RT 100 R

Specialist for the machining of cast materials with patented radius point geometry

EXCLUSIVELINE®

Made by Guhring

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Ratio drill type RT 100 R

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New materials require new tooling solutions. As an innovative tool manufacturer, Guhring has always followed this concept and is reacting to the increasing application of CGI (cast iron with compacted graphite iron) and ADI (austempered ductile iron) in the automotive industry with the new Ratio drill type RT 100 R.

High tensile strength is exceptionally demanding

CGI and ADI offer high tensile strengths, i.e. making it possible to increase the output of an engine whilst keeping the wall thickness of the engine block the same or to reduce the weight through thinner wall thicknesses whilst keeping the output of the engine the same. Subsequently, the automotive industry is demanding tools from tool manufacturers that can economically machine these new materials. Conventional drills have so far not achieved satisfactory results.

Guhring has therefore developed the new Ratio drill type RT 100 R. Thanks to its patented radius point geometry it offers highest performance and economic efficiency for the machining of the new materials. With its unique balance of face contour and flute profile it provides rigidity, dimensional accuracy and process reliability.

Powerful in common cast materials

The new radius point geometry offers more than machining of CGI and ADI. It is also recommended for the machining of common cast materials such as grey cast iron, spheroidal graphite and malleable cast iron.

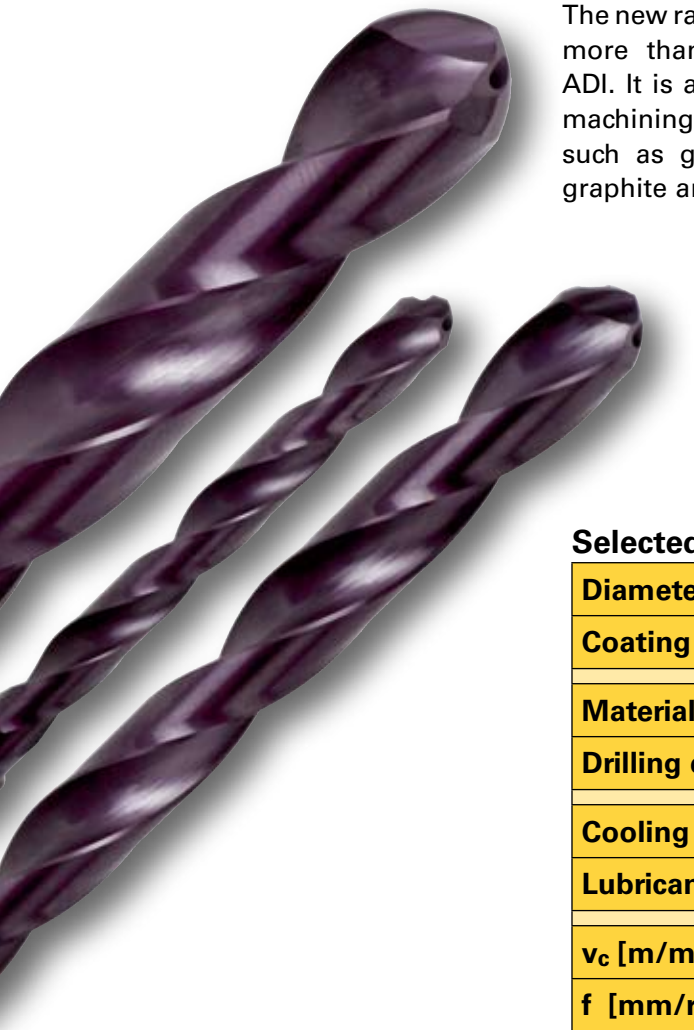
New:
Standard range 5 x D and 7 x D

Now the wear resistant solid carbide drill is available as a standard item in the ExclusiveLine range. The two standard drills are 5 x D and 7 x D with internal cooling and are suitable for a wide range of applications. However, they offer ex-stock availability and reasonable prices.

Furthermore the RT 100 R is available as a special tool with or without internal cooling to fit your specific application. Guhring can, for example, provide application orientated coatings or even modify the design of a step drill. For the special tool request form please see page 7.

