNi 17 7	301 S 21	-	SUS 301	301
1.4350	X 5 CrNi18 9	304 S 31	58E	SUS 302	304
1.4573	X 10 CrNiMoTi 18 12	320 S 33	-	-	316 Ti
1.4583	X 10 CrNiMoNb 18 12	-	-	-	318
1.4000	X 6 Cr 13	403 S 17	-	SUS 403	403
1.4002	X 6 CrAl 13	405 S 17	-	SUS 405	405
1.4016	X 6 Cr 17	430 S 15	960	SUS 430	430



Mat.-Nr.	Deutschland	Groß-britannien		Japan	USA
	DIN	BS	EN	JIS	AISI/SAE/ASTM
1.4113	X 6 CrMo 17	434 S 17	-	SUS 434	434
1.4313	X 5 CrNi 13 4	425 C 11	-	SCS 5	CA 6-NM
1.4510	X 6 CrTi 17	-	-	SUS 430 LX	XM 8; 430 Ti
1.4512	X 5 CrTi 12	409 S 19	-	SUH 409	409
1.4005	X 12 CrS 13	416 S 21	-	SUS 416	416
1.4006	X 10 Cr 13	410 S 21	56A	SUS 410	410; CA-15
1.4021	X 20 Cr 13	420 S 37	-	SUS 420 J 1	420
1.4028	X 30 Cr 13	420 S 45	-	SUS 420 J 2	-
1.4031	X 38 Cr 13	-	-	SUS 420 J 2	-
1.4034	X 46Cr 13	420 S 45	56D	SUS 420 J 2	-
1.4057	X 20 CrNi 17 2	431 S 29	57	SUS 431	431
1.4104	X 12 CrMoS 17	-	-	SUS 430 F	430 F
1.4125	X 105 CrMo 17	-	-	SUS 440 C	440 C
1.4742	X 10 CrAl 18	430 S 15	60	SUS 430; SUH	430
1.4747	X 80 CrNiSi 20	443 S 65	59	SUH 4	HNv 6
1.4762	X 10 CrAl 24	-	-	-	446
1.4876	X 10 NiCrAlTi 33	NA 15 (H)	-	NCF 800	B 163
0.6010	GG-10	-	-	FC 10	A48-20 B
0.6015	GG-15	Grade 150	-	FC 15	A48-25 B
0.6020	GG-20	Grade 220	-	FC 20	A48-30 B
0.6025	GG-25	Grade 260	-	FC 25	A48-40 B
0.6030	GG-30	Grade 300	-	FC 30	A48-45 B
0.6035	GG-35	Grade 350	-	FC 35	A48-50 B
0.6040	GG-40	Grade 400	-	-	A48-60 B
0.6655	GGL-NiCuCr 15 6	L-NUC 15 6 2	-	-	A-436 Type 1
0.7040	GGG-40	SNG 420/12	-	FCD 40	60-40-18
0.7050	GGG-50	SNG 500/7	-	FCD 50	65-45-12
0.7060	GGG-60	SNG 600/3	-	FCD 60	80-55-06
0.7070	GGG-70	SNG 700/2	-	FCD 70	100-70-03
0.7080	GGG-80	SNG 800/2	-	-	120-90-02
0.7660	GGG-NiCr 20 2	S-NiCr 20 2	-	-	A 439 Type D-2
0.7661	GGG-NiCr 20 3	S-NiCr 20 3	-	-	A 439 Type D-2B
0.7670	GGG-Ni 22	S-Ni 22	-	-	A 439 Type D-2C
0.7673	GGG-NiMn 23 4	S-NiMn 23 4	-	-	A 439 Type D-2M
0.7676	GGG-NiCr 30 3	S-NiCr 30 3	-	-	A 439 Type D-3
0.7677	GGG-NiCr 30 1	S-NiCr 30 1	-	-	A 439 Type D-3A
0.7680	GGG-NiSiCr 30 5	S-NiSiCr 30 5 5	-	-	A 439 Type D-4
0.7683	GGG-Ni 35	S-Ni 35	-	-	A 439 Type D-5
0.7685	GGG-NiCr 35 3	S-NiCr 35 3	-	-	A 439 Type D-5B
0.8135	GTS-35	B340/12	-	-	32510
0.8145	GTS-45	P440/7	-	-	40010
0.8155	GTS-55	P510/4	-	-	50005
0.8165	GTS-65	P570/3	-	-	70003
0.8170	GTS-70	P690/2	-	-	90001
0.8035	GTW-35	W340/3	-	-	-
3.0225	Al99.5	1B	-	A1x1	-
3.0305	Al99.9	-	-	-	-
3.0505	AlMn0.5Mg0.5	N31	-	-	-
3.0515	AlMn1	N3	-	144054	-
3.0525	AlMn1Mg0.5	-	-	-	-
3.3315	AlMg1	N41	-	A2x8	-
3.3535	AlMg3	N5	-	-	-
3.1325	AlCuMg1	H14	-	-	-
3.1355	AlCuMg2	2L97	-	A3x4	-
3.2315	AlMgSi1	H30	-	-	-
3.3206	AlMgSi0.5	H9	-	A2x5	-
3.3211	AlMg1SiCu	-	-	-	-
3.4345	AlZnMgCu0.5	L86	-	-	7050
3.4365	AlZnMgCu1.5	L87	-	-	7175
-	Al1Mg1SiCrTi	-	-	-	6011
-	Al0.3Cu1Mg0.6SiCr	-	-	-	6061
-	Al1Cu1.1Mg1.4Si0.8Mn	-	-	-	6066
3.2134	G-AlSi5Cu1Mg	-	-	-	-
3.3241	G-AlMg3Si	-	-	-	-
3.3292	GD-AlMg9	-	-	-	-





# HARTNER

## Härtevergleich

Rm (N/mm <sup>2</sup> )	HRC	HB30	HV10	Rm (N/mm <sup>2</sup> )	HRC	HB30	HV10
240		71	75	1110	35	328	345
255		76	80	1140	36	337	355
270		81	85	1170	37	346	364
285		86	90	1200	38	354	373
305		90	95	1230	39	363	382
320		95	100	1260	40	372	392
335		100	105	1300	41	383	403
350		105	110	1330	42	393	413
370		109	115	1360	43	402	423
385		114	120	1400	44	413	434
400		119	125	1440	45	424	446
415		124	130	1480	46	435	458
430		128	135	1530	47	449	473
450		133	140	1570	48	460	484
465		138	145	1620	49	472	497
480		143	150	1680	50	488	514
495		147	155	1730	51	501	527
510		152	160	1790	52	517	544
530		157	165	1845	53	532	560
545		162	170	1910	54	549	578
560		166	175	1980	55	567	596
575		171	180	2050	56	584	615
595		176	185	2140	57	607	639
610		181	190	2180	58	622	655
625		185	195		59		675
640		190	200		60		698
660		195	205		61		720
675		199	210		62		745
690		204	215		63		773
705		209	220		64		800
720		214	225		65		829
740		219	230		66		864
755		223	235		67		900
770		228	240		68		940
785		233	245				
800	22	238	250				
820	23	242	255				
835	24	247	260				
860	25	255	268				
870	26	258	272				
900	27	266	280				
920	28	273	287				
940	29	278	293				
970	30	287	302				
995	31	295	310				
1020	32	301	317				
1050	33	311	327				
1080	34	319	336				



## Durchmessertoleranzen

### ISO-Abmaße

Die normale Herstellgenauigkeit für Spiralbohrer nach DIN 1414 entspricht dem Toleranzfeld h8. Für Spiralbohrer mit verengten Durchmessertoleranzen nach den Toleranzfeldern h7, h6 und h5 werden Preiszuschläge berechnet.

Durchmesserbereich mm		Abmaße mm (auf den Fasen, an den Schneidecken gemessen)				
		h8	h7	h6	h5	m7
von	1,0	0	0	0		
bis	3,0	-0,014	-0,010	-0,006	-0,004	
über	3,0	0	0	0	0	+0,016
bis	6,0	-0,018	-0,012	-0,008	-0,005	+0,004
über	6,0	0	0	0	0	+0,021
bis	10,0	-0,022	-0,015	-0,009	-0,006	+0,006
über	10,0	0	0	0	0	+0,025
bis	18,0	-0,027	-0,018	-0,011	-0,008	+0,007
über	18,0	0	0	0	0	+0,029
bis	30,0	-0,033	-0,021	-0,013	-0,009	+0,008
über	30,0	0	0	0	0	
bis	50,0	-0,039	-0,025	-0,016	-0,011	
über	50,0	0	0	0	0	
bis	80,0	-0,046	-0,030	-0,019	-0,013	
über	80,0	0	0	0	0	
bis	100,0	-0,054	-0,035	-0,022	-0,015	

### Kleinstbohrertoleranzen nach DIN 1899

Die Herstellgenauigkeit für Kleinstbohrer bis 1,5 mm Durchmesser entspricht den Toleranzen von DIN 1899.

Durchmessertoleranz am Schneidteil = 0/- 0,004 mm  
 Durchmessertoleranz am Schaft h8 = 0/- 0,014 mm

### Freimaßtoleranzen nach DIN-ISO 2768

Grenzabmaße für Längenmaße (Werte in mm)

Genauigkeitsgrad	Nennmaßbereich							
	0,5 bis 3	über 3 bis 6	über 6 bis 30	über 30 bis 120	über 120 bis 400	über 400 bis 1000	über 1000 bis 2000	über 2000 bis 4000
fein	± 0,05	± 0,05	± 0,1	± 0,15	± 0,2	± 0,3	± 0,5	-
mittel	± 0,1	± 0,1	± 0,2	± 0,3	± 0,5	± 0,8	± 1,2	± 2
grob	± 0,15	± 0,2	± 0,5	± 0,8	± 1,2	± 2	± 3	± 4
sehr grob	-	± 0,5	± 1	± 1,5	± 2,5	± 4	± 6	± 8

Grenzabmaße für Winkelmaße (Werte in Grad und Minuten)

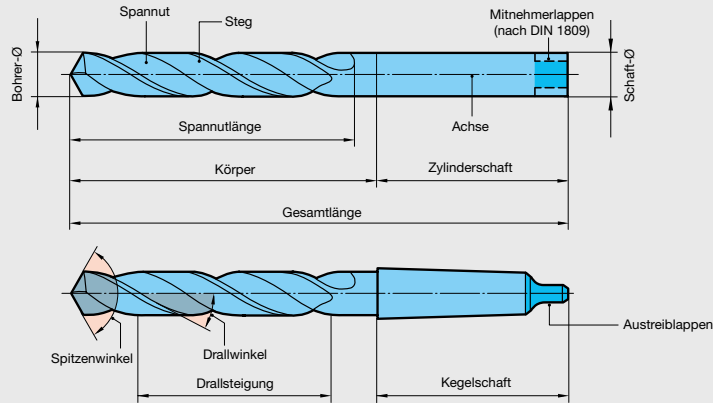
Genauigkeitsgrad	Nennmaßbereich				
	bis 10	über 10 bis 50	über 50 bis 120	über 120 bis 400	über 400
fein, mittel	± 1°	± 0° 30'	± 0° 20'	± 0° 10'	± 0° 5'
grob	± 1° 30'	± 1°	± 0° 30'	± 0° 15'	± 0° 10'
sehr grob	± 3°	± 2°	± 1°	± 0° 30'	± 0° 20'



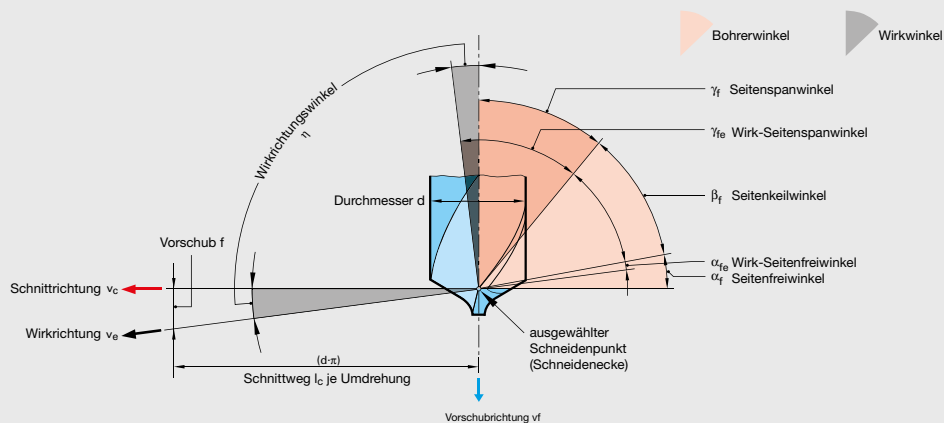
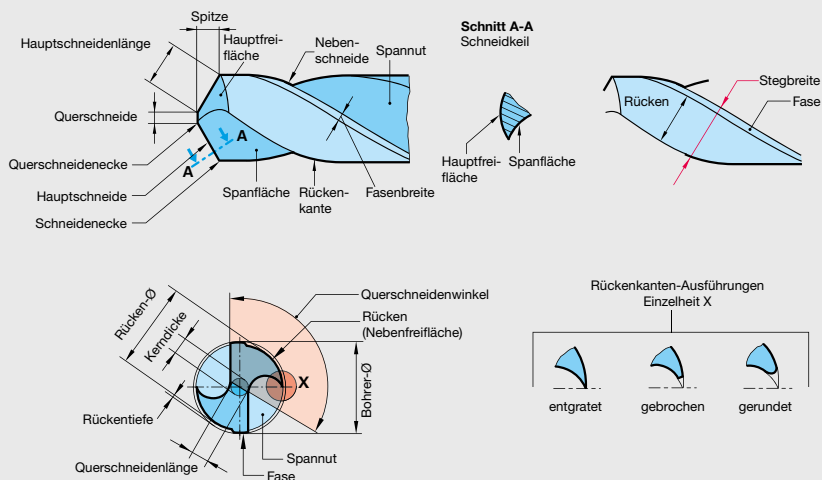
# HARTNER

## Begriffe, Maße und Winkel DIN ISO 5419 (Auszug; Ausgabe 06/98)

### Spiralbohrer mit Zylinderschaft/Kegelschaft



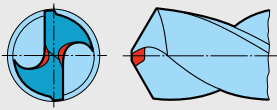
### Schneidteil



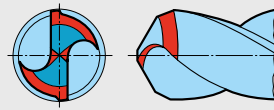


## Anschliffformen und Herstellungsgenauigkeiten

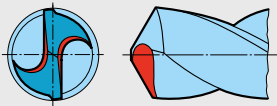
### Anschliffformen DIN 1412 (Auszug; Ausgabe 03/01)



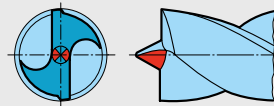
**Form A**  
Ausgespitzte  
Querschneide



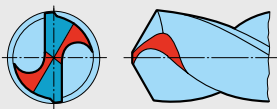
**Form D**  
Anschliff für  
Grauguss



**Form B**  
Ausgespitzte  
Querschneide mit  
korrigierter  
Hauptschneide



**Form E**  
Zentrumschneide



**Form C**  
Kreuzanschliff

### Spiralbohrer-Herstellungsgenauigkeit nach DIN ISO 286, Teil 2

Durchmesser (Nennmaß) bis inkl. mm	Abmaße $\mu\text{m}$	
	h8	h7
0,38 ... 0,60	10	7
0,95	12	8
3,00	14	10
6,00	18	12
10,00	22	15
18,00	27	18
30,00	33	21
50,00	39	25
80,00	46	30
120,00	54	35

#### Hinweis auf andere Normen

- DIN 228 Blatt 1 Werkzeugkegel; Morsekegel und Metrische Kegel, Kegelschäfte
- DIN 1414-1 Technische Lieferbedingungen für Spiralbohrer aus Schnellarbeitsstahl
- DIN 6580 Begriffe der Zerspantechnik; Bewegungen und Geometrie des Zerspanvorganges
- DIN 6581 Begriffe der Zerspantechnik; Bezugssysteme und Winkel am Schneidteil des Werkzeuges

Die Normblätter werden mit Genehmigung des Deutschen Instituts für Normung wiedergegeben. Maßgebend ist die jeweils neueste Ausgabe des Normblattes im Format A 4, die beim Beuth-Verlag GmbH, 10787 Berlin, erhältlich ist.

\* Kommen Sie mit unserer normalen Herstellungsgenauigkeit ISO h8 nicht aus, so bitten wir um Ihren Hinweis. Zuschläge für verengte Maßtoleranzen siehe Zuschlaglisten am Ende des Kapitels Bohrwerkzeuge.



