HARTNER

Precision Cutting Tools

REAMERS

THE NEW FULL PROGRAMME OF REAMERS |

TR 300 HP - HIGH-PERFORMANCE REAMERS |

SOLID CARBIDE AND HSS-E MACHINE REAMERS | HAND REAMERS

+ **NEW FULL PROGRAMME**

Pictograms

Tool material	VHM		HM			HSS	HSS-E	
	Solid carbide		Carbide-tipped					
Standard	DIN 206	DIN 208	DIN 212	DIN 212-2	DIN 212-3	~DIN 8050	~DIN 8051	WN
	to DIN							to Hartner standard
Type	TR 300 HP S			TR 300 HP D				
	Blind hole (S)			Through hole (D)				
Cutting direction/ Internal cooling	R	L						
	r-h	l-h		Internal cooling				
Tolerance	H7	+0,005	+0,004 +0,005					
Hole type								
	Through hole			Blind hole				
Form	A	B						
Shank form	HA	Cyl	MK					
			Morse taper					
Helix angle								
	straight-fluted		left-hand helix					
Flute spacing	≠		EU					
	unequal		extremely unequal					

Optimal diameters of pre-drilled holes

Recommended stock allowance, in mm			up to Ø 6	up to Ø 10	up to Ø 16	up to Ø 25	up to Ø 40	above Ø 40
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

Application recommendations for Hartner reamers

Application group	Material examples
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

HARTNER

Precision Cutting Tools

High-performance reamers

Standard	Form	Shank form	Diameter tolerance	Tool material	Surface finish	Hole type	d1	Order no.	Discount group	Standard range page
High-performance reamers										
										
Hartner Standard	TR 300 HP S	HA	H7	Solid carbide	a		3.000 - 20.000	**88400**	166	5
										
Hartner Standard	TR 300 HP S	HA	+0.005	Solid carbide	a		2.970 - 12.030	**88402**	166	5
										
Hartner Standard	TR 300 HP D	HA	H7	Solid carbide	a		3.000 - 20.000	**88401**	166	8
										
Hartner Standard	TR 300 HP D	HA	+0.005	Solid carbide	a		2.970 - 12.030	**88403**	166	8

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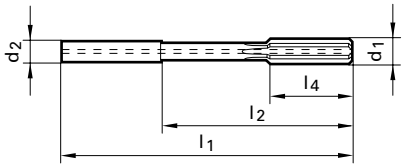
High-performance reamers

TR 300 HP S | WN | HA | EU | R | H7 | +0,005

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.

	Solid carbide	
Order no.	88400	88402
P (N/mm²)	●	●
M	●	●
K	○	○
N		
S	●	●
H (HRC)	63	63
Surface finish	a	a
Discount group	166	166



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability
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	●

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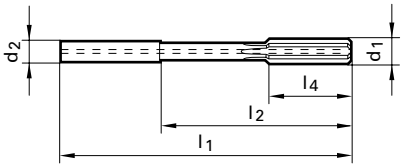
High-performance reamers

TR 300 HP S | WN | 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.

	Solid carbide	
	H7	+0,005
Order no.	**88400**	**88402**
P (N/mm²)	●	●
M	●	●
K	○	○
N		
S	●	●
H (HRC)	63	63
Surface finish	a	a
Discount group	166	166



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability
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	●

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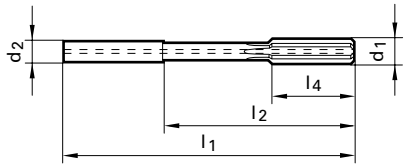
High-performance reamers

TR 300 HP S | WN | 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.

	Solid carbide			
		H7		+0,005
Order no.	**88400**		**88402**	
P (N/mm²)	●		●	
M	●		●	
K	○		○	
N				
S	●		●	
H (HRC)	**63**		**63**	
Surface finish	a		a	
Discount group	**166**		**166**	



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
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	●	

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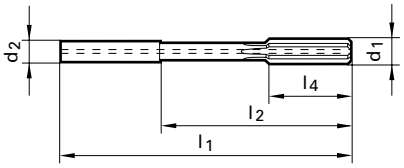
High-performance reamers

TR 300 HP D | WN | HA | EU | R

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.



	Solid carbide			
		H7		+0,005
Order no.	88401		88403	
P (N/mm²)	●		●	
M	●		●	
K	○		○	
N				
S	●		●	
H (HRC)	63		63	
Surface finish	a		a	
Discount group	166		166	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
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		●
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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		●
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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		●

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High-performance reamers

TR 300 HP D | WN | HA | EU | R

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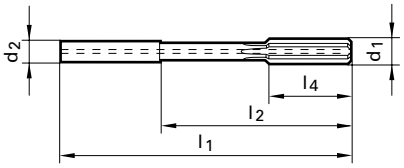
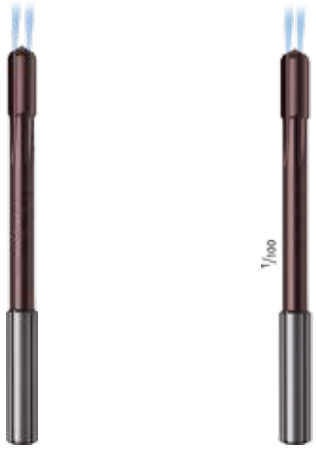
	Solid carbide	
	H7	+0,005
Order no.	88401	88403
P (N/mm²)	●	●
M	●	●
K	○	○
N		
S	●	●
H (HRC)	63	63
Surface finish	a	a
Discount group	166	166





Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability
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	●
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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	●

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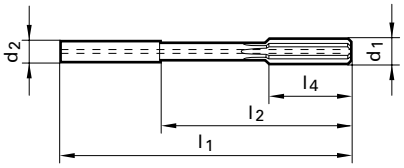
High-performance reamers

TR 300 HP D | WN | HA | EU | R

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.



	Solide carbide			
		H7		+0,005
Order no.	88401		88403	
P (N/mm²)	●		●	
M	●		●	
K	○		○	
N				
S	●		●	
H (HRC)	63		63	
Surface finish	a		a	
Discount group	166		166	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z	Availability
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	●

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Machine reamers

NC machine reamers

Standard	Form	Shank form	Diameter tolerance	Tool material	Surface finish	Hole type	d1	Order no.	Discount group	Standard range page
										
Hartner Standard	B	HA	+0.004 +0.005	Solid carbide	◯		0.980 - 12.050	**88350**	120	12
										
Hartner Standard	B	HA	H7	Solid carbide	◯		3.000 - 12.000	**88351**	120	12

Machine reamers

										
~ DIN 8050	A	cyl.	H7	Carbide	◯		5.000 - 20.000	**88352**	120	17
										
~ DIN 8050	B	cyl.	H7	Carbide	◯		5.000 - 20.000	**88353**	120	17
										
~ DIN 8051	A	MK	H7	Carbide	◯		5.000 - 40.000	**88354**	120	18
										
~ DIN 8051	B	MK	H7	Carbide	◯		6.000 - 32.000	**88355**	120	18

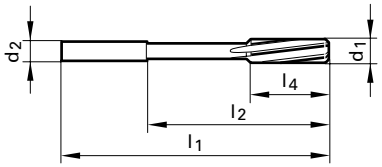
◯ bright

NC machine reamers

B | WN | HA | EU | R

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.



	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

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z	Availability	
0.980	0.980	4.000	50.00	22.00	6.00	3	●	
0.990	0.990	4.000	50.00	22.00	6.00	3	●	
1.000	1.000	4.000	50.00	22.00	6.00	3	●	
1.010	1.010	4.000	50.00	22.00	6.00	3	●	
1.020	1.020	4.000	50.00	22.00	6.00	3	●	
1.030	1.030	4.000	50.00	22.00	9.00	3	●	
1.480	1.480	4.000	50.00	22.00	9.00	3	●	
1.490	1.490	4.000	50.00	22.00	9.00	3	●	
1.500	1.500	4.000	50.00	22.00	9.00	3	●	
1.510	1.510	4.000	50.00	22.00	9.00	3	●	
1.520	1.520	4.000	50.00	22.00	9.00	3	●	
1.530	1.530	4.000	50.00	22.00	9.00	3	●	
1.980	1.980	4.000	50.00	22.00	12.00	4	●	
1.990	1.990	4.000	50.00	22.00	12.00	4	●	
2.000	2.000	4.000	50.00	22.00	12.00	4	●	
2.010	2.010	4.000	50.00	22.00	12.00	4	●	
2.020	2.020	4.000	50.00	22.00	12.00	4	●	
2.030	2.030	4.000	50.00	22.00	12.00	4	●	
2.480	2.480	4.000	60.00	32.00	16.00	4	●	
2.490	2.490	4.000	60.00	32.00	16.00	4	●	
2.500	2.500	4.000	60.00	32.00	16.00	4	●	
2.510	2.510	4.000	60.00	32.00	16.00	4	●	
2.520	2.520	4.000	60.00	32.00	16.00	4	●	
2.530	2.530	4.000	60.00	32.00	16.00	4	●	
2.970	2.970	4.000	64.00	36.00	17.00	6	●	
2.980	2.980	4.000	64.00	36.00	17.00	6	●	
2.990	2.990	4.000	64.00	36.00	17.00	6	●	
3.000	3.000	4.000	64.00	36.00	17.00	6	●	●
3.010	3.010	4.000	64.00	36.00	17.00	6	●	
3.020	3.020	4.000	64.00	36.00	17.00	6	●	

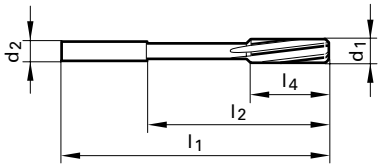
◯ bright

NC machine reamers

B | WN | HA | EU | R

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.



	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	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
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	●	

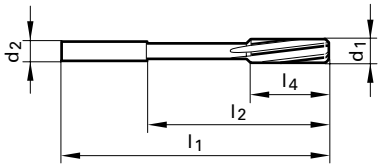
◯ bright

NC machine reamers

B | WN | HA | EU | R

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.