Our recommendation:

The RT 100 R drills are especially suited for machining under minimal quantity lubrication conditions. With MQL we recommend a tool design with conical shank end and the application of Guhring's MQL screw and components. Please contact our technical service department for more information.



Selected machining results with RT 100 R drills

Diameter	16	17
Coating	FIRE	Super A
Material	GGG50	GGG40
Drilling depth (mm)	20	50
Cooling	IK	IK
Lubricant	neat oil	soluble oil
v_c [m/min]	120	160
f [mm/rev.]	0,5	0,6
Tool life [m]	615	305

Ratio drill type RT 100 R

Convincing:
Minimal wear in benchmark test

The performance capacity of the new RT 100 R was very impressively proven in two benchmark tests carried out for the automotive industry. The drill was convincing thanks to having the lowest wear and the highest process reliability in comparison to the other tools tested.

In the first test, PTW Darmstadt determined the wear of the tool by measuring the width of wear at the cutting edge following 100 m tool life travel. With a width of wear of only 0.196 mm, RT 100 R showed the least sign of wear (diagram 2).

PTW compared drills of 5.0 mm diameter with a drilling depth of 20 mm in GGV450 as well as high pressure internal cooling of 65 bar in the test. The cutting rates were v_c = 80 m/min. and f = 0.2 mm/rev.

In addition, PTW also determined the development of the outer corner wear in order to receive a prediction regarding the expected final tool life figure. Even after 5000 holes the outer corner wear showed a consistent low wear of the tool, reason to believe that the end of tool life had not been reached by far – a clear indication of the high economic efficiency and process reliability of RT 100 R (diagram 1).

Tool life testing:

In the second test, a step drill type RT 100 R, FIRE-coated in the diameters 14.5 or 20.0 mm respectively with 45° chamfer was examined in GGV40. The drilling depth was 70 mm, the cutting rates were v_c = 70 m/min and f = 0.3 mm/rev.. The tool had internal cooling with 50 bar.

A minimum tool life of at least 120 m was expected to be achieved in the test. The step drill type RT 100 R had definitely not reached the end of its tool life after 214 m and showed an even wear pattern (diagram 3). Furthermore, it was the only drill in the test that kept the coating at the leading land intact for its entire tool life. In a second test the RT 100 R fared even better!