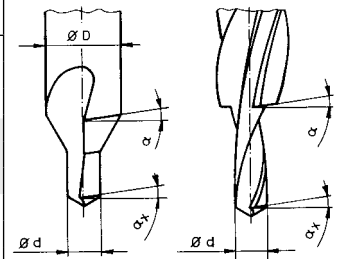
## Freiwinkel/Ausspannhäufigkeit

### Freiwinkel an Spiralbohrern aus HSS und HSS-E

Durchmesserbereich	Typ N, Typ H und für die Bohrstufe an Zentrierbohrern		Typ W, Typ FN, Typ FW, Typ S, Typ IS		Typ V	
	Seitenfreiwinkel $\alpha_x$	Spitzenwinkel	Seitenfreiwinkel $\alpha_x$	Spitzenwinkel	Seitenfreiwinkel $\alpha_x$	Spitzenwinkel
Bohrer-Ø im mm über bis						
0,14 – 0,24	28°	118°	28°	130°	28°	130°
0,24 – 0,48	25°	118°	25°	130°	25°	130°
0,48 – 0,95	23°	118°	23°	130°	23°	130°
0,95 – 2,36	20°	118°	20°	130°	20°	130°
2,36 – 6,00	15°	118°	15°	130°	15°	130°
6,00 – 15,00	13°	118°	13°	130°	13°	130°
15,00 – 37,50	10°	118°	10°	130°	10°	130°
37,50 – 100,00	8°	118°	8°	130°	8°	130°

### Freiwinkel an der Senkschneide bei Mehrfasenstufenbohrern, Stufenbohrern und Zentrierbohrern

Durchmesserbereich	Typ N, Typ S Senkwinkelbereich 20 - 160°      161 - 180°		Typ W, Typ H Senkwinkelbereich 20 - 160°      161 - 180°		Zentrierbohrer
	Seitenfreiwinkel $\alpha_x$	Seitenfreiwinkel $\alpha$	Seitenfreiwinkel $\alpha_x$	Seitenfreiwinkel $\alpha$	
Bohrer-Ø D über bis					Freiwinkel gem. am Schaft-Ø D
0,48 – 0,95	-	-	-	-	7°
0,95 – 2,36	14,0°	8°	16°	9°	7°
2,36 – 3,75	13,0°	7°	15°	8°	6°
3,75 – 6,00	12,5°	6,5°	14°	7°	5°
6,00 – 9,50	11,0°	6°	13°	7°	4°
9,50 – 15,00	10,0°	5°	12°	6°	4°
15,00 – 23,60	9,5°	5°	11°	6°	-
23,60 – 37,50	9,0°	4,5°	11°	5°	-
37,50 – 60,00	8,0°	4°	10°	5°	-

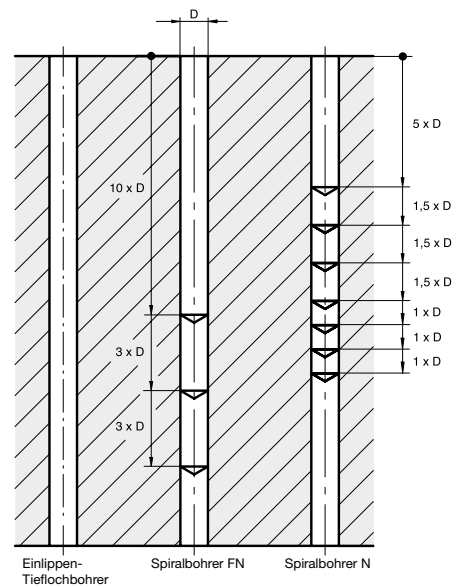


### Ausspannhäufigkeit beim Tiefbohren

Bei tiefen Bohrungen ist besonders zu beachten, dass genügend Kühlmittelflüssigkeit an die Schneiden des Bohrers gelangt. Durch ein- oder mehrmaliges Entspannen der Bohrung wird die Bohrerspitze ausreichend gekühlt. Die Entspannhäufigkeit ist hauptsächlich von dem zu bohrenden Werkstoff, der Bohrtiefe und vom Bohrertyp abhängig.

Bei Verwendung von Tieflochbohrern mit Flachnutprofil FN wird die Entspannhäufigkeit deutlich verringert. Durch Veränderung des Spitzenwinkels kann bei bestimmten Werkstoffen die Art der Spanbildung beeinflusst werden. Eine günstige Spanform verbessert sowohl den Spantransport als auch den Kühlmittelzufluss. Für extrem tiefe Bohrungen oder beim Horizontalbohren sind Kühlkanalbohrer mit innerer Kühlmittelzufuhr zu empfehlen.

Alle aufgeführten Daten sind Richtangaben und stellen Mittelwerte dar.



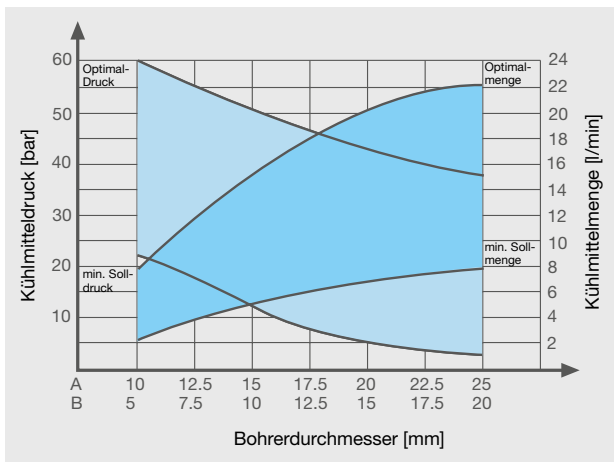




# HARTNER

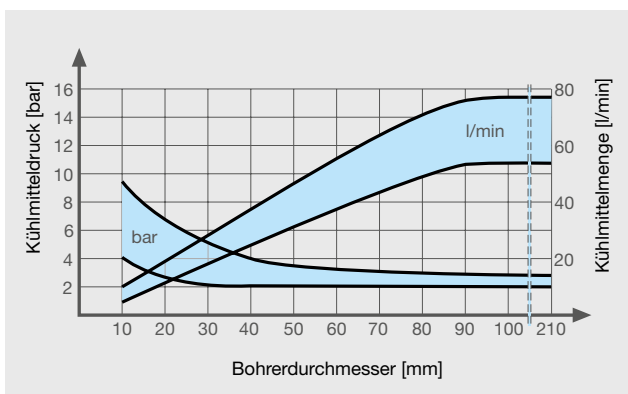
## Kühlmitteldiagramme Kühlmitteldruck und Kühlmittelvolumen

### Für Hartmetall-Spiralbohrer mit Innenkühlkanälen



A = Durchmesserreihe für Werkzeuge mit zentralem Innenkühlkanal  
 B = Durchmesserreihe für Werkzeuge mit verdrehten Innenkühlkanälen

### Für Wechselplatten-Spiralbohrer Multiplex mit Innenkühlkanälen



Als Kühlschmiermittel beim Bohren mit Wechselplatten aus HSS-E und HM dient Bohremulsion; sie kann im üblichen Mischungsverhältnis 1 : 20 verwendet werden.

Von ganz entscheidender Bedeutung ist ein leistungsfähiges Kühlmittelaggregat. Stehen Druck und Menge des Kühlmittels nicht in ausreichendem Maße zur Verfügung, so kann dies zu schlechter

Bohrungs-Oberfläche oder sogar zum Werkzeugbruch führen. Die Größe der Feststoffteilchen im Kühlmittel sollte 50 µm möglichst nicht überschreiten.



## Einsatzempfehlungen Spiralbohrer

- Bestell-Nr.
- Bestell-Nr.
- Norm/DIN
- Schneidstoff
- Oberfläche
- Typ
- Programm Seite

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

- rechtsschneidend
- linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	
Gehärtete Stähle	-		≤48 HRC	
			≤66 HRC	
Rostfreie Stähle, geschwefelt	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		
austenitisch	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1200		
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	
Hartguss	-		≤350 HB	
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤1600		
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤450		
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		
	<b>2.0790</b> CuNi18Zn19Pb	≤850		
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		
aramidfaserverstärkt	Kevlar	≤1000		
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		



## Einsatzempfehlungen Spiralbohrer

Bestell-Nr.
Bestell-Nr.
Norm/DIN
Schneidstoff
Oberfläche
Typ
Programm Seite

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

- rechtsschneidend
- linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		<input type="radio"/>
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		<input type="radio"/>
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		<input type="radio"/>
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		<input type="radio"/>
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		<input type="radio"/>
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		<input type="radio"/>
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		<input type="radio"/>
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		<input type="radio"/>
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		<input type="radio"/>
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		<input type="radio"/>
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		<input checked="" type="radio"/>
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		<input checked="" type="radio"/>
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		<input type="radio"/>
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		<input checked="" type="radio"/>
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		<input type="radio"/>
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		<input checked="" type="radio"/>
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		<input checked="" type="radio"/>
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	<input checked="" type="radio"/>
Gehärtete Stähle	-		≤48 HRC	<input checked="" type="radio"/>
			≤66 HRC	<input checked="" type="radio"/>
Rostfreie Stähle, geschwefelt	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		<input checked="" type="radio"/>
austenitisch	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		<input checked="" type="radio"/>
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		<input checked="" type="radio"/>
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	<input type="radio"/>
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	<input type="radio"/>
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	<input type="radio"/>
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	<input type="radio"/>
Hartguss	-		≤350 HB	<input type="radio"/>
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	<input type="radio"/>
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	<input type="radio"/>
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		<input type="radio"/>
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		<input type="radio"/>
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		<input checked="" type="radio"/>
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		<input checked="" type="radio"/>
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		<input checked="" type="radio"/>
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		<input type="radio"/>
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		<input type="radio"/>
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		<input type="radio"/>
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		<input type="radio"/>
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		<input type="radio"/>
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		<input type="radio"/>
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		<input type="radio"/>
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		<input type="radio"/>
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		<input type="radio"/>
	<b>2.0790</b> CuNi18Zn19Pb	≤850		<input checked="" type="radio"/>
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		<input checked="" type="radio"/>
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		<input checked="" type="radio"/>
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		<input type="radio"/>
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		<input type="radio"/>
aramidfaserverstärkt	Kevlar	≤1000		<input type="radio"/>
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		<input type="radio"/>



# HARTNER

≤3xD

81112
1897
<b>M42</b>
○
N
35

81000
WN
<b>M42</b>
⊙
104

81178
1897
<b>HSS-E</b>
●
IS
44

84803
1897
<b>HSS-E</b>
●
V
40

84503
1897
<b>HSS-E</b>
●
V
40

89253
6539
<b>VHM</b>
●
N
50



V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code
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15	3	15	2			14	3	17	4		
8	2	11	2			9	2	11	3	32	3
4	1	6	1			4	1	5	2	26	4
18	3	18	4	20	4	20	4	22	5	32	2
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35	5	45	6	30	6	40	6	45	7	117	5
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90	7			90	7					260	8
90	7			90	7					260	8
80	7	80	7	80	7					195	7
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70	6	80	6	70	6					234	6
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20		29	4							65	5
30	4	36	5	30	4					52	4
										104	4




## Einsatzempfehlungen Spiralbohrer

Bestell-Nr. 
Bestell-Nr. 
Norm/DIN
Schneidstoff
Oberfläche
Typ
Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.




















































Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

-  Luft
-  Öl
-  Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	
Gehärtete Stähle	-		≤48 HRC	
			≤66 HRC	
Rostfreie Stähle, geschwefelt	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		
austenitisch	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	
Hartguss	-		≤350 HB	
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		
	<b>2.0790</b> CuNi18Zn19Pb	≤850		
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		
aramidfaserverstärkt	Kevlar	≤1000		
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		



## Einsatzempfehlungen Spiralbohrer

Bestell-Nr. 

Bestell-Nr. 

Norm/DIN

Schneidstoff

Oberfläche

Typ

Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		<input type="radio"/>
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		<input type="radio"/>
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		<input type="radio"/>
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		<input type="radio"/>
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		<input type="radio"/>
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		<input type="radio"/>
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		<input type="radio"/>
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		<input type="radio"/>
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		<input type="radio"/>
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		<input type="radio"/>
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		<input checked="" type="radio"/>
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		<input checked="" type="radio"/>
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		<input type="radio"/>
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		<input checked="" type="radio"/>
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		<input type="radio"/>
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		<input checked="" type="radio"/>
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		<input checked="" type="radio"/>
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	<input checked="" type="radio"/>
Gehärtete Stähle	-		≤48 HRC	<input checked="" type="radio"/>
			≤66 HRC	<input checked="" type="radio"/>
Rostfreie Stähle, geschwefelt	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		<input checked="" type="radio"/>
austenitisch	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		<input checked="" type="radio"/>
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		<input checked="" type="radio"/>
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	<input type="radio"/>
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	<input type="radio"/>
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	<input type="radio"/>
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	<input type="radio"/>
Hartguss	-		≤350 HB	<input type="radio"/>
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	<input type="radio"/>
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	<input type="radio"/>
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		<input type="radio"/>
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		<input type="radio"/>
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		<input checked="" type="radio"/>
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		<input checked="" type="radio"/>
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		<input checked="" type="radio"/>
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		<input type="radio"/>
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		<input type="radio"/>
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		<input type="radio"/>
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		<input type="radio"/>
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		<input type="radio"/>
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		<input type="radio"/>
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		<input type="radio"/>
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		<input type="radio"/>
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		<input type="radio"/>
	<b>2.0790</b> CuNi18Zn19Pb	≤850		<input checked="" type="radio"/>
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		<input checked="" type="radio"/>
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		<input checked="" type="radio"/>
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		<input type="radio"/>
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		<input type="radio"/>
aramidfaserverstärkt	Kevlar	≤1000		<input type="radio"/>
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		<input type="radio"/>





≤5xD

81010	81017	82010	81020	81030	82030	81040
81015			81025	81035		81045
338	338	345	338	338	345	338
<b>HSS</b>						
N	N	N	H	W	W	FN
53/57	59	173	60/62	64/66	177	67/69

84406
338
<b>HSS</b>
N
73

84405	84460	84415
338	345	338
<b>HSS</b>		
N	N	FN
71	176	75

84502
338
<b>HSS</b>
FN
75



V <sub>c</sub> m/min	Vorschubreihen-Code					
27	6	6	6			6
22	5	5	5			5
30	6	6	6			6
30	5	5	5			5
25	5	5	5			5
25	5	5	5			5
30	6	6	6			6
16	4	4	4			4
30	6	6	6			6
30	6	6	6			6
25	6	6	6			6
25	6	6	6			6
80				7	7	
80				7	7	
70	7	7	7		7	7
70	6	6	6			6
50	6	6	6	6		6
50	5	5	5		5	5
70				6		
40	5	5	5			5
30	4	4	4	4		
25	4	4	4			
15	4	4	4			4
18	4	4	4	4		4
28	5	5	5	5	5	5

V <sub>c</sub> m/min	VR-Code
32	6
26	5
36	6
36	5
31	5
31	5
28	4
24	4
36	6
22	4
16	4
20	4
36	6
36	6
31	6
24	6
90	6
70	5
80	5
50	5
36	4
33	4
18	4
18	4
29	4
36	5

V <sub>c</sub> m/min	Vorschubreihen-Code		
30	6	6	6
24	5	5	5
33	6	6	6
33	5	5	5
28	5	5	5
28	5	5	5
25	4	4	4
22	4	4	4
33	6	6	6
20	4	4	4
14	4	4	4
18	4	4	4
33	6	6	6
33	6	6	6
28	6	6	6
22	6	6	6
80	6	6	
65	5	5	5
75	5	5	5
45	5	5	5
33	4	4	
27	4	4	
16	4	4	4
15	4	4	4
22	4	4	4
36	5	5	

V <sub>c</sub> m/min	VR-Code
32	7
26	6
36	7
36	6
31	6
31	6
28	5
24	5
36	7
22	5
16	5
20	5
36	7
36	7
31	7
24	7
85	8
85	8
60	8
60	7
90	7
70	6
80	6
50	6
18	5
18	5
29	5



## Einsatzempfehlungen Spiralbohrer

Bestell-Nr.
Bestell-Nr.
Norm/DIN
Schneidstoff
Oberfläche
Typ
Programm Seite

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

- rechtsschneidend
- linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	
Gehärtete Stähle	-		≤48 HRC	
			≤66 HRC	
Rostfreie Stähle, geschwefelt	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		
austenitisch	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	
Hartguss	-		≤350 HB	
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		
	<b>2.0790</b> CuNi18Zn19Pb	≤850		
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		
aramidfaserverstärkt	Kevlar	≤1000		
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		



# HARTNER

≤5xD

81011	82011	81041	81061	81013	82012	81012
338	345	338	338	338	345	338
HSS-E						M42
N	N	FN	S	IS	IS	N
83	177	87	89	85	178	77

84800	84859	84807
338		338
HSS-E		
FN	N	S
91	180	95

84504	84505
338	338
HSS-E	
FN	S
91	95





V <sub>c</sub> m/min	Vorschubreihen- Code					
35	5	5	5	5	5	5
30	5	5	5	5	5	5
40	5	5	5	5	5	5
40	5	5	5	5	5	5
40	5	5	5	5	5	5
40	5	5	5	5	5	5
35	4	4	4	4	4	4
20	4	4	4	4	4	4
16	3	3	3	3	3	3
36	6	6	6	6	6	6
20	4	4	4	4	4	4
15	3	3	3	3	3	3
16	4	4	4	4	4	4
12	3	3	3	3	3	3
15	4	4	4	4	4	4
12	3	3	3	3	3	3
15	3	3	3	3	3	3
8	2	2	2	2	2	2
4						1
18	4	4	4	4	4	3
14	3	3	2	3	3	3
16	3	3	3	3	3	3
35	6	6	6	6	6	5
30	6	6	6	6	6	5
30	6	6	6	6	6	5
28	6	6	6	6	6	5
10	3	3	3	3	3	3
8			1			1
10			2	2	2	2
6			2	2	2	2
90			7	7	7	7
90			7	7	7	7
80		7	7	7	7	7
70		6	6	6	6	6
70			6	6	6	6
40	5	5	5	5	5	5
60			5	5	5	5
40	5	5	4	5	5	5
35	4	4		4	4	4
33	4	4		4	4	4
20	4	4	4	4	4	4
15	4	4	4	1	1	4
20	4	4	4			

V <sub>c</sub> m/min	Vorschubreihen- Code		
38	6	6	6
33	5	5	5
44	5	5	5
38	5	5	5
44	5	5	5
38	4	4	4
27	4	4	4
22	3	3	3
44	4	4	4
22	4	4	4
18	3	3	3
22	4	4	4
18	3	3	3
19	4	4	4
14	3	3	3
14	3	3	3
9		2	2
20	4	4	4
15		3	3
18	3		3
40	6	6	6
35	6	6	6
33	6	6	6
27	6	6	6
12			3
6			2
11			2
7			2
88	5	5	5
40		4	
22	4	4	4
17	4	4	4
22	4	4	4

V <sub>c</sub> m/min	Vorschubreihen- Code	
42	6	6
36	5	5
48	6	6
42	6	6
48	6	6
42	5	5
30	5	5
34	4	4
48	6	6
24	5	5
20	4	4
24	5	5
20	4	4
21	5	5
16	4	4
17	4	4
11	3	3
6	1	1
22	5	5
17	4	4
20	4	4
45	7	7
40	7	7
36	7	7
29	7	7
14	4	4
7		2
12		2
8		2
85	8	8
72	7	7
96	6	6
25	5	5
20	5	5
24	5	5