	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	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
5.020	5.020	6.000	93.00	59.00	26.00	6	●	
5.030	5.030	6.000	93.00	59.00	26.00	6	●	
5.100	5.100	6.000	93.00	59.00	26.00	6		●
5.200	5.200	6.000	93.00	59.00	26.00	6		●
5.300	5.300	6.000	93.00	59.00	26.00	6		●
5.500	5.500	6.000	93.00	57.00	26.00	6		●
5.600	5.600	6.000	93.00	57.00	26.00	6		●
5.700	5.700	6.000	93.00	57.00	26.00	6		●
5.800	5.800	6.000	93.00	57.00	26.00	6		●
5.970	5.970	6.000	93.00	57.00	26.00	6	●	
5.980	5.980	6.000	93.00	57.00	26.00	6	●	
5.990	5.990	6.000	93.00	57.00	26.00	6	●	
6.000	6.000	6.000	93.00	57.00	26.00	6	●	●
6.010	6.010	6.000	93.00	57.00	26.00	6	●	
6.020	6.020	6.000	93.00	57.00	26.00	6	●	
6.030	6.030	6.000	93.00	57.00	26.00	6	●	
6.100	6.100	8.000	101.00	63.00	28.00	6		●
6.200	6.200	8.000	101.00	63.00	28.00	6		●
6.300	6.300	8.000	101.00	63.00	28.00	6		●
6.400	6.400	8.000	101.00	63.00	28.00	6		●
6.500	6.500	8.000	101.00	63.00	28.00	6		●
6.600	6.600	8.000	101.00	63.00	28.00	6		●
6.700	6.700	8.000	101.00	63.00	28.00	6		●
6.800	6.800	8.000	109.00	69.00	31.00	6		●
7.000	7.000	8.000	109.00	69.00	31.00	6	●	●
7.100	7.100	8.000	109.00	69.00	31.00	6		●
7.200	7.200	8.000	109.00	69.00	31.00	6		●
7.400	7.400	8.000	109.00	69.00	31.00	6		●
7.500	7.500	8.000	109.00	69.00	31.00	6		●
7.700	7.700	8.000	117.00	75.00	33.00	6		●

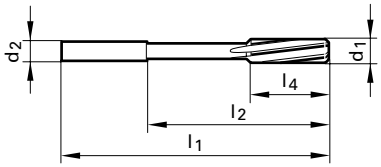
◯ bright

NC machine reamers

B | WN | HA | EU | R

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.



	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	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
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	●	

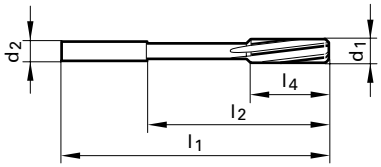
◯ bright

NC machine reamers

B | WN | HA | EU | R

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.



	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

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
10.000	10.000	10.000	133.00	87.00	38.00	6	●	●
10.010	10.010	10.000	133.00	87.00	38.00	6	●	
10.020	10.020	10.000	133.00	87.00	38.00	6	●	
10.030	10.030	10.000	133.00	87.00	38.00	6	●	
10.040	10.040	10.000	133.00	87.00	38.00	6	●	
10.050	10.050	10.000	133.00	87.00	38.00	6	●	
10.100	10.100	10.000	133.00	87.00	38.00	6		●
10.200	10.200	10.000	133.00	87.00	38.00	6		●
10.300	10.300	10.000	133.00	87.00	38.00	6		●
10.400	10.400	10.000	133.00	87.00	38.00	6		●
10.500	10.500	10.000	133.00	87.00	38.00	6		●
10.600	10.600	10.000	133.00	87.00	38.00	6		●
11.000	11.000	10.000	142.00	96.00	41.00	6		●
11.100	11.100	10.000	142.00	96.00	41.00	6		●
11.200	11.200	10.000	142.00	96.00	41.00	6		●
11.300	11.300	10.000	142.00	96.00	41.00	6		●
11.500	11.500	10.000	142.00	96.00	41.00	6		●
11.600	11.600	10.000	142.00	96.00	41.00	6		●
11.800	11.800	10.000	142.00	96.00	41.00	6		●
11.900	11.900	12.000	151.00	105.00	44.00	6		●
11.970	11.970	12.000	151.00	105.00	44.00	6	●	
11.980	11.980	12.000	151.00	105.00	44.00	6	●	
11.990	11.990	12.000	151.00	105.00	44.00	6	●	
12.000	12.000	12.000	151.00	105.00	44.00	6	●	●
12.010	12.010	12.000	151.00	105.00	44.00	6	●	
12.020	12.020	12.000	151.00	105.00	44.00	6	●	
12.030	12.030	12.000	151.00	105.00	44.00	6	●	
12.040	12.040	12.000	151.00	105.00	44.00	6	●	
12.050	12.050	12.000	151.00	105.00	44.00	6	●	

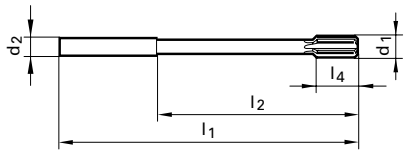
◯ bright

Machine reamers

H7 | ~DIN 8050 | Cyl | EU | R

≤ 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	Availability	
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	●	●

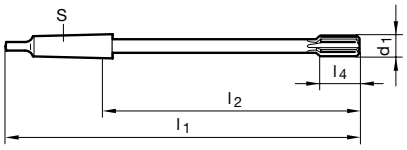
◯ bright

Machine reamers

H7 | ~DIN 8051 | MK | EU | R

≤ 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.	88354	88355
P (N/mm²)	1400	1400
M	○	○
K	●	●
N	●	●
S	○	○
H (HRC)	48	48
Surface finish	◯	◯
Discount group	120	120



Code no.	d1 mm	S	l1 mm	l2 mm	l4 mm	Z	Availability	
5.000	5.000	1	133.00	71.00	12.00	6	●	
6.000	6.000	1	138.00	76.00	12.00	6	●	●
7.000	7.000	1	150.00	88.00	16.00	6	●	
8.000	8.000	1	156.00	94.00	16.00	6	●	●
10.000	10.000	1	168.00	106.00	12.00	6	●	●
11.000	11.000	1	175.00	113.00	12.00	6	●	●
12.000	12.000	1	182.00	120.00	12.00	6	●	●
13.000	13.000	1	182.00	120.00	12.00	6	●	●
14.000	14.000	1	189.00	127.00	16.00	6	●	●
15.000	15.000	2	204.00	129.00	16.00	6	●	●
16.000	16.000	2	210.00	135.00	19.00	6	●	●
17.000	17.000	2	214.00	139.00	19.00	6	●	
18.000	18.000	2	219.00	144.00	19.00	6	●	●
20.000	20.000	2	228.00	153.00	19.00	6	●	●
21.000	21.000	2	232.00	157.00	22.00	6	●	
22.000	22.000	2	237.00	162.00	22.00	6	●	●
23.000	23.000	2	241.00	166.00	22.00	6	●	
24.000	24.000	3	268.00	174.00	22.00	8	●	●
25.000	25.000	3	268.00	174.00	22.00	8	●	●
26.000	26.000	3	273.00	179.00	22.00	8	●	●
28.000	28.000	3	277.00	183.00	25.00	8	●	
30.000	30.000	3	281.00	187.00	25.00	8	●	●
32.000	32.000	4	317.00	199.50	25.00	8	●	●
40.000	40.000	4	329.00	211.50	25.00	8	●	

◯ bright

High speed steel reamers

NC machine reamers

Standard	Form	Shank form	Diameter tolerance	Tool material	Surface finish	Hole type	d1	Order no.	Discount group	Standard range page
										
DIN 212-3	B	HA	+0,004 +0,005	HSS-E	◯		1.000 - 12.020	**88300**	105	20
										
DIN 212-3	B	HA	H7	HSS-E	◯		1.500 - 20.000	**88301**	105	20

+0,005

Machine reamers

Standard	Form	Shank form	Diameter tolerance	Tool material	Surface finish	Hole type	d1	Order no.	Discount group	Standard range page
										
DIN 212	A	cyl.	H7	HSS-E	◯		1.000 - 5.500	**88302**	105	25
										
DIN 212	B	cyl.	H7	HSS-E	◯		1.000 - 3.700	**88304**	105	25
										
DIN 212-2	A	cyl.	H7	HSS-E	◯		4.000 - 20.000	**88305**	105	26
										
DIN 212-2	B	cyl.	H7	HSS-E	◯		3.800 - 20.000	**88306**	105	26
										
DIN 212	B	cyl.	+0,004 +0,005	HSS-E	◯		0.950 - 12.050	**88311**	105	28
										
DIN 208	A	MK	H7	HSS-E	◯		3.000 - 40.000	**88307**	105	30
										
DIN 208	B	MK	H7	HSS-E	◯		3.000 - 50.000	**88308**	105	30

+0,005

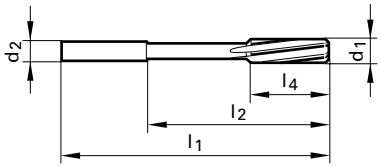
◯ bright

NC machine reamers

B | DIN 212-3 | HA | ≠ | R

≤ 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.



	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	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
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	●	

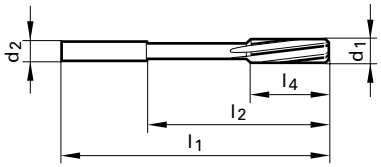
◯ bright

NC machine reamers

B | DIN 212-3 | HA | ≠ | R

≤ 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.



	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	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
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	●	●

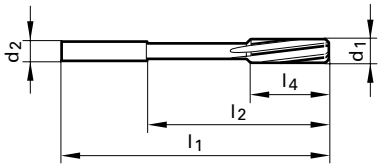
◯ bright

NC machine reamers

B | DIN 212-3 | HA | ≠ | R

≤ 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.