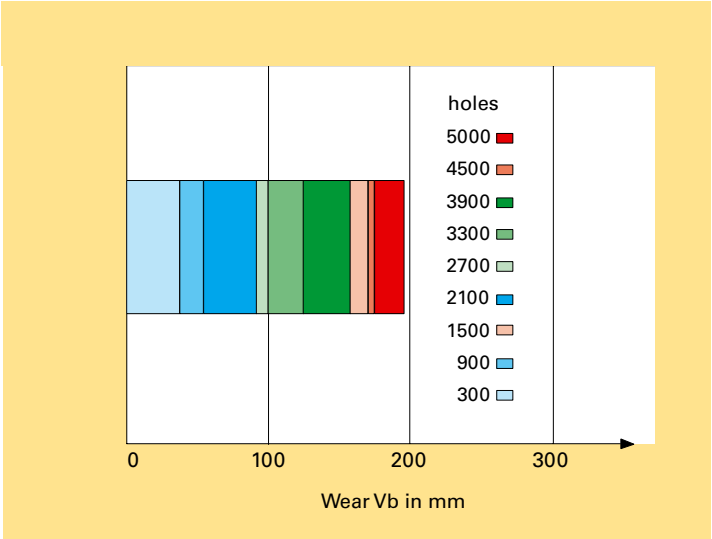


Diagram 1:
Development of the outer corner wear regarding to tool life

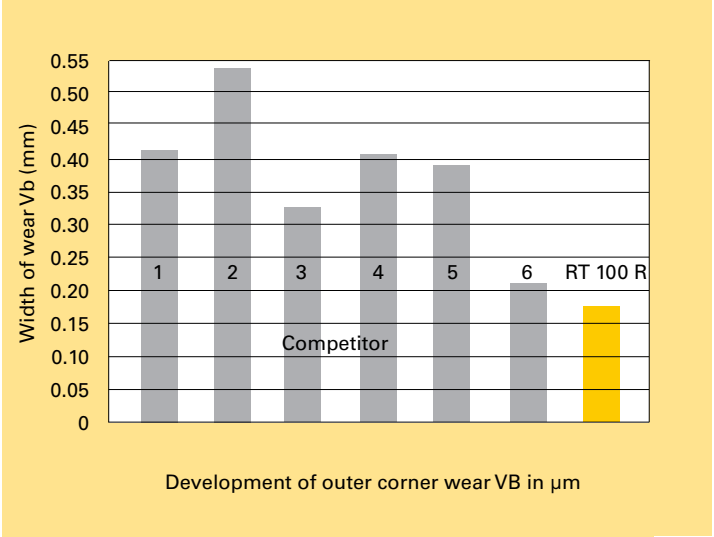


Diagram 2:
Width of wear after 100 m tool life: IXION BAZ 325
High pressure int. cooling 65 bar v_c = 80 m/min; f = 0.2 mm/rev.
d = 5.0 mm; t = 20 mm Test at PTW

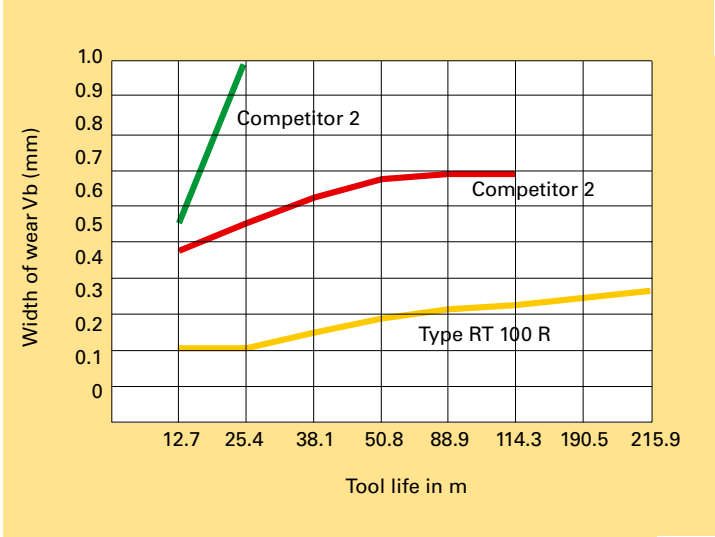


Diagram 3:
Wear of face at a FIRE coated drill type RT 100 R

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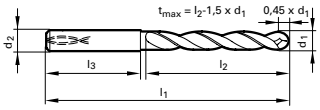
RT 100 R 5 x D – Technical data and dimensions

Tool material	Sol. carb.
Surface finish	F
Cooling	■
Discount group	65
Guhring no.	**6501**
DIN	**6537**
Shank design	**DIN 6535 HA**
Type	**Ratio R**

Product information

- drilling depth ~ 5 x D
- right-hand cutting
- patent pending
- flute design normal
- Ø tolerance m7
- coolant supply through the body



d_1	d_2	l_1	l_2	l_3	Availability
3.00	6	66	28	36	●
3.10	6	66	28	36	●
3.17	6	66	28	36	●
3.20	6	66	28	36	●
3.25	6	66	28	36	●
3.30	6	66	28	36	●
3.40	6	66	28	36	●
3.50	6	66	28	36	●
3.57	6	66	28	36	●
3.60	6	66	28	36	●
3.70	6	66	28	36	●
3.80	6	74	36	36	●
3.90	6	74	36	36	●
3.97	6	74	36	36	●
4.00	6	74	36	36	●
4.10	6	74	36	36	●
4.20	6	74	36	36	●
4.30	6	74	36	36	●
4.37	6	74	36	36	●
4.40	6	74	36	36	●
4.50	6	74	36	36	●
4.60	6	74	36	36	●
4.65	6	74	36	36	●
4.70	6	74	36	36	●
4.76	6	82	44	36	●
4.80	6	82	44	36	●
4.90	6	82	44	36	●
5.00	6	82	44	36	●
5.10	6	82	44	36	●
5.16	6	82	44	36	●
5.20	6	82	44	36	●
5.30	6	82	44	36	●
5.40	6	82	44	36	●
5.50	6	82	44	36	●
5.55	6	82	44	36	●
5.56	6	82	44	36	●
5.60	6	82	44	36	●
5.70	6	82	44	36	●
5.80	6	82	44	36	●