## Einsatzempfehlungen Spiralbohrer

Bestell-Nr. 
Bestell-Nr. 
Norm/DIN
Schneidstoff
Oberfläche
Typ
Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		<input type="radio"/>
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		<input type="radio"/>
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		<input type="radio"/>
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		<input type="radio"/>
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		<input type="radio"/>
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		<input type="radio"/>
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		<input type="radio"/>
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		<input type="radio"/>
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		<input type="radio"/>
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		<input type="radio"/>
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		<input checked="" type="radio"/>
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		<input checked="" type="radio"/>
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		<input type="radio"/>
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		<input checked="" type="radio"/>
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		<input type="radio"/>
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		<input checked="" type="radio"/>
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		<input checked="" type="radio"/>
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	<input checked="" type="radio"/>
Gehärtete Stähle	-		≤48 HRC	<input checked="" type="radio"/>
			≤66 HRC	<input checked="" type="radio"/>
Rostfreie Stähle, geschwefelt austenitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		<input checked="" type="radio"/>
	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		<input checked="" type="radio"/>
	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		<input checked="" type="radio"/>
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	<input type="radio"/>
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	<input type="radio"/>
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	<input type="radio"/>
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	<input type="radio"/>
Hartguss	-		≤350 HB	<input type="radio"/>
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	<input type="radio"/>
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	<input type="radio"/>
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		<input type="radio"/>
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		<input type="radio"/>
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		<input checked="" type="radio"/>
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		<input checked="" type="radio"/>
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		<input checked="" type="radio"/>
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		<input type="radio"/>
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		<input type="radio"/>
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		<input type="radio"/>
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		<input type="radio"/>
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		<input type="radio"/>
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		<input type="radio"/>
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		<input type="radio"/>
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		<input type="radio"/>
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		<input type="radio"/>
	<b>2.0790</b> CuNi18Zn19Pb	≤850		<input checked="" type="radio"/>
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		<input checked="" type="radio"/>
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		<input checked="" type="radio"/>
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		<input type="radio"/>
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		<input type="radio"/>
aramidfaserverstärkt	Kevlar	≤1000		<input type="radio"/>
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		<input type="radio"/>



# HARTNER

≤5xD

81018	81019	81078	84804	84802	84801	84660
338	338	338	338	338	WN	345
M42	M42	HSS-E	HSS-E	HSS-E	HSS-E-PM	HSS-E
N	N	IS	FU 500 DZ	FU 500 DZ	FU 500	FN
79	81	97	93	93	107	176



V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code
35	6	32	7	38	6	35	6	45	6	45	6	42	5
30	5	26	6	33	5	30	5	35	5	35	5		
40	6	36	7	44	6	40	6	50	6	50	6		
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40	5	31	6	44	5	32	6	44	6	44	6		
40	5	31	6	44	5	28	6	44	6	44	6		
35	4	28	5			20	5	40	5	40	5		
20	4	24	5			15	4	27	4	27	4		
16	3					13	3	22	3	22	3		
36	6	36	7	40	6	30	6	44	6	44	6		
20	3	22	5			16	4	22	4	22	4		
15	3					12	3	18	3	18	3		
16	4	16	5			15	4	22	4	22	4		
12	3					10	3	16	3	16	3		
15	3	20	5			15	4	20	4	20	4		
12	3					10	3	15	3	15	3		
15	3					10	3	13	3	13	3		
8	2							9	2	9	2		
4	1												
18	3			20	4	14	4	20	4	20	4		
14	3			15	3	10	4	16	4	16	4		
16	3			18	3	12	4	18	4	18	4		
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30	6	31	7			30	6	40	6	40	6	36	7
28	6	24	7			22	6	30	6	30	6	29	7
10	3												
8	1			8	1								
10	2			12	2								
6	2			8	2								
90	7	85	8	90	7	50	7	70	7	70	7		
90	7	85	8	90	7	50	7	70	7	70	7		
80	7	60	8	80	7	65	7	85	7	85	7		
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70	5	70	6	70	5	70	5	80	5	88	5	96	5
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20	4	29	5			20	4	25	4	25	4	24	5
30	5			30	4	15	4	27	4	27	4		




# Einsatzempfehlungen Spiralbohrer

Bestell-Nr.   
 Norm/DIN  
 Schneidstoff  
 Oberfläche  
 Typ  
 Kühlung  
 Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.





































Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

-  Luft
-  Öl
-  Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		 
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		 
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		  
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		 
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		 
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		 
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		 
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	 
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		  
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	 
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	 
Hartguss	-		≤350 HB	
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	 
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		 
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		 
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		
Al-Gusslegierungen ≤ 10 % Si ≤ 24 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9 <b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤600		 
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		
Messing, langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		 
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		 
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		
aramidfaserverstärkt	Kevlar	≤1000		
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		



# HARTNER

≤5xD

84811
338
<b>HSS-E-PM</b>
<b>T</b>
FN 500 DZ
99

84507
WN
<b>HSS-E-PM</b>
<b>F</b>
FN 500
107

82761
WN
<b>HSS-E</b>
○
FN
axial
120

84461
WN
<b>HSS-E</b>
<b>T</b>
FN
axial
120

89244
WN
<b>VHM</b>
○
N
100

89261
WN
<b>VHM</b>
<b>F</b>
N
102



V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code
40	6	42	6	48	7	60	7	80	4	100	5
32	5	37	5	38	6	48	6	70	4	90	5
45	6	47	6	48	7	60	7	80	5	100	6
40	5	44	6	38	6	48	6	70	4	90	4
42	6	47	6	48	6	60	6	80	4	100	5
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28	4	44	5	45	5	50	5	60	4	80	5
25	4	30	4	30	5	33	5	60	4	80	5
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25	4	22	5	24	5	30	5				
15	3	17	4	17	4	20	4				
15	3	14	4	14	4	18	4				
10	2	12	2	12	3	15	3	25	2	30	3
				4	3	5	3	20	2	20	2
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12	3	20	3	16	4	20	4	25	2	30	2
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32	6	33	7	35	7	40	7	80	4	80	5
8	3	16	4	12	4	15	4				
5	2	6	2	10	2	12	2	15	2	20	3
				14	3	18	3	15	1	15	1
				10	3	12	3	15	1	15	1
								200	7	260	8
								200	7	260	8
				95	7	120	7	150	6	195	7
				75	8	95	8	120	6	155	7
								180	5	235	6
50	5	50	5	90	6	100	6	80	5	100	6
								180	5	235	6
60	5	60	5	50	6	55	6	180	5	235	6
50	5	50	5					120	5	155	6
45	4	44	5	48	5	60	5	120	5	155	6
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32	4	28	5	38	5	45	5	50	3	65	4
25	4	25	4					50	4	50	5
				38	6	48	6	40	3	65	4
								80	3	100	4

# Einsatzempfehlungen Spiralbohrer

Bestell-Nr. 
Bestell-Nr. 
Norm/DIN
Schneidstoff
Oberfläche
Typ
Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		<input type="radio"/>
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		<input type="radio"/>
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		<input type="radio"/>
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		<input type="radio"/>
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		<input type="radio"/>
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		<input type="radio"/>
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		<input type="radio"/>
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		<input type="radio"/>
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		<input type="radio"/>
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		<input type="radio"/>
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		<input checked="" type="radio"/>
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		<input checked="" type="radio"/>
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		<input type="radio"/>
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		<input checked="" type="radio"/>
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		<input type="radio"/>
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		<input checked="" type="radio"/>
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		<input checked="" type="radio"/>
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	<input checked="" type="radio"/>
Gehärtete Stähle	-		≤48 HRC	<input checked="" type="radio"/>
			≤66 HRC	<input checked="" type="radio"/>
Rostfreie Stähle, geschwefelt	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		<input checked="" type="radio"/>
austenitisch	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		<input checked="" type="radio"/>
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		<input checked="" type="radio"/>
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	<input type="radio"/>
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	<input type="radio"/>
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	<input type="radio"/>
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	<input type="radio"/>
Hartguss	-		≤350 HB	<input type="radio"/>
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	<input type="radio"/>
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	<input type="radio"/>
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		<input type="radio"/>
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		<input type="radio"/>
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		<input checked="" type="radio"/>
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		<input checked="" type="radio"/>
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		<input checked="" type="radio"/>
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		<input type="radio"/>
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		<input type="radio"/>
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		<input type="radio"/>
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		<input type="radio"/>
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		<input type="radio"/>
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		<input type="radio"/>
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		<input type="radio"/>
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		<input type="radio"/>
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		<input type="radio"/>
	<b>2.0790</b> CuNi18Zn19Pb	≤850		<input checked="" type="radio"/>
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		<input checked="" type="radio"/>
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		<input checked="" type="radio"/>
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		<input type="radio"/>
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		<input type="radio"/>
aramidfaserverstärkt	Kevlar	≤1000		<input type="radio"/>
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		<input type="radio"/>





## Einsatzempfehlungen Spiralbohrer

Bestell-Nr.   
 Norm/DIN  
 Schneidstoff  
 Oberfläche  
 Typ  
 Kühlung  
 Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- ◐ Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		○
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		○
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		○
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		○
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		●
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		●
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		○
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	●
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		●
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	○
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	○
Hartguss	-		≤350 HB	○
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	○
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		○
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		●
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
Al-Gusslegierungen ≤ 10 % Si ≤ 24 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9 <b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤600		○
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		○
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		○
Messing, langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		○
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		○
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		○
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		○
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		○
aramidfaserverstärkt	Kevlar	≤1000		○
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		○



# HARTNER

## ≤10xD

81311	82211	81341	81361
340	341	340	340
HSS-E			
N	N	FN	S
138	185	139	141

81362
340
HSS-E
S
141

84508
340
HSS-E
FN
145



V <sub>c</sub> m/min	Vorschubreihen- Code			
33	5	5	5	
27	5	5	5	
36	5	5	5	
32	5	5	5	
36	5	5	5	
36	5	5	5	
22	4	4	4	
18	4	4	4	
14	3	3	3	3
32	5	5	5	
18	4	4	4	
13	3	3	3	
14	4	4	4	
10	3	3	3	
13	4	4	4	
10	3	3	3	
12	3	3	3	
6	2	2	2	
4			1	
12	4	4	4	4
8	3	3	2	3
10	3	3	3	3
32	6	6	6	
27	6	6	6	
26	6	6	6	
24	6	6	6	
6	3	3	3	3
5	1	1		1
8				2
5				2
70			7	
60			6	
60				5
36	5	5	5	
54			5	
36	5	5	5	
30	4	4	5	
24	4	4	5	
18	4	4	4	
13	4	4	4	4
16	4	4	4	
26				4

V <sub>c</sub> m/min	VR- Code
15	3
13	3
10	3
10	3
10	3
10	3
8	2
15	4
10	3
13	3
6	3
6	1
10	2
6	2
25	4

V <sub>c</sub> m/min	VR- Code
36	5
30	4
40	5
36	5
40	5
40	5
26	4
18	4
15	3
32	5
20	4
18	3
18	4
12	3
15	4
12	3
14	3
9	3
5	1
14	4
10	3
12	3
35	6
30	6
30	6
26	6
12	3
77	7
66	6
40	6
40	6
21	5
15	5
30	5

## Einsatzempfehlungen Spiralbohrer

Bestell-Nr.   
 Norm/DIN  
 Schneidstoff  
 Oberfläche  
 Typ  
 Kühlung  
 Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		<input type="radio"/> <input type="radio"/>
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		<input type="radio"/> <input type="radio"/>
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		<input type="radio"/> <input type="radio"/> <input type="radio"/>
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		<input type="radio"/> <input type="radio"/>
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		<input type="radio"/>
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		<input checked="" type="radio"/> <input type="radio"/>
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		<input type="radio"/> <input checked="" type="radio"/>
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		<input type="radio"/> <input checked="" type="radio"/>
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		<input checked="" type="radio"/>
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	<input checked="" type="radio"/>
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	<input checked="" type="radio"/> <input checked="" type="radio"/>
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		<input checked="" type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/>
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	<input type="radio"/> <input type="radio"/>
Kugelgraphit- und Tempereguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	<input type="radio"/> <input type="radio"/>
Hartguss	-		≤350 HB	<input type="radio"/>
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	<input type="radio"/> <input type="radio"/>
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		<input type="radio"/> <input type="radio"/>
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		<input checked="" type="radio"/>
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		<input checked="" type="radio"/> <input checked="" type="radio"/>
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		<input type="radio"/>
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		<input type="radio"/>
Al-Gusslegierungen ≤ 10 % Si ≤ 24 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9 <b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤600		<input type="radio"/> <input type="radio"/>
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		<input type="radio"/>
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		<input type="radio"/>
Messing, kurzspanend langspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2 <b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600 ≤600		<input type="radio"/> <input type="radio"/>
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		<input type="radio"/> <input checked="" type="radio"/>
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		<input checked="" type="radio"/> <input checked="" type="radio"/>
Kunststoffe, duroplastisch thermoplastisch	Bakelit, Resopal, Pertinax, Moltopren Plexiglas, Hostalen, Novodur, Makralon	≤150 ≤100		<input type="radio"/> <input type="radio"/>
aramidfaserverstärkt glas-/kohlefaserverstärkt	Kevlar GFK/CFK	≤1000 ≤1000		<input type="radio"/> <input type="radio"/>



# HARTNER

≤10xD

89286
WN
VHM
○
N
axial
146

82710	82521	82535
WN	WN	WN
HSS		
○	●	●
FN	N	FN
axial	axial	axial
121	195	196

82525
WN
HSS-E
●
FN
axial
197

82515
WN
HSS-E
●
FN
axial
198



V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	Vorschubreihen-Code			V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code
		26	6	6	6	35	6	30	5
		22	5	5	5	30	5	25	4
		30	6	6	6	30	6	30	5
		30	5	5	5	30	5	25	4
		24	5	5	5	35	5	30	4
		24	5	5	5	29	5	25	4
		22	4	4	4	22	4	18	3
		20	4	4	4	18	4	16	3
		14	3	3	3	14	3	12	2
		30	6	6	6	35	6	30	5
		17	4	4	4	18	4	16	3
		12	3	3	3	14	3	12	2
		14	4	4	4	14	4	12	3
		10	3	3	3	12	3	10	2
		15	4	4	4	15	4	13	3
		10	3	3	3	11	3	9	2
		10	3	3	3	11	3	9	2
		7	2	2	2	8	2	6	2
						4	2	4	1
						14	4	12	3
						10	3	8	2
						12	3	12	2
		30	6	6	6	30	6	28	5
		30	6	6	6	24	6	22	5
		24	6	6	6	24	6	22	5
		20	6	6	6	20	6	18	5
		7	3	3	3	8	3	6	2
						8	1	6	1
						10	2	8	2
						8	2	6	2
		80	6						
		50	7	7	7	60	7	55	6
		50	6	6	6	50	6	44	5
		60	5	5	5	38	5	35	4
						55	5	50	4
		40	5	5	5	36	5	33	4
		24	4	4	4	24	4	22	4
		24	4	4	4	20	4	18	4
		22	4	4	4	14	4	12	4
50	4								
40	3	24	5	5	5	25	5	25	4
80	3								

## Einsatzempfehlungen Spiralbohrer

Bestell-Nr. 

Norm/DIN

Schneidstoff

Oberfläche




Typ

Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.










































Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

-  Luft
-  Öl
-  Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	
Gehärtete Stähle	-		≤48 HRC	
			≤66 HRC	
Rostfreie Stähle, geschwefelt	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		
austenitisch	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	
Hartguss	-		≤350 HB	
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		
	<b>2.0790</b> CuNi18Zn19Pb	≤850		
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		
aramidfaserverstärkt	Kevlar	≤1000		
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		



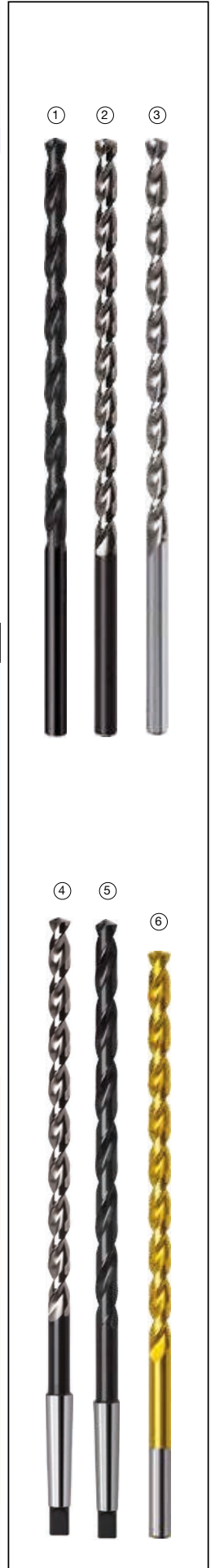
## >10xD

81410	82310	81450	81440	81740	82340	82466
81510	82410		81540	81750	82440	82467
81610			81640	81760		82468
						82469
1869	1870	1869	1869	WN	1870	WN
<b>HSS</b>						
N	N	FW	FN	FN	FN	FN
147/152/ 156	186/189	149	148/153/ 157	159-161	187/190	191-194
①	⑤	③	②	④	④	④

84425	
84426	
1869	
<b>HSS</b>	
FN	
150/154	
⑥	

81441	
81541	
81641	
1869	
<b>HSS-E</b>	
FN	
151/155/ 158	
②	

82341	
1870	
<b>HSS-E</b>	
FN	
188	
④	



V <sub>c</sub> m/min	Vorschubreihen-Code					
22	5	5	5	5	5	5
18	4	4	4	4	4	4
20	5	5	5	5	5	5
20	4	4	4	4	4	4
25	4	4	4	4	4	4
25	4	4	4	4	4	4
12	3	3				
22	5	5	5	5	5	5
10	3	3				
8	3	3				
12	3	3	3	3	3	3
6	2	2	2	2	2	2
6	2	2				
22	5	5	5	5	5	5
18	5	5	5	5	5	5
20	5	5	5	5	5	5
14	5	5	5	5	5	5
55	6					
55	6					
45	6	6	6	6	6	6
36	5	5	5	5	5	5
55	5	5	5	5	5	5
22	4	4	4	4	4	4
45	4	4				
28	4	4	4	4	4	4
22	3	3	3	3	3	3
20	3	3	3	3	3	3
18	3	3	3	3	3	3
12	3	3	3	3	3	3
18	4	4	4	4	4	4

V <sub>c</sub> m/min	VR-Code
28	5
22	4
28	5
22	4
28	4
22	4
16	3
28	5
12	3
8	2
10	2
14	3
10	2
10	3
8	2
11	3
8	2
8	2
5	1
3	1
28	5
22	5
25	5
18	5
6	1
70	6
70	6
55	6
45	5
70	5
28	4
36	4
28	3
25	3
22	3
18	3
15	3
22	4

V <sub>c</sub> m/min	VR-Code
30	4
25	4
33	4
30	4
33	4
33	4
20	3
14	3
10	2
29	4
14	3
10	2
10	3
8	2
11	3
8	2
8	2
5	1
3	1
10	3
8	2
10	2
20	5
16	5
5	2
5	1
6	1
5	1
50	6
40	5
30	4
45	4
30	4
25	4
20	4
16	3
10	3
14	3
20	3

V <sub>c</sub> m/min	VR-Code
30	4
25	4
33	4
30	4
33	4
33	4
20	3
14	3
10	2
29	4
14	3
10	2
10	3
8	2
11	3
8	2
8	2
5	1
3	1
10	3
8	2
10	2
20	5
16	5
5	2
5	1
6	1
5	1
50	6
70	5
30	4
45	4
30	4
25	4
20	4
16	3
10	3
14	3
20	3



## Einsatzempfehlungen Kleinstbohrer

Artikel-Nr.

