



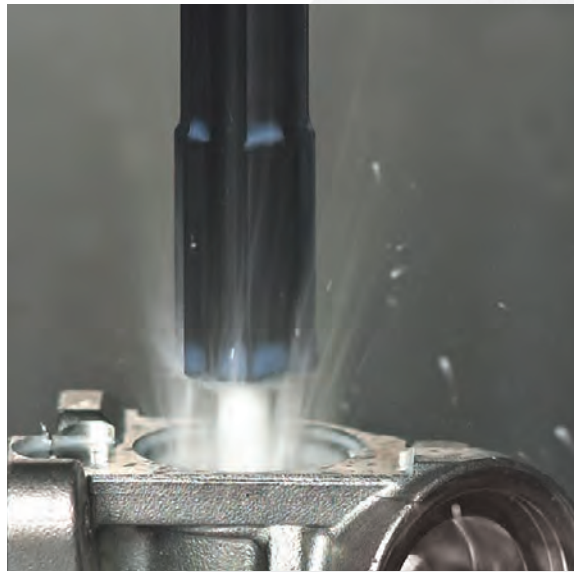
HARTNER

Precision Cutting Tools

REAMERS

TR 300 HP - HIGH-PERFORMANCE REAMERS

SOLID CARBIDE AND HSS-E MACHINE REAMERS | HAND REAMERS



ISO code

P	Steel, high-alloyed steel
M	Stainless steel
K	Grey cast iron, spher. graphite iron/malleable cast iron
N	Aluminium and other non-ferrous metals
S	Special, super and titanium alloys
H	Hardened steel and chilled cast iron

Pictograms

Tool material	VHM		HM		HSS		HSS-E	
	Solid carbide		Carbide-tipped					
Type	TR 300 HP S		TR 300 HP D					
	Blind hole (S)		Through hole (D)					
Form	A		B					
Hole type								
	Through hole		Blind hole					
Norm	DIN 206	DIN 208	DIN 212	DIN 212-2	DIN 212-3	~DIN 8050	~DIN 8051	
	to DIN							
			to Hartner standard					
Tolerance on Ø	H7	+0,005 +0	+0,004 +0,005					
Cutting direction								
	right		left					
Shank form								
			Morse taper					
Helix angle								
	straight-fluted		left-hand helix					
Flute spacing								
	unequal		extremely unequal					
Internal cooling								
	with IC		without IC					

Optimal diameters of pre-drilled holes

Recommended stock allowance, in mm			up to Ø6	up to Ø10	up to Ø16	up to Ø25	up to Ø40	up to Ø40
all materials			Ø 0.1-0.2	Ø 0.2	Ø 0.2-0.3	Ø 0.3	Ø 0.3-0.4	Ø 0.4-0.5
hardened steel	H	up to 48 HRC	Ø 0.1-0.2	Ø 0.2	Ø 0.2	Ø 0.2	Ø 0.3	Ø 0.3
		up to 63 HRC	Ø 0.1	Ø 0.1	Ø 0.1-0.2	Ø 0.2	Ø 0.2	Ø 0.2





TR 300 HIGH-PERFORMANCE REAMERS

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SOLID CARBIDE REAMERS

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HSS-E- MACHINE REAMERS

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HAND REAMERS

▼ PAGE 35

TECHNICAL SECTION

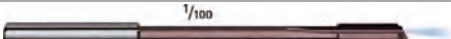
▼ PAGE 40



High-performance reamers

Standard	Form	Shank form	Diameter tolerance	Tool material	Surface finish	Hole type	d1	Order no.	Discount group	Standard range page
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High-performance reamers

	Hartner Standard	TR 300 HP S	HA	H7	Solid carbide			3.000 - 20.000	88400	166	5
											
	Hartner Standard	TR 300 HP S	HA	+0.005	Solid carbide			2.970 - 12.030	88402	166	5
	Hartner Standard	TR 300 HP D	HA	H7	Solid carbide			3.000 - 20.000	88401	166	8
											
	Hartner Standard	TR 300 HP D	HA	+0.005	Solid carbide			2.970 - 12.030	88403	166	8
	Hartner Standard	TR 300 S	HA	H7	Solid carbide			3.000 - 14.000	88404	166	11
	Hartner Standard	TR 300 D	HA	H7	Solid carbide			3.000 - 14.000	88405	166	11

High-performance reamers

TR 300
HP S

WN

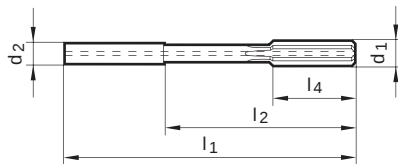
HA



EU



The solid carbide HPC reamer HR 500 S operates with highest cutting rates and produces extremely high-quality holes. Therefore, it often enables considerable savings in the process costs. In addition, it provides very high process reliability.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
2.970	2.970	4.000	68.00	40.00	12.00	4
2.980	2.980	4.000	68.00	40.00	12.00	4
2.990	2.990	4.000	68.00	40.00	12.00	4
3.000	3.000	4.000	68.00	40.00	12.00	4
3.010	3.010	4.000	68.00	40.00	12.00	4
3.020	3.020	4.000	68.00	40.00	12.00	4
3.030	3.030	4.000	68.00	40.00	12.00	4
3.500	3.500	4.000	68.00	40.00	12.00	4
3.970	3.970	4.000	68.00	40.00	12.00	4
3.980	3.980	4.000	68.00	40.00	12.00	4
3.990	3.990	4.000	68.00	40.00	12.00	4
4.000	4.000	4.000	68.00	40.00	12.00	4
4.010	4.010	4.000	68.00	40.00	12.00	4
4.020	4.020	4.000	68.00	40.00	12.00	4
4.030	4.030	4.000	68.00	40.00	12.00	4
4.500	4.500	6.000	76.00	40.00	12.00	4
4.970	4.970	6.000	76.00	40.00	12.00	4
4.980	4.980	6.000	76.00	40.00	12.00	4
4.990	4.990	6.000	76.00	40.00	12.00	4
5.000	5.000	6.000	76.00	40.00	12.00	4
5.010	5.010	6.000	76.00	40.00	12.00	4
5.020	5.020	6.000	76.00	40.00	12.00	4
5.030	5.030	6.000	76.00	40.00	12.00	4
5.500	5.500	6.000	76.00	40.00	12.00	4
5.970	5.970	6.000	76.00	40.00	12.00	4
5.980	5.980	6.000	76.00	40.00	12.00	4
5.990	5.990	6.000	76.00	40.00	12.00	4
6.000	6.000	6.000	76.00	40.00	12.00	4
6.010	6.010	6.000	76.00	40.00	12.00	4
6.020	6.020	6.000	76.00	40.00	12.00	4

Solid carbide



H7



+0,005

Order no.

88400

88402

P (N/mm²)

•

•

M

•

•

K

○

○

N

S

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H (HRC)

63

63

Surface finish

a

a

Discount group

166

166



Availability

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High-performance reamers

TR 300
HP S

WN

HA

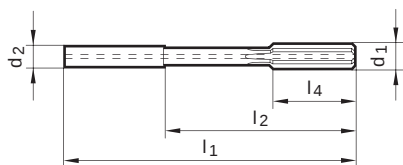
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HA

EU

R

The solid carbide HPC reamer TR 300 HP S operates with highest cutting rates and produces extremely high-quality holes. Therefore, it often enables considerable savings in the process costs. In addition, it provides very high process reliability.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
6.030	6.030	6.000	76.00	40.00	12.00	4
6.500	6.500	8.000	101.00	65.00	16.00	6
7.000	7.000	8.000	101.00	65.00	16.00	6
7.500	7.500	8.000	101.00	65.00	16.00	6
7.970	7.970	8.000	101.00	65.00	16.00	6
7.980	7.980	8.000	101.00	65.00	16.00	6
7.990	7.990	8.000	101.00	65.00	16.00	6
8.000	8.000	8.000	101.00	65.00	16.00	6
8.010	8.010	8.000	101.00	65.00	16.00	6
8.020	8.020	8.000	101.00	65.00	16.00	6
8.030	8.030	8.000	101.00	65.00	16.00	6
8.500	8.500	10.000	101.00	61.00	19.00	6
9.000	9.000	10.000	101.00	61.00	19.00	6
9.500	9.500	10.000	101.00	61.00	19.00	6
9.970	9.970	10.000	101.00	61.00	19.00	6
9.980	9.980	10.000	101.00	61.00	19.00	6
9.990	9.990	10.000	101.00	61.00	19.00	6
10.000	10.000	10.000	101.00	61.00	19.00	6
10.010	10.010	10.000	101.00	61.00	19.00	6
10.020	10.020	10.000	101.00	61.00	19.00	6
10.030	10.030	10.000	101.00	61.00	19.00	6
10.500	10.500	12.000	130.00	85.00	19.00	6
11.000	11.000	12.000	130.00	85.00	19.00	6
11.500	11.500	12.000	130.00	85.00	19.00	6
11.970	11.970	12.000	130.00	85.00	19.00	6
11.980	11.980	12.000	130.00	85.00	19.00	6
11.990	11.990	12.000	130.00	85.00	19.00	6
12.000	12.000	12.000	130.00	85.00	19.00	6
12.010	12.010	12.000	130.00	85.00	19.00	6
12.020	12.020	12.000	130.00	85.00	19.00	6

Solid carbide

H7

+0,005

Order no.

88400

88402

P (N/mm²)

•

•

M

•

•

K

○

○

N

S

•

•

H (HRC)

63

63

Surface finish

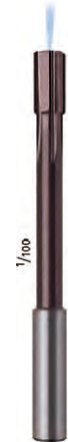
a

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Discount group

166

166



Availability

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High-performance reamers

TR 300
HP S

WN

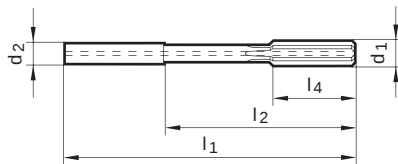
HA



EU



The solid carbide HPC reamer TR 300 HP S operates with highest cutting rates and produces extremely high-quality holes. Therefore, it often enables considerable savings in the process costs. In addition, it provides very high process reliability.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
12.030	12.030	12.000	130.00	85.00	19.00	6
13.000	13.000	14.000	130.00	85.00	22.00	6
14.000	14.000	14.000	130.00	85.00	22.00	6
15.000	15.000	16.000	150.00	102.00	22.00	6
16.000	16.000	16.000	150.00	102.00	22.00	6
17.000	17.000	18.000	150.00	102.00	25.00	6
18.000	18.000	18.000	150.00	102.00	25.00	6
19.000	19.000	20.000	150.00	100.00	25.00	6
20.000	20.000	20.000	150.00	100.00	25.00	6

Solid carbide



H7



+0,005

Order no.	88400	88402
P (N/mm ²)	●	●
M	●	●
K	○	○
N		
S	●	●
H (HRC)	63	63
Surface finish	a	a
Discount group	166	166



Availability

●	●
●	
●	
●	
●	
●	
●	
●	
●	

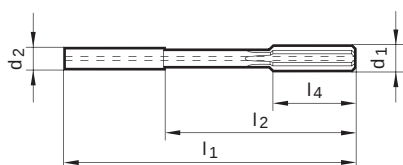
High-performance reamers

High-performance reamers

TR 300
HP D



The solid carbide HPC reamer TR 300 HP D operates with highest cutting rates and produces extremely high-quality holes. Therefore, it often enables considerable savings in the process costs. In addition, it provides very high process reliability. The special coolant supply with flutes in the shank ensures optimal chip evacuation and reliable cooling.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
2.970	2.970	4.000	68.00	40.00	12.00	4
2.980	2.980	4.000	68.00	40.00	12.00	4
2.990	2.990	4.000	68.00	40.00	12.00	4
3.000	3.000	4.000	68.00	40.00	12.00	4
3.010	3.010	4.000	68.00	40.00	12.00	4
3.020	3.020	4.000	68.00	40.00	12.00	4
3.030	3.030	4.000	68.00	40.00	12.00	4
3.500	3.500	4.000	68.00	40.00	12.00	4
3.970	3.970	4.000	68.00	40.00	12.00	4
3.980	3.980	4.000	68.00	40.00	12.00	4
3.990	3.990	4.000	68.00	40.00	12.00	4
4.000	4.000	4.000	68.00	40.00	12.00	4
4.010	4.010	4.000	68.00	40.00	12.00	4
4.020	4.020	4.000	68.00	40.00	12.00	4
4.030	4.030	4.000	68.00	40.00	12.00	4
4.500	4.500	6.000	76.00	40.00	12.00	4
4.970	4.970	6.000	76.00	40.00	12.00	4
4.980	4.980	6.000	76.00	40.00	12.00	4
4.990	4.990	6.000	76.00	40.00	12.00	4
5.000	5.000	6.000	76.00	40.00	12.00	4
5.010	5.010	6.000	76.00	40.00	12.00	4
5.020	5.020	6.000	76.00	40.00	12.00	4
5.030	5.030	6.000	76.00	40.00	12.00	4
5.500	5.500	6.000	76.00	40.00	12.00	4
5.970	5.970	6.000	76.00	40.00	12.00	4
5.980	5.980	6.000	76.00	40.00	12.00	4
5.990	5.990	6.000	76.00	40.00	12.00	4
6.000	6.000	6.000	76.00	40.00	12.00	4
6.010	6.010	6.000	76.00	40.00	12.00	4
6.020	6.020	6.000	76.00	40.00	12.00	4

Solid carbide



H7



+0,005

Order no.
P (N/mm²)
M
K
N
S
H (HRC)
Surface finish
Discount group

88401

88403

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63

63

a

a

166

166



Availability

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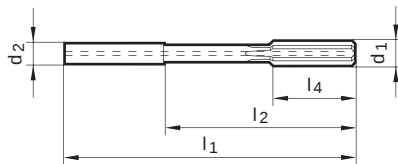
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High-performance reamers

TR 300
HP D



The solid carbide HPC reamer TR 300 HP D operates with highest cutting rates and produces extremely high-quality holes. Therefore, it often enables considerable savings in the process costs. In addition, it provides very high process reliability. The special coolant supply with flutes in the shank ensures optimal chip evacuation and reliable cooling.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
6.030	6.030	6.000	76.00	40.00	12.00	4
6.500	6.500	8.000	101.00	65.00	16.00	6
7.000	7.000	8.000	101.00	65.00	16.00	6
7.500	7.500	8.000	101.00	65.00	16.00	6
7.970	7.970	8.000	101.00	65.00	16.00	6
7.980	7.980	8.000	101.00	65.00	16.00	6
7.990	7.990	8.000	101.00	65.00	16.00	6
8.000	8.000	8.000	101.00	65.00	16.00	6
8.010	8.010	8.000	101.00	65.00	16.00	6
8.020	8.020	8.000	101.00	65.00	16.00	6
8.030	8.030	8.000	101.00	65.00	16.00	6
8.500	8.500	10.000	101.00	61.00	19.00	6
9.000	9.000	10.000	101.00	61.00	19.00	6
9.500	9.500	10.000	101.00	61.00	19.00	6
9.970	9.970	10.000	101.00	61.00	19.00	6
9.980	9.980	10.000	101.00	61.00	19.00	6
9.990	9.990	10.000	101.00	61.00	19.00	6
10.000	10.000	10.000	101.00	61.00	19.00	6
10.010	10.010	10.000	101.00	61.00	19.00	6
10.020	10.020	10.000	101.00	61.00	19.00	6
10.030	10.030	10.000	101.00	61.00	19.00	6
10.500	10.500	12.000	130.00	85.00	19.00	6
11.000	11.000	12.000	130.00	85.00	19.00	6
11.500	11.500	12.000	130.00	85.00	19.00	6
11.970	11.970	12.000	130.00	85.00	19.00	6
11.980	11.980	12.000	130.00	85.00	19.00	6
11.990	11.990	12.000	130.00	85.00	19.00	6
12.000	12.000	12.000	130.00	85.00	19.00	6
12.010	12.010	12.000	130.00	85.00	19.00	6
12.020	12.020	12.000	130.00	85.00	19.00	6

Solid carbide



H7



+0,005

Order no.
P (N/mm²)
M
K
N
S
H (HRC)
Surface finish
Discount group

88401

88403



Availability

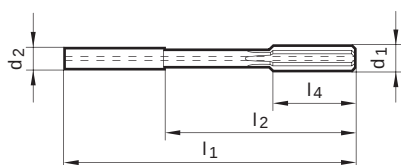
High-performance reamers

High-performance reamers

TR 300
HP D



The solid carbide HPC reamer TR 300 HP D operates with highest cutting rates and produces extremely high-quality holes. Therefore, it often enables considerable savings in the process costs. In addition, it provides very high process reliability. The special coolant supply with flutes in the shank ensures optimal chip evacuation and reliable cooling.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
12.030	12.030	12.000	130.00	85.00	19.00	6
13.000	13.000	14.000	130.00	85.00	22.00	6
14.000	14.000	14.000	130.00	85.00	22.00	6
15.000	15.000	16.000	150.00	102.00	22.00	6
16.000	16.000	16.000	150.00	102.00	22.00	6
17.000	17.000	18.000	150.00	102.00	25.00	6
18.000	18.000	18.000	150.00	102.00	25.00	6
19.000	19.000	20.000	150.00	100.00	25.00	6
20.000	20.000	20.000	150.00	100.00	25.00	6