Tool material	Sol. carb.
Surface finish	F
Cooling	■
Discount group	65
Guhring no.	**6501**

d_1	d_2	l_1	l_2	l_3	Availability
5.90	6	82	44	36	●
5.95	6	82	44	36	●
6.00	6	82	44	36	●
6.10	8	91	53	36	●
6.20	8	91	53	36	●
6.30	8	91	53	36	●
6.35	8	91	53	36	●
6.40	8	91	53	36	●
6.50	8	91	53	36	●
6.60	8	91	53	36	●
6.70	8	91	53	36	●
6.75	8	91	53	36	●
6.80	8	91	53	36	●
6.90	8	91	53	36	●
7.00	8	91	53	36	●
7.10	8	91	53	36	●
7.14	8	91	53	36	●
7.20	8	91	53	36	●
7.30	8	91	53	36	●
7.40	8	91	53	36	●
7.50	8	91	53	36	●
7.54	8	91	53	36	●
7.60	8	91	53	36	●
7.70	8	91	53	36	●
7.80	8	91	53	36	●
7.90	8	91	53	36	●
7.94	8	91	53	36	●
8.00	8	91	53	36	●
8.10	10	103	61	40	●
8.20	10	103	61	40	●
8.30	10	103	61	40	●
8.33	10	103	61	40	●
8.40	10	103	61	40	●
8.50	10	103	61	40	●
8.60	10	103	61	40	●
8.70	10	103	61	40	●
8.73	10	103	61	40	●
8.80	10	103	61	40	●
8.90	10	103	61	40	●
9.00	10	103	61	40	●
9.10	10	103	61	40	●
9.13	10	103	61	40	●
9.20	10	103	61	40	●
9.25	10	103	61	40	●
9.30	10	103	61	40	●
9.40	10	103	61	40	●
9.50	10	103	61	40	●
9.52	10	103	61	40	●
9.60	10	103	61	40	●
9.70	10	103	61	40	●
9.80	10	103	61	40	●
9.90	10	103	61	40	●
9.92	10	103	61	40	●
10.00	10	103	61	40	●
10.10	12	118	71	45	●
10.20	12	118	71	45	●
10.30	12	118	71	45	●
10.32	12	118	71	45	●
10.40	12	118	71	45	●
10.50	12	118	71	45	●
10.60	12	118	71	45	●
10.70	12	118	71	45	●
10.72	12	118	71	45	●

Tool material	Sol. carb.
Surface finish	F
Cooling	■
Discount group	65
Guhring no.	**6501**