Artikel-Nr.

Norm/DIN

Schneidstoff

HM-Anwendungsgruppe

Oberfläche

Typ

Kühlung

Programm Seite

Bohrer-Ø mm	Vorschubreihen-Code								
	101	102	103	104	105	106	107	108	109
	f (mm/U)								
0,10	0,002	0,003	0,003	0,004	0,006	0,007	0,010	0,013	0,016
0,16	0,002	0,003	0,004	0,005	0,007	0,009	0,012	0,016	0,022
0,25	0,003	0,004	0,005	0,007	0,009	0,011	0,014	0,019	0,024
0,30	0,004	0,005	0,007	0,009	0,011	0,015	0,019	0,025	0,033
0,50	0,005	0,007	0,008	0,011	0,014	0,019	0,024	0,031	0,041
0,63	0,007	0,009	0,012	0,015	0,020	0,026	0,034	0,044	0,057
0,80	0,010	0,013	0,016	0,020	0,024	0,031	0,038	0,048	0,060
1,00	0,020	0,024	0,029	0,035	0,041	0,050	0,060	0,072	0,086
1,50	0,030	0,035	0,040	0,046	0,052	0,060	0,069	0,080	0,092
2,00	0,040	0,046	0,053	0,061	0,070	0,080	0,093	0,106	0,122

Bohrer-Ø mm	Vorschubreihen-Code Art.-Nr. 6400/6401/6408/6412												
	56	57	58	59	60	61	62	63	64	65	66	67	68
	f (mm/U)												
0,80	0,008	0,016	0,024	0,032	0,04	0,05	0,06	0,07	0,08	0,08	0,08	0,09	0,09
1,00	0,012	0,022	0,032	0,042	0,06	0,07	0,08	0,09	0,10	0,10	0,11	0,11	0,12
1,50	0,021	0,036	0,051	0,066	0,09	0,10	0,12	0,13	0,15	0,15	0,16	0,17	0,18
2,00	0,032	0,052	0,072	0,092	0,12	0,14	0,16	0,18	0,20	0,21	0,22	0,23	0,24
2,50	0,045	0,070	0,095	0,120	0,15	0,17	0,20	0,22	0,25	0,26	0,27	0,28	0,30
3,00	0,060	0,090	0,120	0,150	0,18	0,21	0,24	0,27	0,30	0,31	0,33	0,34	0,36

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

- rechtsschneidend
- linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	1.0035 S185(St33), 1.0486 P275N(StE285), 1.0345 P235GH(H1), 1.0425 P265GH(H2) 1.0050 E295 (St50-2), 1.0070 E360 (St70-2), 1.8937 P500NH (WStE500)	≤500 ≤1000		<input type="radio"/>
Automatenstähle	1.0718 11SMnPb30 (9SMnPb28), 1.0736 11SMn37 (9SMn36) 1.0727 46S20 (45S20), 1.0728 (60S20), 1.0757 46SPb20 (45SPb20)	≤850 ≤1000		<input type="radio"/>
Unlegierte Vergütungsstähle	1.0402 C22, 1.1178 C30E (Ck30) 1.0503 C45, 1.1191 C45E (Ck45) 1.0601 C60, 1.1221 C60E (Ck60)	≤700 ≤850 ≤1000		<input type="radio"/>
Legierte Vergütungsstähle	1.5131 50MnSi4, 1.7003 38Cr2, 1.7030 28Cr4 1.5710 36NiCr6, 1.7035 41Cr4, 1.7225 42CrMo4	≤1000 ≤1400		<input type="radio"/>
Unlegierte Einsatzstähle	1.0301 (C10), 1.1121 C10E (Ck10)	≤850		<input type="radio"/>
Legierte Einsatzstähle	1.7276 10CrMo11, 1.5125 11MnSi6 1.5752 15NiCr13, 1.7131 16MnCr5, 1.7264 20CrMo5	≤1000 ≤1400		<input checked="" type="radio"/>
Nitrierstähle	1.8504 34CrAl6 1.8519 31CrMoV9, 1.8550 34CrAlNi7	≤1000 ≤1400		<input checked="" type="radio"/>
Werkzeugstähle	1.1750 C75W, 1.2067 102Cr6, 1.2307 29CrMoV9 1.2080 X210Cr12, 1.2083 X42Cr13, 1.2419 105WCr6, 1.2767 X45NiCrMo4	≤850 ≤1400		<input type="radio"/>
Schnellarbeitsstähle	1.3243 S 6-5-2-5, 1.3343 S 6-5-2, 1.3344 S 6-5-3	≤1400		<input checked="" type="radio"/>
Federstähle	1.5026 55Si7, 1.7176 55Cr3, 1.8159 51CrV4 (51CrV4)		≤350 HB	<input checked="" type="radio"/>
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	<input checked="" type="radio"/>
Rostfreie Stähle, geschwefelt austenitisch martensitisch	1.4005 X12CrS13, 1.4104 X14CrMoS17, 1.4105 X6CrMoS17, 1.4305 X8CrNiS18-9 1.4301 X5CrNi18-10 (V2A), 1.4541 X6CrNiTi18-10, 1.4571 X6CrNiMoTi 17-12-2 (V4A) 1.4057 X20CrNi172 (X17CrNi16-2), 1.4122 X39CrMo17-1, 1.4521 X2CrMoTi18-2	≤900 ≤1100 ≤1500		<input checked="" type="radio"/>
Gusseisen	0.6010 EN-GJL-100 (GG10), 0.6020 EN-GJL-200 (GG20) 0.6025 EN-GJL-250 (GG25), 0.6035 EN-GJL-350 (GG35)		≤240 HB ≤350 HB	<input type="radio"/>
Kugelgraphit- und Temperguss	0.7050 EN-GJS-500-7 (GGG50), 0.8035 EN-GJMW-350-4 (GTW35) 0.7070 EN-GJS-700-2 (GGG70), 0.8170 EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	<input type="radio"/>
Hartguss	-		≤350 HB	<input type="radio"/>
Neue Gusswerkstoffe GGV	EN-GJV250 (GGV25), EN-GJV350 (GGV35) EN-GJV400 (GGV40), EN-GJV500 (GGV50), SiMo 6		≤220 HB ≤300 HB	<input type="radio"/>
Neue Gusswerkstoffe ADI	EN-GJS-800-8 (ADI800), EN-GJS-1000-5 (ADI1000) EN-GJS-1200-2 (ADI1200), EN-GJS-1400-1 (ADI1400)	≤1000 ≤1400		<input type="radio"/>
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		<input checked="" type="radio"/>
Titan und Titan-Legierungen	3.7024 Ti99,5, 3.7114 TiAl5Sn2,5, 3.7124 TiCu2 3.7154 TiAl6Zr5, 3.7165 TiAl6V4, 3.7184 TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		<input checked="" type="radio"/>
Aluminium und Al-Legierungen	3.0255 Al99,5, 3.2315 AlMgSi1, 3.3515 AlMg1	≤400		<input type="radio"/>
Al-Knetlegierungen	3.0615 AlMgSiPb, 3.1325 AlCuMg1, 3.3245 AlMg3Si, 3.4365 AlZnMgCu1,5	≤650		<input type="radio"/>
Al-Gusslegierungen ≤ 10 % Si	3.2131 G-AlSi5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9	≤600		<input type="radio"/>
≤ 24 % Si	3.2581 G-AlSi12, 3.2583 G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		<input type="radio"/>
Magnesium-Legierungen	3.5200 MgMn2, 3.5812.05 G-MgAl8Zn1, 3.5612.05 G-MgAl6Zn1	≤400		<input type="radio"/>
Kupfer, niedriglegiert	2.0070 SE-Cu, 2.1020 CuSn6, 2.1096 G-CuSn5ZnPb	≤500		<input type="radio"/>
Messing, kurzspanend	2.0380 CuZn39Pb2, 2.0401 CuZn39Pb3, 2.0410 CuZn43Pb2	≤600		<input type="radio"/>
langspanend	2.0250 CuZn20, 2.0280 CuZn33, 2.0332 CuZn37Pb0,5	≤600		<input type="radio"/>
Bronzen, kurzspanend	2.1090 CuSn7ZnPb, 2.1170 CuPb5Sn5, 2.1176 CuPb10Sn 2.0790 CuNi18Zn19Pb	≤600 ≤850		<input checked="" type="radio"/>
Bronzen, langspanend	2.0916 CuAl5, 2.0960 CuAl9Mn, 2.1050 CuSn10 2.0980 CuAl11Ni, 2.1247 CuBe2	≤850 ≤1000		<input checked="" type="radio"/>
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		<input type="radio"/>
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		<input type="radio"/>
aramidfaserverstärkt	Kevlar	≤1000		<input type="radio"/>
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		<input type="radio"/>





# HARTNER

## ≤4xD ≤7xD

## ≤5xD ≤8xD ≤15xD

87011
87016
1899
HSS-E-PM

84810
1899
HSS-E-PM

89281
WN
VHM
K10/K20

86402
WN
VHM
K/P

86400	86401
WN	WN
VHM	VHM
K/P	K/P

86405	86408	86412
WN	WN	WN
VHM	VHM	VHM
K/P	K/P	K/P



329/331

332

335

333

334 336

axial axial axial  
337 338 339



V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	Vorschubreihen-Code	V <sub>c</sub> m/min	Vorschubreihen-Code		
21	106	27	106	50	105	100	62	100	64 62	105	62	58	58
18	105	23	105	35	104	100	62	100	64 62	100	62	58	58
18	106	23	106	50	105	100	62	100	64 62	105	62	59	59
16	105	21	105	45	104	90	61	90	63 61	90	61	59	59
20	105	26	105	45	104	90	62	90	64 62	95	62	58	58
18	105	23	105	35	104	90	62	90	64 62	95	62	58	58
14	104	18	104	30	103	90	61	90	63 61	90	61	58	58
14	104	18	104	30	103	90	61	90	63 61	90	61	58	58
12	103	16	103	70	60	70	60	70	62 60	70	60	58	58
18	106	23	106	50	103	100	61	100	63 61	100	61	57	57
14	104	18	104	40	103	85	61	85	63 61	85	61	58	58
12	103	16	103	70	60	70	60	70	62 60	70	60	58	58
14	104	18	104	25	103	70	60	70	62 60	70	60	57	57
12	103	16	103	60	60	60	60	60	62 60	60	60	57	57
16	104	20	104	25	103	50	60	50	62 60	50	60	58	58
14	103	18	103	60	60	60	60	60	62 60	50	60	58	58
14	103	18	103	60	60	60	60	60	57 57	50	57	57	57
8	102	10	102	20	102	60	57	60	57 57	50	57	57	57
				15	104								
18	104	20	104	25	103			30	57 57	70	57	57	57
14	103	16	103	25	102			15	56 56	60	56	56	56
16	103	18	103	25	102			30	57 57	70	57	57	57
26	106	33	106	80	105	130	66	130	68 66	150	60	60	60
22	106	28	106	60	105	130	66	130	68 66	140	60	60	60
18	106	23	106	60	105	130	66	130	68 66	140	60	60	60
22	106	28	106	50	105	120	65	120	67 65	130	60	60	60
				15	103			10	56 56	25	56	56	56
				45	104			15	56 56	35	56	56	56
				25	104			15	56 56	35	56	56	56
				160	107			70	68 68	70	68	68	68
				150	106			70	68 68	70	68	68	68
26	107			100	106			135	59 59	135	59	59	59
18	106			60	106			135	59 59	135	59	59	59
75	106	80	106	150	105								
42	105	53	105	50	105								
				67	106								
22	105	28	105	44	104								
22	104	28	104	68	103								
18	104	23	104	49	103								
13	104	16	104	53	103								
		14	104	36	103								
16	104	20	104	50	103								
18	104	23	104	36	103								
				60	104								



## Einsatzempfehlungen TS-Drills

Bestell-Nr.

Norm/DIN

Schneidstoff

HM-Gruppe

Oberfläche

Typ

Schaffform

Kühlung

Programm Seite

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

- rechtsschneidend
- linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		<input type="radio"/> <input type="radio"/>
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		<input type="radio"/> <input type="radio"/>
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		<input type="radio"/> <input type="radio"/> <input type="radio"/>
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		<input type="radio"/> <input type="radio"/>
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		<input type="radio"/>
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		<input checked="" type="radio"/> <input checked="" type="radio"/>
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		<input type="radio"/> <input checked="" type="radio"/>
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		<input type="radio"/> <input type="radio"/>
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		<input checked="" type="radio"/>
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	<input checked="" type="radio"/>
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	<input checked="" type="radio"/> <input checked="" type="radio"/>
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		<input checked="" type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/>
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	<input type="radio"/> <input type="radio"/>
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	<input type="radio"/> <input type="radio"/>
Hartguss	-		≤350 HB	<input type="radio"/>
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	<input type="radio"/> <input type="radio"/>
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		<input type="radio"/> <input type="radio"/>
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		<input checked="" type="radio"/>
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		<input checked="" type="radio"/> <input checked="" type="radio"/>
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		<input type="radio"/>
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		<input type="radio"/>
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		<input type="radio"/>
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		<input type="radio"/>
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		<input type="radio"/>
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		<input type="radio"/>
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		<input type="radio"/>
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		<input type="radio"/>
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		<input type="radio"/> <input checked="" type="radio"/>
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		<input checked="" type="radio"/> <input checked="" type="radio"/>
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		<input type="radio"/>
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		<input type="radio"/>
aramidfaserverstärkt	Kevlar	≤1000		<input type="radio"/>
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		<input type="radio"/>



# HARTNER

≤3xD

89306	89264	89237	89422	89413	89402	89401	89450	89550	89266
6538K	6537K	6539	6537K	6537K	6537K	6539	6537K	6537K	6537K
VHM	VHM		VHM	VHM			VHM	VHM	VHM
	K/P	K/P		K/P	K/P	K/P	K/P	K/P	K/P
TS80U	TS100U	TS100U	TS100H	TS100U	TS100U	TS100U	TS100 INOX		TS100U
HE	HE	DZ	HA	HA	HE	DZ	HA	HE	HE
	axial	axial					axial	axial	axial
221	210	216	214	212	212	216	227	227	222



V <sub>c</sub> m/min	VR- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	VR- Code	V <sub>c</sub> m/min	Vorschubreihen- Code			V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	VR- Code	
95	6	100	6	130	7	130	7	7	7			110	6	
80	5	85	5	110	6	110	6	6	6			90	5	
95	7	110	7	145	8	145	8	8	8			130	7	
75	6	85	6	110	7	110	7	7	7			110	7	
80	6	90	6	120	7	120	7	7	7			100	7	
75	6	85	6	110	7	110	7	7	7			95	6	
70	6	80	6	105	7	105	7	7	7			90	6	
75	6	80	6	105	7	105	7	7	7			90	6	
60	5	75	5	100	6	100	6	6	6			80	6	
90	7	100	7	130	8	130	8	8	8			110	7	
75	6	90	6	120	7	120	7	7	7			90	6	
60	5	65	4	85	5	85	5	5	5			65	4	
75	6	75	5	100	6	100	6	6	6			85	6	
60	5	70	4	90	5	90	5	5	5			80	5	
45	5	50	5	65	6	65	6	6	6			60	5	
35	5	40	4	55	5	55	5	5	5			50	4	
40	4			55	4							45	3	
		35	2	45	3	45	3	3	3			45	2	
		35	1	40	1	40	1	1	1			40	2	
		20	1	20	1	20	1	1	1			20	1	
40	2	40	2	40	2	40	2	2	2	80	5	45	4	
35	2	15	1	15	1	15	1	1	1	60	2-3	40	2	
35	2	35	2	35	2	35	2	2	2	80	5	35	4	
150	7	160	7			210	8	8	8			160	8	
110	7	120	7			155	8	8	8			120	8	
110	7	120	6			155	7	7	7			100	8	
90	6	95	6			125	7	7	7			95	7	
		25	2			35	3	3	3			30	2	
		20	3	25	4	25	4	4	4	30	4	4	25	3
		15	1	15	1	15	1	1	1	45	4	4	35	3
		15	1	15	1	15	1	1	1	40	3	3	30	2
200	8	200	8			260	9	9	9			240	8	
200	8	200	8			260	9	9	9			240	8	
170	8	170	8			220	8	8	8			200	8	
140	7	140	7			180	8	8	8			170	8	
		200	7			260	8	8	8			230	7	
		80	6			105	7	7	7			95	6	
		210	7			270	8	8	8			250	7	
		140	6			180	7	7	7			170	6	
		80	5			105	6	6	6			95	6	
		65	5			85	6	6	6			80	5	
		60	4			80	5	5	5			70	5	
		45	4			60	5	5	5			60	5	




## Einsatzempfehlungen TS-Drills

Bestell-Nr. 
Norm/DIN
Schneidstoff
HM-Gruppe
Oberfläche
Typ
Schaffform
Kühlung
Programm Seite



Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.




















































Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

-  Luft
-  Öl
-  Emulsion

Schneidrichtung:

-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	
Gehärtete Stähle	-		≤48 HRC	
			≤66 HRC	
Rostfreie Stähle, geschwefelt	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		
austenitisch	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi17-12-2 (V4A)	≤1100		
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	
Hartguss	-		≤350 HB	
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		
	<b>2.0790</b> CuNi18Zn19Pb	≤850		
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		
aramidfaserverstärkt	Kevlar	≤1000		
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		