	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	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
5.010	5.010	5.000	86.00	58.00	23.00	6	●	
5.020	5.020	5.000	86.00	58.00	23.00	6	●	
5.030	5.030	5.000	86.00	58.00	23.00	6	●	
5.100	5.100	5.000	86.00	58.00	23.00	6		●
5.200	5.200	5.000	86.00	58.00	23.00	6		●
5.300	5.300	5.000	86.00	58.00	23.00	6		●
5.400	5.400	6.000	93.00	57.00	26.00	6		●
5.500	5.500	6.000	93.00	57.00	26.00	6		●
5.600	5.600	6.000	93.00	57.00	26.00	6		●
5.700	5.700	6.000	93.00	57.00	26.00	6		●
5.800	5.800	6.000	93.00	57.00	26.00	6		●
5.900	5.900	6.000	93.00	57.00	26.00	6		●
5.980	5.980	6.000	93.00	57.00	26.00	6	●	
5.990	5.990	6.000	93.00	57.00	26.00	6	●	
6.000	6.000	6.000	93.00	57.00	26.00	6	●	●
6.010	6.010	6.000	101.00	65.00	28.00	6	●	
6.020	6.020	6.000	101.00	65.00	28.00	6	●	
6.030	6.030	6.000	101.00	65.00	28.00	6	●	
6.100	6.100	6.000	101.00	65.00	28.00	6		●
6.200	6.200	6.000	101.00	65.00	28.00	6		●
6.300	6.300	6.000	101.00	65.00	28.00	6		●
6.400	6.400	6.000	101.00	65.00	28.00	6		●
6.500	6.500	6.000	101.00	65.00	28.00	6		●
6.600	6.600	6.000	101.00	65.00	28.00	6		●
6.800	6.800	8.000	109.00	73.00	31.00	6		●
6.900	6.900	8.000	109.00	73.00	31.00	6		●
7.000	7.000	8.000	109.00	73.00	31.00	6		●
7.100	7.100	8.000	109.00	73.00	31.00	6		●
7.300	7.300	8.000	109.00	73.00	31.00	6		●
7.400	7.400	8.000	109.00	73.00	31.00	6		●

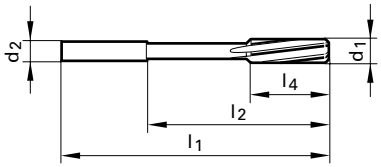
◯ bright

NC machine reamers

B | DIN 212-3 | HA | R

≤ 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.



	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	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
7.500	7.500	8.000	109.00	73.00	31.00	6		●
7.600	7.600	8.000	117.00	81.00	33.00	6		●
7.700	7.700	8.000	117.00	81.00	33.00	6		●
7.800	7.800	8.000	117.00	81.00	33.00	6		●
7.900	7.900	8.000	117.00	81.00	33.00	6		●
7.970	7.970	8.000	117.00	81.00	33.00	6	●	
7.980	7.980	8.000	117.00	81.00	33.00	6	●	
7.990	7.990	8.000	117.00	81.00	33.00	6	●	
8.000	8.000	8.000	117.00	81.00	33.00	6	●	●
8.010	8.010	8.000	117.00	81.00	33.00	6	●	
8.020	8.020	8.000	117.00	81.00	33.00	6	●	
8.030	8.030	8.000	117.00	81.00	33.00	6	●	
8.100	8.100	8.000	117.00	81.00	33.00	6		●
8.200	8.200	8.000	117.00	81.00	33.00	6		●
8.300	8.300	8.000	117.00	81.00	33.00	6		●
8.500	8.500	8.000	117.00	81.00	33.00	6		●
8.600	8.600	10.000	125.00	85.00	36.00	6		●
8.700	8.700	10.000	125.00	85.00	36.00	6		●
8.800	8.800	10.000	125.00	85.00	36.00	6		●
9.000	9.000	10.000	125.00	85.00	36.00	6	●	●
9.010	9.010	10.000	125.00	85.00	36.00	6	●	
9.100	9.100	10.000	125.00	85.00	36.00	6		●
9.200	9.200	10.000	125.00	85.00	36.00	6		●
9.300	9.300	10.000	125.00	85.00	36.00	6		●
9.500	9.500	10.000	125.00	85.00	36.00	6		●
9.700	9.700	10.000	133.00	93.00	38.00	6		●
9.970	9.970	10.000	133.00	93.00	38.00	6	●	
9.980	9.980	10.000	133.00	93.00	38.00	6	●	
9.990	9.990	10.000	133.00	93.00	38.00	6	●	
10.000	10.000	10.000	133.00	93.00	38.00	6	●	●

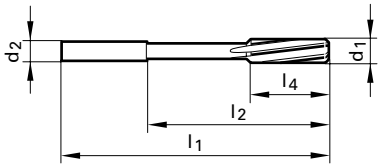
◯ bright

NC machine reamers

B | DIN 212-3 | HA | ≠ | R

≤ 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.



	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	

Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability
10.010	10.010	10.000	133.00	93.00	38.00	6	●
10.020	10.020	10.000	133.00	93.00	38.00	6	●
10.030	10.030	10.000	133.00	93.00	38.00	6	●
11.000	11.000	10.000	142.00	102.00	41.00	6	●
11.980	11.980	10.000	151.00	111.00	44.00	6	●
11.990	11.990	10.000	151.00	111.00	44.00	6	●
12.000	12.000	10.000	151.00	111.00	44.00	6	● ●
12.010	12.010	10.000	151.00	111.00	44.00	6	●
12.020	12.020	10.000	151.00	111.00	44.00	6	●
13.000	13.000	10.000	151.00	111.00	44.00	6	●
14.000	14.000	14.000	160.00	115.00	47.00	8	●
15.000	15.000	14.000	162.00	117.00	50.00	8	●
16.000	16.000	14.000	170.00	125.00	52.00	8	●
17.000	17.000	14.000	175.00	130.00	54.00	8	●
18.000	18.000	14.000	182.00	137.00	56.00	8	●
19.000	19.000	16.000	189.00	141.00	58.00	8	●
20.000	20.000	16.000	195.00	147.00	60.00	8	●

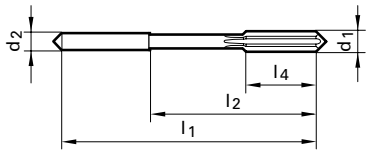
◯ bright

Machine reamers

H7 | DIN 212 | Cyl | ≠ | R

≤ Ø 3.75 mm with external centres on both ends
> Ø 3.75 mm with internal centres on both ends

	HSS-E	
	A	B
Order no.	**88302**	**88304**
P (N/mm²)	**1000**	**1000**
M	○	○
K	●	●
N	●	●
S	○	○
H (HRC)		
Surface finish	◯	◯
Discount group	**105**	**105**



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability	
1.000	1.000	1.000	34.00	15.00	5.50	3	●	●
1.200	1.200	1.200	38.00	16.50	7.50	3	●	●
1.300	1.300	1.300	38.00	16.50	7.50	3		●
1.400	1.400	1.400	40.00	18.00	8.00	3		●
1.500	1.500	1.500	40.00	18.00	8.00	3	●	●
1.600	1.600	1.600	43.00	20.00	9.00	3	●	●
1.800	1.800	1.800	46.00	22.00	10.00	4	●	●
1.900	1.900	1.900	46.00	22.00	10.00	4		●
2.000	2.000	2.000	49.00	24.00	11.00	4	●	●
2.200	2.200	2.200	53.00	25.00	12.00	4	●	●
2.300	2.300	2.300	53.00	25.00	12.00	4		●
2.500	2.500	2.500	57.00	29.00	14.00	4	●	●
2.700	2.700	2.800	61.00	33.00	15.00	6		●
2.800	2.800	2.800	61.00	33.00	15.00	6		●
2.900	2.900	3.000	61.00	33.00	15.00	6		●
3.000	3.000	3.000	61.00	33.00	15.00	6	●	●
3.200	3.200	3.200	65.00	37.00	16.00	6	●	●
3.500	3.500	3.500	70.00	42.00	18.00	6	●	●
3.700	3.700	3.500	70.00	42.00	18.00	6		●
5.500	5.500	5.600	93.00	57.00	26.00	6	●	

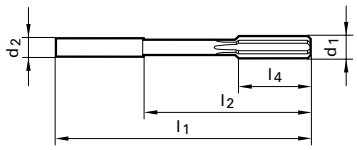
◯ bright

Machine reamers

H7 | DIN 212-2 | Cyl | ≠ | R

≤ Ø 3.75 mm with external centres on both ends
> Ø 3.75 mm with internal centres on both ends

	HSS-E	
	A	B
Order no.	88305	88306
P (N/mm²)	1000	1000
M	○	○
K	●	●
N	●	●
S	○	○
H (HRC)		
Surface finish	◯	◯
Discount group	105	105



Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	z	Availability
3.800	3.800	4.000	75.00	47.00	19.00	6	●
4.000	4.000	4.000	75.00	47.00	19.00	6	● ●
4.400	4.400	4.500	80.00	52.00	21.00	6	●
4.500	4.500	4.500	80.00	52.00	21.00	6	● ●
4.700	4.700	4.500	80.00	52.00	21.00	6	●
4.900	4.900	5.000	86.00	58.00	23.00	6	●
5.000	5.000	5.000	86.00	58.00	23.00	6	● ●
5.100	5.100	5.000	86.00	58.00	23.00	6	●
5.500	5.500	5.600	93.00	57.00	26.00	6	● ●
6.000	6.000	5.600	93.00	57.00	26.00	6	● ●
6.100	6.100	6.300	101.00	65.00	28.00	6	●
6.200	6.200	6.300	101.00	65.00	28.00	6	●
6.500	6.500	6.300	101.00	65.00	28.00	6	●
6.900	6.900	7.100	109.00	73.00	31.00	6	●
7.000	7.000	7.100	109.00	73.00	31.00	6	● ●
7.100	7.100	7.100	109.00	73.00	31.00	6	●
7.200	7.200	7.100	109.00	73.00	31.00	6	●
7.400	7.400	7.100	109.00	73.00	31.00	6	●
7.500	7.500	7.100	109.00	73.00	31.00	6	●
8.000	8.000	8.000	117.00	81.00	33.00	6	● ●
8.100	8.100	8.000	117.00	81.00	33.00	6	●
8.300	8.300	8.000	117.00	81.00	33.00	6	●
8.500	8.500	8.000	117.00	81.00	33.00	6	● ●
9.000	9.000	9.000	125.00	85.00	36.00	6	● ●
9.200	9.200	9.000	125.00	85.00	36.00	6	●
9.400	9.400	9.000	125.00	85.00	36.00	6	●
9.500	9.500	9.000	125.00	85.00	36.00	6	● ●
9.800	9.800	10.000	133.00	93.00	38.00	6	●
9.900	9.900	10.000	133.00	93.00	38.00	6	●
10.000	10.000	10.000	133.00	93.00	38.00	6	● ●

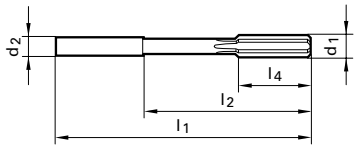
◯ bright

Machine reamers

H7 | DIN 212-2 | Cyl | ≠ | R

≤ Ø 3.75 mm with external centres on both ends
> Ø 3.75 mm with internal centres on both ends