Solide carbide



H7



+0,005

Order no.	88401	88403
P (N/mm ²)	●	●
M	●	●
K	○	○
N		
S	●	●
H (HRC)	63	63
Surface finish	a	a
Discount group	166	166



Availability

●	●
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●	

High-performance reamers

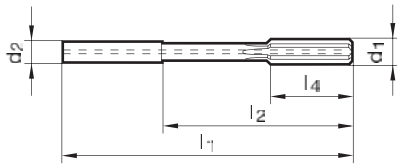
H7

WN

HA

R

- H7 series in accordance with DIN 1420
- extremely unequal flute spacing
- central internal coolant supply
- intermediate dimensions of Ø 1.95 - 20.1 mm possible
- for clamping in hydraulic and shrink fit chucks



Code no.	d1 mm	d2 mm	l1 mm	l2 mm	l4 mm	Z
3.000	3.000	4.000	50.000	22.000	10.000	4
3.500	3.500	4.000	50.000	22.000	10.000	4
4.000	4.000	4.000	50.000	22.000	10.000	4
4.500	4.500	6.000	58.000	22.000	10.000	4
5.000	5.000	6.000	58.000	22.000	10.000	4
5.500	5.500	6.000	58.000	22.000	10.000	4
6.000	6.000	6.000	58.000	22.000	10.000	4
6.500	6.500	8.000	76.000	40.000	16.000	6
7.000	7.000	8.000	76.000	40.000	16.000	6
7.500	7.500	8.000	76.000	40.000	16.000	6
8.000	8.000	8.000	76.000	40.000	16.000	6
8.500	8.500	10.000	76.000	36.000	19.000	6
9.000	9.000	10.000	76.000	36.000	19.000	6
9.500	9.500	10.000	76.000	36.000	19.000	6
10.000	10.000	10.000	76.000	36.000	19.000	6
10.500	10.500	12.000	80.000	35.000	19.000	6
11.000	11.000	12.000	80.000	35.000	19.000	6
11.500	11.500	12.000	80.000	35.000	19.000	6
12.000	12.000	12.000	80.000	35.000	19.000	6
13.000	13.000	14.000	90.000	45.000	22.000	6
14.000	14.000	14.000	90.000	45.000	22.000	6

Solid carbide

TR 300
Short S



TR 300
Short D



Order no.	88404	88405
P	●	●
M	○	○
K	○	○
N	○	○
S	●	●
H (HRC)	●	●
Surface finish	a	a
Discount group	105	105

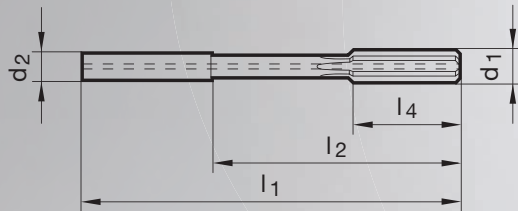


Availability



TR 300 HP L & XL

***Special tools for reaming
deep or sunken holes***



TR 300 HP L & XL

Design	d1 mm	d2 mm	l1 mm	l2 mm	l4 mm	Z
L	4.00	4.00	101.0	73.0	12.0	4
XL	4.00	4.00	150.0	122.0	12.0	4
L	5.00	5.00	101.0	65.0	12.0	4
XL	5.00	5.00	150.0	114.0	12.0	4
L	6.00	6.00	101.0	94.0	12.0	4
XL	6.00	6.00	150.0	124.0	12.0	4
L	8.00	8.00	130.0	94.0	16.0	6
XL	8.00	8.00	200.0	164.0	16.0	6
L	10.00	10.00	130.0	90.0	19.0	6
XL	10.00	10.00	200.0	160.0	19.0	6
L	12.00	12.00	160.0	115.0	19.0	6
XL	12.00	12.00	200.0	155.0	19.0	6

We also offer longer designs on enquiry.
Please contact our sales team.



The quickest way to find the right reamer

Select #1675 for blind hole machining or #1676 for through hole machining. Add the code at the bottom of the table listed with respect to diameter and your tolerance requirements. The table shows you the appropriate diameter for your fit. The diameters marked in yellow show you the extended market standard.



New: Fixed size addition, 5μ increments ± 0.05 range

Tolerance class	Nominal diameter										
	2	3	4	5	6	7	8	9	10	11	12
E6	2.015	3.015	4.020	5.020	6.020	7.025	8.025	9.025	10.025	11.035	12.035
E7	2.015	3.015	4.025	5.025	6.025	7.035	8.035	9.035	10.035	11.045	12.045
E8	2.020	3.020	4.030	5.030	6.030	7.040	8.040	9.040	10.040	11.050	12.050
E9	2.030	3.030	4.045	5.045	6.045	7.050	8.050	9.050	10.050	11.050	12.050
F6			4.010	5.010	6.010	7.015	8.015	9.015	10.015	11.020	12.020
F7	2.010	3.010	4.015	5.015	6.015	7.020	8.020	9.020	10.020	11.025	12.025
F8	2.015	3.015	4.020	5.020	6.020	7.030	8.030	9.030	10.030	11.035	12.035
F9	2.025	3.025	4.035	5.035	6.035	7.040	8.040	9.040	10.040	11.050	12.050
G6			4.005	5.005	6.005	7.005	8.005	9.005	10.005	11.010	12.010
G7	2.005	3.005	4.010	5.010	6.010	7.015	8.015	9.015	10.015	11.015	12.015
G8	2.010	3.010	4.015	5.015	6.015	7.020	8.020	9.020	10.020	11.025	12.025
G9	2.020	3.020	4.025	5.025	6.025	7.035	8.035	9.035	10.035	11.040	12.040
H6	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.005	12.005
H7	See #1685, #1686 H7 series										
H8	2.005	3.005	4.010	5.010	6.010	7.015	8.015	9.015	10.015	11.020	12.020
H9	2.020	3.020	4.025	5.025	6.025	7.030	8.030	9.030	10.030	11.035	12.035
J6			4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000
J7	1.995	2.995	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.005	12.005
J8	2.000	3.000	4.005	5.005	6.005	7.005	8.005	9.005	10.005	11.010	12.010
J9/JS9	2.005	3.005	4.010	5.010	6.010	7.010	8.010	9.010	10.010	11.015	12.015
K6	1.995	2.995	3.995	4.995	5.995	6.995	7.995	8.995	9.995	10.995	11.995
K7	1.995	2.995	3.995	4.995	5.995	7.000	8.000	9.000	10.000	11.000	12.000
K8	1.995	2.995	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000
K9	1.995	2.995	Not defined in DIN ISO 286								
M6						6.990	7.990	8.990	9.990	10.990	11.990
M7	1.990	2.990	3.995	4.995	5.995	6.995	7.995	8.995	9.995	10.995	11.995
M8	1.990	2.990	3.995	4.995	5.995	6.995	7.995	8.995	9.995	10.995	11.995
M9	1.990	2.990	3.990	4.990	5.990	6.985	7.985	8.985	9.985	10.985	11.985
N6	1.990	2.990	3.990	4.990	5.990	6.985	7.985	8.985	9.985	10.985	11.985
N7	1.990	2.990	3.990	4.990	5.990	6.990	7.990	8.990	9.990	10.990	11.990
N8	1.990	2.990	3.990	4.990	5.990	6.990	7.990	8.990	9.990	10.990	11.990
N9	1.990	2.990	3.995	4.995	5.995	6.995	7.995	8.995	9.995	10.995	11.995
P6			3.985	4.985	5.985	6.980	7.980	8.980	9.980	10.980	11.980
P7	1.985	2.985	3.985	4.985	5.985	6.985	7.985	8.985	9.985	10.980	11.980
P8	1.985	2.985	3.980	4.980	5.980	6.980	7.980	8.980	9.980	10.975	11.975
P9	1.985	2.985	3.980	4.980	5.980	6.980	7.980	8.980	9.980	10.975	11.975
R6	1.985	2.985	3.980	4.980	5.980	6.975	7.975	8.975	9.975	10.975	11.975
R7	1.985	2.985	3.980	4.980	5.980	6.980	7.980	8.980	9.980	10.975	11.975
R8	1.985	2.985	3.980	4.980	5.980	6.975	7.975	8.975	9.975	10.970	11.970
R9	1.985	2.985	3.980	4.980	5.980	6.975	7.975	8.975	9.975	10.970	11.970
S6	1.980	2.980				6.975	7.975	8.975	9.975	10.970	11.970
S7	1.980	2.980	3.980	4.980	5.980	6.975	7.975	8.975	9.975	10.970	11.970
S8	1.980	2.980	3.975	4.975	5.975	6.970	7.970	8.970	9.970	10.965	11.965
S9	1.980	2.980	3.975	4.975	5.975	6.970	7.970	8.970	9.970	10.965	11.965

Machine reamers

Standard	Form	Shank form	Diameter tolerance	Tool material	Surface finish	Hole type	d1	Order no.	Discount group	Standard range page
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NC machine reamers

										
Hartner Standard	B	HA	+0.004 +0.005	Solid carbide			0.980 - 12.050	88350	120	15
										
Hartner Standard	B	HA	H7	Solid carbide			3.000 - 12.000	88351	120	15

Machine reamers

										
~ DIN 8050	A	cyl.	H7	Carbide			5.000 - 20.000	88352	120	20
										
~ DIN 8050	B	cyl.	H7	Carbide			5.000 - 20.000	88353	120	20
										
~ DIN 8051	A	MK	H7	Carbide			5.000 - 40.000	88354	120	21
										
~ DIN 8051	B	MK	H7	Carbide			6.000 - 32.000	88355	120	21

 bright

Solid carbide

NC machine reamers

B



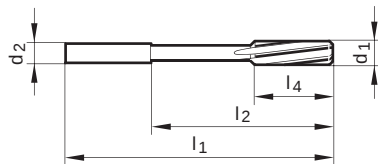
Ø > 3.75 mm with extremely unequal flute spacing

Tolerance for Order no. 88350:

≤ Ø 5.50 mm: 0.000/+0.004

> Ø 5.50 mm: 0.000/+0.005

NC machine reamers similar to DIN 8093 with straight shank (h6) for standardised tool clamping in hydraulic or shrink fit chucks offer highest concentricity and process reliability for the production of holes to required tolerances.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
3.030	3.030	4.000	64.00	36.00	17.00	6
3.100	3.100	4.000	68.00	40.00	18.00	6
3.200	3.200	4.000	68.00	40.00	18.00	6
3.300	3.300	4.000	68.00	40.00	18.00	6
3.400	3.400	4.000	74.00	46.00	20.00	6
3.500	3.500	4.000	74.00	46.00	20.00	6
3.600	3.600	4.000	74.00	46.00	20.00	6
3.700	3.700	4.000	74.00	46.00	20.00	6
3.800	3.800	4.000	77.00	45.00	21.00	6
3.970	3.970	4.000	77.00	45.00	21.00	6
3.980	3.980	4.000	77.00	45.00	21.00	6
3.990	3.990	4.000	77.00	45.00	21.00	6
4.000	4.000	4.000	77.00	45.00	21.00	6
4.010	4.010	4.000	77.00	45.00	21.00	6
4.020	4.020	4.000	77.00	45.00	21.00	6
4.030	4.030	4.000	77.00	45.00	21.00	6
4.100	4.100	6.000	82.00	50.00	23.00	6
4.200	4.200	6.000	82.00	50.00	23.00	6
4.300	4.300	6.000	82.00	50.00	23.00	6
4.400	4.400	6.000	82.00	50.00	23.00	6
4.500	4.500	6.000	82.00	50.00	23.00	6
4.600	4.600	6.000	82.00	50.00	23.00	6
4.700	4.700	6.000	82.00	50.00	23.00	6
4.800	4.800	6.000	93.00	59.00	26.00	6
4.900	4.900	6.000	93.00	59.00	26.00	6
4.970	4.970	6.000	93.00	59.00	26.00	6
4.980	4.980	6.000	93.00	59.00	26.00	6
4.990	4.990	6.000	93.00	59.00	26.00	6
5.000	5.000	6.000	93.00	59.00	26.00	6
5.010	5.010	6.000	93.00	59.00	26.00	6

Solid carbide



+0.004
+0.005



H7

Order no.

88350

88351

P (N/mm²)

•

•

M

○

○

K

•

•

N

•

•

S

○

○

H (HRC)

52

52

Surface finish

○

○

Discount group

120

120



Availability

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○ bright

Solid carbide

NC machine reamers

B



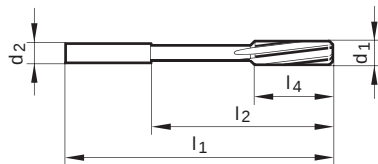
Ø > 3.75 mm with extremely unequal flute spacing

Tolerance for Order no. 88350:

≤ Ø 5.50 mm: 0.000/+0.004

> Ø 5.50 mm: 0.000/+0.005

NC machine reamers similar to DIN 8093 with straight shank (h6) for standardised tool clamping in hydraulic or shrink fit chucks offer highest concentricity and process reliability for the production of holes to required tolerances.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
7.800	7.800	8.000	117.00	75.00	33.00	6
7.900	7.900	8.000	117.00	75.00	33.00	6
7.970	7.970	8.000	117.00	75.00	33.00	6
7.980	7.980	8.000	117.00	75.00	33.00	6
7.990	7.990	8.000	117.00	75.00	33.00	6
8.000	8.000	8.000	117.00	75.00	33.00	6
8.010	8.010	8.000	117.00	75.00	33.00	6
8.020	8.020	8.000	117.00	75.00	33.00	6
8.030	8.030	8.000	117.00	75.00	33.00	6
8.040	8.040	8.000	117.00	75.00	33.00	6
8.100	8.100	10.000	117.00	75.00	33.00	6
8.200	8.200	10.000	117.00	75.00	33.00	6
8.300	8.300	10.000	117.00	75.00	33.00	6
8.400	8.400	10.000	117.00	75.00	33.00	6
8.500	8.500	10.000	117.00	75.00	33.00	6
8.600	8.600	10.000	117.00	75.00	33.00	6
8.700	8.700	10.000	125.00	81.00	36.00	6
8.800	8.800	10.000	125.00	81.00	36.00	6
8.900	8.900	10.000	125.00	81.00	36.00	6
9.000	9.000	10.000	125.00	81.00	36.00	6
9.100	9.100	10.000	125.00	81.00	36.00	6
9.300	9.300	10.000	125.00	81.00	36.00	6
9.500	9.500	10.000	125.00	81.00	36.00	6
9.600	9.600	10.000	125.00	81.00	36.00	6
9.700	9.700	10.000	133.00	87.00	38.00	6
9.800	9.800	10.000	133.00	87.00	38.00	6
9.900	9.900	10.000	133.00	87.00	38.00	6
9.970	9.970	10.000	133.00	87.00	38.00	6
9.980	9.980	10.000	133.00	87.00	38.00	6
9.990	9.990	10.000	133.00	87.00	38.00	6

Solid carbide



+0.004
+0.005



H7

Order no.

88350

88351

P (N/mm²)

•

•

M

○

○

K

•

•

N

•

•

S

○

○

H (HRC)

52

52

Surface finish

○

○

Discount group

120

120



Availability

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○ bright

Solid carbide

H7

Machine reamers

H7

~DIN
8050

Cyl



≤ Ø 9.50 mm: solid carbide
> Ø 9.50 mm: carbide head
Allocation to hartner standard
≤ Ø 9.50 mm with ext. centres on both ends
> Ø 9.50 mm with int. centres on both ends

Carbide



A



B



Order no.