# HARTNER

## ≤3xD

89410	89415
6537K	6537K
VHM	
K/P	K/P
<b>F</b>	<b>F</b>
TS 100 U	TS 100 U
HA	HE
axial	axial
223	223



V <sub>c</sub> m/min	Vorschubreihen- Code	
145	7	7
120	6	6
170	8	8
145	8	8
130	8	8
125	7	7
120	7	7
120	7	7
105	7	7
145	8	8
120	7	7
85	5	5
110	7	7
105	5	5
80	6	6
65	5	5
60	4	4
60	3	3
55	3	3
35	2	2
60	5	5
55	2	2
45	5	5
210	9	9
160	9	9
140	9	9
130	8	8
40	3	3
35	4	4
45	4	4
40	3	3
310	9	9
310	9	9
260	9	9
220	9	9
280	8	8
125	7	7
325	8	8
220	7	7
125	7	7
105	6	6
90	6	6
80	6	6

89423	89424
6537K	6537K
VHM	VHM
<b>Y</b>	<b>Y</b>
TS 100 H	TS 100 H
HA	HE
axial	axial
225	225



V <sub>c</sub> m/min	Vorschubreihen- Code	
145	7	7
120	6	6
170	8	8
145	8	8
130	8	8
125	7	7
120	7	7
120	7	7
105	7	7
145	8	8
120	7	7
85	5	5
110	7	7
105	5	5
80	6	6
65	5	5
60	4	4
60	3	3
55	3	3
35	2	2
35	4	4
45	4	4
40	3	3

## ≤4xD

89292
WN
VHM
K
○
TS 150 GG
HA
axial
229



V <sub>c</sub> m/min	VR- Code
120	7
100	7
90	7
80	7
40	2
410	9
410	9
380	9
330	9
280	9
110	6
80	5

## ≤5xD

89307
6538M
HM
P
<b>T</b>
TS 80 U
HE
axial
230



V <sub>c</sub> m/min	VR- Code
95	5
80	4
95	6
75	5
80	5
75	5
75	5
75	5
55	4
90	6
75	5
55	4
70	5
55	4
40	4
35	4
40	3
40	2
35	2
35	2
150	6
110	6
110	6
90	5
200	7
200	7
170	7
140	6

89420
6537L
VHM
K/P
<b>F</b>
TS 100 R
HA
axial
234



V <sub>c</sub> m/min	VR- Code
210	9
160	9
160	9
130	8
130	8
100	8
80	8
60	8

89451	89551
6537L	6537L
VHM	VHM
K/P	K/P
<b>a</b>	<b>a</b>
TS 100 INOX	
HA	HE
axial	axial
238	238



V <sub>c</sub> m/min	Vorschubreihen- Code	
80	5	5
60	2-3	2-3
80	5	5
30	4	4
45	4	4
40	3	3



## Einsatzempfehlungen TS-Drills

<b>Bestell-Nr.</b>
<b>Norm/DIN</b>
<b>Schneidstoff</b>
<b>HM-Gruppe</b>
<b>Oberfläche</b>
<b>Typ</b>
<b>Schaffform</b>
<b>Kühlung</b>
<b>Programm Seite</b>

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- ◐ Emulsion

Schneidrichtung:

- rechtsschneidend
- linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		○
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		○
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		○
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		○
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		○
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		○
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		○
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		○
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		○
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		●
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		●
Nitrierstähle	<b>1.8504</b> 34CrAl6	≤1000		○
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		●
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		○
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		○
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
Gehärtete Stähle	-		≤48 HRC	●
			≤66 HRC	●
Rostfreie Stähle, geschwefelt austenitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		●
	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		●
martensitisch	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1200		●
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	○
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	○
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	○
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	○
Hartguss	-		≤350 HB	○
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	○
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	○
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		○
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		○
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		●
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		●
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		○
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		○
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		○
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		○
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		○
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		○
	<b>2.0790</b> CuNi18Zn19Pb	≤850		○
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		○
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		○
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		○
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		○
aramidfaserverstärkt	Kevlar	≤1000		○
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		○



# HARTNER

≤5xD

89275
WN
VHM
K/P
T
TS100U
DZ
220

89414	89417
6537L	6537L
VHM	VHM
K/P	K/P
F	F
TS100U	TS100U
HA	HE
218	218

89272
6537L
VHM
K/P
T
TS100U
HE
axial
231

89411	89408
6537L	6537L
VHM	VHM
K/P	K/P
F	F
TS100U	TS100U
HA	HE
axial	axial
232	232

89425	89426
6537L	6537L
VHM	VHM
Y	Y
TS100H	TS100H
HA	HE
axial	axial
236	236



V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	Vorschubreihen-Code		V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	Vorschubreihen-Code		V <sub>c</sub> m/min	Vorschubreihen-Code	
100	6	130	7	7	110	6	145	7	7	145	7	7
85	5	110	6	6	90	5	120	6	6	120	6	6
110	7	145	8	8	130	7	170	8	8	170	8	8
85	6	110	7	7	110	7	145	8	8	145	8	8
90	6	120	7	7	100	7	130	8	8	130	8	8
85	6	110	7	7	95	6	125	7	7	125	7	7
80	6	105	7	7	90	6	120	7	7	120	7	7
80	6	105	7	7	90	6	120	7	7	120	7	7
75	5	100	6	6	80	6	105	7	7	105	7	7
100	7	130	8	8	110	7	145	8	8	145	8	8
90	6	120	7	7	90	6	120	7	7	120	7	7
65	4	85	5	5	65	4	85	5	5	85	5	5
75	5	100	6	6	85	6	105	7	7	110	7	7
70	4	90	5	5	80	5	100	5	5	105	5	5
50	5	65	6	6	60	5	70	6	6	80	6	6
40	4	55	5	5	50	4	55	5	5	65	5	5
					45	4	60	5	5	60	4	4
35	2	45	3	3	45	2	60	3	3	60	3	3
35	1	35	1	1	40	2	55	2	2	55	3	3
20	1	20	1	1	25	1	35	2	2	35	2	2
40	2	40	2	2	45	4	60	5	5			
15	1	15	1	1	40	2	55	5	5			
35	2	35	2	2	35	4	45	5	5			
160	7	210	8	8	160	8	195	9	9			
120	7	155	8	8	120	8	160	9	9			
120	6	145	7	7	100	8	140	9	9			
95	6	125	7	7	95	7	130	8	8			
25	2	35	3	3	30	2	40	3	3			
20	3	25	4	4	25	3	35	4	4	35	4	4
15	1	15	1	1	35	3	45	4	4	45	4	4
15	1	15	1	1	30	2	40	3	3	40	3	3
200	8	260	9	9	240	8	310	9	9			
200	8	260	9	9	240	8	310	9	9			
170	8	235	9	9	200	8	260	9	9			
140	7	170	8	8	170	8	220	9	9			
200	7	260	8	8	230	7	280	8	8			
80	6	105	7	7	95	6	125	7	7			
210	7	270	8	8	250	7	325	8	8			
140	6	180	7	7	170	6	220	7	7			
80	5	105	6	6	95	6	125	7	7			
65	5	85	6	6	80	5	105	6	6			
60	4	80	5	5	70	5	90	6	6			
45	4	60	5	5	60	5	80	6	6			



## Einsatzempfehlungen TS-Drills

- Bestell-Nr.**
- Norm/DIN**
- Schneidstoff**
- HM-Gruppe**
- Oberfläche**
- Typ**
- Schaffform**
- Kühlung**
- Programm Seite**

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Schneidrichtung:

- rechtsschneidend
- linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
<b>Allgemeine Baustähle</b>	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		
<b>Automatenstähle</b>	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		
<b>Unlegierte Vergütungsstähle</b>	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		
<b>Legierte Vergütungsstähle</b>	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		
<b>Unlegierte Einsatzstähle</b>	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		
<b>Legierte Einsatzstähle</b>	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		
<b>Nitrierstähle</b>	<b>1.8504</b> 34CrAl6	≤1000		
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		
<b>Werkzeugstähle</b>	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		
<b>Schnellarbeitsstähle</b>	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		
<b>Federstähle</b>	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	
<b>Gehärtete Stähle</b>	-		≤48 HRC	
			≤66 HRC	
<b>Rostfreie Stähle, geschwefelt</b>	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		
<b>austenitisch</b>	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		
<b>martensitisch</b>	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		
<b>Gusseisen</b>	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	
<b>Kugelgraphit- und Tempereguss</b>	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	
<b>Hartguss</b>	-		≤350 HB	
<b>Neue Gusswerkstoffe GGV</b>	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	
<b>Neue Gusswerkstoffe ADI</b>	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		
<b>Sonderlegierungen</b>	Nimonic, Inconel, Monel, Hastelloy	≤2000		
<b>Titan und Titan-Legierungen</b>	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		
<b>Aluminium und Al-Legierungen</b>	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		
<b>Al-Knetlegierungen</b>	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		
<b>Al-Gusslegierungen ≤ 10 % Si</b>	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		
<b>≤ 24 % Si</b>	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		
<b>Magnesium-Legierungen</b>	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		
<b>Kupfer, niedriglegiert</b>	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		
<b>Messing, kurzspanend</b>	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		
<b>langspanend</b>	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		
<b>Bronzen, kurzspanend</b>	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		
	<b>2.0790</b> CuNi18Zn19Pb	≤850		
<b>Bronzen, langspanend</b>	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		
<b>Kunststoffe, duroplastisch</b>	Bakelit, Resopal, Pertinax, Moltopren	≤150		
<b>thermoplastisch</b>	Plexiglas, Hostalen, Novodur, Makralon	≤100		
<b>aramidfaserverstärkt</b>	Kevlar	≤1000		
<b>glas-/kohlefaserverstärkt</b>	GFK/CFK	≤1000		





# HARTNER

## ≤5xD

89560
6537L
<b>VHM</b>
K
○
TS 100 ALU
HA
240

89460
6537L
<b>VHM</b>
K/P
<b>F</b>
TS 100 HPC
HA
axial
242

89239	89247
6539	6537L
<b>VHM</b>	<b>VHM</b>
K	K
○	○
TS 3 G	TS 3 G
DZ	HA
263	262

## ≤7xD

89308
6538L
<b>VHM</b>
P
<b>T</b>
TS 80 U
HE
244

89294
WN
<b>VHM</b>
K
○
TS 150 GG
HA
axial
245

89421
WN
<b>VHM</b>
K/P
<b>F</b>
TS 100 R
HA
axial
248



V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	Vorschubreihen-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code
		200	8			95	4				
		200	7			75	3				
		200	8			90	5				
		200	8			75	4				
		180	8			80	4				
		160	8			75	4				
		130	8			60	4				
		120	8			75	4				
		120	7			60	3				
		180	8			90	5				
		120	8			75	4				
		110	7			55	3				
		110	7			75	4				
		100	5			55	3				
		90	7			40	3				
		65	6			35	3				
		60	5			40	2				
		60	5								
		55	3								
		80	5			35	1				
		60	5			33	1				
		180	9	100	6 6	25	1				
		160	9	80	6 6	150	5	120	6	210	8
		140	9	80	6 6	110	5	100	6	160	8
		140	8	70	6 6	110	5	90	6	160	8
						90	4	80	6	130	7
								40	2		
		140	8							130	7
		140	8							100	7
		80	7							80	7
		80	7							60	7
		30	4								
		40	4								
		35	3								
350	9			180	7 7	180	6	410	8		
350	9			160	7 7	180	6	410	8		
320	8			150	7 7	160	6	380	8		
280	7			120	6 6	130	5	330	8		
320	7			180	6 6						
190	7										
160	6			180	6 6						
160	6							280	7		
160	6										
160	6							110	6		
150	6							80	5		
150	6										
100	3										
100	3										
100	2										

# Einsatzempfehlungen TS-Drills

Bestell-Nr.   
 Norm/DIN   
 Schneidstoff   
 HM-Gruppe   
 Oberfläche   
 Typ   
 Schaffform   
 Kühlung   
 Programm Seite

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>0,50</b>	0,004	0,006	0,007	0,008	0,010	0,012	0,014	0,016	0,019
<b>1,00</b>	0,006	0,008	0,012	0,014	0,016	0,018	0,020	0,023	0,025
<b>2,00</b>	0,020	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
<b>20,00</b>	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
<b>25,00</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
<b>31,50</b>	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
<b>40,00</b>	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250
<b>50,00</b>	0,250	0,310	0,400	0,500	0,630	0,800	1,000	1,250	1,250
<b>63,00</b>	0,315	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600
<b>80,00</b>	0,400	0,500	0,630	0,800	1,000	1,250	1,600	1,600	2,000

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- ◐ Emulsion

Schneidrichtung:

- rechtsschneidend
- linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		○
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		○
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		○
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		○
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		●
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		○
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		○
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	●
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		●
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	○
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	○
Hartguss	-		≤350 HB	○
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	○
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		○
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		●
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		○
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		○
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		○
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		○
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		○
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		○
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		○
Kunststoffe, duroplastisch	Bakelit, Resopal, Pertinax, Moltopren	≤150		○
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		○
aramidfaserverstärkt	Kevlar	≤1000		○
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		○



# HARTNER

## ≤7xD

89461
6537L
VHM
K/P
F
TS 100HPC
HA
axial
251

89412	89416
WN	WN
VHM	VHM
K/P	K/P
F	F
TS 100U	TS 100U
HA	HE
axial	axial
246	246

## ≤10xD

89427
WN
VHM
Y
TS 100H
HA
axial
250

## ≤12xD

89293	89295
WN	WN
VHM	VHM
K	K
○	○
TS 150 GG	TS 150 GG
HA	HA
axial	axial
253	253

89418
WN
VHM
K/P
F
TS 100U
HA
axial
255



V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code		V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code		V <sub>c</sub> m/min	Vorschubreihen- Code
180	8	145	6	6	145	6			110	6	
180	7	120	5	5	120	5			110	5	
180	8	170	7	7	170	7			110	7	
180	8	145	7	7	145	7			100	7	
160	8	130	7	7	130	7			110	7	
140	8	125	6	6	125	6			110	6	
120	8	120	6	6	120	6			100	6	
110	8	120	6	6	120	6			110	6	
110	7	105	6	6	105	6			105	6	
160	8	145	7	7	145	7			110	7	
110	8	120	6	6	120	6			110	6	
100	7	85	4	4	85	4			85	4	
100	7	110	6	6	110	6			100	6	
90	5	105	4	4	105	4			80	4	
80	7	80	5	5	80	5			80	5	
60	6	65	4	4	65	4			65	4	
55	5	60	4	4	60	3			50	4	
55	5	60	2	2	60	2			50	2	
45	3	55	2	2	55	2					
		35	1	1	35	1					
70	5	60	4	4					60	4	
		55	2	2					55	2	
50	5	45	4	4					45	4	
165	9	195	8	8			120	6	6	120	8
145	9	160	8	8			100	6	6	120	8
130	9	140	8	8			90	6	6	100	8
130	8	130	7	7			80	6	6	90	7
		40	2	2			40	1	2		
130	8										
130	8										
70	7										
70	7										
25	4	35	3	3	35	3					
35	4	40	3	3	45	3					
30	3	40	2	2	40	4					
		310	8	8			410	8	6	150	8
		310	8	8			410	8	6	150	8
		260	8	8			380	8	6	150	8
		220	8	8			330	8	6	120	8
		280	7	7					150	7	
		125	6	6					80	6	
		325	7	7			280	7	7	120	7
		220	6	6					120	6	
		125	6	6			110	6	6	40	6
		105	5	5			80	5	5		
		90	5	5							
		80	5	5					40	5	

## Einsatzempfehlungen TS-Drills

**Bestell-Nr. **
**Norm/DIN**
**Schneidstoff**
**HM-Gruppe**
**Typ**
**Oberfläche**
**Kühlung**
**Programm Seite**
**Vorgehensweise:**



- Anfräsen einer Fläche rechtwinklig zum Eintrittswinkel der Bohrbearbeitung (nur bei schrägen Flächen notwendig).
- Herstellen einer zylindrischen Pilotbohrung (Toleranz F9) mit einer Bohrtiefe von mindestens 1 x D.
- Einfahren in Pilotbohrung mit ca. 300 U/min bei f = 500 mm/min.
- Einstellen des Kühlschmierstoffdruckes und der Drehzahl.
- Kontinuierliches Bohren auf volle Bohrtiefe ohne Entspanzyklus.
- Bei Durchgangsbohrungen mit schrägem Austritt die Vorschubgeschwindigkeit vf ca. 1mm vor dem Durchbrechen auf 40% reduzieren.
- Nach Erreichen der Bohrtiefe Drehzahl und Kühlschmierstoff abschalten, Ausfahren im Eilgang.