	HSS-E	
	A	B
Order no.	**88305**	**88306**
P (N/mm²)	**1000**	**1000**
M	○	○
K	●	●
N	●	●
S	○	○
H (HRC)		
Surface finish	◯	◯
Discount group	**105**	**105**



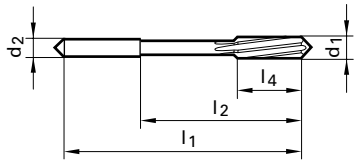
Code no.	d1 mm	d2 h6 mm	l1 mm	l2 mm	l4 mm	Z	Availability	
10.100	10.100	10.000	133.00	93.00	38.00	6		●
10.500	10.500	10.000	133.00	93.00	38.00	6	●	
10.700	10.700	10.000	142.00	102.00	41.00	6		●
11.000	11.000	10.000	142.00	102.00	41.00	6	●	●
11.500	11.500	10.000	142.00	102.00	41.00	6	●	●
12.000	12.000	10.000	151.00	111.00	44.00	6	●	●
13.000	13.000	10.000	151.00	111.00	44.00	6	●	●
14.000	14.000	12.500	160.00	115.00	47.00	8	●	●
15.000	15.000	12.500	162.00	117.00	50.00	8	●	●
16.000	16.000	12.500	170.00	125.00	52.00	8	●	●
17.000	17.000	14.000	175.00	130.00	54.00	8	●	●
18.000	18.000	14.000	182.00	137.00	56.00	8	●	●
19.000	19.000	16.000	189.00	141.00	58.00	8	●	●
20.000	20.000	16.000	195.00	147.00	60.00	8	●	●

◯ bright

B | DIN 212 | Cyl | ≠ | R

≤ Ø 3.75 mm with external centres on both ends
> Ø 3.75 mm with internal centres on both ends
Ø in increments of 0.01 mm
Tolerance:
Ø 0.95 - 5.50 mm: 0.000/+0.004
Ø 5.51 - 12.05 mm: 0.000/+0.005

	HSS-E	
		+0,004 +0,005
Order no.	88311	
P (N/mm²)	1000	
M	○	
K	●	
N	●	
S	○	
H (HRC)		
	◯ 105	



from d1 mm	to d1 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	Z	Availability
0.950	1.060	1.000	34.000	15.000	5.500	3	●
1.070	1.180	1.100	36.000	15.500	6.500	3	●
1.190	1.320	1.200	38.000	16.500	7.500	3	●
1.330	1.390	1.400	40.000	18.000	8.000	3	●
1.400	1.410	1.400	40.000	18.000	8.000	3	●
1.420	1.490	1.500	40.000	18.000	8.000	3	●
1.500	1.500	1.500	40.000	18.000	8.000	3	●
1.510	1.700	1.600	43.000	20.000	9.000	3	●
1.710	1.900	1.800	46.000	22.000	10.000	4	●
1.910	1.990	2.000	49.000	24.000	11.000	4	●
2.000	2.090	2.000	49.000	24.000	11.000	4	●
2.100	2.120	2.000	49.000	24.000	11.000	4	●
2.130	2.360	2.200	53.000	25.000	12.000	4	●
2.370	2.490	2.500	57.000	29.000	14.000	4	●
2.500	2.590	2.500	57.000	29.000	14.000	4	●
2.600	2.650	2.500	57.000	29.000	14.000	4	●
2.660	2.800	2.800	61.000	33.000	15.000	6	●
2.810	2.990	3.000	61.000	33.000	15.000	6	●
3.000	3.000	3.000	61.000	33.000	15.000	6	●
3.010	3.090	3.200	65.000	37.000	16.000	6	●
3.100	3.350	3.200	65.000	37.000	16.000	6	●
3.360	3.490	3.500	70.000	42.000	18.000	6	●
3.500	3.590	3.500	70.000	42.000	18.000	6	●
3.600	3.740	3.500	70.000	42.000	18.000	6	●
3.760	3.810	4.000	75.000	47.000	19.000	6	●
3.820	4.200	4.000	75.000	47.000	19.000	6	●
4.210	4.250	4.000	75.000	47.000	19.000	6	●
4.260	4.750	4.500	80.000	52.000	21.000	6	●
4.760	5.200	5.000	86.000	58.000	23.000	6	●
5.210	5.300	5.000	86.000	58.000	23.000	6	●

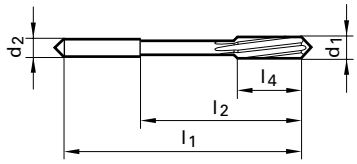
◯ bright

Machine reamers

B | DIN 212 | Cyl | ≠ | R

≤ Ø 3.75 mm with external centres on both ends
> Ø 3.75 mm with internal centres on both ends
Ø in increments of 0.01 mm
Tolerance:
Ø 0.95 - 5.50 mm: 0.000/+0.004
Ø 5.51 - 12.05 mm: 0.000/+0.005

	HSS-E	
		+0,004 +0,005
Order no.	88311	
P (N/mm²)	1000	
M	○	
K	●	
N	●	
S	○	
H (HRC)		
	◯	
	105	



from d1 mm	to d1 mm	d2 h9 mm	l1 mm	l2 mm	l4 mm	Z	Availability
5.310	6.000	5.600	93.000	57.000	26.000	6	●
6.010	6.110	6.300	101.000	65.000	28.000	6	●
6.120	6.700	6.300	101.000	65.000	28.000	6	●
6.710	7.500	7.100	109.000	73.000	31.000	6	●
7.510	8.200	8.000	117.000	81.000	33.000	6	●
8.210	8.500	8.000	117.000	81.000	33.000	6	●
8.510	9.500	9.000	125.000	85.000	36.000	6	●
9.990	10.000	10.000	133.000	93.000	38.000	6	●
10.210	10.600	10.000	133.000	93.000	38.000	6	●
10.610	11.200	10.000	142.000	102.000	41.000	6	●
11.210	11.800	10.000	142.000	102.000	41.000	6	●
11.810	12.000	10.000	151.000	111.000	44.000	6	●
12.010	12.050	10.000	151.000	74.500	44.000	6	●

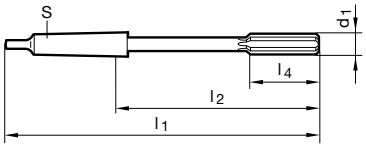
◯ bright

Machine reamers

H7 | DIN 208 | MK | ≠ | R

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



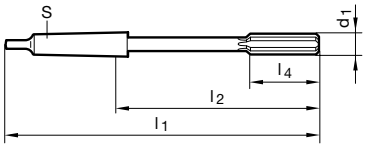
Code no.	d1 mm	S	l1 mm	l2 mm	l4 mm	Z	Availability	
3.000	3.000	1	115.00	53.00	15.00	6	●	●
4.000	4.000	1	125.00	63.00	19.00	6	●	●
5.000	5.000	1	133.00	71.00	23.00	6	●	●
5.100	5.100	1	133.00	71.00	23.00	6	●	
5.500	5.500	1	138.00	76.00	26.00	6	●	
6.000	6.000	1	138.00	76.00	26.00	6	●	●
6.100	6.100	1	144.00	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	●	●

◯ bright

Machine reamers

H7 | DIN 208 | MK | ≠ | R

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

Code no.	d1 mm	S	l1 mm	l2 mm	l4 mm	Z	Availability	
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

Hand reamers

DIN 206	A	cyl.	H7	HSS	◯		2.000 - 49.000	**88309**	105	33

DIN 206	B	cyl.	H7	HSS	◯		1.400 - 43.000	**88310**	105	33

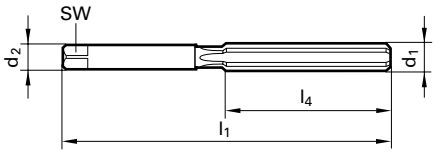
◯ bright

Hand reamers

H7 | DIN 206 | ~HA | R

With square to DIN 10
≤ Ø 3.75 mm with ext. centres on both ends
> Ø 3.75 mm with int. centres on both ends
≤ 1.75 mm to hartner standard

	HSS	
	A	B
Order no.	88309	88310
P (N/mm²)	900	900
M		
K	●	●
N	●	●
S		
H (HRC)		
Surface finish	◯	◯
Discount group	105	105



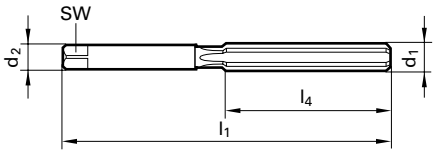
Code no.	d1 mm	d2 mm	l1 mm	l4 mm	SW	Z	Availability	
1.400	1.400	1.400	41.00	20.00	1.12	3		●
1.500	1.500	1.500	41.00	20.00	1.12	3		●
2.000	2.000	2.000	50.00	25.00	1.60	4	●	●
2.200	2.200	2.200	54.00	27.00	1.80	4	●	●
2.500	2.500	2.500	58.00	29.00	2.10	4	●	●
3.000	3.000	3.000	62.00	31.00	2.40	6	●	●
3.200	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

Hand reamers

H7 | DIN 206 | ~HA | R

with square to DIN 10
≤ Ø 3.75 mm with ext. centres on both ends
> Ø 3.75 mm with int. centres on both ends
≤ 1.75 mm to hartner standard



	HSS	
	A	B
Order no.	88309	88310
P (N/mm²)	900	900
M		
K	●	●
N	●	●
S		
H (HRC)		
Surface finish	◯	◯
Discount group	105	105

Code no.	d1 mm	d2 mm	l1 mm	l4 mm	SW	Z	Availability	
16.000	16.000	16.000	175.00	87.00	12.00	8	●	●
16.500	16.500	16.500	175.00	87.00	13.00	8		●
17.000	17.000	17.000	175.00	87.00	13.00	8	●	●
18.000	18.000	18.000	188.00	93.00	14.50	8		●
19.000	19.000	19.000	188.00	93.00	14.50	8		●
20.000	20.000	20.000	201.00	100.00	16.00	8	●	●
21.000	21.000	21.000	201.00	100.00	16.00	8	●	●
22.000	22.000	22.000	215.00	107.00	18.00	8	●	●
24.000	24.000	24.000	231.00	115.00	18.00	8		●
25.000	25.000	25.000	231.00	115.00	20.00	8	●	●
28.000	28.000	28.000	247.00	124.00	22.00	10	●	●
30.000	30.000	30.000	247.00	124.00	24.00	10		●
31.000	31.000	31.000	265.00	133.00	24.00	10		●
32.000	32.000	32.000	265.00	133.00	24.00	10		●
33.000	33.000	33.000	265.00	133.00	26.00	10		●
34.000	34.000	34.000	284.00	142.00	26.00	10		●
35.000	35.000	35.000	284.00	142.00	29.00	10		●
38.000	38.000	38.000	305.00	152.00	29.00	10		●
38.100	38.100	38.100	305.00	152.00	29.00	10	●	
40.000	40.000	40.000	305.00	152.00	32.00	10		●
43.000	43.000	43.000	326.00	163.00	35.00	12		●
44.000	44.000	44.000	326.00	163.00	32.00	12	●	
46.000	46.000	46.000	326.00	163.00	35.00	12	●	
49.000	49.000	49.000	347.00	174.00	39.00	12	●	

◯ bright

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

Order no. ®
Standard/DIN
Tool material
Surface finish
Form
Cooling

Tools with bold feed column no. are preferred choice.