88352

88353

P (N/mm²)

1400

1400

M



K



N



S



H (HRC)

48

48

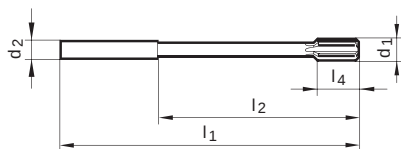
Surface finish



Discount group

120

120



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
5.000	5.000	5.000	86.00	52.00	12.00	6
6.000	6.000	5.600	93.00	57.00	12.00	6
7.000	7.000	7.100	109.00	69.00	16.00	6
8.000	8.000	8.000	117.00	75.00	16.00	6
9.000	9.000	9.000	125.00	81.00	19.00	6
10.000	10.000	10.000	133.00	87.00	12.00	6
11.000	11.000	10.000	142.00	96.00	12.00	6
12.000	12.000	10.000	151.00	105.00	12.00	6
13.000	13.000	10.000	151.00	105.00	12.00	6
14.000	14.000	12.000	160.00	110.00	16.00	6
15.000	15.000	12.000	162.00	112.00	16.00	6
16.000	16.000	12.000	170.00	120.00	19.00	6
18.000	18.000	14.000	182.00	130.00	19.00	6
20.000	20.000	16.000	195.00	137.00	19.00	6

Availability

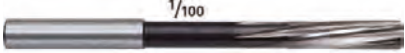


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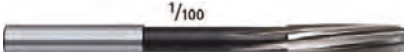
High speed steel reamers

Standard	Form	Shank form	Diameter tolerance	Tool material	Surface finish	Hole type	d1	Order no.	Discount group	Standard range page
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NC machine reamers

	DIN 212-3	B	HA	+0,004 +0,005	HSS-E			1.000 - 12.020	88300	105	23
	DIN 212-3	B	HA	H7	HSS-E			1.500 - 20.000	88301	105	23

Machine reamers

	DIN 212	A	cyl.	H7	HSS-E			1.000 - 5.500	88302	105	28
	DIN 212	B	cyl.	H7	HSS-E			1.000 - 3.700	88304	105	28
	DIN 212-2	A	cyl.	H7	HSS-E			4.000 - 20.000	88305	105	29
	DIN 212-2	B	cyl.	H7	HSS-E			3.800 - 20.000	88306	105	29
	DIN 212	B	cyl.	+0,004 +0,005	HSS-E			0.950 - 12.050	88311	105	31
	DIN 208	A	MK	H7	HSS-E			3.000 - 40.000	88307	105	33
	DIN 208	B	MK	H7	HSS-E			3.000 - 50.000	88308	105	33

 bright

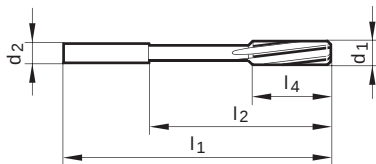
NC machine reamers



$\leq \varnothing 3.75$ mm with external centres on both ends
 $> \varnothing 3.75$ mm with internal centres on both ends
 Tolerance for Order no. 88300:
 $\leq \varnothing 5.50$ mm: 0.000/+0.004
 $> \varnothing 5.50$ mm: 0.000/+0.005

The combination of NC machine reamer and hydraulic, high precision clamping or shrink fit chuck respectively offers highest concentricity and process reliability for the production of holes to required tolerances.

NC machine reamers are similar to DIN 212 with straight shank (h6) for standardised tool clamping in hydraulic or shrink fit chucks. Short delivery for intermediate sizes.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
1.000	1.000	1.000	34.00	15.00	5.50	3
1.010	1.010	1.000	34.00	15.00	5.50	3
1.500	1.500	2.000	40.00	18.00	8.00	3
1.510	1.510	2.000	43.00	20.00	9.00	3
1.530	1.530	2.000	43.00	20.00	9.00	3
1.600	1.600	2.000	43.00	20.00	9.00	3
1.700	1.700	2.000	43.00	20.00	9.00	3
1.800	1.800	2.000	46.00	22.00	10.00	4
1.970	1.970	2.000	49.00	24.00	11.00	4
1.980	1.980	2.000	49.00	24.00	11.00	4
1.990	1.990	2.000	49.00	24.00	11.00	4
2.000	2.000	2.000	49.00	24.00	11.00	4
2.010	2.010	2.000	49.00	24.00	11.00	4
2.020	2.020	2.000	49.00	24.00	11.00	4
2.030	2.030	2.000	49.00	24.00	11.00	4
2.100	2.100	2.000	49.00	24.00	11.00	4
2.200	2.200	3.000	53.00	25.00	12.00	4
2.300	2.300	3.000	53.00	25.00	12.00	4
2.400	2.400	3.000	57.00	29.00	14.00	4
2.470	2.470	3.000	57.00	29.00	14.00	4
2.490	2.490	3.000	57.00	29.00	14.00	4
2.500	2.500	3.000	57.00	29.00	14.00	4
2.510	2.510	3.000	57.00	29.00	14.00	4
2.520	2.520	3.000	57.00	29.00	14.00	4
2.530	2.530	3.000	57.00	29.00	14.00	4
2.600	2.600	3.000	57.00	29.00	14.00	4
2.700	2.700	3.000	61.00	33.00	15.00	6
2.800	2.800	3.000	61.00	33.00	15.00	6
2.900	2.900	3.000	61.00	33.00	15.00	6
2.970	2.970	3.000	61.00	33.00	15.00	6

HSS-E			
	+0,004 +0,005		H7
Order no.	88300	88301	
P (N/mm ²)	1000	1000	
M	○	○	
K	●	●	
N	●	●	
S	○	○	
H (HRC)			
Surface finish	105	105	
Discount group			
Availability			
●			
●			
●		●	
●			
●			
		●	
		●	
		●	
●			
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●		●	
●			
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●		●	
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●			
●			
●		●	
●		●	
●		●	
●			
●			

○ bright

NC machine reamers

B

DIN
212-3

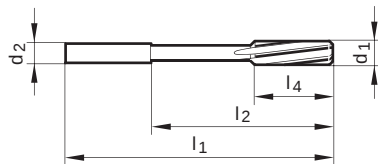
HA



≤ Ø 3.75 mm with external centres on both ends
> Ø 3.75 mm with internal centres on both ends
Tolerance for Order no. 88300:
≤ Ø 5.50 mm: 0.000/+0.004
> Ø 5.50 mm: 0.000/+0.005

The combination of NC machine reamer and hydraulic, high precision clamping or shrink fit chuck respectively offers highest concentricity and process reliability for the production of holes to required tolerances.

NC machine reamers are similar to DIN 212 with straight shank (h6) for standardised tool clamping in hydraulic or shrink fit chucks. Short delivery for intermediate sizes.



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z
2.980	2.980	3.000	61.00	33.00	15.00	6
2.990	2.990	3.000	61.00	33.00	15.00	6
3.000	3.000	3.000	61.00	33.00	15.00	6
3.010	3.010	4.000	65.00	37.00	16.00	6
3.020	3.020	4.000	65.00	37.00	16.00	6
3.030	3.030	4.000	65.00	37.00	16.00	6
3.100	3.100	4.000	65.00	37.00	16.00	6
3.200	3.200	4.000	65.00	37.00	16.00	6
3.300	3.300	4.000	65.00	37.00	16.00	6
3.500	3.500	4.000	70.00	42.00	18.00	6
3.600	3.600	4.000	70.00	42.00	18.00	6
3.700	3.700	4.000	70.00	42.00	18.00	6
3.800	3.800	4.000	75.00	47.00	19.00	6
3.900	3.900	4.000	75.00	47.00	19.00	6
3.970	3.970	4.000	75.00	47.00	19.00	6
3.980	3.980	4.000	75.00	47.00	19.00	6
3.990	3.990	4.000	75.00	47.00	19.00	6
4.000	4.000	4.000	75.00	47.00	19.00	6
4.010	4.010	4.000	75.00	47.00	19.00	6
4.020	4.020	4.000	75.00	47.00	19.00	6
4.030	4.030	4.000	75.00	47.00	19.00	6
4.100	4.100	4.000	75.00	47.00	19.00	6
4.200	4.200	4.000	75.00	47.00	19.00	6
4.500	4.500	5.000	80.00	52.00	21.00	6
4.700	4.700	5.000	80.00	52.00	21.00	6
4.800	4.800	5.000	86.00	58.00	23.00	6
4.900	4.900	5.000	86.00	58.00	23.00	6
4.980	4.980	5.000	86.00	58.00	23.00	6
4.990	4.990	5.000	86.00	58.00	23.00	6
5.000	5.000	5.000	86.00	58.00	23.00	6

HSS-E



+0,004
+0,005



H7

Order no.

88300

88301

P (N/mm²)

1000

1000

M

○

○

K

●

●

N

●

●

S

○

○

H (HRC)

Surface finish

Discount group

○

105

○

105



Availability

●

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○ bright

High speed steel reamers

Technical drawing of a shaft with dimensions d_1 , d_2 , l_1 , l_2 , and l_4 .

[illegible]

30

Machine reamers

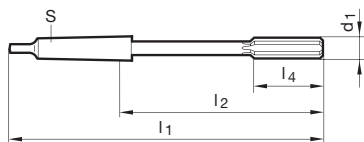
H7

DIN
208

MK



Ø 3.00 mm with external centre on cutting end, with internal centre on shank end
> Ø 3.00 mm with internal centres on both ends
≤ Ø 4.00 mm to hartner standard



Code no.	d1 mm	S	l1 mm	l2 mm	l4 mm	Z
3.000	3.000	1	115.00	53.00	15.00	6
4.000	4.000	1	125.00	63.00	19.00	6
5.000	5.000	1	133.00	71.00	23.00	6
5.100	5.100	1	133.00	71.00	23.00	6
5.500	5.500	1	138.00	76.00	26.00	6
6.000	6.000	1	138.00	76.00	26.00	6
6.100	6.100	1	144.00	82.00	28.00	6
6.200	6.200	1	144.00	82.00	28.00	6
6.500	6.500	1	144.00	82.00	28.00	6
7.000	7.000	1	150.00	88.00	31.00	6
7.500	7.500	1	150.00	88.00	31.00	6
8.000	8.000	1	156.00	94.00	33.00	6
8.500	8.500	1	156.00	94.00	33.00	6
9.000	9.000	1	162.00	100.00	36.00	6
9.500	9.500	1	162.00	100.00	36.00	6
9.800	9.800	1	168.00	106.00	38.00	6
10.000	10.000	1	168.00	106.00	38.00	6
10.100	10.100	1	168.00	106.00	38.00	6
11.000	11.000	1	175.00	113.00	41.00	6
12.000	12.000	1	182.00	120.00	44.00	6
13.000	13.000	1	182.00	120.00	44.00	6
14.000	14.000	1	189.00	127.00	47.00	8
15.000	15.000	2	204.00	129.00	50.00	8
15.700	15.700	2	210.00	135.00	52.00	8
16.000	16.000	2	210.00	135.00	52.00	8
17.000	17.000	2	214.00	139.00	54.00	8
18.000	18.000	2	219.00	144.00	56.00	8
19.000	19.000	2	223.00	148.00	58.00	8
19.500	19.500	2	228.00	153.00	60.00	8
20.000	20.000	2	228.00	153.00	60.00	8

HSS-E



A



B



Order no.

88307

88308

P (N/mm²)

1000

1000

M



K



N



S



H (HRC)

Surface finish

Discount group



105

105



Availability



○ bright

Machine reamers

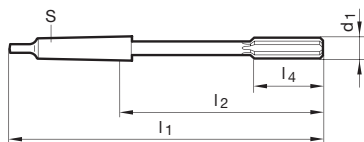
H7

DIN
208

MK



Ø 3.00 mm with external centre on cutting end, with internal centre on shank end
> Ø 3.00 mm with internal centres on both ends
≤ Ø 4.00 mm to hartner standard



HSS-E



A



B



Order no.

88307

88308

P (N/mm²)

1000

1000

M



K



N



S



H (HRC)

Surface finish

Discount group



105

105



Availability

Code no.	d1 mm	S	l1 mm	l2 mm	l4 mm	Z
21.000	21.000	2	232.00	157.00	62.00	8
22.000	22.000	2	237.00	162.00	64.00	8
23.000	23.000	2	241.00	166.00	66.00	8
24.000	24.000	3	268.00	174.00	68.00	8
25.000	25.000	3	268.00	174.00	68.00	8
26.000	26.000	3	273.00	179.00	70.00	8
27.000	27.000	3	277.00	183.00	71.00	10
28.000	28.000	3	277.00	183.00	71.00	10
29.000	29.000	3	281.00	187.00	73.00	10
30.000	30.000	3	281.00	187.00	73.00	10
31.000	31.000	3	285.00	191.00	75.00	10
32.000	32.000	4	317.00	199.50	77.00	10
33.000	33.000	4	317.00	199.50	77.00	10
34.000	34.000	4	321.00	203.50	78.00	10
35.000	35.000	4	321.00	203.50	78.00	10
36.000	36.000	4	325.00	207.50	79.00	10
38.000	38.000	4	329.00	211.50	81.00	10
40.000	40.000	4	329.00	211.50	81.00	10
42.000	42.000	4	333.00	215.50	82.00	12
44.000	44.000	4	336.00	218.50	83.00	12
45.000	45.000	4	336.00	218.50	83.00	12
46.000	46.000	4	340.00	222.50	84.00	12
48.000	48.000	4	344.00	226.50	86.00	12
50.000	50.000	4	344.00	226.50	86.00	12



○ bright

Hand reamers

Standard	Form	Shank form	Diameter tolerance	Tool material	Surface finish	Hole type	d1	Order no.	Discount group	Standard range page
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Hand reamers

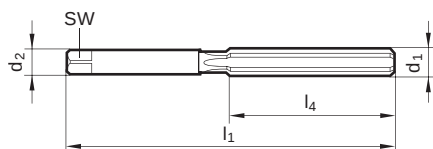
										
DIN 206	A	cyl.	H7	HSS	○		2.000 - 49.000	88309	105	36
										
DIN 206	B	cyl.	H7	HSS	○		1.400 - 43.000	88310	105	36

○ bright

Hand reamers



with square to DIN 10
 $\leq \varnothing 3.75$ mm with ext. centres on both ends
 $> \varnothing 3.75$ mm with int. centres on both ends
 ≤ 1.75 mm to hartner standard

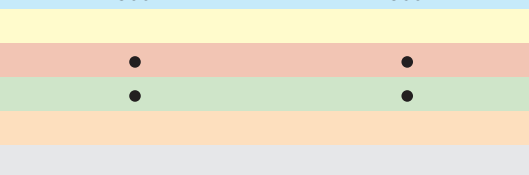
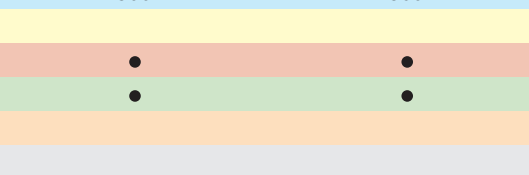


Code no.	d1	d2	l1	l4	SW	Z	Availability	
	mm	mm	mm	mm				
1.400	1.400	1.400	41.00	20.00	1.12	3		●
1.500	1.500	1.500	41.00	20.00	1.12	3		●
2.000	2.000	2.000	50.00	25.00	1.60	4	●	●
2.200	2.200	2.200	54.00	27.00	1.80	4	●	●
2.500	2.500	2.500	58.00	29.00	2.10	4	●	●
3.000	3.000	3.000	62.00	31.00	2.40	6	●	●
3.200	3.200	3.200	66.00	33.00	2.40	6	●	●
3.500	3.500	3.500	71.00	35.00	2.70	6	●	●
4.000	4.000	4.000	76.00	38.00	3.00	6	●	●
4.500	4.500	4.500	81.00	41.00	3.40	6	●	●
5.000	5.000	5.000	87.00	44.00	3.80	6	●	●
5.500	5.500	5.500	93.00	47.00	4.30	6	●	●
6.000	6.000	6.000	93.00	47.00	4.90	6	●	●
6.500	6.500	6.500	100.00	50.00	4.90	6		●
7.000	7.000	7.000	107.00	54.00	5.50	6	●	●
7.500	7.500	7.500	107.00	54.00	6.20	6		●
8.000	8.000	8.000	115.00	58.00	6.20	6	●	●
8.500	8.500	8.500	115.00	58.00	7.00	6		●
9.000	9.000	9.000	124.00	62.00	7.00	6	●	●
9.500	9.500	9.500	124.00	62.00	8.00	6	●	●
10.000	10.000	10.000	133.00	66.00	8.00	6	●	●
10.500	10.500	10.500	133.00	66.00	8.00	6		●
11.000	11.000	11.000	142.00	71.00	9.00	6	●	●
11.500	11.500	11.500	142.00	71.00	9.00	6		●
12.000	12.000	12.000	152.00	76.00	9.00	6	●	●
12.500	12.500	12.500	152.00	76.00	10.00	6		●
13.000	13.000	13.000	152.00	76.00	10.00	6		●
14.000	14.000	14.000	163.00	81.00	11.00	8	●	●
15.000	15.000	15.000	163.00	81.00	12.00	8	●	●
15.500	15.500	15.500	175.00	87.00	12.00	8	●	

○ bright



Technical drawing of a shaft with a keyway. The shaft has a diameter d_1 and a length l_1 . A keyway is located at the left end, with a width d_2 and a depth l_4 . The key is labeled SW.