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
<b>2,50</b>	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
<b>3,15</b>	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,160
<b>4,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,200
<b>5,00</b>	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
<b>6,30</b>	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
<b>8,00</b>	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,315
<b>10,00</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
<b>12,50</b>	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
<b>16,00</b>	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

- Schneidrichtung:
-  rechtsschneidend
-  linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
<b>Allgemeine Baustähle</b>	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2)	≤500		<input type="radio"/>
	<b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤1000		<input type="radio"/>
<b>Automatenstähle</b>	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36)	≤850		<input type="radio"/>
	<b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤1000		<input type="radio"/>
<b>Unlegierte Vergütungsstähle</b>	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30)	≤700		<input type="radio"/>
	<b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45)	≤850		<input type="radio"/>
	<b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤1000		<input type="radio"/>
<b>Legierte Vergütungsstähle</b>	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4	≤1000		<input type="radio"/>
	<b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1400		<input type="radio"/>
<b>Unlegierte Einsatzstähle</b>	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		<input type="radio"/>
<b>Legierte Einsatzstähle</b>	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6	≤1000		<input checked="" type="radio"/>
	<b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1400		<input checked="" type="radio"/>
<b>Nitrierstähle</b>	<b>1.8504</b> 34CrAl6	≤1000		<input type="radio"/>
	<b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1400		<input checked="" type="radio"/>
<b>Werkzeugstähle</b>	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9	≤850		<input type="radio"/>
	<b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤1400		<input checked="" type="radio"/>
<b>Schnellarbeitsstähle</b>	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		<input checked="" type="radio"/>
<b>Federstähle</b>	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	<input checked="" type="radio"/>
<b>Gehärtete Stähle</b>	-		≤48 HRC	<input checked="" type="radio"/>
			≤66 HRC	<input checked="" type="radio"/>
<b>Rostfreie Stähle, geschwefelt</b>	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		<input checked="" type="radio"/>
<b>austenitisch</b>	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		<input checked="" type="radio"/>
<b>martensitisch</b>	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		<input checked="" type="radio"/>
<b>Gusseisen</b>	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20)		≤240 HB	<input type="radio"/>
	<b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤350 HB	<input type="radio"/>
<b>Kugelgraphit- und Tempereguss</b>	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35)		≤240 HB	<input type="radio"/>
	<b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤350 HB	<input type="radio"/>
<b>Hartguss</b>	-		≤350 HB	<input type="radio"/>
<b>Neue Gusswerkstoffe GGV</b>	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35)		≤220 HB	<input type="radio"/>
	<b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤300 HB	<input type="radio"/>
<b>Neue Gusswerkstoffe ADI</b>	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000)	≤1000		<input type="radio"/>
	<b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1400		<input type="radio"/>
<b>Sonderlegierungen</b>	Nimonic, Inconel, Monel, Hastelloy	≤2000		<input checked="" type="radio"/>
<b>Titan und Titan-Legierungen</b>	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2	≤850		<input checked="" type="radio"/>
	<b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		<input checked="" type="radio"/>
<b>Aluminium und Al-Legierungen</b>	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		<input type="radio"/>
<b>Al-Knetlegierungen</b>	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		<input type="radio"/>
<b>Al-Gusslegierungen ≤ 10 % Si</b>	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		<input type="radio"/>
<b>≤ 24 % Si</b>	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		<input type="radio"/>
<b>Magnesium-Legierungen</b>	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		<input type="radio"/>
<b>Kupfer, niedriglegiert</b>	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		<input type="radio"/>
<b>Messing, kurzspanend</b>	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		<input type="radio"/>
<b>langspanend</b>	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		<input type="radio"/>
<b>Bronzen, kurzspanend</b>	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn	≤600		<input type="radio"/>
	<b>2.0790</b> CuNi18Zn19Pb	≤850		<input checked="" type="radio"/>
<b>Bronzen, langspanend</b>	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10	≤850		<input checked="" type="radio"/>
	<b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤1000		<input checked="" type="radio"/>
<b>Kunststoffe, duroplastisch</b>	Bakelit, Resopal, Pertinax, Moltopren	≤150		<input type="radio"/>
<b>thermoplastisch</b>	Plexiglas, Hostalen, Novodur, Makralon	≤100		<input type="radio"/>
<b>aramidfaserverstärkt</b>	Kevlar	≤1000		<input type="radio"/>
<b>glas-/kohlefaserverstärkt</b>	GFK/CFK	≤1000		<input type="radio"/>



# HARTNER

## ≤15xD

86509
WN
VHM
K/P
TS 100 T
<b>A</b>
40 bar MQL
257



## ≤20xD

86511
WN
VHM
K/P
TS 100 T
<b>A</b>
40 bar MQL
258



## ≤25xD

86512
WN
VHM
K/P
TS 100 T
<b>A</b>
40 bar MQL
259



## ≤30xD

86513
WN
VHM
K/P
TS 100 T
<b>A</b>
40 bar MQL
260



## ≤40xD

86514
WN
VHM
K/P
TS 100 T
<b>A</b>
40 bar
261



V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code		
110	8			110	8			100	8			80	7		80	7	
110	8			110	8			100	8			80	7		80	7	
120	8			120	8			120	8			100	8		100	8	
120	8			120	8			100	8			100	8		100	8	
110	6			110	6			110	6			110	6		110	6	
110	8			110	8			100	8			80	7		80	7	
100	7			100	7			100	7			80	7		80	7	
110	7	80	7	110	7	80	7	100	7	70	7	80	7	60	7	80	6-7
110	6	80	7	110	6	80	7	100	6	70	7	80	6	60	7	80	6
110	8			110	8			100	8			80	7		80	7	
110	7	80	6-7	110	7	80	6-7	100	7	70	6-7	80	6	60	6-7	80	6
110	6	80	6-7	110	6	80	6-7	100	6	70	6-7	80	6	60	6-7	80	6
100	5			100	5			80	5			80	5		80	5	
80	5			80	5			60	5			60	5		60	5	
100	6-7			100	6			90	6			80	6		80	6-7	
80	5			80	5			70	4			70	4		70	4	
50	5			50	5			50	4			50	4		50	4	
50	5			50	5			50	4			50	4		50	4	
50	4			50	4			50	4			50	4		50	4	
100	5			100	5			100	5			80	5		80	5	
70	2-3			60	3			60	3			60	3		70	2-3	
100	5			100	5			100	5			80	5		80	5	
140	8			140	8			130	8			120	8		120	8	
100	8			100	8			90	8			80	8		80	8	
140	8			140	8			130	8			120	8		120	8	
100	8			100	8			90	8			80	8	65	8	80	8
100	6			100	6			90	6			80	6		80	6	
100	6			100	6			90	6			80	6		80	6	
90	8	90	8	90	8	90	8	80	8	80	8	70	8	70	8	70	8
30	2			30	2			30	2			30	2		30	2	
120	1			120	1			120	1			120	1		120	1	
120	8			120	8			110	8			100	8		100	8	



## Einsatzempfehlungen Tieflochbohrer

### Die Arbeitsschritte beim Tiefbohren

- Herstellen einer Pilotbohrung ( $L = 1,5 \times D / \text{Alu } L \approx 3 \times D$ , Toleranz H8)
- Einfahren mit einer Drehzahl von ca. 200 U/min, Vorschub ca. 500 mm/min. Bei Werkzeugen ab  $40 \times D$  einfahren im Linkslauf.
- Einstellen des Kühlschmierstoff-Drucks und der Drehzahl
- Kontinuierliches Bohren auf Bohrtiefe ohne Entspanen. Bei Einsatz von Tieflochbohrern mit sehr großem Längen-Durchmesser-Verhältnis empfehlen wir, bis zu einer Bohrtiefe von ca. 25 mm mit reduzierten Schnittparametern (ca. 75% der optimalen Schnittgeschwindigkeit) zu arbeiten.
- Abschalten der Kühlschmierstoff-Zufuhr nach Erreichen der Bohrtiefe
- Rückzug im Eilgang mit stehender Spindel

Bohrer-Ø mm	Vorschubreihen-Code									
	20	19	18	17	16	15	14	13	12	11
	f (mm/U)									
1,0	0,050	0,030	0,022	0,015	0,010	0,006	0,004	0,003	0,002	0,001
1,5	0,075	0,050	0,045	0,032	0,020	0,012	0,008	0,006	0,004	0,002
2,0	0,100	0,060	0,055	0,046	0,028	0,016	0,010	0,007	0,005	0,003
2,5	0,125	0,075	0,070	0,054	0,030	0,018	0,012	0,008	0,006	0,004
4,0	0,240	0,120	0,085	0,065	0,043	0,025	0,016	0,010	0,007	0,005
6,0	0,360	0,180	0,120	0,085	0,061	0,035	0,024	0,013	0,009	0,007
8,0	0,480	0,240	0,150	0,100	0,068	0,045	0,032	0,022	0,014	0,010
10,0	0,600	0,300	0,160	0,120	0,075	0,055	0,040	0,028	0,016	0,012
14,0	0,700	0,350	0,180	0,130	0,085	0,065	0,050	0,035	0,025	0,020
20,0	0,800	0,400	0,250	0,180	0,110	0,080	0,060	0,045	0,035	0,026
24,0	0,900	0,450	0,300	0,185	0,130	0,085	0,065	0,047	0,036	0,027
30,0	1,050	0,500	0,400	0,200	0,150	0,100	0,070	0,050	0,040	0,030
35,0	1,100	0,600	0,450	0,250	0,180	0,120	0,075	0,055	0,045	0,035
40,0	1,200	0,700	0,500	0,300	0,200	0,150	0,080	0,060	0,050	0,040
52,0	1,300	0,800	0,550	0,350	0,230	0,180	0,100	0,070	0,060	0,050

### Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

## E100

Einlippenbohrer

VHM

0,9 ... 16,0

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Programm Seite



\* Die Vorschubwerte beziehen sich immer auf Werkzeuge mit der empfohlenen Beschichtung. In einigen Fällen kann die Funktion der Werkzeuge ohne Beschichtung nicht gewährleistet werden.

Werkstoffgruppe	Werkstoffbeispiele Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigk. Härte N/mm <sup>2</sup>	Kühl- mittel	empf. Schicht	<35xD		>35xD	
					v <sub>c</sub> m/min	Vorschub- Code	v <sub>c</sub> m/min	Vorschub- Code
Allgemeine Baustähle	1.0035 S185(St33), 1.0486 P275N(StE285), 1.0345 1.0050 E295 (St50-2), 1.0070 E360 (St70-2), 1.8937	≤500	●	○	100	15	100	15
Automatenstähle	1.0718 11SMnPb30 (9SMnPb28), 1.0736 11SMn37	≤850	●	○	85	15	85	15
Unlegierte Vergütungsstähle	1.0727 46S20 (45S20), 1.0728 (60S20), 1.0757 46SPb2	≤1000	●	○	90	15	90	15
Legierte Vergütungsstähle	1.0402 C22, 1.1178 C30E (Ck30)	≤700	●	○	80	15	80	15
Unlegierte Einsatzstähle	1.0503 C45, 1.1191 C45E (Ck45)	≤850	●	○	80	14	80	14
Legierte Einsatzstähle	1.0601 C60, 1.1221 C60E (Ck60)	≤1000	●	○	75	14	75	14
Nitrierstähle	1.5131 50MnSi4, 1.7003 38Cr2, 1.7030 28Cr4	≤1400	●	○	75	14	75	14
Werkzeugstähle	1.5710 36NiCr6, 1.7035 41Cr4, 1.7225 42CrMo4	≤1400	●	○	65	14	65	14
Schnellarbeitsstähle	1.0301 (C10), 1.1121 C10E (Ck10)	≤850	●	○	80	15	80	15
Federstähle	1.7276 10CrMo11, 1.5125 11MnSi6	≤1000	●	○	75	14	75	14
Gehärtete Stähle	1.5752 15NiCr13, 1.7131 16MnCr5, 1.7264 20CrMo5	≤1400	●	○	65	14	65	14
Rostfreie Stähle, geschwefelt	1.8504 34CrAl6	≤1000	●	○	75	14	75	14
austenitisch	1.8519 31CrMoV9, 1.8550 34CrAlNi7	≤1400	●	○	65	14	65	14
martensitisch	1.1750 C75W, 1.2067 102Cr6, 1.2307 29CrMoV9	≤850	●	○	75	13	75	13
Gusseisen	1.2080 X210Cr12, 1.2083 X42Cr13, 1.2419 105WCr6	≤1400	●	○	65	13	65	13
Kugelgraphit- und Temperguss	1.3243 S 6-5-2-5, 1.3343 S 6-5-2, 1.3344 S 6-5-3	≤1400	●	○	55	12	55	12
Hartguss	1.5026 55Si7, 1.7176 55Cr3, 1.8159 51CrV4 (51CrV4)	≤350 HB	●	○	65	13	65	13
Neue Gusswerkstoffe GGV	EN-GJV250 (GGV25), EN-GJV350 (GGV35)	≤220 HB	●	○	30	13	30	13
Neue Gusswerkstoffe ADI	EN-GJV400 (GGV40), EN-GJV500 (GGV50), SiMo 6	≤300 HB	●	○	25	10	25	14
Sonderlegierungen	EN-GJS-800-8 (ADI800), EN-GJS-1000-5 (ADI1000)	≤1000	●	○	40	14	40	14
Titan und Titan-Legierungen	EN-GJS-1200-2 (ADI1200), EN-GJS-1400-1 (ADI1400)	≤1400	●	○	35	14	35	14
Aluminium und Al-Legierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000	●	○	35	14	35	14
Al-Knetlegierungen	3.7024 Ti99,5, 3.7114 TiAl5Sn2,5, 3.7124 TiCu2	≤850	●	○	85	16	85	16
Al-Gusslegierungen ≤ 10 % Si	3.7154 TiAl6Zr5, 3.7165 TiAl6V4, 3.7184 TiAl4Mo4Sn2,5	≤1400	●	○	80	16	80	16
Al-Gusslegierungen ≤ 24 % Si	3.0255 Al99,5, 3.2315 AlMgSi1, 3.3515 AlMg1	≤400	●	○	80	15	80	15
Magnesium-Legierungen	3.0615 AlMgSiPb, 3.1325 AlCuMg1, 3.3245 AlMg3Si	≤650	●	○	70	15	70	15
Kupfer, niedriglegiert	3.2131 G-AlSi5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9	≤600	●	○	55	14	55	14
Messing, kurzspanend	3.2581 G-AlSi12, 3.2583 G-AlSi12Cu, - G-AlSi12CuNiMg	≤600	●	○				
Messing, langspanend	2.0070 SE-Cu, 2.1020 CuSn6, 2.1096 G-CuSn5ZnPb	≤500	●	○				
Bronzen, kurzspanend	2.0380 CuZn39Pb2, 2.0401 CuZn39Pb3, 2.0410	≤600	●	○				
Bronzen, langspanend	2.0250 CuZn20, 2.0280 CuZn33, 2.0332 CuZn37Pb0,5	≤600	●	○				
Kunststoffe, duroplastisch	2.1090 CuSn7ZnPb, 2.1170 CuPb5Sn5, 2.1176	≤600	●	○				
thermoplastisch	2.0790 CuNi18Zn19Pb	≤850	●	○				
aramidfaserverstärkt	2.0916 CuAl5, 2.0960 CuAl9Mn, 2.1050 CuSn10	≤850	●	○				
glas-/kohlefaserverstärkt	2.0980 CuAl11Ni, 2.1247 CuBe2	≤1000	●	○				
	Bakelit, Resopal, Pertinax, Moltopren	≤150	○	○				
	Plexiglas, Hostalen, Novodur, Makralon	≤100	○	○				
	Kevlar	≤1000	○	○				
	GFK/CFK	≤1000	○	○				



### Tipps und Tricks

- Bei Bohrtiefen über 40 x D empfehlen wir die Verwendung von zwei oder mehr Tieflochbohrern, z.B. Ø 10 x 400 mm und Ø 9,95 x 800mm.
- Tieflochbohrer für Bohrtiefen über 40 x D sollten im Linkslauf in die Pilotbohrung eingefahren werden.
- Beim Einwechseln von Werkzeugen ab 40 x D kann das Werkzeug durch Aufschalten der Hochdruck-Innenkühlung für ca. 1 Sekunde beruhigt werden.
- Für die Bearbeitung langspanender Werkstoffe empfehlen wir die Bestellung von Tieflochbohrern mit polierten Spannuten.
- Generell empfehlen wir, den Fettgehalt der Emulsion auf mindestens 10% einzustellen.
- Einlippen-Tieflochbohrer für langspanendes Aluminium sollten mit Anschlag 180° und Ölraumabsatz bestellt werden.
- Beim Anbohren in Aluminium mit weniger als 1% Si-Anteil, d.h. bei empfohlenen Schnittgeschwindigkeiten  $V_C > 160$  m/min, empfehlen wir, in mehreren Schritten auf die Enddrehzahl hochzufahren. Außerdem sollte eine tiefere Pilotbohrung von ca. 3 x D vorgebohrt werden.



Sämtliche Tieflochbohrer müssen beim Anbohren geführt werden. Tieflochbohrer dürfen nie mit voller Drehzahl frei im Maschinenraum bewegt werden.

## E80/E80XXL

Einlippenbohrer	
<b>VHM-Kopf</b>	
2,0 ... 40,0	
280/284	



## Z80

Zweilippenbohrer	
<b>VHM-Kopf</b>	
6,0 ... 30,0	
295	



## E800

Einlippenbohrer	
mit Wechselplatten	
12,0 ... 52,0	
292	



empf. Schicht	≤35xD		>35xD		empf. Schicht	≤35xD		>35xD		empf. Schicht	≤35xD		>35xD	
	$v_c$ m/min	Vorschub-Code	$v_c$ m/min	Vorschub-Code		$v_c$ m/min	Vorschub-Code	$v_c$ m/min	Vorschub-Code		$v_c$ m/min	Vorschub-Code	$v_c$ m/min	Vorschub-Code
○	100	14	95	13										
	85	14	80	13										
ⓧ	90	14	85	13						ⓧ	90	15	85	15
	80	14	75	13						ⓧ	80	15	75	15
	90	13	85	12							85	16	80	16
ⓧ	80	13	75	12							75	16	70	16
	75	13	70	12							85	15	80	15
	75	13	70	12							75	15	70	15
ⓧ	65	13	60	12							75	15	70	15
	80	14	75	13							65	15	60	15
ⓧ	75	13	70	12							80	15	75	15
	65	13	60	12							75	15	70	15
ⓧ	75	13	70	12							70	15	65	15
	65	13	60	12							60	15	55	15
ⓧ	75	12	70	11							65	14	60	14
	65	12	60	11							60	14	55	14
ⓧ	55	11	50	11							55	14	50	14
	65	12	60	12							65	15	60	15
ⓧ	30	12	25	11							30	13	25	13
	25	11	20	11							25	12	20	12
ⓧ	55	13	50	12							50	14	45	14
	45	13	40	12							45	14	40	14
ⓧ	35	13	35	12							40	14	35	14
	85	15	80	14							85	16	80	16
ⓧ	80	15	75	14							80	16	75	16
	80	14	75	13							75	16	70	16
ⓧ	70	14	65	13							70	16	65	16
	55	13	50	12							55	15	50	15
ⓧ														
ⓧ														
ⓧ														
ⓧ	20	11	20	11							25	13	20	13
	35	11	30	11							35	13	30	13
ⓧ	30	11	25	11							30	12	25	12
	150	16	140	15							140	16	135	16
ⓧ	120	15	115	14							125	16	120	16
	150	16	140	15							170	17	165	17
ⓧ	130	16	120	15							140	17	135	17
	110	16	100	15							115	16	110	16
ⓧ	75	14	70	13							75	15	70	15
	120	17	115	16							120	17	115	17
ⓧ	90	17	85	16							90	17	85	17
	95	16	90	15							95	17	90	17
ⓧ	75	16	70	15							75	17	70	17
	70	16	65	15							70	17	65	17
ⓧ	60	16	55	15							60	17	55	17
	75	14	70	13							75	16	70	16
ⓧ	70	14	65	13							70	16	65	16
	60	13	55	12							60	15	55	15
ⓧ	50	13	45	12							50	15	45	15



## Einsatzempfehlungen für Kegelsenker

- Artikel-Nr.
- Norm/DIN
- Schneidstoff
- Oberfläche
- Kegelwinkel
- Schaftform
- Programm Seite

Werkzeuge mit fett gesetzter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

### Wichtiger Hinweis zu den spiralisierten Kegelsenkern:

Kleinster senkbarer Bohrungsdurchmesser und Eignung für Senkschrauben bei spiralisierten Kegelsenkern.