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

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/mm2)	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	**0.7050** EN-GJS-500-7 (GGG50), **0.8035** EN-GJMW-350-4 (GTW35)		≤240 HB	◍
malleable cast iron	**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 (a) AlTiN nano

88400/88401	88402/88403
G.S.	G.S.
Solid carbide	
a	a
TR 300 HP S	TR 300 HP D
axial	axial

88350	88350
G.S.	G.S.
Solid carbide	
○	○
B	B

88352	88353	88354	88355
~ 8050	~ 8050	~ 8051	~ 8051
Solid carbide			
○	○	○	○
A	B	A	B

v_c m/min	Feed column no.	
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
120-250	75-76	75-76
60-120	75-76	75-76
30-60	73-74	73-74
60-120	74-75	74-75
40-80	74-75	74-75
60-120	74-75	74-75
40-60	73-74	73-74
30-60	73-74	73-74
40-60	74-75	74-75
60-140	75-76	75-76
60-140	75-76	75-76
120-250	74-75	74-75
60-120	74-75	74-75
30-50	74-75	74-75
40-60	74	74
40-60	74	74
80-160	75-76	75-76
100-250	75-76	75-76
100-250	75-76	75-76
100-250	75-76	75-76
80-200	75-76	75-76
80-200	75-76	75-76
80	75-76	75-76
80	75-76	75-76
80	71	71
80	71	71

v_c m/min	Feed column no.	
18	72	72
16	72	72
18	72	72
16	72	72
18	71	71
16	72	72
14	71	71
14	71	71
12	71	71
18	71	71
14	71	71
12	71	71
14	71	71
12	71	71
12	71	71
10	71	71
10	71	71
8	71	71
6	71	71
6	71	71
6	71	71
6	71	71
20	71	71
18	71	71
20	71	71
18	71	71
10	71	71
10	71	71
30	73	73
30	73	73
40	72	72
30	72	72
25	72	72
25	72	72
35	72	72
30	72	72
35	72	72
30	72	72
30	72	72
25	72	72
20	73	73
20	73	73
16	71	71
16	71	71
12	71	71
12	71	71

v_c m/min	Feed column no.			
18	72	72	72	72
16	72	72	72	72
18	72	72	72	72
16	72	72	72	72
18	71	71	71	71
16	72	72	72	72
14	71	71	71	71
14	71	71	71	71
12	71	71	71	71
18	71	71	71	71
14	71	71	71	71
12	71	71	71	71
14	71	71	71	71
12	71	71	71	71
12	71	71	71	71
10	71	71	71	71
10	71	71	71	71
8	71	71	71	71
6	71	71	71	71
6	71	71	71	71
6	71	71	71	71
20	71	71	71	71
18	71	71	71	71
20	71	71	71	71
18	71	71	71	71
10	71	71	71	71
10	71	71	71	71
30	73	73	73	73
30	73	73	73	73
40	72	72	72	72
30	72	72	72	72
25	72	72	72	72
25	72	72	72	72
35	72	72	72	72
30	72	72	72	72
35	72	72	72	72
30	72	72	72	72
30	72	72	72	72
25	72	72	72	72
20	73	73	73	73
20	73	73	73	73
16	71	71	71	71
16	71	71	71	71

Application recommendation for HSS-E reamers

Order no.
Standard/DIN
Tool material
Surface finish
Form

Tools with bold feed column no. are preferred choice.

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

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/mm2)	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	**0.7050** EN-GJS-500-7 (GGG50), **0.8035** EN-GJMW-350-4 (GTW35)		≤240 HB	◍
malleable cast iron	**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		○

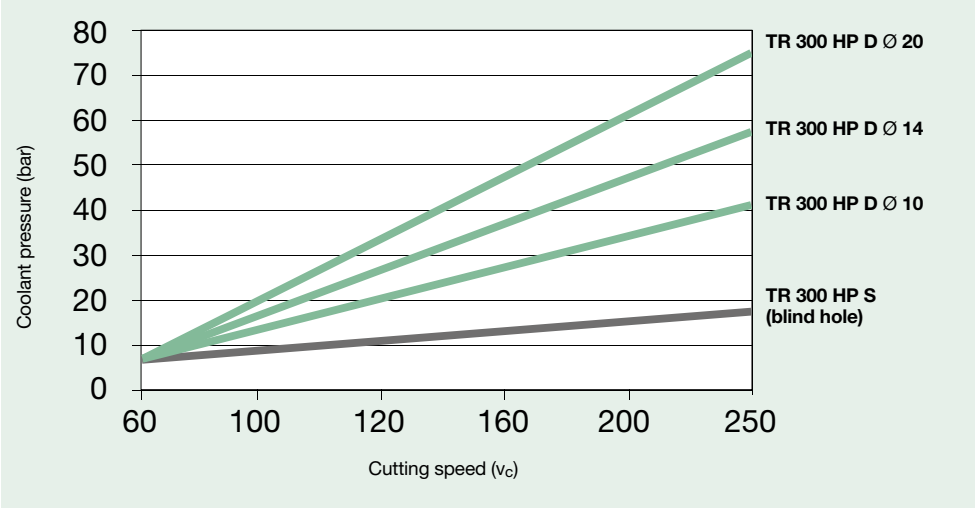
○ bright (a) AlTiN nano

88300	88301	88302	88304	88305	88306	88307	88308	88311
201-2	212-3	212	212	212-2	212-2	208	208	212
HSS-E		HSS-E						HSS-E
○	○	○	○	○	○	○	○	○
B	B	A	B	A	B	A	B	B

v_c m/min	Feed column no.		Feed column no.						v_c m/min	Feed col. no.
16	**72**	**72**	16	**72**	**72**	**72**	**72**	**72**	16	**72**
12	**72**	**72**	12	**72**	**72**	**72**	**72**	**72**	12	**72**
12	**72**	**72**	12	**72**	**72**	**72**	**72**	**72**	12	**72**
10	**71**	**71**	10	**71**	**71**	**71**	**71**	**71**	10	**71**
14	**72**	**72**	14	**72**	**72**	**72**	**72**	**72**	14	**72**
12	**71**	**71**	12	**71**	**71**	**71**	**71**	**71**	12	**71**
10	**71**	**71**	10	**71**	**71**	**71**	**71**	**71**	10	**71**
10	**71**	**71**	10	**71**	**71**	**71**	**71**	**71**	10	**71**
8	71	71	8	71	71	71	71	71	8	71
16	**72**	**72**	16	**72**	**72**	**72**	**72**	**72**	16	**72**
10	**71**	**71**	10	**71**	**71**	**71**	**71**	**71**	10	**71**
8	71	71	8	71	71	71	71	71	8	71
10	**71**	**71**	10	**71**	**71**	**71**	**71**	**71**	10	**71**
8	71	71	8	71	71	71	71	71	8	71
14	**72**	**72**	14	**72**	**72**	**72**	**72**	**72**	14	**72**
10	**71**	**71**	10	**71**	**71**	**71**	**71**	**71**	10	**71**
10	**71**	**71**	10	**71**	**71**	**71**	**71**	**71**	10	**71**
6	72	72	6	72	72	72	72	72	6	72
6	72	72	6	72	72	72	72	72	6	72
4	72	72	4	72	72	72	72	72	4	72
4	71	71	4	71	71	71	71	71	4	71
14	**71**	**71**	14	**71**	**71**	**71**	**71**	**71**	14	**71**
12	**71**	**71**	12	**71**	**71**	**71**	**71**	**71**	12	**71**
12	**71**	**71**	12	**71**	**71**	**71**	**71**	**71**	12	**71**
10	**71**	**71**	10	**71**	**71**	**71**	**71**	**71**	10	**71**
6	71	71	6	71	71	71	71	71	6	71
4	71	71	4	71	71	71	71	71	4	71
18	**73**	**73**	18	**73**	**73**	**73**	**73**	**73**	18	**73**
18	**73**	**73**	18	**73**	**73**	**73**	**73**	**73**	18	**73**
20	**72**	**72**	20	**72**	**72**	**72**	**72**	**72**	20	**72**
18	**72**	**72**	18	**72**	**72**	**72**	**72**	**72**	18	**72**
20	**72**	**72**	20	**72**	**72**	**72**	**72**	**72**	20	**72**
18	**72**	**72**	18	**72**	**72**	**72**	**72**	**72**	18	**72**
18	**72**	**72**	18	**72**	**72**	**72**	**72**	**72**	18	**72**
16	**72**	**72**	16	**72**	**72**	**72**	**72**	**72**	16	**72**
20	**72**	**72**	20	**72**	**72**	**72**	**72**	**72**	20	**72**
18	**72**	**72**	18	**72**	**72**	**72**	**72**	**72**	18	**72**
18	**72**	**72**	18	**72**	**72**	**72**	**72**	**72**	18	**72**
14	**72**	**72**	14	**72**	**72**	**72**	**72**	**72**	14	**72**
12	**73**	**73**	12	**73**	**73**	**73**	**73**	**73**	12	**73**
14	**73**	**73**	14	**73**	**73**	**73**	**73**	**73**	14	**73**
8	71	71	8	71	71	71	71	71	8	71
8	71	71	8	71	71	71	71	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