HSS	
	
A	B
88309	88310
900	900
	
	
105	105
	
Availability	
	
	
	
	
	
	

Hand reamers



HARTNER

Precision Cutting Tools

Maximum performance for all materials

Our comprehensive TR 300 HP range includes reamers for the machining of most materials. The perfect combination of special geometries, tool material and coatings provides optimal machining results for all reaming operations.





Application recommendation for solid carbide reamers

Tools with bold feed column no. are preferred choice.

For blind holes with close diameter tolerances choose straight-fluted reamers.

Order no. 

Standard/DIN

Tool material

Surface finish

Form

Cooling

Counter-sink Ø mm	Feed column no.						
	71	72	73	74	75	76	77
	f (mm/U)						
< 4.00	0.080	0.100	0.125	0.300	0.500	0.800	1.000
4.00	0.100	0.125	0.160	0.300	0.500	1.000	1.200
5.00	0.100	0.125	0.160	0.400	0.600	1.000	1.400
6.30	0.125	0.160	0.200	0.400	0.700	1.200	1.600
8.00	0.160	0.200	0.250	0.600	1.000	1.800	2.400
10.00	0.200	0.250	0.315	0.600	1.200	1.800	2.400
12.50	0.200	0.250	0.315	0.800	1.200	2.000	2.500
16.00	0.250	0.315	0.400	0.800	1.400	2.200	2.600
20.00	0.315	0.400	0.500	0.800	1.400	2.200	2.600
25.00	0.400	0.500	0.630	1.000	1.600	2.500	3.000
31.50	0.400	0.500	0.630	1.000	2.000	3.000	3.600
40.00	0.500	0.630	0.800	1.200	2.000	3.000	3.600
50.00	0.630	0.800	1.000	1.400	2.200	3.200	3.600
> 50.00	0.800	1.000	1.250	1.600	2.200	3.200	3.600

Coolant:

-  Air
-  Neat oil
-  Soluble oil

Cutting direction:

-  right-hand cutting

Material group	Material examples, new description (old description in brackets) Figures in bold = material no. to DIN EN	Tensile str. MPa (N/mm ²)	Hard- ness	Coolant
Common structural steels	1.0035 S185(St33), 1.0486 P275N(StE285), 1.0345 P235GH(H1), 1.0425 P265GH(H2)	≤500		
	1.0050 E295 (St50-2), 1.0070 E360 (St70-2), 1.8937 P500NH (WStE500)	≤1000		
Free-cutting steels	1.0718 11SMnPb30 (9SMnPb28), 1.0736 11SMn37 (9SMn36)	≤850		
	1.0727 46S20 (45S20), 1.0728 (60S20), 1.0757 46SPb20 (45SPb20)	≤1000		
Unalloyed heat-treatable steels	1.0402 C22, 1.1178 C30E (Ck30)	≤700		
	1.0503 C45, 1.1191 C45E (Ck45)	≤850		
	1.0601 C60, 1.1221 C60E (Ck60)	≤1000		
Alloyed heat-treatable steels	1.5131 50MnSi4, 1.7003 38Cr2, 1.7030 28Cr4	≤1000		
	1.5710 36NiCr6, 1.7035 41Cr4, 1.7225 42CrMo4	≤1400		
Unalloyed case hard. steels	1.0301 (C10), 1.1121 C10E (Ck10)	≤850		
Alloyed case hardened steels	1.7276 10CrMo11, 1.5125 11MnSi6	≤1000		
	1.5752 15NiCr13, 1.7131 16MnCr5, 1.7264 20CrMo5	≤1400		
Nitriding steels	1.8504 34CrAl6	≤1000		
	1.8519 31CrMoV9, 1.8550 34CrAlNi7	≤1400		
Tool steels	1.1750 C75W, 1.2067 102Cr6, 1.2307 29CrMoV9	≤850		
	1.2080 X210Cr12, 1.2083 X42Cr13, 1.2419 105WCr6, 1.2767 X45NiCrMo4	≤1400		
High speed steels	1.3243 S 6-5-2-5, 1.3343 S 6-5-2, 1.3344 S 6-5-3	≤1400		
Spring steels	1.5026 55Si7, 1.7176 55Cr3, 1.8159 51CrV4 (51CrV4)		≤350 HB	
Stainless steels, sulphured	1.4005 X12CrS13, 1.4104 X14CrMoS17, 1.4105 X6CrMoS17, 1.4305 X8CrNiS18-9	≤900		
austenitic	1.4301 X5CrNi18-10 (V2A), 1.4541 X6CrNiTi18-10, 1.4571 X6CrNiMoTi 17-12-2 (V4A)	≤1100		
martensitic	1.4057 X20CrNi172 (X17CrNi16-2), 1.4122 X39CrMo17-1, 1.4521 X2CrMoTi18-2	≤1500		
Hardened steels	-		≤48 HRC ≤63 HRC	
Special alloys	Nimonic, Inconel, Monel, Hastelloy	≤2000		
Cast iron	0.6010 EN-GJL-100 (GG10), 0.6020 EN-GJL-200 (GG20)		≤240 HB	
	0.6025 EN-GJL-250 (GG25), 0.6035 EN-GJL-350 (GG35)		≤350 HB	
Spheroidal graphite iron and malleable cast iron	0.7050 EN-GJS-500-7 (GGG50), 0.8035 EN-GJMW-350-4 (GTW35)		≤240 HB	
	0.7070 EN-GJS-700-2 (GGG70), 0.8170 EN-GJMB-700-2 (GTS70)		≤350 HB	
Chilled cast iron	-		≤350 HB	
Ti and Ti-alloys	3.7024 Ti99.5, 3.7114 TiAl5Sn2.5, 3.7124 TiCu2	≤850		
	3.7154 TiAl6Zr5, 3.7165 TiAl6V4, 3.7184 TiAl4Mo4Sn2.5, - TiAl8Mo1V1	≤1400		
Aluminium and Al-alloys	3.0255 Al99.5, 3.2315 AlMgSi1, 3.3515 AlMg1	≤400		
Al wrought alloys	3.0615 AlMgSiPb, 3.1325 AlCuMg1, 3.3245 AlMg3Si, 3.4365 AlZnMgCu1.5	≤650		
Al cast alloys ≤ 10 % Si	3.2131 G-AlSi5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9	≤600		
≤ 24 % Si	3.2581 G-AlSi12, 3.2583 G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		
Magnesium alloys	3.5200 MgMn2, 3.5812.05 G-MgAl8Zn1, 3.5612.05 G-MgAl6Zn1	≤400		
Copper, low-alloyed	2.0070 SE-Cu, 2.1020 CuSn6, 2.1096 G-CuSn5ZnPb	≤500		
Brass, short-chipping	2.0380 CuZn39Pb2, 2.0401 CuZn39Pb3, 2.0410 CuZn43Pb2	≤600		
long-chipping	2.0250 CuZn20, 2.0280 CuZn33, 2.0332 CuZn37Pb0.5	≤600		
Bronze, short-chipping	2.1090 CuSn7ZnPb, 2.1170 CuPb5Sn5, 2.1176 CuPb10Sn	≤600		
	2.0790 CuNi18Zn19Pb	≤850		
Bronze, long-chipping	2.0916 CuAl5, 2.0960 CuAl9Mn, 2.1050 CuSn10	≤850		
	2.0980 CuAl11Ni, 2.1247 CuBe2	≤1000		
Duroplastics	Epoxidharz, Resopal, Pertinax, Moltopren	≤150		
Thermoplastics	Plexiglas, Hostalen, Novodur, Makralon	≤100		
New cast materials CGI	EN-GJV250 (GGV25), EN-GJV350 (GGV35)		≤220 HB	
	EN-GJV400 (GGV40), EN-GJV500 (GGV50), SiMo 6		≤300 HB	
New cast materials ADI	EN-GJS-800-8 (ADI800), EN-GJS-1000-5 (ADI1000)	≤1000		
	EN-GJS-1200-2 (ADI1200), EN-GJS-1400-1 (ADI1400)	≤1400		
Kevlar	Kevlar	≤1000		
Glass, carbon conc. plastics	GFK/CFK	≤1000		

 bright

 AlTiN nano

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Application recommendation for HSS-E reamers

Tools with bold feed column no. are preferred choice.

For blind holes with close diameter tolerances choose straight-fluted reamers.

Order no. 

Standard/DIN

Tool material

Surface finish

Form

Counter-sink Ø mm	Feed column no.						
	71	72	73	74	75	76	77
	f (mm/U)						
< 4.00	0.080	0.100	0.125	0.300	0.500	0.800	1.000
4.00	0.100	0.125	0.160	0.300	0.500	1.000	1.200
5.00	0.100	0.125	0.160	0.400	0.600	1.000	1.400
6.30	0.125	0.160	0.200	0.400	0.700	1.200	1.600
8.00	0.160	0.200	0.250	0.600	1.000	1.800	2.400
10.00	0.200	0.250	0.315	0.600	1.200	1.800	2.400
12.50	0.200	0.250	0.315	0.800	1.200	2.000	2.500
16.00	0.250	0.315	0.400	0.800	1.400	2.200	2.600
20.00	0.315	0.400	0.500	0.800	1.400	2.200	2.600
25.00	0.400	0.500	0.630	1.000	1.600	2.500	3.000
31.50	0.400	0.500	0.630	1.000	2.000	3.000	3.600
40.00	0.500	0.630	0.800	1.200	2.000	3.000	3.600
50.00	0.630	0.800	1.000	1.400	2.200	3.200	3.600
> 50.00	0.800	1.000	1.250	1.600	2.200	3.200	3.600

Coolant:

- Air
- Neat Oil
- Soluble oil

Cutting direction:

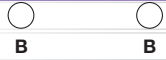
-  right-hand cutting

Material group	Material examples, new description (old description in brackets) Figures in bold = material no. to DIN EN	Tensile str. MPa (N/mm ²)	Hard- ness	Coolant
Common structural steels	1.0035 S185(St33), 1.0486 P275N(StE285), 1.0345 P235GH(H1), 1.0425 P265GH(H2)	≤500		●
	1.0050 E295 (St50-2), 1.0070 E360 (St70-2), 1.8937 P500NH (WStE500)	≤1000		●
Free-cutting steels	1.0718 11SMnPb30 (9SMnPb28), 1.0736 11SMn37 (9SMn36)	≤850		●
	1.0727 46S20 (45S20), 1.0728 (60S20), 1.0757 46SPb20 (45SPb20)	≤1000		●
Unalloyed heat-treatable steels	1.0402 C22, 1.1178 C30E (Ck30)	≤700		●
	1.0503 C45, 1.1191 C45E (Ck45)	≤850		●
	1.0601 C60, 1.1221 C60E (Ck60)	≤1000		●
Alloyed heat-treatable steels	1.5131 50MnSi4, 1.7003 38Cr2, 1.7030 28Cr4	≤1000		●
	1.5710 36NiCr6, 1.7035 41Cr4, 1.7225 42CrMo4	≤1400		●
Unalloyed case hard. steels	1.0301 (C10), 1.1121 C10E (Ck10)	≤850		●
Alloyed case hardened steels	1.7276 10CrMo11, 1.5125 11MnSi6	≤1000		●
	1.5752 15NiCr13, 1.7131 16MnCr5, 1.7264 20CrMo5	≤1400		●
Nitriding steels	1.8504 34CrAl6	≤1000		●
	1.8519 31CrMoV9, 1.8550 34CrAlNi7	≤1400		●
Tool steels	1.1750 C75W, 1.2067 102Cr6, 1.2307 29CrMoV9	≤850		●
	1.2080 X210Cr12, 1.2083 X42Cr13, 1.2419 105WCr6, 1.2767 X45NiCrMo4	≤1400		●
High speed steels	1.3243 S 6-5-2-5, 1.3343 S 6-5-2, 1.3344 S 6-5-3	≤1400		●
Spring steels	1.5026 55Si7, 1.7176 55Cr3, 1.8159 51CrV4 (51CrV4)		≤350 HB	●
Stainless steels, sulphured	1.4005 X12CrS13, 1.4104 X14CrMoS17, 1.4105 X6CrMoS17, 1.4305 X8CrNiS18-9	≤900		●
austenitic	1.4301 X5CrNi18-10 (V2A), 1.4541 X6CrNiTi18-10, 1.4571 X6CrNiMoTi 17-12-2 (V4A)	≤1100		●
martensitic	1.4057 X20CrNi172 (X17CrNi16-2), 1.4122 X39CrMo17-1, 1.4521 X2CrMoTi18-2	≤1500		●
Hardened steels	-		≤48 HRC	●
			≤63 HRC	●
Special alloys	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Cast iron	0.6010 EN-GJL-100 (GG10), 0.6020 EN-GJL-200 (GG20)		≤240 HB	●○
	0.6025 EN-GJL-250 (GG25), 0.6035 EN-GJL-350 (GG35)		≤350 HB	●○
Spheroidal graphite iron and malleable cast iron	0.7050 EN-GJS-500-7 (GGG50), 0.8035 EN-GJMW-350-4 (GTW35)		≤240 HB	●
	0.7070 EN-GJS-700-2 (GGG70), 0.8170 EN-GJMB-700-2 (GTS70)		≤350 HB	●
Chilled cast iron	-		≤350 HB	●
Ti and Ti-alloys	3.7024 Ti99,5, 3.7114 TiAl5Sn2,5, 3.7124 TiCu2	≤850		●
	3.7154 TiAl6Zr5, 3.7165 TiAl6V4, 3.7184 TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤1400		●
Aluminium and Al-alloys	3.0255 Al99,5, 3.2315 AlMgSi1, 3.3515 AlMg1	≤400		●
Al wrought alloys	3.0615 AlMgSiPb, 3.1325 AlCuMg1, 3.3245 AlMg3Si, 3.4365 AlZnMgCu1,5	≤650		●
Al cast alloys ≤ 10 % Si	3.2131 G-AlSi5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9	≤600		●
≤ 24 % Si	3.2581 G-AlSi12, 3.2583 G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		●
Magnesium alloys	3.5200 MgMn2, 3.5812.05 G-MgAl8Zn1, 3.5612.05 G-MgAl6Zn1	≤400		○
Copper, low-alloyed	2.0070 SE-Cu, 2.1020 CuSn6, 2.1096 G-CuSn5ZnPb	≤500		●
Brass, short-chipping	2.0380 CuZn39Pb2, 2.0401 CuZn39Pb3, 2.0410 CuZn43Pb2	≤600		●
long-chipping	2.0250 CuZn20, 2.0280 CuZn33, 2.0332 CuZn37Pb0,5	≤600		●
Bronze, short-chipping	2.1090 CuSn7Zn1Pb, 2.1170 CuPb5Sn5, 2.1176 CuPb10Sn	≤600		●
	2.0790 CuNi18Zn19Pb	≤850		●
Bronze, long-chipping	2.0916 CuAl5, 2.0960 CuAl9Mn, 2.1050 CuSn10	≤850		●
	2.0980 CuAl11Ni, 2.1247 CuBe2	≤1000		●
Duroplastics	Epoxidharz, Resopal, Pertinax, Moltopren	≤150		○
Thermoplastics	Plexiglas, Hostalen, Novodur, Makralon	≤100		○
New cast materials CGI	EN-GJV250 (GGV25), EN-GJV350 (GGV35)		≤220 HB	●○
	EN-GJV400 (GGV40), EN-GJV500 (GGV50), SiMo 6		≤300 HB	●○
New cast materials ADI	EN-GJS-800-8 (ADI800), EN-GJS-1000-5 (ADI1000)	≤1000		●○
	EN-GJS-1200-2 (ADI1200), EN-GJS-1400-1 (ADI1400)	≤1400		●○
Kevlar	Kevlar	≤1000		○
Glass, carbon conc. plastics	GFK/CFK	≤1000		○

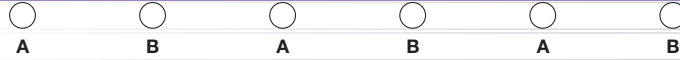
○ bright

 AlTiN nano

88300	88301
201-2	212-3
HSS-E	



88302	88304	88305	88306	88307	88308
212	212	212-2	212-2	208	208
HSS-E					



88311
212
HSS-E



V _c m/min	Feed column no.	
16	72	72
12	72	72
12	72	72
10	71	71
14	72	72
12	71	71
10	71	71
10	71	71
8	71	71
16	72	72
10	71	71
8	71	71
10	71	71
8	71	71
14	72	72
10	71	71
10	71	71
6	72	72
6	72	72
4	72	72

V _c m/min	Feed column no.					
16	72	72	72	72	72	72
12	72	72	72	72	72	72
12	72	72	72	72	72	72
10	71	71	71	71	71	71
14	72	72	72	72	72	72
12	71	71	71	71	71	71
10	71	71	71	71	71	71
10	71	71	71	71	71	71
8	71	71	71	71	71	71
16	72	72	72	72	72	72
10	71	71	71	71	71	71
8	71	71	71	71	71	71
10	71	71	71	71	71	71
8	71	71	71	71	71	71
14	72	72	72	72	72	72
10	71	71	71	71	71	71
10	71	71	71	71	71	71
6	72	72	72	72	72	72
6	72	72	72	72	72	72
4	72	72	72	72	72	72