Werkzeug-Ø mm	Vorschubreihen-Code					
	81	82	83	84	85	86
	f (mm/U)					
2,00	0,03	0,04	0,06	0,08	0,10	0,13
2,50	0,03	0,05	0,07	0,10	0,13	0,16
3,15	0,03	0,05	0,08	0,11	0,15	0,20
4,00	0,04	0,06	0,09	0,13	0,17	0,22
5,00	0,04	0,07	0,10	0,14	0,18	0,23
6,30	0,04	0,07	0,12	0,15	0,19	0,24
8,00	0,05	0,08	0,13	0,16	0,20	0,25
10,00	0,06	0,09	0,14	0,17	0,22	0,26
12,50	0,06	0,10	0,15	0,19	0,23	0,28
16,00	0,07	0,11	0,17	0,21	0,26	0,31
20,00	0,08	0,13	0,18	0,23	0,28	0,33
25,00	0,09	0,15	0,21	0,26	0,30	0,38
31,50	0,12	0,17	0,24	0,30	0,36	0,42
40,00	0,14	0,21	0,28	0,34	0,40	0,46

d1	kleinster senkbarer Bohrungs-Ø	für Senkschrauben ISO 2009, 2010, 7046, 7047	für Senkschrauben DIN 7991
6,30	2,00	-	M3
8,00	2,50	M4	-
8,30	2,50	-	M4
10,00	3,00	M5	-
10,40	3,00	-	M5
11,50	3,30	M6	-
12,40	3,30	-	M6
15,00	3,70	M8	-
16,50	3,70	-	M8
19,00	4,50	M10	-
20,50	4,50	-	M10
23,00	4,80	M12	-
25,00	4,80	-	M12
31,00	5,20	-	M16

- Werkstoffbezogene Kühlmittel:
- Luft
  - Öl
  - ◉ Emulsion

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm²)	Härte	Kühlmittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		○
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		○
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		○
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		○
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		●
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		●
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		○
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	●
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		●
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	○
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMw-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	○
Hartguss	-		≤350 HB	○
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	○
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		○
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		●
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
Al-Gusslegierungen ≤ 10 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9	≤600		○
≤ 24 % Si	<b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		○
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤600		○
Messing, kurzspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		○
langspanend	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		○
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		○
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		○
Kunststoffe, duroplastisch	Epoxidharz, Resopal, Pertinax, Moltopren	≤150		○
thermoplastisch	Plexiglas, Hostalen, Novodur, Makralon	≤100		○
aramidfaserverstärkt	Kevlar	≤1000		○
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		○





# HARTNER

88200	88021
335	335
<b>HSS</b>	<b>HSS</b>
○	○
90°	90°
zyl.	zyl.
382	384

88201	88022
335	335
<b>HSS-E</b>	<b>HSS-E</b>
Ⓐ	Ⓐ
90°	90°
zyl.	zyl.
383	385



V <sub>e</sub> m/min	Vorschubreihen-Code	
32	85	85
30	85	85
32	85	85
30	85	85
32	85	85
30	85	85
20	84	84
15	84	84
12	84	84
25	85	85
15	84	84
10	84	84
15	85	85
12	84	84
17	84	84
15	84	84
15	84	84
10	84	84
16	84	84
12	84	84
14	84	84
25	85	85
16	84	84
22	84	84
20	84	84
8	84	84
25	84	84
16	84	84
8	84	84
15	85	85
10	85	85
90	85	85
70	86	86
40	85	85
30	85	85
100	86	86
60	84	84
80	85	85
50	85	85
30	86	86
26	86	86
24	86	86
20	86	86
30	84	84
40	85	85
70	84	84

V <sub>e</sub> m/min	Vorschubreihen-Code	
41	83	83
39	82	82
41	83	83
39	82	82
41	83	83
39	83	83
25	82	82
19	83	83
15	82	82
32	83	83
19	83	83
13	82	82
19	82	82
15	81	81
22	82	82
19	81	81
19	81	81
13	81	81
20	82	82
15	81	81
18	81	81
32	83	83
20	83	83
28	83	83
25	83	83
10	81	81
28	83	83
18	83	83
10	81	81
19	82	82
13	81	81
114	84	84
89	84	84
51	83	83
39	83	83
127	84	84
76	84	84
101	84	84
64	84	84
39	84	84
33	84	84
31	84	84
25	84	84
39	84	84
51	84	84

# Einsatzempfehlungen Multiplex

Bestell-Nr.  
Ø-Bereich  
Schneidstoff  
Oberfläche  
Programm Seite

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code					
	1	2	3	4	5	6
	f (mm/U)					
10,00	0,08	0,09	0,11	0,14	0,19	0,24
12,50	0,09	0,11	0,13	0,17	0,22	0,28
16,00	0,11	0,13	0,16	0,21	0,27	0,34
20,00	0,13	0,15	0,19	0,25	0,32	0,40
25,00	0,16	0,18	0,23	0,29	0,38	0,48
31,50	0,19	0,22	0,27	0,35	0,45	0,57
40,00	0,23	0,26	0,33	0,42	0,54	0,69
50,00	0,27	0,31	0,39	0,50	0,64	0,82
63,00	0,32	0,38	0,47	0,60	0,77	0,98
102,00	0,40	0,48	0,59	0,74	0,85	1,20
150,00	0,59	0,70	0,87	1,09	1,25	1,76
100,00	0,78	0,93	1,16	1,45	1,67	2,35

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- ⊙ Emulsion

Schneidrichtung:

- Ⓡ rechtsschneidend
- Ⓛ linksschneidend

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm²)	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		○
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		○
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		○
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		○
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		●
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		●
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		○
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	●
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		●
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	○
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMw-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	○
Hartguss	-		≤350 HB	○
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	○
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		○
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		●
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
Al-Gusslegierungen ≤ 10 % Si ≤ 24 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9 <b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤600		○
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		○
Messing, kurzspanend langspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2 <b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600 ≤600		○
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		○
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		○
Kunststoffe, duroplastisch thermoplastisch	Bakelit, Resopal, Pertinax, Moltopren Plexiglas, Hostalen, Novodur, Makralon	≤150 ≤100		○
aramidfaserverstärkt	Kevlar	≤1000		○
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		○



# HARTNER

86602
10...25
HSS-E-PM
<b>T</b>
411

86608
10...25
HSS-E-PM
<b>F</b>
413

86605
25...102
HSS-E
<b>T</b>
412

86609
10...102
HSS-E-PM
<b>A</b>
414

86611
10...65
HSS-E-PM
<b>A</b>
415



V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code
40	4	48	4	40	4	48	4	25	3
35	4	42	4	35	4	42	4	25	3
50	5	60	5	50	5	60	5	30	3
40	5	50	5	40	5	50	5	25	3
40	4	45	4	40	4	45	4	22	3
35	4	40	4	35	4	40	4	20	3
30	4	35	4	30	4	35	4	20	3
25	3	28	3	25	3	28	3	15	2
22	2	25	2	22	2	25	2	15	2
35	3	40	3	35	3	40	3	20	2
25	3	28	3	25	3	28	3	15	2
22	2	25	2	22	2	25	2	15	2
22	3	25	3	22	3	25	3	15	2
15	2	18	2	15	2	18	2	12	1
26	3	28	3	26	3	28	3	15	2
22	2	25	2	22	2	25	2	15	2
12	2	18	2	12	2	18	2	10	1
10	2	13	2	10	2	13	2	8	1
20	2	23	2	20	2	23	2	10	1
15	2	17	2	15	2	17	2	10	1
15	2	20	2	15	2	20	2	10	1
35	4	40	4	35	4	40	4	20	3
35	4	40	4	35	4	40	4	20	3
35	4	40	4	35	4	40	4	20	3
28	4	33	4	28	4	33	4	20	3
60	5	65	5	60	5	65	5	32	4
80	5	85	5	80	5	85	5	42	4
85	5	85	5	85	5	85	5	42	4
70	5	70	5	70	5	70	5	35	4
45	4	50	4	45	4	50	4	25	3
45	4	50	4	45	4	50	4	25	3
60	5	65	5	60	5	65	5	32	4
45	4	50	4	45	4	50	4	25	3
32	5	35	5	32	5	35	5	20	4
40	3	45	3	40	3	45	3	22	2
36	3	40	3	36	3	40	3	20	2
28	3	32	3	28	3	32	3	15	2
22	3	27	3	22	3	27	3	15	2

## Einsatzempfehlungen Multiplex

Bestell-Nr.  
 Ø-Bereich  
 Schneidstoff  
 Hartmetallsorte  
 HM-Anwendungsgruppe  
 Oberfläche  
 Programm Seite

Werkzeuge mit fett gedruckter Vorschubreihen-Nr. sind bevorzugt auszuwählen.

Bohrer-Ø mm	Vorschubreihen-Code					
	1	2	3	4	5	6
	f (mm/U)					
10,00	0,08	0,09	0,11	0,14	0,19	0,24
12,50	0,09	0,11	0,13	0,17	0,22	0,28
16,00	0,11	0,13	0,16	0,21	0,27	0,34
20,00	0,13	0,15	0,19	0,25	0,32	0,40
25,00	0,16	0,18	0,23	0,29	0,38	0,48
31,50	0,19	0,22	0,27	0,35	0,45	0,57
40,00	0,23	0,26	0,33	0,42	0,54	0,69
50,00	0,27	0,31	0,39	0,50	0,64	0,82
63,00	0,32	0,38	0,47	0,60	0,77	0,98
102,00	0,40	0,48	0,59	0,74	0,85	1,20
150,00	0,59	0,70	0,87	1,09	1,25	1,76
100,00	0,78	0,93	1,16	1,45	1,67	2,35

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion



Schneidrichtung:



- Ⓡ rechtsschneidend
- Ⓛ linksschneidend


Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		○
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		○
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		○
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		○
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		●
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		○
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		○
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	●
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.4105</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		●
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	○
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMw-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	○
Hartguss	-		≤350 HB	○
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	○
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		○
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		●
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
Al-Gusslegierungen ≤ 10 % Si ≤ 24 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9 <b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤600		○
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		○
Messing, kurzspanend langspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2 <b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600 ≤600		○
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		○
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		○
Kunststoffe, duroplastisch thermoplastisch	Bakelit, Resopal, Pertinax, Moltopren Plexiglas, Hostalen, Novodur, Makralon	≤150 ≤100		○
aramidfaserverstärkt	Kevlar	≤1000		○
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		○



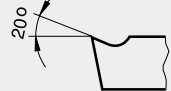
# HARTNER

86708	86709
10...35	10...35
VHM	VHM
H22	H22
K20/K40	K20/K40
	
419	420

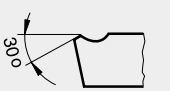
86701	86702
10...35	10...35
VHM	VHM
H22	H22
K20/K40	K20/K40
	
417	418

86711
10...65
VHM
H22
K20/K40

421

**Art.-Nr. 86709/86701  
ohne Fasen**  
für Werkstoffe bis  
ca. 600 N/mm<sup>2</sup>  
Zugfestigkeit



**Art.-Nr. 86708/86702  
mit Fasen**  
für Werkstoffe ab  
ca. 600 N/mm<sup>2</sup>  
Zugfestigkeit





V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code	V <sub>c</sub> m/min	Vorschubreihen- Code
60	5	70	5		
55	4	65	4		
100	4	115	4		
95	4	105	4		
80	4	90	4		
80	4	90	4		
75	3	85	3		
70	4	80	4		
60	3	70	3		
85	4	95	4		
70	4	80	4		
55	3	65	3		
60	3	65	3		
50	2	55	2		
40	3	45	3		
35	2	40	2		
40	2	45	2		
35	2	40	2		
25	1	30	1		
40	2	45	2		
25	2	30	2		
100	5	120	5		
90	4	105	4		
80	4	90	4		
65	3	75	3		
25	1	30	1		
180	5	200	5	180	5
160	5	180	5	160	5
140	5	160	5	140	5
130	5	150	5	130	5
150	5	160	5	150	4
70	4	80	4	70	5
160	5	180	5	160	4
110	4	120	4	110	5
80	5	90	5	80	4
65	4	75	4	65	4
45	4	50	4	45	4
35	4	40	4	35	4
70	3	85	3	70	3
70	3	85	3	70	3
70	3	85	3	70	3
70	3	85	3	70	3

## Einsatzempfehlungen Multiplex HPC

Artikel-Nr.
Norm/DIN
Schneidstoff
HM-Gruppe
Bohrtiefe
Oberfläche
Typ
Programm Seite

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
10,00	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
12,50	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
16,00	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
20,00	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
25,00	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
31,50	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
40,00	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- Emulsion

Alle Angaben sind Richtwerte. Die tatsächlich erreichbaren Schnittgeschwindigkeiten und Vorschübe hängen von den jeweiligen Bearbeitungsbedingungen ab. Wir empfehlen entsprechende Bohrversuche.

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
<b>Allgemeine Baustähle</b>	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		○
<b>Automatenstähle</b>	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		○
<b>Unlegierte Vergütungsstähle</b>	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		○
<b>Legierte Vergütungsstähle</b>	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		○
<b>Unlegierte Einsatzstähle</b>	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
<b>Legierte Einsatzstähle</b>	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		●
<b>Nitrierstähle</b>	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		●
<b>Werkzeugstähle</b>	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		○
<b>Schnellarbeitsstähle</b>	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
<b>Federstähle</b>	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
<b>Gehärtete Stähle</b>	-		≤48 HRC ≤66 HRC	●
<b>Rostfreie Stähle, geschwefelt</b>	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.86681</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		●
<b>austenitisch</b>	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		●
<b>martensitisch</b>	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		●
<b>Gusseisen</b>	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	○
<b>Kugelgraphit- und Temperguss</b>	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	○
<b>Hartguss</b>	-		≤350 HB	○
<b>Neue Gusswerkstoffe GGV</b>	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	○
<b>Neue Gusswerkstoffe ADI</b>	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		○
<b>Sonderlegierungen</b>	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
<b>Titan und Titan-Legierungen</b>	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		●
<b>Aluminium und Al-Legierungen</b>	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
<b>Al-Knetlegierungen</b>	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
<b>Al-Gusslegierungen ≤ 10 % Si</b>	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9 <b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤600		○
<b>Magnesium-Legierungen</b>	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
<b>Kupfer, niedriglegiert</b>	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		○
<b>Messing, kurzspanend</b>	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		○
<b>langspanend</b>	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		○
<b>Bronzen, kurzspanend</b>	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		○
<b>Bronzen, langspanend</b>	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		○
<b>Kunststoffe, duroplastisch</b>	Bakelit, Resopal, Pertinax, Moltopren	≤150		○
<b>thermoplastisch</b>	Plexiglas, Hostalen, Novodur, Makralon	≤100		○
<b>aramidfaserverstärkt</b>	Kevlar	≤1000		○
<b>glas-/kohlefaserverstärkt</b>	GFK/CFK	≤1000		○

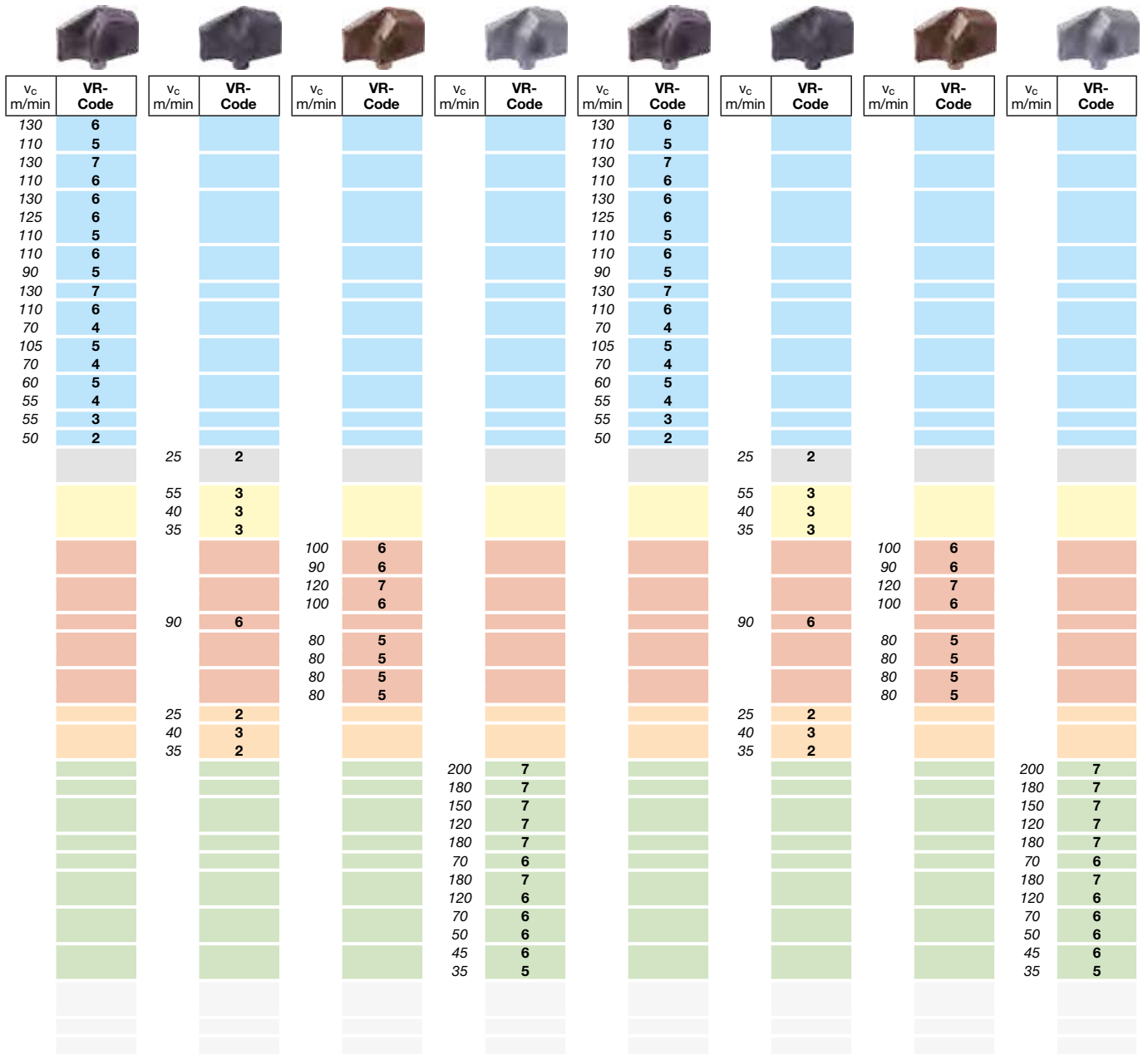


# HARTNER

## ≤1,5xD

## ≤3xD

86722	86725	86723	86724	86722	86725	86723	86724
WN	WN	WN	WN	WN	WN	WN	WN
VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM
K/P	K/P	K/P	K/P	K/P	K/P	K/P	K/P
1,5xD	1,5xD	1,5xD	1,5xD	3xD	3xD	3xD	3xD
F	a	Y	○	F	a	Y	○
Stahl	rostfr. St.	Guss	Al/Al-Leg.	Stahl	rostfr. St.	Guss	Al/Al-Leg.
446	455	449	452	446	455	449	452



# Einsatzempfehlungen Multiplex HPC

<b>Artikel-Nr.</b>
<b>Norm/DIN</b>
<b>Schneidstoff</b>
<b>HM-Gruppe</b>
<b>Bohrtiefe</b>
<b>Oberfläche</b>
<b>Typ</b>
<b>Programm Seite</b>

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
10,00	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
12,50	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
16,00	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
20,00	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
25,00	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
31,50	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
40,00	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- ◐ Emulsion

Alle Angaben sind Richtwerte. Die tatsächlich erreichbaren Schnittgeschwindigkeiten und Vorschübe hängen von den jeweiligen Bearbeitungsbedingungen ab. Wir empfehlen entsprechende Bohrversuche.