HARTNER

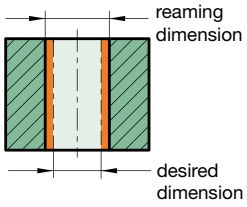
Troubleshooting

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:

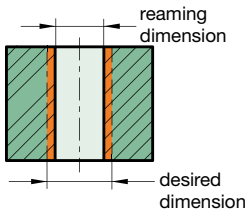
Desired dim.	Required finish dimension of bore hole, defined as max./min. dimension of tolerance zone
Reaming dim.	the finish dimension reached in fact
„*Bore hole*"	The reached bore hole after reaming

❶ Holes too large



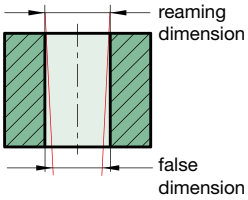
- Tool diameter too large
- Cutting speed too high
- Concentricity error of machine spindle
- Bevel lead of tool too short/uneven
- Cutting edge build up due to wrong cutting speeds or poor lubrication
- Lubricating agent unsuitable, holes too large due to lubrication

❷ Holes too small



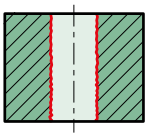
- Reamer blunt. Does not cut, scrapes
- Cutting speed too low
- Component is thin-walled, springs back
- Insufficient stock removal allowance, tool seizes in hole
- Hole is not round due to distortion

❸ Conical hole malformation



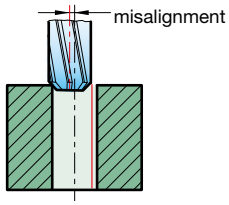
- Tool knocks in spindle
- Bevel lead incorrect
- Axis shifting between tool and predrilled hole. Application of floating holders
- Pre-machining inaccurate

❹ Unsatisfactory surface finish



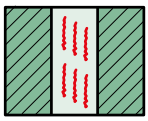
- Cutting speed too low
- No/insufficient lubrication. Cutting edge build-up.
- Tool damaged, i. e. broken cutting edge
- Material has a tendancy to cause build up on cutting edges.
- Concentricity bevel lead incorrect

❺ Misalignment of hole



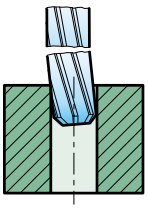
- Pre-drilled hole misaligned
- Concentricity bevel lead incorrect
- Apply floating holder if necessary
- If necessary pilot drill to correct predrilled position

❻ Hole has chatter marks



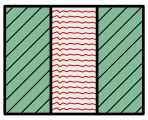
- Feed too low
- Cutting edge build-up
- Grease content in coolant too low
- Circular lands too small
- Stock removal allowance insufficient
- Tool incorrectly clamped in tool holder
- Machine spindle not concentric

❼ 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

❽ 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

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	+330	+154	+165	+180	+200	+74	+85	+100	+120
		+270	+270	+140	+140	+140	+140	+60	+60	+60	+60
3	6	+300	+345	+158	+170	+188	+215	+88	+100	+118	+145
		+270	+270	+140	+140	+140	+140	+70	+70	+70	+70
6	10	+316	+370	+172	+186	+208	+240	+102	+116	+138	+170
		+280	+280	+150	+150	+150	+150	+80	+80	+80	+80
10	18	+333	+400	+177	+193	+220	+260	+122	+138	+165	+205
		+290	+290	+150	+150	+150	+150	+95	+95	+95	+95
18	30	+352	+430	+193	+212	+244	+290	+143	+162	+194	+240
		+300	+300	+160	+160	+160	+160	+110	+110	+110	+110
30	40	+372	+470	+209	+232	+270	+330	+159	+182	+220	+280
		+310	+310	+170	+170	+170	+170	+120	+120	+120	+120
40	50	+382	+480	+219	+242	+280	+340	+169	+192	+230	+290
		+320	+320	+180	+180	+180	+180	+130	+130	+130	+130
50	65	+414	+530	+236	+264	+310	+380	+186	+214	+260	+330
		+340	+340	+190	+190	+190	+190	+140	+140	+140	+140
65	80	+434	+550	+246	+274	+320	+390	+196	+224	+270	+340
		+360	+360	+200	+200	+200	+200	+150	+150	+150	+150
80	100	+467	+600	+274	+307	+360	+440	+224	+257	+310	+390
		+380	+380	+220	+220	+220	+220	+170	+170	+170	+170
100	120	+497	+630	+294	+327	+380	+460	+234	+267	+320	+400
		+410	+410	+240	+240	+240	+240	+180	+180	+180	+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	+45	+60	+80	+120	+24	+28	+39	+12	16	+20	+31
		+20	+20	+20	+20	+20	+14	+14	+14	+6	+6	+6	+6
3	6	+48	+60	+78	+105	+150	+32	+38	+50	+18	+22	+28	+40
		+30	+30	+30	+30	+30	+20	+20	+20	+10	+10	+10	+10
6	10	+62	+76	+98	+130	+190	+40	+47	+61	+22	+28	+35	+49
		+40	+40	+40	+40	+40	+25	+25	+25	+13	+13	+13	+13
10	18	+77	+93	+120	+160	+230	+50	+59	+75	+27	+34	+43	+59
		+50	+50	+50	+50	+50	+32	+32	+32	+16	+16	+16	+16
18	30	+98	+117	+149	+195	+275	+61	+73	+92	+33	+41	+53	+72
		+65	+65	+65	+65	+65	+40	+40	+40	+20	+20	+20	+20
30	50	+119	+142	+180	+240		+75	+89	+112	+41	+50	+64	+87
		+80	+80	+80	+80		+50	+50	+50	+25	+25	+25	+25
50	80	+146	+174	+220	+290		+90	+106	+134	+49	+60	+76	+104
		+100	+100	+100	+100		+60	+60	+60	+30	+30	+30	+30
80	120	+174	+207	+260	+340		+107	+126	+159	+58	+71	+90	+123
		+120	+120	+120	+120		+72	+72	+72	+36	+36	+36	+36
120	180							+148					
								+85					
180	250							+172					
								+100					

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

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

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											
over	to	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

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

Manufacturing tolerances

(tolerance zones R ... Z)
DIN 1420

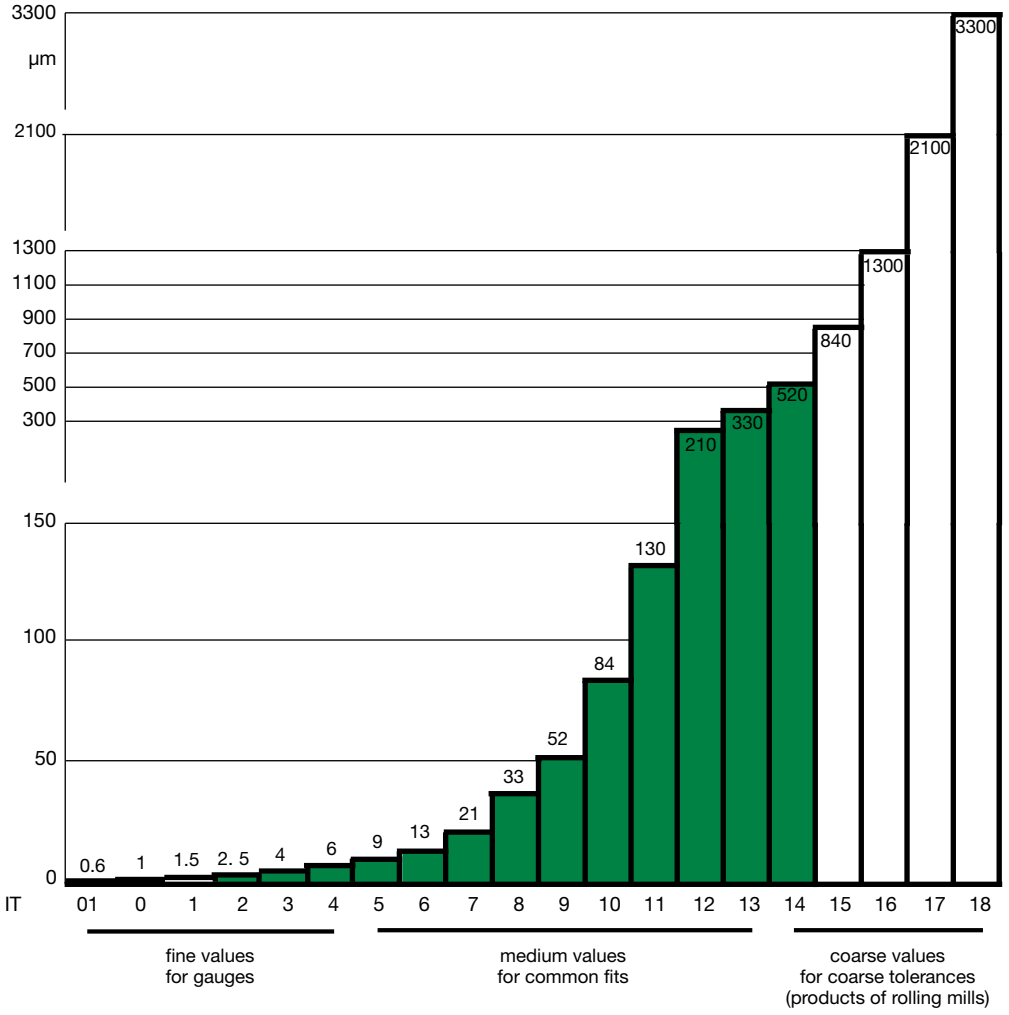
Nominal diameter in mm		Permissible upper and lower tolerances on nominal reamer diameter d_1 in µm for hole tolerance zone											
over	to	R6	R7	S6	S7	T6	U6	U7	U10	X10	X11	Z10	Z11
1	3	– 11	– 12	– 15	– 16		– 19	– 20				– 32	
		– 14	– 16	– 18	– 20		– 22	– 24				– 46	
3	6	– 14	– 13	– 18	– 17		– 22	– 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

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 determing 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_{1max}. The permissible smallest reamer diameter d_{1min} ranges at about 35% of the approximate hole tolerance (0.35 IT) below the permissible maximum diameter d_{1max} (ex. 1).