V _c m/min	Feed col. no.
16	72
12	72
12	72
10	71
14	72
12	71
10	71
10	71
8	71
16	72
10	71
8	71
10	71
8	71
14	72
10	71
10	71
6	72
6	72
4	72

4	71	71
14	71	71
12	71	71
12	71	71
10	71	71
6	71	71
4	71	71
18	73	73
18	73	73
20	72	72
18	72	72
20	72	72
18	72	72
18	72	72
16	72	72
20	72	72
18	72	72
18	72	72
14	72	72
12	73	73
14	73	73
8	71	71
8	71	71

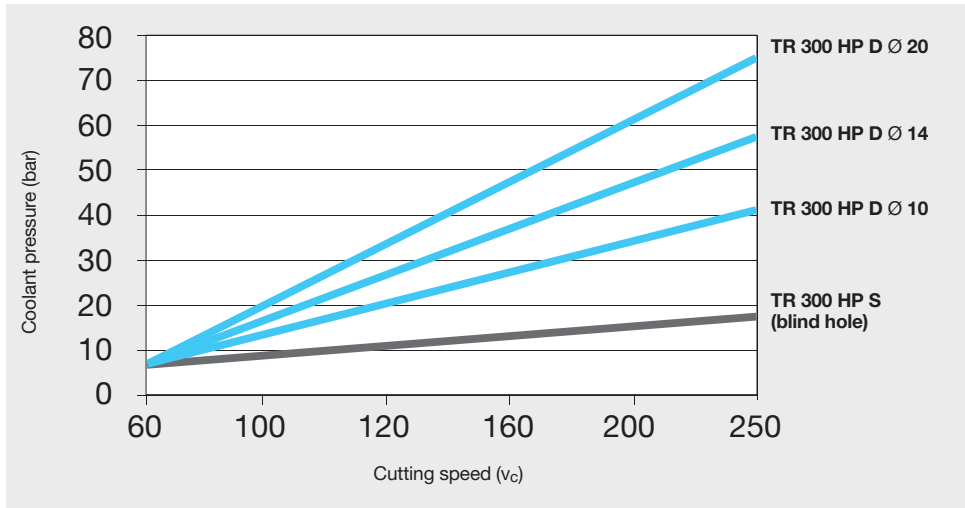
4	71	71	71	71	71	71
14	71	71	71	71	71	71
12	71	71	71	71	71	71
12	71	71	71	71	71	71
10	71	71	71	71	71	71
6	71	71	71	71	71	71
4	71	71	71	71	71	71
18	73	73	73	73	73	73
18	73	73	73	73	73	73
20	72	72	72	72	72	72
18	72	72	72	72	72	72
20	72	72	72	72	72	72
18	72	72	72	72	72	72
18	72	72	72	72	72	72
16	72	72	72	72	72	72
20	72	72	72	72	72	72
18	72	72	72	72	72	72
18	72	72	72	72	72	72
14	72	72	72	72	72	72
12	73	73	73	73	73	73
14	73	73	73	73	73	73
8	71	71	71	71	71	71
8	71	71	71	71	71	71

4	71
14	71
12	71
12	71
10	71
6	71
4	71
18	73
18	73
20	72
18	72
20	72
18	72
18	72
16	72
20	72
18	72
18	72
14	72
12	73
14	73
8	71
8	71



Recommendations for the application of high-performance reamers TR 300 HP

Coolant pressure



Coolant pressure - cutting speed
valid for standard dimensions.
Preconditions: sufficient capacity of coolant pump





Adapted cutting speed, an appropriate feed rate and good cooling and lubricating agents should always be a top priority for reaming operations. A further point to be considered is that the reamer always follows the direction of the pre-drilled hole. An exception is the machine bottoming reamer or a very small reamer. Consequently reamers do not correct alignment errors of predrilled holes. Errors between the spindle axis and the axis of a pre-drilled hole can be adjusted with the aid of floating holders. The following fault finding chart will be found useful in tracing the cause of some common reaming problems.

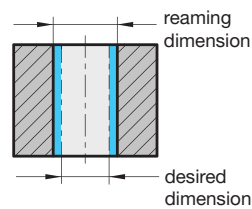
Wording:

Desired dim. Required finish dimension of bore hole, defined as max./min. dimension of tolerance zone

Reaming dim. the finish dimension reached in fact

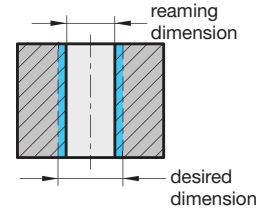
„Bore hole“ The reached bore hole after reaming

1 Holes too large



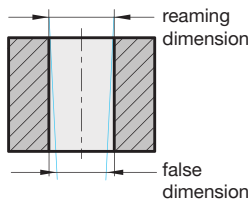
- Tool diameter too large
- Cutting speed too high
- Concentricity error of machine spindle
- Bevel lead of tool too short/uneven
- Cutting edge build up due to wrong cutting speeds or poor lubrication
- Lubricating agent unsuitable, holes too large due to lubrication

2 Holes too small



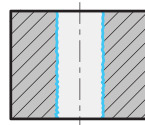
- Reamer blunt. Does not cut, scrapes
- Cutting speed too low
- Component is thin-walled, springs back
- Insufficient stock removal allowance, tool seizes in hole
- Hole is not round due to distortion

3 Conical hole malformation



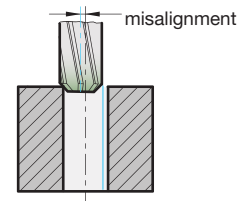
- Tool knocks in spindle
- Bevel lead incorrect
- Axis shifting between tool and predrilled hole. Application of floating holders
- Pre-machining inaccurate

4 Unsatisfactory surface finish



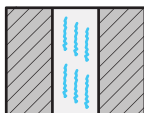
- Cutting speed too low
- No/insufficient lubrication. Cutting edge build-up.
- Tool damaged, i. e. broken cutting edge
- Material has a tendency to cause build up on cutting edges.
- Concentricity bevel lead incorrect

5 Misalignment of hole



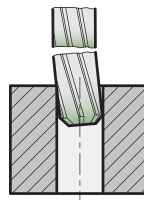
- Pre-drilled hole misaligned
- Concentricity bevel lead incorrect
- Apply floating holder if necessary
- If necessary pilot drill to correct predrilled position

6 Hole has chatter marks



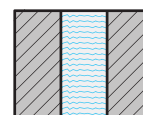
- Feed too low
- Cutting edge build-up
- Grease content in coolant too low
- Circular lands too small
- Stock removal allowance insufficient
- Tool incorrectly clamped in tool holder
- Machine spindle not concentric

7 Reamer seizes and breaks



- Position to pilot hole incorrect
- Back taper incorrect
- Circular lands too wide
- Pre-drilled hole is too small
- Bevel lead blunt/ground unevenly
- Feed rate too high
- Chip congestion – increase feed rate to produce shorter chips

8 Feed scoring marks in hole



- Cutting speed too low
- Worn cutting edges
- Crumbling on cutting edges
- Build up on cutting edges
- Position to pilot hole incorrect
- Insufficient lubrication



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The most common tolerance zones in μm

Nominal diameter in mm over to	A		B				C			
	9	11	8	9	10	11	8	9	10	11
0 3	+295 +270	+330 +270	+154 +140	+165 +140	+180 +140	+200 +140	+74 +60	+85 +60	+100 +60	+120 +60
3 6	+300 +270	+345 +270	+158 +140	+170 +140	+188 +140	+215 +140	+88 +70	+100 +70	+118 +70	+145 +70
6 10	+316 +280	+370 +280	+172 +150	+186 +150	+208 +150	+240 +150	+102 +80	+116 +80	+138 +80	+170 +80
10 18	+333 +290	+400 +290	+177 +150	+193 +150	+220 +150	+260 +150	+122 +95	+138 +95	+165 +95	+205 +95
18 30	+352 +300	+430 +300	+193 +160	+212 +160	+244 +160	+290 +160	+143 +110	+162 +110	+194 +110	+240 +110
30 40	+372 +310	+470 +310	+209 +170	+232 +170	+270 +170	+330 +170	+159 +120	+182 +120	+220 +120	+280 +120
40 50	+382 +320	+480 +320	+219 +180	+242 +180	+280 +180	+340 +180	+169 +130	+192 +130	+230 +130	+290 +130
50 65	+414 +340	+530 +340	+236 +190	+264 +190	+310 +190	+380 +190	+186 +140	+214 +140	+260 +140	+330 +140
65 80	+434 +360	+550 +360	+246 +200	+274 +200	+320 +200	+390 +200	+196 +150	+224 +150	+270 +150	+340 +150
80 100	+467 +380	+600 +380	+274 +220	+307 +220	+360 +220	+440 +220	+224 +170	+257 +170	+310 +170	+390 +170
100 120	+497 +410	+630 +410	+294 +240	+327 +240	+380 +240	+460 +240	+234 +180	+267 +180	+320 +180	+400 +180

Nominal diameter in mm over to	D					E			F			
	8	9	10	11	12	7	8	9	6	7	8	9
0 3	+34 +20	+45 +20	+60 +20	+80 +20	+120 +20	+24 +14	+28 +14	+39 +14	+12 +6	16 +6	+20 +6	+31 +6
3 6	+48 +30	+60 +30	+78 +30	+105 +30	+150 +30	+32 +20	+38 +20	+50 +20	+18 +10	+22 +10	+28 +10	+40 +10
6 10	+62 +40	+76 +40	+98 +40	+130 +40	+190 +40	+40 +25	+47 +25	+61 +25	+22 +13	+28 +13	+35 +13	+49 +13
10 18	+77 +50	+93 +50	+120 +50	+160 +50	+230 +50	+50 +32	+59 +32	+75 +32	+27 +16	+34 +16	+43 +16	+59 +16
18 30	+98 +65	+117 +65	+149 +65	+195 +65	+275 +65	+61 +40	+73 +40	+92 +40	+33 +20	+41 +20	+53 +20	+72 +20
30 50	+119 +80	+142 +80	+180 +80	+240 +80		+75 +50	+89 +50	+112 +50	+41 +25	+50 +25	+64 +25	+87 +25
50 80	+146 +100	+174 +100	+220 +100	+290 +100		+90 +60	+106 +60	+134 +60	+49 +30	+60 +30	+76 +30	+104 +30
80 120	+174 +120	+207 +120	+260 +120	+340 +120		+107 +72	+126 +72	+159 +72	+58 +36	+71 +36	+90 +36	+123 +36
120 180							+148 +85					
180 250							+172 +100					



HARTNER

The most common tolerance zones in μm

Nominal diameter in mm over to	G		H								J		
	6	7	6	7	8	9	10	11	12		6	7	8
0 3	+8 +2	+12 +2	+6 0	+10 0	+14 0	+25 0	+40 0	+60 0	+100 0		+2 -4	+4 -6	+6 -8
3 6	+12 +4	+16 +4	+8 0	+12 0	+18 0	+30 0	+48 0	+75 0	+120 0		+5 -3	+6 -6	+10 -8
6 10	+14 +5	+20 +5	+9 0	+15 0	+22 0	+36 0	+58 0	+90 0	+150 0		+5 -4	+8 -7	+12 -10
10 18	+17 +6	+24 +6	+11 0	+18 0	+27 0	+43 0	+70 0	+110 0	+180 0		+6 -5	+10 -8	+15 -12
18 30	+20 +7	+28 +7	+13 0	+21 0	+33 0	+52 0	+84 0	+130 0	+210 0		+8 -5	+12 -9	+20 -13
30 50	+25 +9	+34 +9	+16 0	+25 0	+39 0	+62 0	+100 0	+160 0	+250 0		+10 -6	+14 -11	+24 -15
50 80	+29 +10	+40 +10	+19 0	+30 0	+46 0	+74 0	+120 0	+190 0	+300 0		+13 -6	+18 -12	+28 -18
80 120	+34 +12	+47 +12	+22 0	+35 0	+54 0	+87 0	+140 0	+220 0	+350 0		+16 -6	+22 -13	+34 -20
120 180		+54 +14	+25 0	+40 0	+63 0	+100 0	+160 0	+250 0			+18 -7	+26 -14	+41 -22
180 250		+61 +15	+29 0	+46 0	+72 0	+115 0	+185 0	+290 0			+22 -7	+30 -16	+47 -25

Nominal diameter in mm over to	JS				K			M		
	6	7	8	9	6	7	8	6	7	8
0 3	+3 -3	+5 -5	+7 -7	+12,5 -12,5	0 -6	0 -10	0 -14	-2 -8	-2 -12	-4 -18
3 6	+4 -4	+6 -6	+9 -9	+15 -15	+2 -6	+3 -9	+5 -13	-1 -9	0 -12	+2 -16
6 10	+4,5 -4,5	+7,5 -7,5	+11 -11	+18 -18	+2 -7	+5 -10	+6 -16	-3 -12	0 -215	+1 -21
10 18	+5,5 -5,5	+9 -9	+13,5 -13,5	+21,5 -21,5	+2 -9	+6 -12	+8 -19	-4 -15	0 -18	+2 -25
18 30	+6,5 -6,5	+10,5 -10,5	+16,5 -16,5	+26 -26	+2 -11	+6 -15	+10 -23	-4 -17	0 -21	+4 -29
30 50	+8 -8	+12,5 -12,5	+19,5 -19,5	+31 -31	+3 -13	+7 -18	+12 -27	-4 -20	0 -25	+5 -34
50 80	+9,5 -9,5	+15 -15	+23 -23	+37 -37	+4 -15	+9 -21	+14 -32	-5 -24	0 -30	+5 -41
80 120	+11 -11	+17,5 -17,5	+27 -27	+43,5 -43,5	+4 -18	+10 -25	+16 -38	-6 -28	0 -35	+6 -48
120 180					+4 -21	+12 -28				
180 250					+5 -24	+13 -33				

**HARTNER****The most common tolerance zones in μm**

Nominal diameter in mm over to	N						P			R	
	6	7	8	9	10	11	6	7	9	6	7
0 3	-4 -10	-4 -14	-4 -8	-4 -29	-4 -44	-4 -64	-6 -12	-6 -16	-6 -31	-10 -16	-10 -20
3 6	-5 -13	-4 -16	-2 -20	0 -30	0 -48	0 -75	-9 -17	-8 -20	-12 -42	-12 -20	-11 -23
6 10	-7 -16	-4 -19	-3 -25	0 -36	0 -58	0 -90	-12 -21	-9 -24	-15 -51	-16 -25	-13 -28
10 18	-9 -20	-5 -23	-3 -30	0 -43	0 -70	0 -110	-15 -26	-11 -29	-18 -61	-20 -31	-16 -34
18 30	-11 -24	-7 -28	-3 -36	0 -52	0 -84	0 -130	-18 -31	-14 -35	-22 -74	-24 -37	-20 -41
30 50	-12 -28	-8 -33	-3 -42	0 -62	0 -100	0 -160	-21 -37	-17 -42	-26 -88	-29 -45	-25 -50
50 65	-14 -33	-9 -39	-4 -50	0 -74	0 -120	0 -190	-26 -45	-21 -51	-32 -106	-35 -54	-30 -60
65 80	-14 -33	-9 -39	-4 -50	0 -74	0 -120	0 -190	-26 -45	-21 -51	-32 -106	-37 -56	-32 -62
80 100	-16 -38	-10 -45	-4 -58	0 -87	0 -140	0 -220	-30 -52	-24 -59	-37 -124	-44 -66	-38 -73
100 120	-16 -38	-10 -45	-4 -58	0 -87	0 -140	0 -220	-30 -52	-24 -59		-47 -69	-41 -76