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm²)	Härte	Kühl- mittel
<b>Allgemeine Baustähle</b>	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		○
<b>Automatenstähle</b>	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		○
<b>Unlegierte Vergütungsstähle</b>	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		○
<b>Legierte Vergütungsstähle</b>	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		○
<b>Unlegierte Einsatzstähle</b>	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
<b>Legierte Einsatzstähle</b>	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		●
<b>Nitrierstähle</b>	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		●
<b>Werkzeugstähle</b>	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		○
<b>Schnellarbeitsstähle</b>	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
<b>Federstähle</b>	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
<b>Gehärtete Stähle</b>	-		≤48 HRC ≤66 HRC	●
<b>Rostfreie Stähle, geschwefelt</b>	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.86681</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9	≤900		●
<b>austenitisch</b>	<b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A)	≤1100		●
<b>martensitisch</b>	<b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤1500		●
<b>Gusseisen</b>	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	○
<b>Kugelgraphit- und Temperguss</b>	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	○
<b>Hartguss</b>	-		≤350 HB	○
<b>Neue Gusswerkstoffe GGV</b>	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	○
<b>Neue Gusswerkstoffe ADI</b>	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		○
<b>Sonderlegierungen</b>	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
<b>Titan und Titan-Legierungen</b>	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		●
<b>Aluminium und Al-Legierungen</b>	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
<b>Al-Knetlegierungen</b>	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
<b>Al-Gusslegierungen ≤ 10 % Si</b>	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9 <b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤600		○
<b>Magnesium-Legierungen</b>	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
<b>Kupfer, niedriglegiert</b>	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		○
<b>Messing, kurzspanend</b>	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2	≤600		○
<b>langspanend</b>	<b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600		○
<b>Bronzen, kurzspanend</b>	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		○
<b>Bronzen, langspanend</b>	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		○
<b>Kunststoffe, duroplastisch</b>	Bakelit, Resopal, Pertinax, Moltopren	≤150		○
<b>thermoplastisch</b>	Plexiglas, Hostalen, Novodur, Makralon	≤100		○
<b>aramidfaserverstärkt</b>	Kevlar	≤1000		○
<b>glas-/kohlefaserverstärkt</b>	GFK/CFK	≤1000		○





# HARTNER

≤5xD

≤7xD

86722	86725	86723	86724	86722	86725	86723	86724
WN	WN	WN	WN	WN	WN	WN	WN
VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM
K/P	K/P	K/P	K/P	K/P	K/P	K/P	K/P
1,5xD	1,5xD	1,5xD	1,5xD	3xD	3xD	3xD	3xD
F	a	Y	○	F	a	Y	○
Stahl	rostfr. St.	Guss	Al/Al-Leg.	Stahl	rostfr. St.	Guss	Al/Al-Leg.
446	455	449	452	446	455	449	452



V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	
125	6							120	5					
105	5							105	4					
125	7							120	6					
105	6							105	5					
125	6							120	5					
120	6							110	5					
105	5							100	4					
105	6							100	5					
85	5							85	4					
125	7							120	6					
105	6							100	5					
70	4							70	4					
105	5							105	4					
70	4							70	3					
55	5							55	4					
50	4							50	3					
55	3							55	2					
50	2							50	2					
		25	2							25	1			
		55	3							55	2			
		40	3							40	2			
		35	3							35	2			
				100	6							80	6	
				90	6							70	6	
				120	7							100	7	
				100	6							80	6	
		90	6							70	6			
				80	5							60	5	
				80	5							60	5	
				80	5							60	5	
				80	5							60	5	
		25	2							25	1			
		40	3							40	2			
		35	2							35	1			
								180	7				180	6
								180	7				180	6
								140	7				140	6
								110	7				110	6
								180	7				180	6
								70	6				70	5
								180	7				180	6
								120	6				120	5
								70	6				70	5
								50	6				50	5
								45	6				45	5
								35	5				35	4



## Einsatzempfehlungen Multiplex HPC

Artikel-Nr.
Norm/DIN
Schneidstoff
HM-Gruppe
Bohrtiefe
Oberfläche
Typ
Programm Seite

Bohrer-Ø mm	Vorschubreihen-Code								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
10,00	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,400
12,50	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
16,00	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
20,00	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,630
25,00	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	0,800
31,50	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000
40,00	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000	1,250

Werkstoffbezogene Kühlmittel:

- Luft
- Öl
- ⊙ Emulsion

Alle Angaben sind Richtwerte. Die tatsächlich erreichbaren Schnittgeschwindigkeiten und Vorschübe hängen von den jeweiligen Bearbeitungsbedingungen ab. Wir empfehlen entsprechende Bohrversuche.

Werkstoffgruppe	Werkstoffbeispiele, neue Bezeichnung (in Klammern alte Bezeichnung) Fettgedruckte Zahlen = Werkstoff-Nr. nach DIN EN	Zugfestigkeit MPa (N/mm <sup>2</sup> )	Härte	Kühl- mittel
Allgemeine Baustähle	<b>1.0035</b> S185(St33), <b>1.0486</b> P275N(StE285), <b>1.0345</b> P235GH(H1), <b>1.0425</b> P265GH(H2) <b>1.0050</b> E295 (St50-2), <b>1.0070</b> E360 (St70-2), <b>1.8937</b> P500NH (WStE500)	≤500 ≤1000		○
Automatenstähle	<b>1.0718</b> 11SMnPb30 (9SMnPb28), <b>1.0736</b> 11SMn37 (9SMn36) <b>1.0727</b> 46S20 (45S20), <b>1.0728</b> (60S20), <b>1.0757</b> 46SPb20 (45SPb20)	≤850 ≤1000		○
Unlegierte Vergütungsstähle	<b>1.0402</b> C22, <b>1.1178</b> C30E (Ck30) <b>1.0503</b> C45, <b>1.1191</b> C45E (Ck45) <b>1.0601</b> C60, <b>1.1221</b> C60E (Ck60)	≤700 ≤850 ≤1000		○
Legierte Vergütungsstähle	<b>1.5131</b> 50MnSi4, <b>1.7003</b> 38Cr2, <b>1.7030</b> 28Cr4 <b>1.5710</b> 36NiCr6, <b>1.7035</b> 41Cr4, <b>1.7225</b> 42CrMo4	≤1000 ≤1400		○
Unlegierte Einsatzstähle	<b>1.0301</b> (C10), <b>1.1121</b> C10E (Ck10)	≤850		○
Legierte Einsatzstähle	<b>1.7276</b> 10CrMo11, <b>1.5125</b> 11MnSi6 <b>1.5752</b> 15NiCr13, <b>1.7131</b> 16MnCr5, <b>1.7264</b> 20CrMo5	≤1000 ≤1400		●
Nitrierstähle	<b>1.8504</b> 34CrAl6 <b>1.8519</b> 31CrMoV9, <b>1.8550</b> 34CrAlNi7	≤1000 ≤1400		●
Werkzeugstähle	<b>1.1750</b> C75W, <b>1.2067</b> 102Cr6, <b>1.2307</b> 29CrMoV9 <b>1.2080</b> X210Cr12, <b>1.2083</b> X42Cr13, <b>1.2419</b> 105WCr6, <b>1.2767</b> X45NiCrMo4	≤850 ≤1400		○
Schnellarbeitsstähle	<b>1.3243</b> S 6-5-2-5, <b>1.3343</b> S 6-5-2, <b>1.3344</b> S 6-5-3	≤1400		●
Federstähle	<b>1.5026</b> 55Si7, <b>1.7176</b> 55Cr3, <b>1.8159</b> 51CrV4 (51CrV4)		≤350 HB	●
Gehärtete Stähle	-		≤48 HRC ≤66 HRC	●
Rostfreie Stähle, geschwefelt austenitisch martensitisch	<b>1.4005</b> X12CrS13, <b>1.4104</b> X14CrMoS17, <b>1.86681</b> X6CrMoS17, <b>1.4305</b> X8CrNiS18-9 <b>1.4301</b> X5CrNi18-10 (V2A), <b>1.4541</b> X6CrNiTi18-10, <b>1.4571</b> X6CrNiMoTi 17-12-2 (V4A) <b>1.4057</b> X20CrNi172 (X17CrNi16-2), <b>1.4122</b> X39CrMo17-1, <b>1.4521</b> X2CrMoTi18-2	≤900 ≤1100 ≤1500		●
Gusseisen	<b>0.6010</b> EN-GJL-100 (GG10), <b>0.6020</b> EN-GJL-200 (GG20) <b>0.6025</b> EN-GJL-250 (GG25), <b>0.6035</b> EN-GJL-350 (GG35)		≤240 HB ≤350 HB	○
Kugelgraphit- und Temperguss	<b>0.7050</b> EN-GJS-500-7 (GGG50), <b>0.8035</b> EN-GJMW-350-4 (GTW35) <b>0.7070</b> EN-GJS-700-2 (GGG70), <b>0.8170</b> EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	○
Hartguss	-		≤350 HB	○
Neue Gusswerkstoffe GGV	<b>EN-GJV250</b> (GGV25), <b>EN-GJV350</b> (GGV35) <b>EN-GJV400</b> (GGV40), <b>EN-GJV500</b> (GGV50), SiMo 6		≤220 HB ≤300 HB	○
Neue Gusswerkstoffe ADI	<b>EN-GJS-800-8</b> (ADI800), <b>EN-GJS-1000-5</b> (ADI1000) <b>EN-GJS-1200-2</b> (ADI1200), <b>EN-GJS-1400-1</b> (ADI1400)	≤1000 ≤1400		○
Sonderlegierungen	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Titan und Titan-Legierungen	<b>3.7024</b> Ti99,5, <b>3.7114</b> TiAl5Sn2,5, <b>3.7124</b> TiCu2 <b>3.7154</b> TiAl6Zr5, <b>3.7165</b> TiAl6V4, <b>3.7184</b> TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		●
Aluminium und Al-Legierungen	<b>3.0255</b> Al99,5, <b>3.2315</b> AlMgSi1, <b>3.3515</b> AlMg1	≤400		○
Al-Knetlegierungen	<b>3.0615</b> AlMgSiPb, <b>3.1325</b> AlCuMg1, <b>3.3245</b> AlMg3Si, <b>3.4365</b> AlZnMgCu1,5	≤650		○
Al-Gusslegierungen ≤ 10 % Si ≤ 24 % Si	<b>3.2131</b> G-AlSi5Cu1, <b>3.2153</b> G-AlSi7Cu3, <b>3.2573</b> G-AlSi9 <b>3.2581</b> G-AlSi12, <b>3.2583</b> G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤600		○
Magnesium-Legierungen	<b>3.5200</b> MgMn2, <b>3.5812.05</b> G-MgAl8Zn1, <b>3.5612.05</b> G-MgAl6Zn1	≤400		○
Kupfer, niedriglegiert	<b>2.0070</b> SE-Cu, <b>2.1020</b> CuSn6, <b>2.1096</b> G-CuSn5ZnPb	≤500		○
Messing, kurzspanend langspanend	<b>2.0380</b> CuZn39Pb2, <b>2.0401</b> CuZn39Pb3, <b>2.0410</b> CuZn43Pb2 <b>2.0250</b> CuZn20, <b>2.0280</b> CuZn33, <b>2.0332</b> CuZn37Pb0,5	≤600 ≤600		○
Bronzen, kurzspanend	<b>2.1090</b> CuSn7ZnPb, <b>2.1170</b> CuPb5Sn5, <b>2.1176</b> CuPb10Sn <b>2.0790</b> CuNi18Zn19Pb	≤600 ≤850		○
Bronzen, langspanend	<b>2.0916</b> CuAl5, <b>2.0960</b> CuAl9Mn, <b>2.1050</b> CuSn10 <b>2.0980</b> CuAl11Ni, <b>2.1247</b> CuBe2	≤850 ≤1000		○
Kunststoffe, duroplastisch thermoplastisch	Bakelit, Resopal, Pertinax, Moltopren Plexiglas, Hostalen, Novodur, Makralon	≤150 ≤100		○
aramidfaserverstärkt	Kevlar	≤1000		○
glas-/kohlefaserverstärkt	GFK/CFK	≤1000		○



## ≤10xD

86722
WN
VHM
K/P
1,5xD
F
Stahl
446

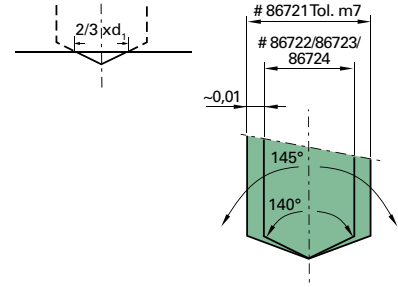
86725
WN
VHM
K/P
1,5xD
a
rostfr. St.
455

86723
WN
VHM
K/P
1,5xD
Y
Guss
449

86724
WN
VHM
K/P
1,5xD
○
Al/Al-Leg.
452

## ≤1xD Pilotieren/Senken

86721
WN
VHM
K/P
1xD
a
Pil./Senken
443



- Bei Durchgangsbohrungen ist darauf zu achten, dass die Führungsfasen im Eingriff bleiben. Außerdem empfehlen wir, vor dem Durchbohren den Vorschub zu reduzieren.
- Generell empfehlen wir bei Bohrtiefen ab 5xD mit Halter Art.-Nr. 86681 und Pilotierplatte Art.-Nr. 86721 zu zentrieren bzw. zu pilotieren.
- Beim Bohren ohne Anzentrieren empfehlen wir eine Reduzierung des Vorschubs während des Anbohrens.
- Das Bohrwerkzeug ist nicht ohne Versuch im unterbrochenen Schnitt (Nuten, Querbohrungen) einzusetzen. Bei unterbrochenem Schnitt (max. 0,2xD) empfehlen wir den Vorschub nach Möglichkeit zu reduzieren.
- Multiplex ist im Gegensatz zum klassischen Wendepplattenbohrer auch zum Bohren von Blechpaketen geeignet.
- Bei Drehmaschinen (stehendes Bohrwerkzeug) ist darauf zu achten, dass das Werkzeug exakt auf Mitte steht.
- Voraussetzung für eine optimale Zerspanung ist eine ausreichende Kühlschmierstoff-Versorgung durch Emulsion oder Öl.
- Das Werkzeug ist nur bedingt für die Trockenbearbeitung oder MMS geeignet. Bei MMS-Einsatz empfehlen wir die Verwendung des kegeligen MMS-Schaftendes sowie der MMS-Bauteile. Unser Außendienst berät Sie gerne.




V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code	V <sub>c</sub> m/min	VR-Code
100	5					130	6		
95	4					110	5		
100	6					130	7		
95	5					110	6		
100	5					130	6		
95	5					125	6		
90	4					110	5		
90	5					110	6		
85	4					90	5		
100	6					130	7		
90	5					110	6		
70	4					70	4		
95	4					105	5		
70	3					70	4		
55	4					60	5		
50	3					55	4		
55	2					55	3		
50	2					50	2		
		25	1			25	2		
		55	2			55	3		
		40	2			40	3		
		35	2			35	3		
				80	6	100	6		
				70	6	90	6		
				100	7	120	7		
				80	6	100	6		
		70	6			90	6		
				60	5	80	5		
				60	5	80	5		
				60	5	80	5		
				60	5	80	5		
		25	1			25	2		
		40	2			40	3		
		35	1			35	2		
						150	6	200	7
						150	6	180	7
						130	6	150	7
						105	6	120	7
						150	6	180	7
						70	5	70	6
						150	6	180	7
						110	5	120	6
						70	5	70	6
						50	5	50	6
						45	5	45	6
						35	4	35	5











Baumaßänderungen infolge Weiterentwicklung oder Normenänderung behalten wir uns vor.

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Druckfehler jeder Art, auch bei technischen Daten oder Preisen, berechtigen nicht zu Ansprüchen.

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