Simplified determination of permissible max. and min. reamer dimensions

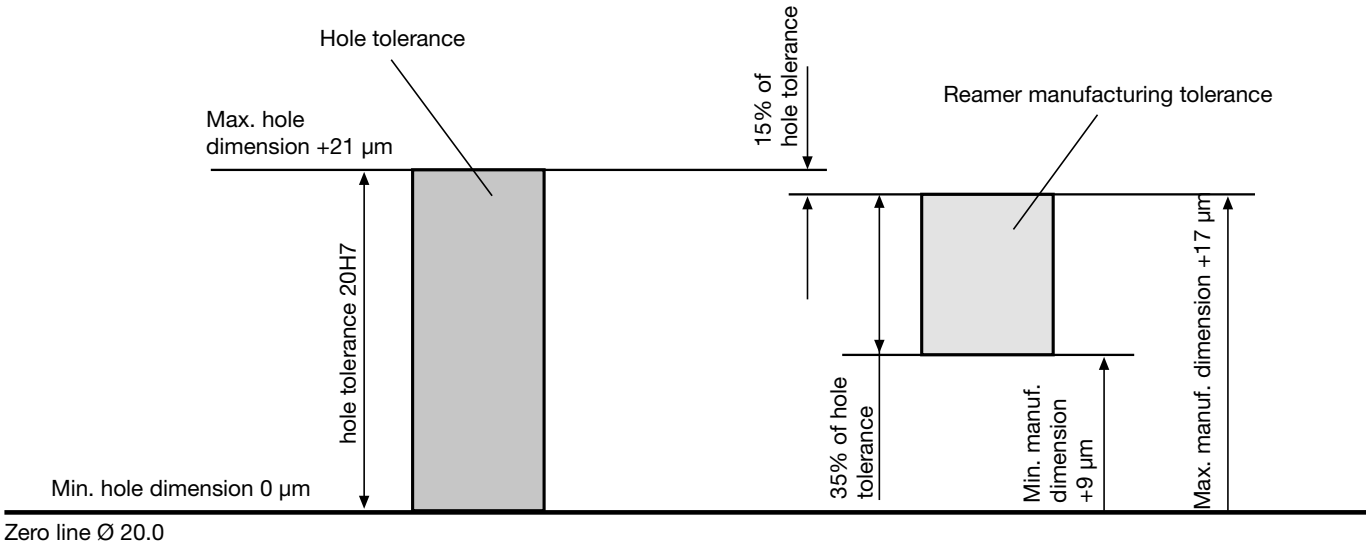
In order to facilitate calculations, the table on page 47 indicates the upper and lower tolerance limits on the nominal diameter d_1 for the most common “H” tolerance zones. With the aid of these tolerance limits the permissible maximum and minimum reamer dimensions can be calculated.

Example 1

nominal diameter d_1	=20.000 mm	minimum reamer diameter:
maximum diameter of the hole	=20.021 mm	$d_{1\,min} = d_{1\,max} - 0.35$ IT 7
hole tolerance (IT 7)	=0.021 mm	= 20.017 – 0.008 = 20.009 mm
15% of the hole tolerance (0.15 IT 7)	=0.0031 mm ≈0.004 mm	
maximum reamer diameter:		
$d_{1\,max}$ = 20.021 – 0.004	= 20.017 mm	
manufacturing tolerance of reamer:		
35% of the hole tolerance (0.35 IT 7)	=0.0073 mm ≈0.008 mm	

Simplified calculation of the permissible maximum and minimum dimensions for reamers

Example: Hole tolerance zone Ø 20 H7/nom. dimension d_1 of reamer 20 mm



Zero line Ø 20.0

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:

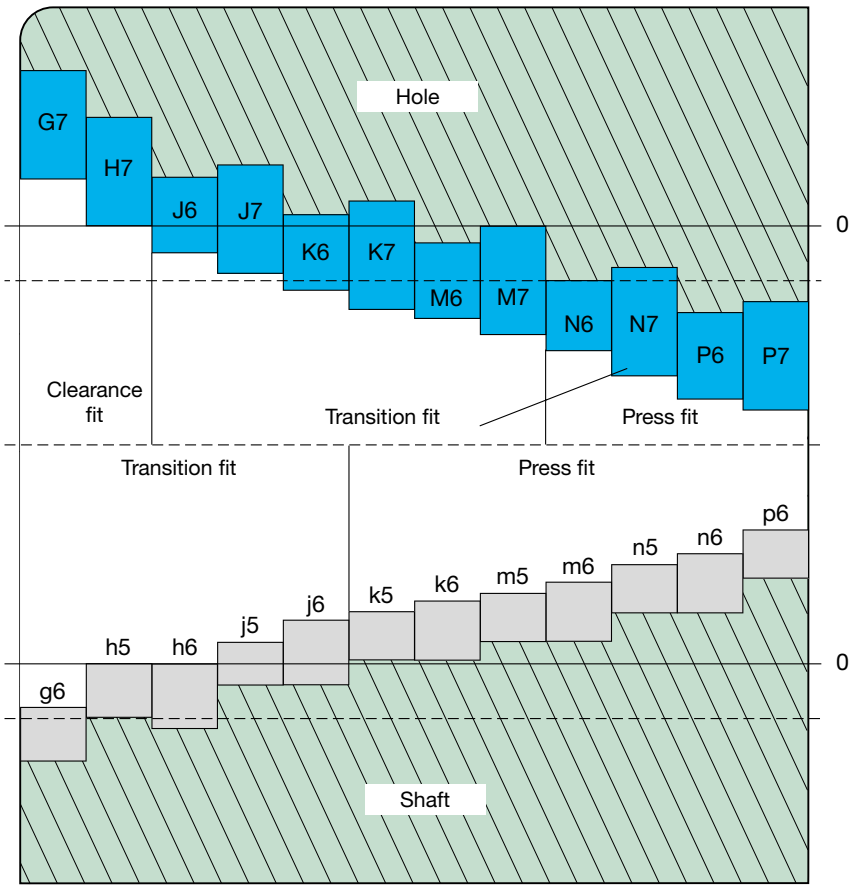
reamer 20 H 7 DIN ... (" ... ": for DIN no. indication of appropriate reamer)

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:

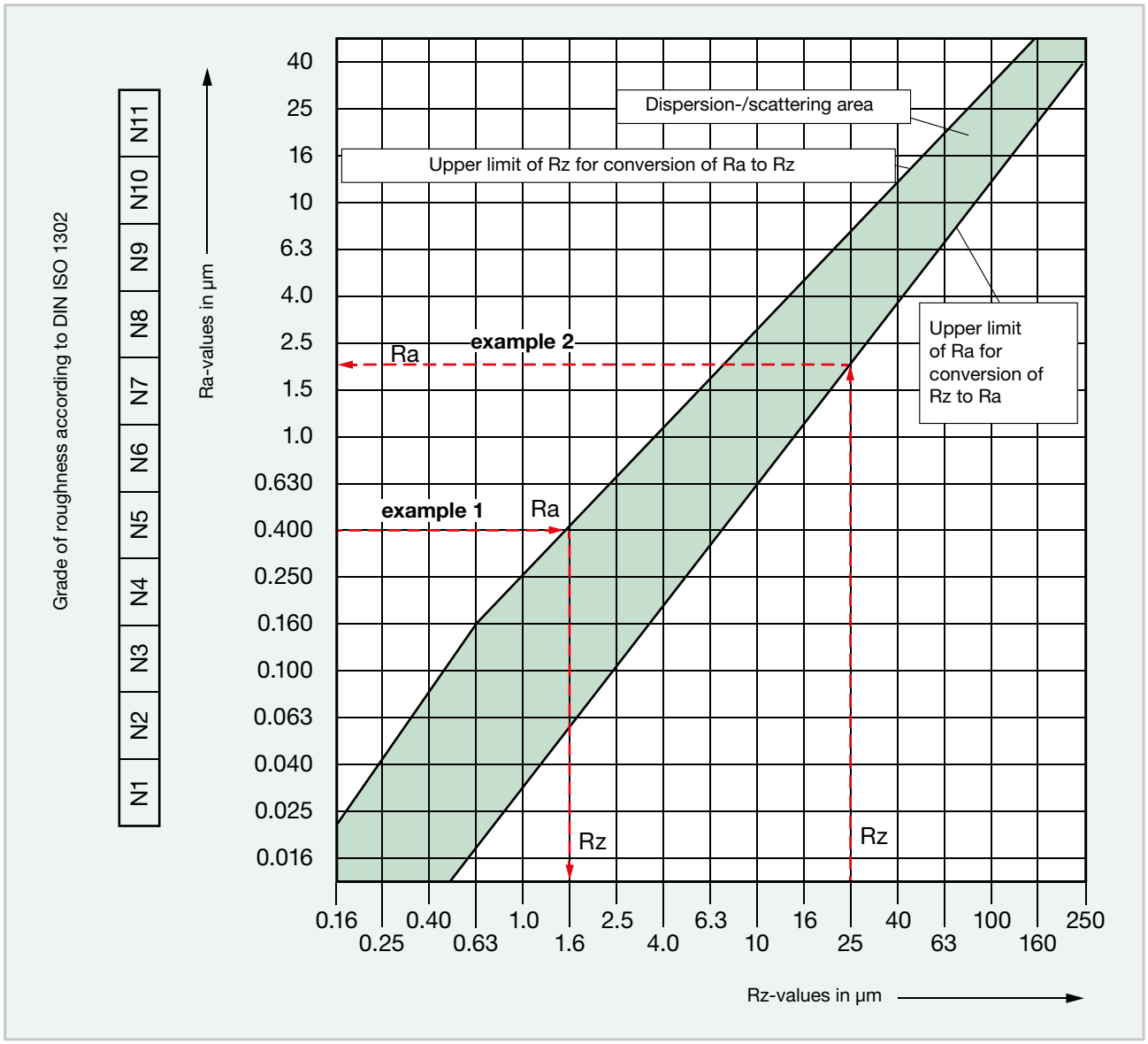
reamer 20 p 25 p 15 DIN ...

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



Conversion ratio to DIN 47



Reading example 1 R_a in R_z

When comparing the average roughness index R_a = 0.4 µm to the average roughness R_z we achieve a value of R_z = 1.6 µm.

Reading example 2 R_z in R_a

When comparing the average roughness R_z = 25 µm to the average roughness index R_a we achieve a value of R_a = 2 µm.