Nominal diameter in mm over to	S		T	U			X		Z	
	6	7	6	6	7	10	10	11	10	11
0 3	-14 -20	-14 -24	-18 -24	-18 -24	-18 -28	-18 -58	-20 -60	-20 -80	-26 -66	-26 -86
3 6	-16 -24	-15 -27	-20 -28	-20 -28	-19 -31	-23 -71	-28 -76	-28 -103	-35 -83	-35 -110
6 10	-20 -29	-17 -32	-25 -34	-25 -34	-22 -37	-28 -86	-34 -92	-34 -124	-42 -100	-42 -132
10 14	-25 -36	-21 -39	-30 -41	-30 -41	-26 -44	-33 -103	-40 -110	-40 -150	-50 -120	-50 -160
14 18	-25 -36	-21 -39	-30 -41	-30 -41	-26 -44	-33 -103	-45 -115	-45 -155	-60 -130	-60 -170
18 24	-31 -44	-27 -48	-37 -50	-37 -50	-33 -54	-41 -125	-54 -138	-54 -184	-73 -157	-73 -203
24 30	-31 -44	-27 -48	-37 -50	-44 -57	-40 -61	-48 -132	-64 -148	-64 -194	-88 -172	-88 -218
30 40	-38 -54	-34 -59	-43 -59	-55 -71	-51 -76	-60 -160	-80 -180	-80 -240	-112 -212	-112 -272
40 50	-38 -54	-34 -59	-49 -65	-65 -81	-61 -86	-70 -170	-97 -197	-97 -257	-136 -236	-136 -296
50 65	-47 -66	-42 -72	-60 -79	-81 -100	-76 -106	-87 -207	-122 -242	-122 -312	-172 -292	-172 -362
65 80	-53 -72	-48 -78	-69 -88	-96 -115	-91 -121	-102 -222	-146 -266	-146 -336	-210 -330	-210 -400
80 100	-64 -86	-58 -93	-84 -106	-117 -139	-111 -146	-124 -264	-178 -318	-178 -398	-258 -398	-258 -478
100 120	-72 -94	-66 -101	-97 -119	-137 -159	-131 -166	-144 -284	-210 -350	-210 -430	-310 -450	-310 -530



Manufacturing tolerances

(tolerance zones A ... G)

DIN 1420

Nominal diameter in mm		Permissible upper and lower tolerances on nominal reamer diameter d_1 in μm for hole tolerance zone									
over	to	A9	A11	B8	B9	B10	B11	C8	C9	C10	C11
1	3	+ 291	+ 321	+ 151	+ 161	+ 174	+ 191	+ 71	+ 81	+ 94	+ 111
		+ 282	+ 300	+ 146	+ 152	+ 160	+ 170	+ 66	+ 72	+ 80	+ 90
3	6	+ 295	+ 333	+ 155	+ 165	+ 180	+ 203	+ 85	+ 95	+ 110	+ 133
		+ 284	+ 306	+ 148	+ 154	+ 163	+ 176	+ 78	+ 84	+ 93	+ 106
6	10	+ 310	+ 356	+ 168	+ 180	+ 199	+ 226	+ 98	+ 110	+ 129	+ 156
		+ 297	+ 324	+ 160	+ 167	+ 178	+ 194	+ 90	+ 97	+ 108	+ 124
10	18	+ 326	+ 383	+ 172	+ 186	+ 209	+ 243	+ 117	+ 131	+ 154	+ 188
		+ 310	+ 344	+ 162	+ 170	+ 184	+ 204	+ 107	+ 115	+ 129	+ 149
18	30	+ 344	+ 410	+ 188	+ 204	+ 231	+ 270	+ 138	+ 154	+ 181	+ 220
		+ 325	+ 364	+ 176	+ 185	+ 201	+ 224	+ 126	+ 135	+ 151	+ 174
30	40	+ 362	+ 446	+ 203	+ 222	+ 255	+ 306	+ 153	+ 172	+ 205	+ 256
		+ 340	+ 390	+ 189	+ 200	+ 220	+ 250	+ 139	+ 150	+ 170	+ 200
40	50	+ 372	+ 456	+ 213	+ 232	+ 265	+ 316	+ 163	+ 182	+ 215	+ 266
		+ 350	+ 400	+ 199	+ 210	+ 230	+ 260	+ 149	+ 160	+ 180	+ 210
50	65	+ 402	+ 501	+ 229	+ 252	+ 292	+ 351	+ 179	+ 202	+ 242	+ 301
		+ 376	+ 434	+ 212	+ 226	+ 250	+ 284	+ 162	+ 176	+ 200	+ 234
65	80	+ 422	+ 521	+ 239	+ 262	+ 302	+ 361	+ 189	+ 212	+ 252	+ 311
		+ 396	+ 454	+ 222	+ 236	+ 260	+ 294	+ 172	+ 186	+ 210	+ 244
80	100	+ 453	+ 567	+ 265	+ 293	+ 339	+ 407	+ 215	+ 243	+ 289	+ 357
		+ 422	+ 490	+ 246	+ 262	+ 290	+ 330	+ 196	+ 212	+ 240	+ 280
100	120	+ 483	+ 597	+ 285	+ 313	+ 359	+ 427	+ 225	+ 253	+ 299	+ 367
		+ 452	+ 520	+ 266	+ 282	+ 310	+ 350	+ 206	+ 222	+ 250	+ 290
120	140	+ 545	+ 672	+ 313	+ 345	+ 396	+ 472	+ 253	+ 285	+ 336	+ 412
		+ 510	+ 584	+ 290	+ 310	+ 340	+ 384	+ 230	+ 250	+ 280	+ 324
140	160	+ 605	+ 732	+ 333	+ 365	+ 416	+ 492	+ 263	+ 295	+ 346	+ 422
		+ 570	+ 644	+ 310	+ 330	+ 360	+ 404	+ 240	+ 260	+ 290	+ 334
160	180	+ 665	+ 792	+ 363	+ 395	+ 446	+ 522	+ 283	+ 315	+ 366	+ 442
		+ 630	+ 704	+ 340	+ 360	+ 390	+ 434	+ 260	+ 280	+ 310	+ 354

Nominal diameter in mm		Permissible upper and lower tolerances on nominal reamer diameter d ₁ in μm for hole tolerance zone												
		D8	D9	D10	D11	E7	E8	E9	F6	F7	F8	F9	G6	G7
1	3	+ 31	+ 41	+ 54	+ 71	+ 22	+ 25	+ 35	+ 11	+ 14	+ 17	+ 27	+ 7	+ 10
		+ 26	+ 32	+ 40	+ 50	+ 18	+ 20	+ 26	+ 8	+ 10	+ 12	+ 18	+ 4	+ 6
3	6	+ 45	+ 55	+ 70	+ 93	+ 30	+ 35	+ 45	+ 16	+ 20	+ 25	+ 35	+ 10	+ 14
		+ 38	+ 44	+ 53	+ 66	+ 25	+ 28	+ 34	+ 13	+ 15	+ 18	+ 24	+ 7	+ 9
6	10	+ 58	+ 70	+ 89	+ 116	+ 37	+ 43	+ 55	+ 20	+ 25	+ 31	+ 43	+ 12	+ 17
		+ 50	+ 57	+ 68	+ 84	+ 31	+ 35	+ 42	+ 16	+ 19	+ 23	+ 30	+ 8	+ 11
10	18	+ 72	+ 86	+ 109	+ 143	+ 47	+ 54	+ 68	+ 25	+ 31	+ 38	+ 52	+ 15	+ 21
		+ 62	+ 70	+ 84	+ 104	+ 40	+ 44	+ 52	+ 21	+ 24	+ 28	+ 36	+ 11	+ 14
18	30	+ 93	+ 109	+ 136	+ 175	+ 57	+ 68	+ 84	+ 31	+ 37	+ 48	+ 64	+ 18	+ 24
		+ 81	+ 90	+ 106	+ 129	+ 49	+ 56	+ 65	+ 26	+ 29	+ 36	+ 45	+ 13	+ 16
30	50	+ 113	+ 132	+ 165	+ 216	+ 71	+ 83	+ 102	+ 38	+ 46	+ 58	+ 77	+ 22	+ 30
		+ 99	+ 110	+ 130	+ 160	+ 62	+ 69	+ 80	+ 32	+ 37	+ 44	+ 55	+ 16	+ 21
50	80	+ 139	+ 162	+ 202	+ 261	+ 85	+ 99	+ 122	+ 46	+ 55	+ 69	+ 92	+ 26	+ 35
		+ 122	+ 136	+ 160	+ 194	+ 74	+ 82	+ 96	+ 39	+ 44	+ 52	+ 66	+ 19	+ 24
80	120	+ 165	+ 193	+ 239	+ 307	+ 101	+ 117	+ 145	+ 54	+ 65	+ 81	+ 109	+ 30	+ 41
		+ 146	+ 162	+ 190	+ 230	+ 88	+ 98	+ 114	+ 46	+ 52	+ 62	+ 78	+ 22	+ 28
120	180	+ 198	+ 230	+ 281	+ 357	+ 119	+ 138	+ 170	+ 64	+ 77	+ 96	+ 128	+ 35	+ 48
		+ 175	+ 195	+ 225	+ 269	+ 105	+ 115	+ 135	+ 55	+ 63	+ 73	+ 93	+ 26	+ 34



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Manufacturing tolerances

(tolerance zones H ... P)
DIN 1420

Nominal diameter in mm over to	Permissible upper and lower tolerances on nominal reamer diameter d ₁ in µm for hole tolerance zone													
	H6	H7	H8	H9	H10	H11	H12	J6	J7	J8	JS6	JS7	JS8	JS9
>1.....3	+ 5	+ 8	+11	+21	+ 34	+ 51	+ 85	+ 1	+ 2	+ 3	+ 2	+ 3	+ 4	+ 8
	+ 2	+ 4	+ 6	+12	+ 20	+ 30	+ 50	- 2	- 2	- 2	- 1	- 1	- 1	- 1
>3.....6	+ 6	+10	+15	+25	+ 40	+ 63	+102	+ 3	+ 4	+ 7	+ 2	+ 4	+ 6	+10
	+ 3	+ 5	+ 8	+14	+ 23	+ 36	+ 60	0	- 1	0	- 1	- 1	- 1	- 1
>6.....10	+ 7	+12	+18	+30	+ 49	+ 76	+127	+ 3	+ 5	+ 8	+ 3	+ 5	+ 7	+12
	+ 3	+ 6	+10	+17	+ 28	+ 44	+ 74	- 1	- 1	0	- 1	- 1	- 1	- 1
>10.....18	+ 9	+15	+22	+36	+ 59	+ 93	+153	+ 4	+ 7	+10	+ 3	+ 6	+ 8	+15
	+ 5	+ 8	+12	+20	+ 34	+ 54	+ 90	0	0	0	- 1	- 1	- 1	- 1
>18.....30	+11	+17	+28	+44	+ 71	+110	+178	+ 6	+ 8	+15	+ 4	+ 7	+11	+18
	+ 6	+ 9	+16	+25	+ 41	+ 64	+104	+ 1	0	+ 3	- 1	- 1	- 1	- 1
>30.....50	+13	+21	+33	+52	+ 85	+136	+212	+ 7	+10	+18	+ 5	+ 8	+13	+21
	+ 7	+12	+19	+30	+ 50	+ 80	+124	+ 1	+ 1	+ 4	- 1	- 1	- 1	- 1
>50.....80	+16	+25	+39	+62	+102	+161	+255	+10	+13	+21	+ 6	+10	+16	+25
	+ 9	+14	+22	+36	+ 60	+ 94	+150	+ 3	+ 2	+ 4	- 1	- 1	- 1	- 1
>80...120	+18	+29	+45	+73	+119	+187	+297	+12	+16	+25	+ 7	+12	+18	+30
	+10	+16	+26	+42	+ 70	+110	+174	+ 4	+ 3	+ 6	- 1	- 1	- 1	- 1
>120...180	+21	+34	+53	+85	+136	+212	+340	+14	+20	+31	+ 8	+14	+22	+35
	+12	+20	+30	+50	+ 80	+124	+200	+ 5	+ 6	+ 8	- 1	0	- 1	0

Our
standard
manufacturing accuracy

Nominal diameter in mm over to	Permissible upper and lower tolerances on nominal reamer diameter d ₁ in µm for hole tolerance zone													
	K6	K7	K8	M6	M7	M8	N6	N7	N8	N9	N10	N11	P6	P7
1 3	- 1	- 2	- 3	- 3	- 4		- 5	- 6	- 7	- 8	-10	- 13	- 7	- 8
	- 4	- 6	- 8	- 6	- 8		- 8	-10	-12	-17	-24	- 34	-10	-12
3 6	0	+ 1	+ 2	- 3	- 2	- 1	- 7	- 6	- 5	- 5	- 8	- 12	-11	-10
	- 3	- 4	- 5	- 6	- 7	- 8	-10	-11	-12	-16	-25	- 39	-14	-15
6 10	0	+ 2	+ 2	- 5	- 3	- 3	- 9	- 7	- 7	- 6	- 9	- 14	-14	-12
	- 4	- 4	- 6	- 9	- 9	-11	-13	-13	-15	-19	-30	- 46	-18	-18
10 18	0	+ 3	+ 3	- 6	- 3	- 3	-11	- 8	- 8	- 7	-11	- 17	-17	-14
	- 4	- 4	- 7	-10	-10	-13	-15	-15	-18	-23	-36	- 56	-21	-21
18 30	0	+ 2	+ 5	- 6	- 4	- 1	-13	-11	- 8	- 8	-13	- 20	-20	-1
	- 5	- 6	- 7	-11	-12	-13	-18	-19	-20	-27	-43	- 66	-25	-26
30 50	0	+ 3	+ 6	- 7	- 4	- 1	-15	-12	- 9	-10	-15	- 24	-24	-21
	- 6	- 6	- 8	-13	-13	-15	-21	-21	-23	-32	-50	- 80	-30	-30
50 80	+ 1	+ 4	+ 7	- 8	- 5	- 2	-17	-14	-11	-12	-18	- 29	-29	-26
	- 6	- 7	-10	-15	-16	-19	-24	-25	-28	-38	-60	- 96	-36	-37
80 120	0	+ 4	+ 7	-10	- 6	- 3	-20	-16	-13	-14	-21	- 33	-34	-30
	- 8	- 9	-12	-18	-19	-22	-28	-29	-32	-45	-70	-110	-42	-43
120 180	0	+ 6	+10	-12	- 6	- 2	-24	-18	-14	-15	-24	- 38	-40	-43
	- 9	- 8	-13	-21	-20	-25	-33	-32	-37	-50	-80	-126	-49	-48



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Manufacturing tolerances

(tolerance zones R ... Z)
DIN 1420

Nominal diameter in mm		Permissible upper and lower tolerances on nominal reamer diameter d_1 in μm for hole tolerance zone											
over	to	R6	R7	S6	S7	T6	U6	U7	U10	X10	X11	Z10	Z11
1	3	- 11	- 12	- 15	- 16		- 19	- 20				- 32	
		- 14	- 16	- 18	- 20		- 22	- 24				- 46	
3	6	- 14	- 13	- 18	- 17		- 22	- 21	- 31			- 43	
		- 17	- 18	- 21	- 22		- 25	- 26	- 48			- 60	
6	10	- 18	- 16	- 22	- 20		- 27	- 25	- 37			- 51	
		- 22	- 22	- 26	- 26		- 31	- 31	- 58			- 72	
10	14	- 22	- 19	- 27	- 24		- 32	- 29	- 44			- 61	
		- 26	- 26	- 31	- 31		- 36	- 36	- 69			- 86	
14	18	- 22	- 19	- 27	- 24		- 32	- 29	- 44	- 56		- 71	
		- 26	- 26	- 31	- 31		- 36	- 36	- 69	- 81		- 96	
18	24	- 26	- 24	- 33	- 31		- 39	- 37		- 67		- 86	
		- 31	- 32	- 38	- 39		- 44	- 45		- 97		-116	
24	30	- 26	- 24	- 33	- 31	- 39	- 46	- 44		- 77		-101	-108
		- 31	- 32	- 38	- 39	- 44	- 51	- 52		-107		-131	-154
30	40	- 32	- 29	- 41	- 38	- 46	- 58	- 55		- 95		-127	-136
		- 38	- 38	- 47	- 47	- 52	- 64	- 64		-130		-162	-192
40	50	- 32	- 29	- 41	- 38	- 52	- 68	- 65	- 85	-112		-151	-160
		- 38	- 38	- 47	- 47	- 58	- 74	- 74	-120	-147		-186	-216
50	65	- 38	- 35	- 50	- 47	- 63	- 84	- 81	-105	-140	-151	-190	-201
		- 45	- 46	- 57	- 58	- 70	- 91	- 92	-147	-182	-218	-232	-268
65	80	- 40	- 37	- 56	- 53	- 72	- 99	- 96	-120	-164	-175	-228	-239
		- 47	- 48	- 63	- 64	- 79	-106	-107	-162	-206	-242	-270	-306
80	100	- 48	- 44	- 68	- 64	- 88	-121	-117	-145	-199	-211	-279	-291
		- 56	- 57	- 76	- 77	- 96	-129	-130	-194	-248	-288	-328	-368
100	120	- 51	- 47	- 76	- 72	-101	-141	-137	-165	-231	-243	-331	-343
		- 59	- 60	- 84	- 85	-109	-149	-150	-214	-280	-320	-380	-420
120	140	- 60	- 54	- 89	- 83	-119	-167	-161	-194	-272	-286	-389	-403
		- 69	- 68	- 98	- 97	-128	-176	-175	-250	-328	-374	-445	-491
140	160	- 62	- 56	- 97	- 91	-131	-187	-181	-214	-304	-318	-439	-453
		- 71	- 70	-106	-105	-140	-196	-195	-270	-360	-406	-495	-541
160	180	- 65	- 59	-105	- 99	-143	-207	-201	-234	-334	-348	-489	-503
		- 74	- 73	-114	-113	-152	-216	-215	-290	-390	-436	-545	-591



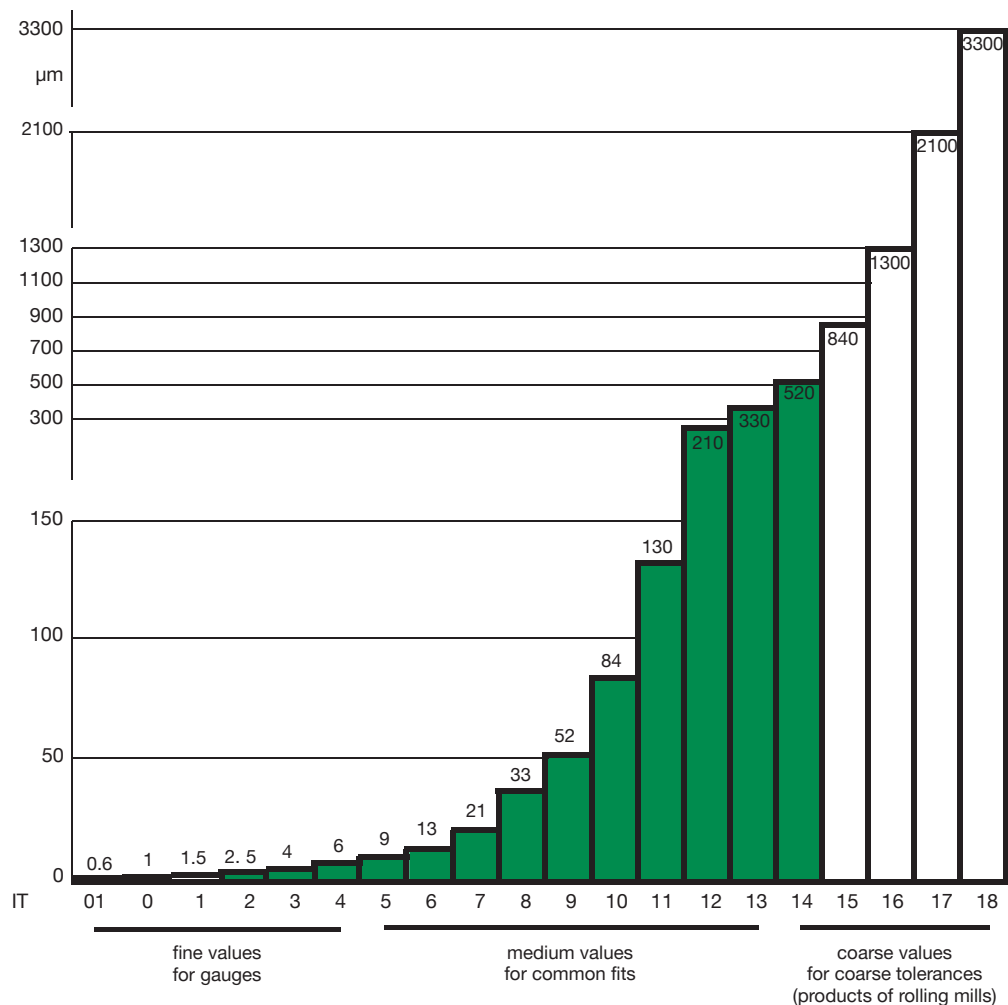
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Basic ISO tolerances

DIN ISO 286-1

Range of nominal size mm		IT in μm											
		3	4	5	6	7	8	9	10	11	12	13	14
from	1	2	3	4	6	10	14	25	40	60	100	140	250
to	3												
over	3	2.5	4	5	8	12	18	30	48	75	120	180	300
to	6												
over	6	2.5	4	6	9	15	22	36	58	90	150	220	360
to	10												
over	10	3	5	8	11	18	27	43	70	110	180	270	430
to	18												
over	18	4	6	9	13	21	33	52	84	130	210	330	520
to	30												
over	30	4	7	11	16	25	39	62	100	160	250	390	620
to	50												
over	50	5	8	13	19	30	46	74	120	190	300	460	740
to	80												
over	80	6	10	15	22	35	54	87	140	220	350	540	870
to	120												

Example: Basic ISO tolerances for a range of nominal sizes over 18 to 30 mm





Manufacturing tolerances to DIN 1420

General remarks for the determination of manufacturing tolerances for reamers

The manufacturing tolerances to DIN 1420 are allocated to certain tolerance zones of the holes to be reamed. Generally they ensure the positioning of reamed holes within the relevant tolerance zone as well as the most economical use of the reamer.

It must, however, be taken into account that the size of the reamed hole depends, in addition to the manufacturing tolerance of the reamer, on various other factors, such as angles of cutting edges; bevel lead of reamer; clamping of the workpiece; the tool holder; condition of the machine; the coolant and on the material of the workpiece. Therefore, from time to time other manufacturing tolerances than IT7 (H7) might prove more advantageous. However, in the interest of economic production and storage, it is recommended that non-standard manufacturing tolerances are used only in exceptional cases.

For determining the manufacturing tolerances the following well-proven basic rules were stipulated:

Determination of perm. max. and min. sizes of reamers

The largest permitted reamer diameter ranges at about 15% of the approximate hole tolerance (0.15 IT) below the permissible maximum diameter of the hole (see fig.), whereby the value 0.15 IT will be rounded of to the next higher integer or half μm -value, so that even μm values are derived for $d_{1\text{max}}$. The permissible smallest reamer diameter $d_{1\text{min}}$ ranges at about 35% of the approximate hole tolerance (0.35 IT) below the permissible maximum diameter $d_{1\text{max}}$ (ex. 1).

Simplified determination of permissible max. and min. reamer dimensions

In order to facilitate calculations, the table on page 47 indicates the upper and lower tolerance limits on the nominal diameter d_1 for the most common "H" tolerance zones. With the aid of these tolerance limits the permissible maximum and minimum reamer dimensions can be calculated.

Example 1

nominal diameter d_1	=20.000 mm
maximum diameter of the hole	=20.021 mm
hole tolerance (IT 7)	=0.021 mm
15% of the hole tolerance (0.15 IT 7)	=0.0031 mm
	≈ 0.004 mm
maximum reamer diameter:	
$d_{1\text{max}} = 20.021 - 0.004$	= <u>20.017 mm</u>
manufacturing tolerance of reamer:	
35% of the hole tolerance (0.35 IT 7)	=0.0073 mm
	≈ 0.008 mm

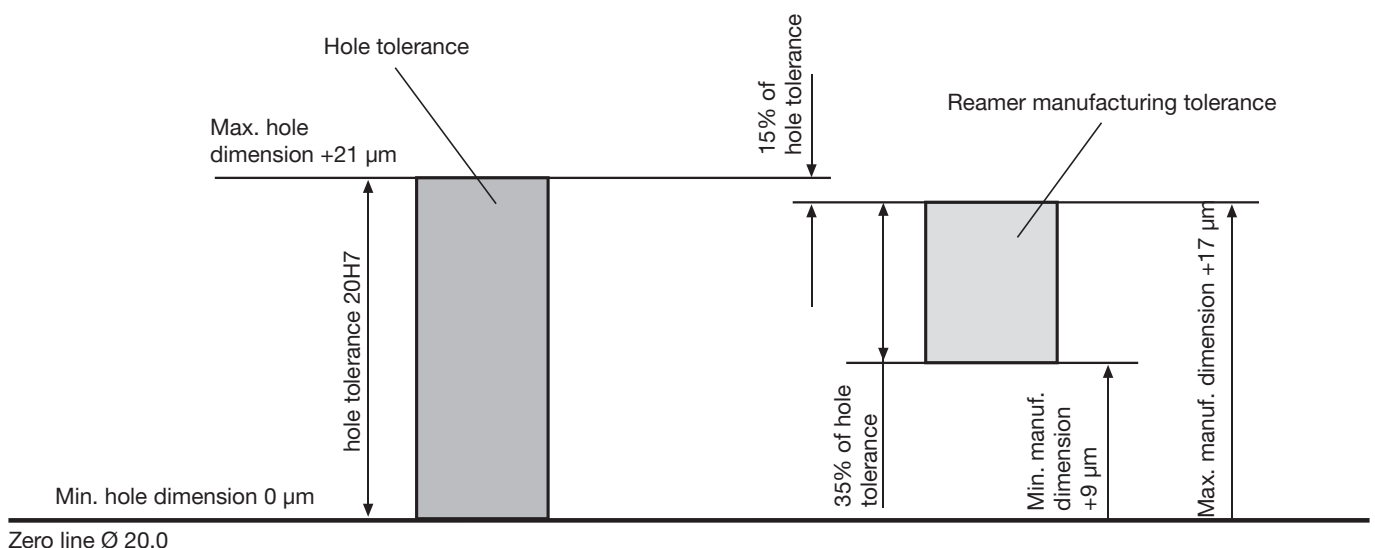
minimum reamer diameter:

$$d_{1\text{min}} = d_{1\text{max}} - 0.35 \text{ IT } 7$$

$$= 20.017 - 0.008 = \underline{20.009 \text{ mm}}$$

Simplified calculation of the permissible maximum and minimum dimensions for reamers

Example: Hole tolerance zone $\varnothing 20 \text{ H7/nom. dimension } d_1$ of reamer 20 mm





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Designation to DIN 1420

Designation

For the designation of reamers the ISO abbreviation for the tolerance zone of the hole is indicated after the nominal diameter. Designation of a reamer with nominal diameter $d_1 = 20$ mm, for hole tolerance H 7:

reamer 20 H 7 DIN ...
 (" ... ": for DIN no. indication
 of appropriate reamer)

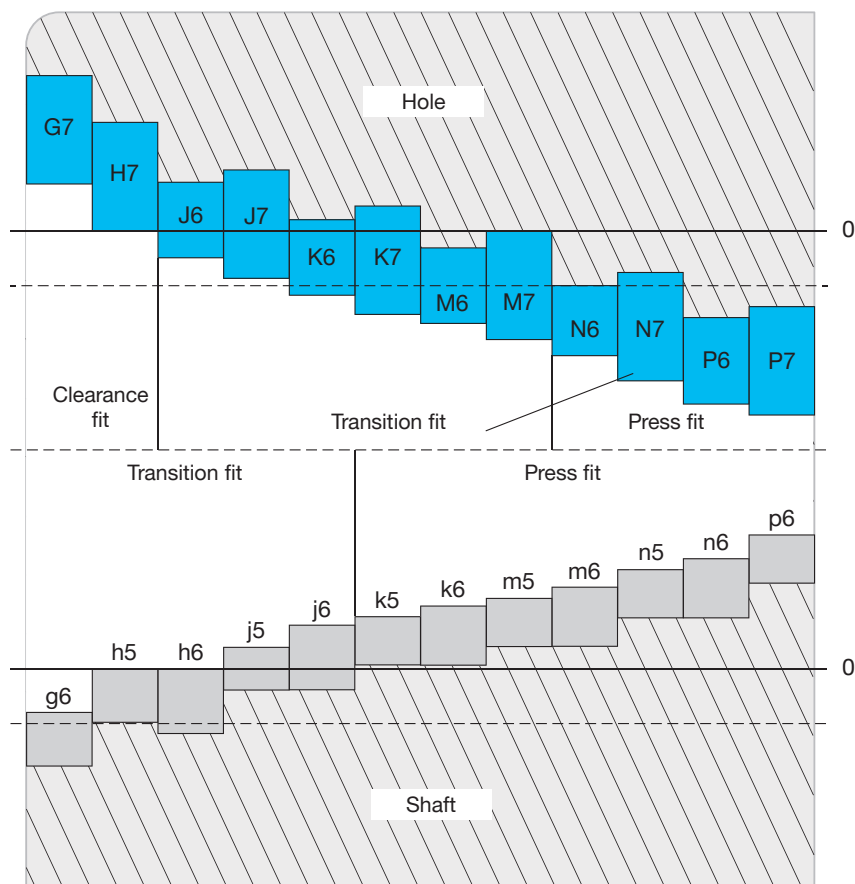
In special cases, reamers are ordered with maximum and minimum dimensions deviating from this standard, the ISO abbreviation for the hole tolerance zone must be replaced

by the upper and lower tolerance limit of the reamer in μm , e.g. for a reamer with a nominal diameter $d_1 = 20$ mm, upper tolerance limit = + (p) 25 μm and lower tolerance limit = + (p) 15 μm :

reamer 20 p 25 p 15 DIN ...

The designation shows a 'p' instead of the plus and an 'm' instead of the minus sign, because »+« and »-« cannot be written on all machines, particularly not on data processing machines.

Tolerance position

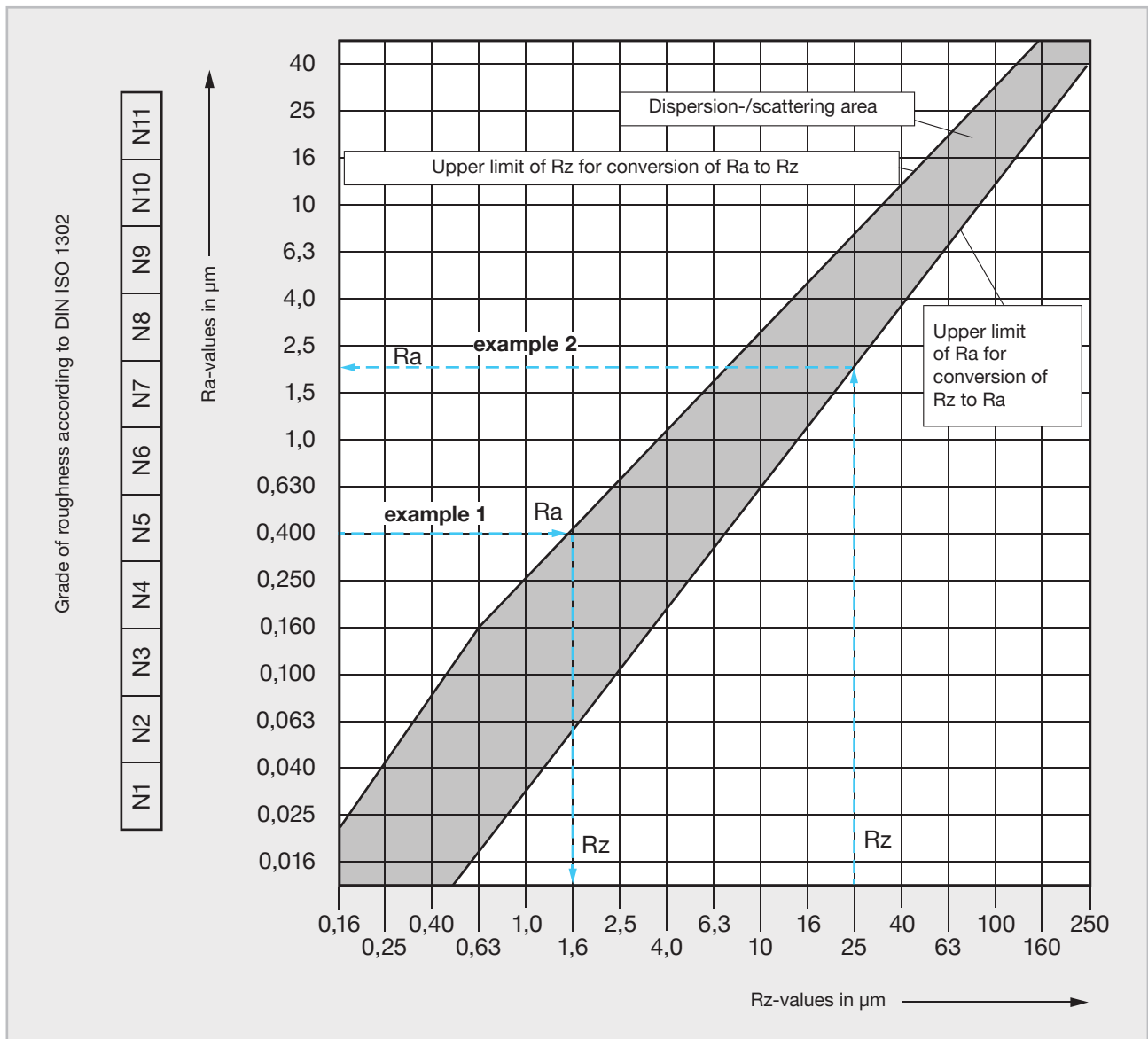




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Surface quality

Conversion ratio to DIN 47



Reading example 1 R_a in R_z

When comparing the average roughness index $R_a = 0.4 \mu\text{m}$ to the average roughness R_z we achieve a value of $R_z = 1.6 \mu\text{m}$.