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

HARTNER

Hardness comparison

Tens. strength (N/mm²)	HRC	HB30	HV10
240		71	75
255		76	80
270		81	85
285		86	90
305		90	95
320		95	100
335		100	105
350		105	110
370		109	115
385		114	120
400		119	125
415		124	130
430		128	135
450		133	140
465		138	145
480		143	150
495		147	155
510		152	160
530		157	165
545		162	170
560		166	175
575		171	180
595		176	185
610		181	190
625		185	195
640		190	200
660		195	205
675		199	210
690		204	215
705		209	220
720		214	225
740		219	230
755		223	235
770		228	240
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

Tens. strength (N/mm²)	HRC	HB30	HV10
1110	35	328	345
1140	36	337	355
1170	37	346	364
1200	38	354	373
1230	39	363	382
1260	40	372	392
1300	41	383	403
1330	42	393	413
1360	43	402	423
1400	44	413	434
1440	45	424	446
1480	46	435	458
1530	47	449	473
1570	48	460	484
1620	49	472	497
1680	50	488	514
1730	51	501	527
1790	52	517	544
1845	53	532	560
1910	54	549	578
1980	55	567	596
2050	56	584	615
2140	57	607	639
2180	58	622	655
	59		675
	60		698
	61		720
	62		745
	63		773
	64		800
	65		829
	66		864
	67		900
	68		940

Selection and application

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.

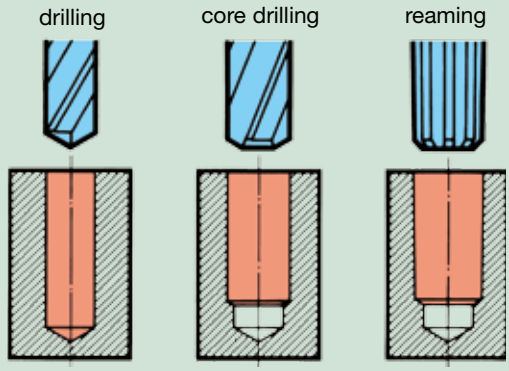


Fig. 1

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.

Selection and application

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 gene-rally 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.

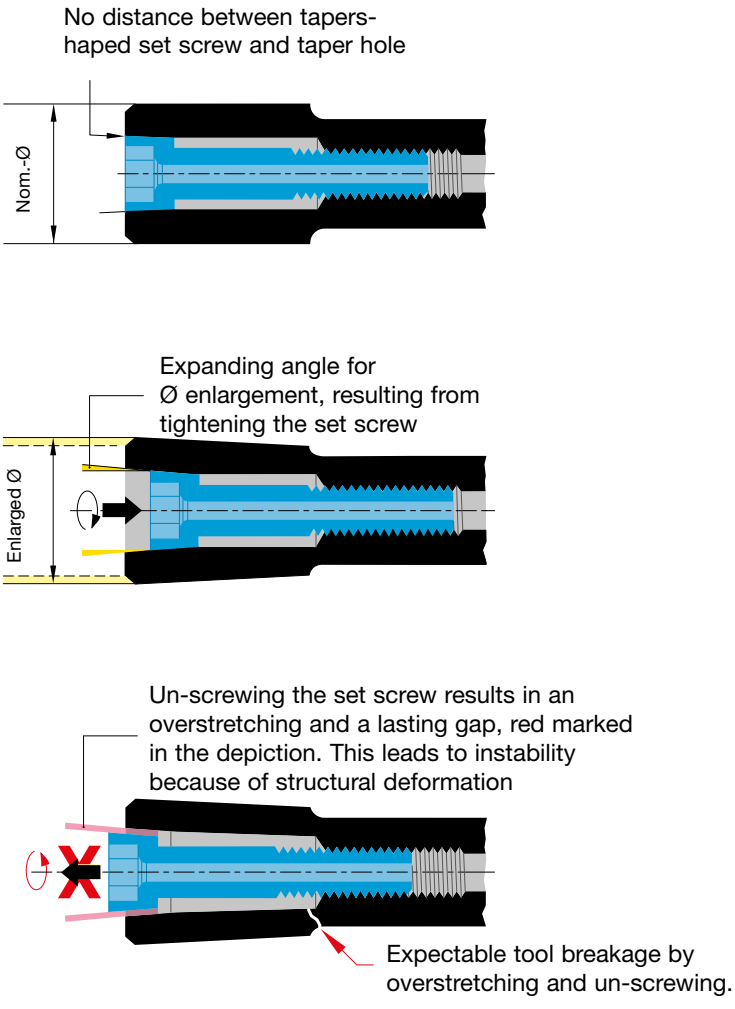
Interrupted holes
Spiral reamers are preferred for the application in interrupted holes because the cutting edge geometry, in comparison to straight-fluted tools, possesses a lesser tendency of grabbing on the oblique hole. If the oblique hole is > 0.25 x D, spiral reamers can also be applied in blind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

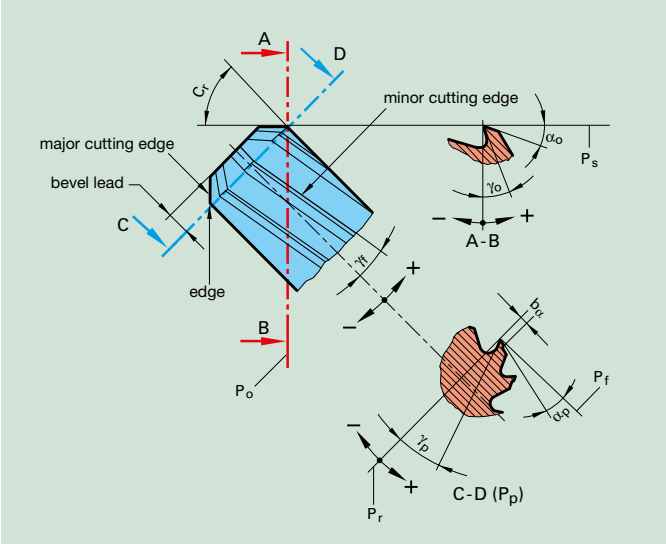
Positional accuracy of the hole
A machine bottoming reamer often provides the best solution when optimal positional accuracy is required, thanks to its special chamfer lead the ‘wander’ of the tool is minimal. In addition, machine bottoming reamers are often applied when the pre-drilled hole and the 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)

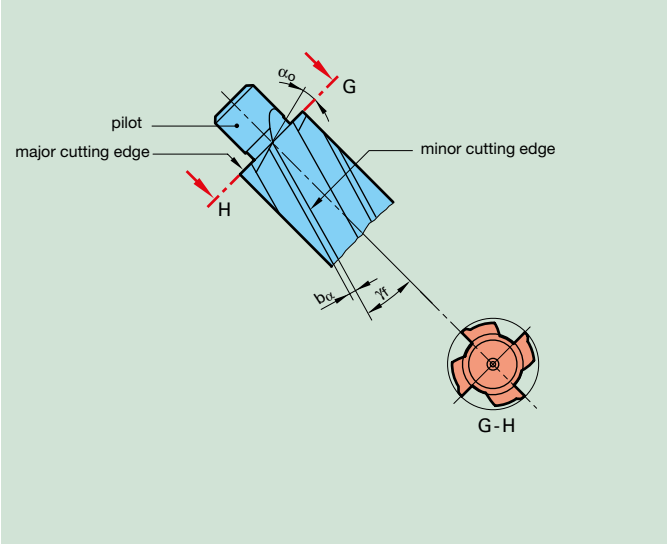


Definitions, dimensions and angles

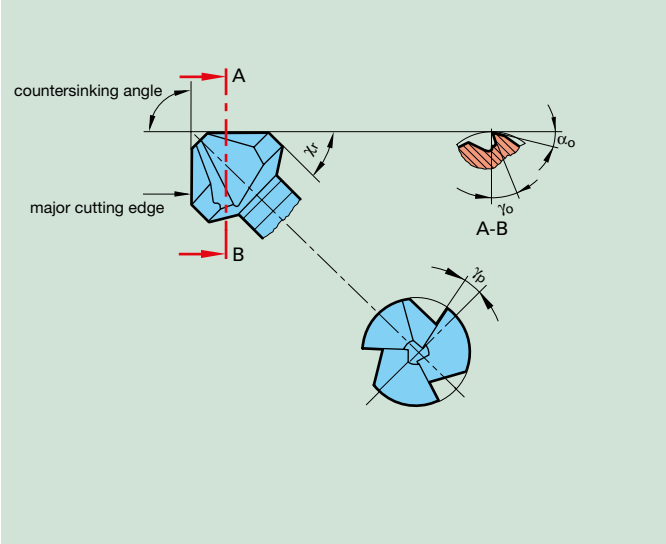
Reamers

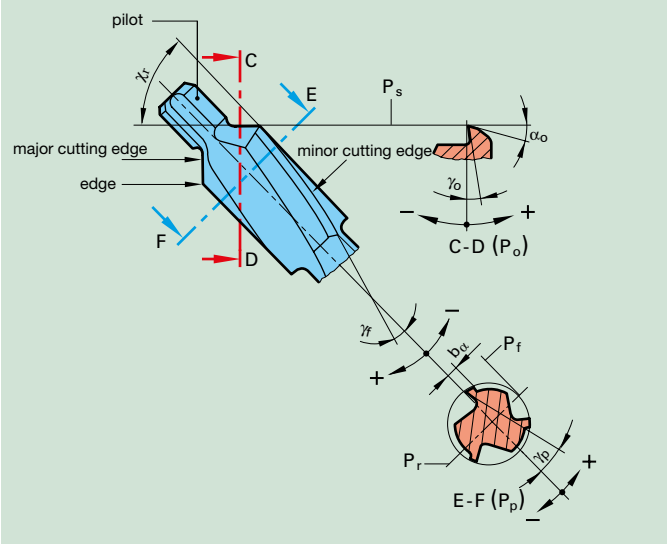


Counterbores



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

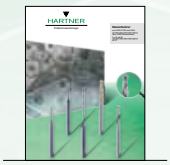
Notes

Notes

Our programme:


FU 500/FN500

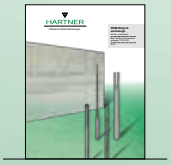

INOX Drills


Micro Precision Drills

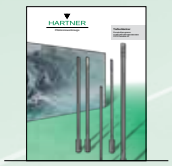

TS-Drills


Highlights


Threading Tools

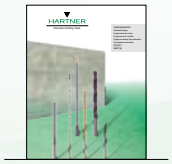

De-burring Tools


TF 100 Multi-Mill


Gun Drills


Multiplex


Multiplex HPC


Standard Range


TM Vending Machines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Chamfering Milling Cutters

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