Reading example 2 R_z in R_a

When comparing the average roughness $R_z = 25 \mu\text{m}$ to the average roughness index R_a we achieve a value of $R_a = 2 \mu\text{m}$.



Achievable surface quality for reaming operations

Roughness classes		N11	N10	N9	N8		N7	N6		N5	N4	N3	N2	N1
Average roughness R_a		25	12.5	6.3	3.2		1.6	0.8		0.4	0.2	0.1	0.05	0.025
Average peak-to-valley height R_z		100	63	40	25	16	10	6.3	4	2.5	1.6	1	0.63	0.25
P	Struct. steel, low-alloyed steels: Case-hard. and heat-treat. steels													
M	Stainless steels Heat-resistant steels													
K	Grey cast iron, ferritic													
	Grey cast iron, pearlitic													
	Spheroidal graphite iron, ferritic													
	Spheroidal graphite iron, pearlitic													
N	Copper-alloy, brass													
	Aluminium wrought alloy													
	Aluminium cast alloy: Si-content < 10 %													
	Aluminium cast alloy: Si-content > 10 %													
S	Special alloy: Inconel													
	Titanium, titanium alloys													
H	Hardened steel < 45 HRC													
	Hardened steel > 45 HRC, ≤ 63 HRC													

achievable

limited achievability



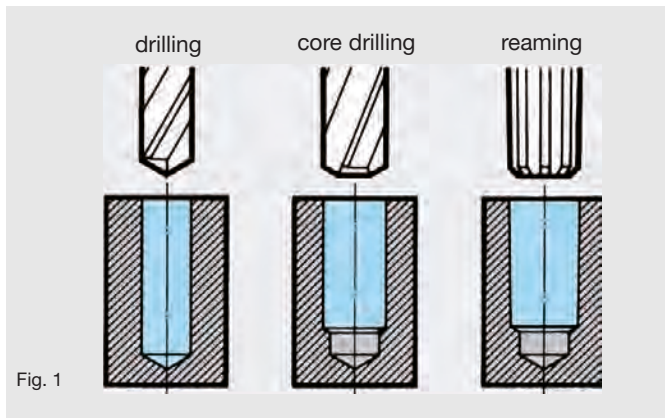
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Hardness comparison

Tens. strength (N/mm ²)	HRC	HB30	HV10	Tens. strength (N/mm ²)	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				



The reamer is the most commonly used tool for the production of holes true to form and tolerance with high surface quality. The latter meets the requirement of 'finishing' or 'fine finishing' i.e. from approximately Ra 0.2 to 6.5 µm according to the scales laid down in DIN 4766. However, finishes to Ra = 0.5 µm can be regarded as satisfactory. Generally, the achievable tolerance ranks at IT 7. In special cases IT 6 or even IT 5 are possible, provided that the reamer is appropriately ground and all other operating conditions meet the high specifications.



In preparation for the reaming process, holes have to be pre-drilled and normally core drilled (fig. 1). Pre-drilled holes produced with gun drills, are due to their highly compressed surface, not particularly suitable for reaming. Moreover, holes produced with gun drills show generally excellent tolerances on fit and surface qualities, so that additional fine finishing is usually not required. Should any further information on our gun drills be needed, please do not hesitate to contact us.

Which reamer for which purpose?

With regard to their application we differentiate between:

- hand reamers
- machine reamers

Hand reamers

Hand reamers are turned in the hole by means of a tap wrench which is mounted on the square. The feeding action is produced manually. Because of the low cutting rates these tools are made of HSS. To ensure a proper guidance in the hole the taper lead length of hand reamers is made considerably longer than that of machine reamers. Hand reamers are available for both cylindrical and tapered holes.

Hand reamers to DIN 859 may be adjusted within the elasticity tolerance range of hardened HSS. This corresponds in practice to 1% of the diameter, i.e. for example 0.1 mm on a reamer with 10 mm diameter. In the fully expanded condition these tools are not very resistant to breakage and must therefore be protected against impact. They should be stored with the tension released.

Expanding reamers can be adjusted over a much larger range, even up to a few millimeters! For accuracy reasons setting must be carried out with a ring gauge.

A basic rule for reaming by hand: turn the tool only in the cutting direction, i.e. never reverse the tool contrary to standard practice in thread cutting. Cutting edges will become immediately blunt if the reamer is turned back.



Fig. 2: taper hand reamer



Fig. 3: adjustable hand reamer



Fig. 4: expanding hand reamer with blades

Machine reamers

Machine reamers are - as the name implies - exclusively designed for use on machines and differ with regard to the type of tool material. Due to the possibility of higher cutting values, these tools are available in HSS-E, solid carbide or carbide-tipped (fig. 5). The tool material should be selected in accordance with the material to be machined.



Fig. 5: carbide-tipped machine reamer

Carbide reamers offer the following advantages:

- Higher cutting speeds and feed rates.
- Most economic machining of materials of over 1200 mm² tensile strength.
- The tool life is much higher than that of HSS-E reamers.



Reamers with special form

Reamers with special form and to special tolerances have recently become more and more common place. Their manufacture requires a great deal of know-how as well as the most modern and sophisticated tooling. We have all the machines and the knowledge to produce even the most complicated tools very economically. Leave the machining problems to us. To meet and overcome them is the daily task of our engineers. They are ready to assist you at all times, to find the best possible solution and, if necessary, to arrange for an obligation-free demonstration of our tools on your own machines.

A further distinctive feature of hand and machine reamers is the geometry of the cutting section, standardised under the following headings:

- straight-fluted reamers
- LH spiral reamers
- reamers with quick spiral (45°) left-hand flutes

Tools with right-hand spiral flutes are only applied in special cases. They produce, as do twist drills, a chip flow up the flutes, which often results in an unsatisfactory surface finish quality.

Reamers with straight flutes are suitable for the machining of blind holes. Here again the absence of chip space at the bottom of the hole means that swarf must be evacuated up the reamer flutes. For all other machining tasks, and particularly for interrupted holes (e.g. holes with keyways, intersecting holes and the like), reamers with left-hand spiral flutes are much more suitable. Chip removal is always in the direction of the feed and for this reason this flute geometry is used almost exclusively for through holes. Their application in blind holes is limited to tasks where reaming to the full depth is not required, so that sufficient space for the chip volume created is available.



Fig. 6: machine roughing reamer



Fig. 7: machine bottoming reamer

The 45° LH quick spiral reamer (fig. 6) has been well tried and tested in long-chipping materials. For absolutely straight and precisely located deep holes we recommend our machine bottoming reamers (fig. 7). Their bevel lead is face-cutting, i.e., they do not cut in conformity with the pre-drilled hole, but correct it truly to size. Machine bottoming reamers should always be applied with bushings.



Fig. 8: stepped carbide-tipped machine reamer

Accuracy in surface quality and form is tremendously improved by dividing the machining process into rough and finishing reaming. Stepped machine reamers (fig. 8) perform these two operations in one pass.

Badly worn taper pin reamers can be salvaged by resharpening of taper and reduction of circular land width.

Storage of reamers

Reamers are finishing tools and therefore very vulnerable. To avoid damage, individual storage and transport in our plastic sleeves is recommended. Tools reward careful treatment by producing excellent results and giving much higher operational life.



Special recommendations for reaming with machine reamers

Blind hole or through hole

Straight-fluted reamers are generally applied in blind holes as they, due to their cutting edge geometry, evacuate the chips from the hole against the direction of the feed. Spiral reamers are preferred for the application in through holes because the spiral evacuates the chips from the hole in direction of the feed.

Interrupted holes

Spiral reamers are preferred for the application in interrupted holes because the cutting edge geometry, in comparison to straight-fluted tools, possesses a lesser tendency of grabbing on the oblique hole. If the oblique hole is $> 0.25 \times D$, spiral reamers can also be applied in blind holes.

Stock removal allowance of the pre-drilled hole

In the event of the stock removal allowance of the pre-drilled hole exceeding the standard stock removal allowance (see table „Recommended stock allowance“ on page 47), a quick spiral reamer or a machine bridge reamer should be applied. It is possible to machine a considerably larger stock removal allowance with these tools, however, they should not be applied in blind holes due to the bevel lead length and the spiral angle.

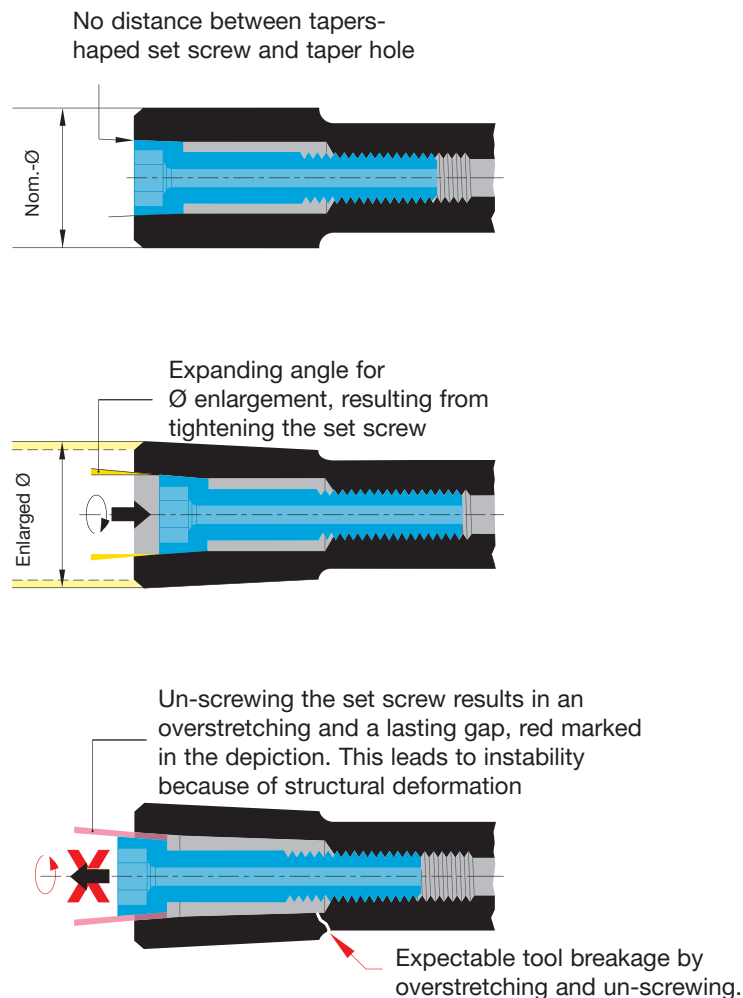
Expanding reamers

Expanding reamers can only be expanded. Subsequently, if the resulting measurement is too large it is not possible to turn the screw back as the pretension of the tool would be lost. In most cases this leads to tool breakage. If the pre-tension has been taken from the tool, it requires re-adjusting and re-grinding.

Positional accuracy of the hole

A machine bottoming reamer often provides the best solution when optimal positional accuracy is required, thanks to its special chamfer lead the 'wander' of the tool is minimal. In addition, machine bottoming reamers are often applied when the pre-drilled hole and the reamer are not on the same axis (slight misalignment).

Schematic depiction of expanding and of risk of tool breakage when re-turning set screw (excessive depiction)



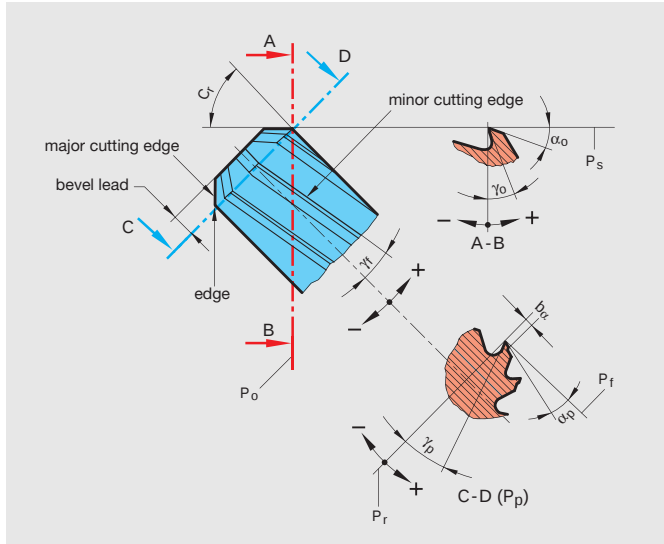


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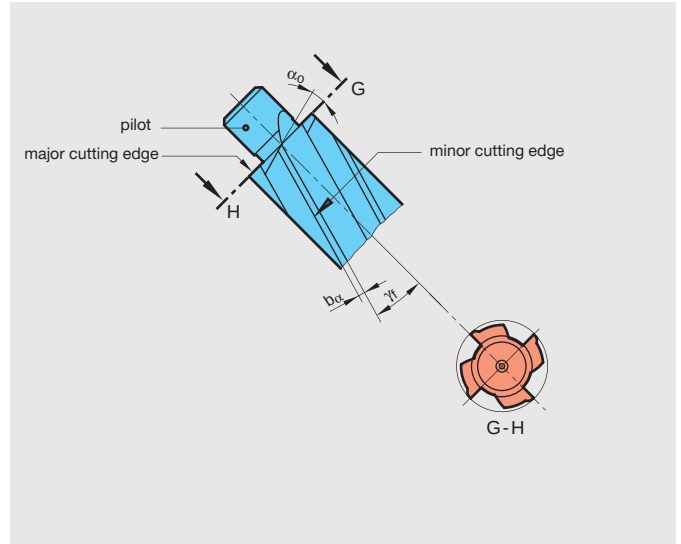
General Information

Definitions, dimensions and angles

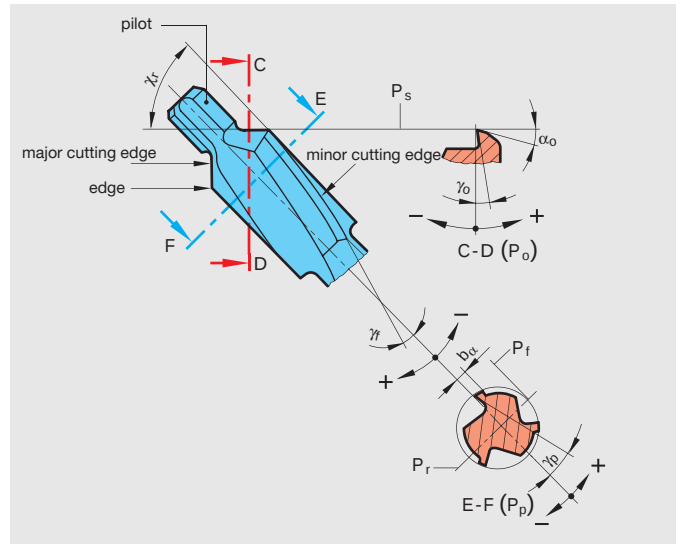
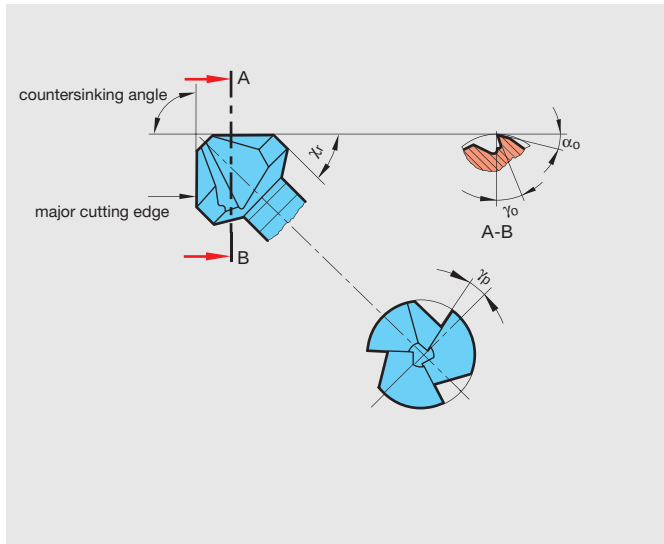
Reamers



Counterbores



Countersinks



α_o = clearance angle
 α_p = clearance angle of minor cutting edge
 b_α = circular land width
 γ_o = orthogonal rake angle
 γ_f = helix angle
 γ_p = back rake angle of minor cutting edge

χ_r = face setting angle
 P_o = tool orthogonal plane
 P_f = assumed operating plane
 P_p = tool back plane
 P_r = tool reference plane
 P_s = tool cutting edge plane

THE HARTNER PROGRAMME



▼ FU 500 / FN 500



▼ GUN DRILLS



▼ INOX DRILLS



▼ MICRO PRECISION DRILLS



▼ THREADING TOOLS



▼ TS-DRILLS



▼ TF 100 MULTI-MILL



▼ SOLID CARBIDE
MILLING CUTTERS



▼ CHAMFERING
MILLING CUTTERS



▼ MULTIPLEX



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