d_1	d_2	l_1	l_2	l_3	Availability
10.80	12	118	71	45	●
10.90	12	118	71	45	●
11.00	12	118	71	45	●
11.10	12	118	71	45	●
11.11	12	118	71	45	●
11.20	12	118	71	45	●
11.30	12	118	71	45	●
11.40	12	118	71	45	●
11.50	12	118	71	45	●
11.60	12	118	71	45	●
11.70	12	118	71	45	●
11.80	12	118	71	45	●
11.90	12	118	71	45	●
11.91	12	118	71	45	●
12.00	12	118	71	45	●
12.10	14	124	77	45	●
12.20	14	124	77	45	●
12.30	14	124	77	45	●
12.40	14	124	77	45	●
12.50	14	124	77	45	●
12.60	14	124	77	45	●
12.70	14	124	77	45	●
12.80	14	124	77	45	●
12.90	14	124	77	45	●
13.00	14	124	77	45	●
13.10	14	124	77	45	●
13.30	14	124	77	45	●
13.40	14	124	77	45	●
13.50	14	124	77	45	●
13.70	14	124	77	45	●
13.80	14	124	77	45	●
13.90	14	124	77	45	●
14.00	14	124	77	45	●
14.10	16	133	83	48	●
14.20	16	133	83	48	●
14.29	16	133	83	48	●
14.30	16	133	83	48	●
14.40	16	133	83	48	●
14.50	16	133	83	48	●
14.60	16	133	83	48	●
14.70	16	133	83	48	●
14.90	16	133	83	48	●
15.00	16	133	83	48	●
15.10	16	133	83	48	●
15.20	16	133	83	48	●
15.30	16	133	83	48	●
15.40	16	133	83	48	●
15.50	16	133	83	48	●
15.60	16	133	83	48	●
15.70	16	133	83	48	●
15.80	16	133	83	48	●
15.87	16	133	83	48	●
15.90	16	133	83	48	●
16.00	16	133	83	48	●
16.50	18	143	93	48	●
16.67	18	143	93	48	●
17.00	18	143	93	48	●
17.50	18	143	93	48	●
18.00	18	143	93	48	●
18.50	20	153	101	50	●
19.00	20	153	101	50	●
19.50	20	153	101	50	●
20.00	20	153	101	50	●

FIRE-coated (F) ■ with internal cooling

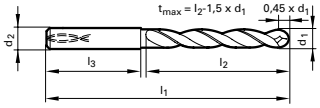
EXCLUSIVELINE®

RT 100 R 7 x D – Technical data and dimensions

Tool material	Sol. carb.
Surface finish	F
Cooling	■
Discount group	65
Guhring no.	**6502**
DIN	**Guhring std.**
Shank design	**DIN 6535 HA**
Type	**Ratio R**

Product information

- drilling depth ~ 7 x D
- right-hand cutting
- patent pending
- flute design normal
- Ø tolerance m7
- coolant supply through the body



d_1	d_2	l_1	l_2	l_3	Availability
4.00	6	75.0	37.5	36	●
4.10	6	75.0	37.5	36	●
4.20	6	75.0	37.5	36	●
4.30	6	85.0	45.0	36	●
4.37	6	85.0	45.0	36	●
4.40	6	85.0	45.0	36	●
4.50	6	85.0	45.0	36	●
4.60	6	85.0	45.0	36	●
4.65	6	85.0	45.0	36	●
4.70	6	85.0	45.0	36	●
4.76	6	90.0	50.0	36	●
4.80	6	90.0	50.0	36	●
4.90	6	90.0	50.0	36	●
5.00	6	90.0	50.0	36	●
5.10	6	90.0	50.0	36	●
5.16	6	90.0	50.0	36	●
5.20	6	90.0	50.0	36	●
5.30	6	90.0	50.0	36	●
5.40	6	97.0	57.0	36	●
5.50	6	97.0	57.0	36	●
5.55	6	97.0	57.0	36	●
5.56	6	97.0	57.0	36	●
5.60	6	97.0	57.0	36	●
5.70	6	97.0	57.0	36	●
5.80	6	97.0	57.0	36	●
5.90	6	97.0	57.0	36	●
5.95	6	97.0	57.0	36	●
6.00	6	97.0	57.0	36	●
6.10	8	106.0	66.0	36	●
6.20	8	106.0	66.0	36	●
6.30	8	106.0	66.0	36	●
6.35	8	106.0	66.0	36	●
6.40	8	106.0	66.0	36	●
6.50	8	106.0	66.0	36	●
6.60	8	106.0	66.0	36	●
6.70	8	106.0	66.0	36	●
6.75	8	106.0	66.0	36	●
6.80	8	106.0	66.0	36	●
6.90	8	116.0	76.0	36	●

Tool material	Sol. carb.
Surface finish	F
Cooling	■
Discount group	65
Guhring no.	**6502**

d_1	d_2	l_1	l_2	l_3	Availability
7.00	8	116	76	36	●
7.10	8	116	76	36	●
7.14	8	116	76	36	●
7.20	8	116	76	36	●
7.30	8	116	76	36	●
7.40	8	116	76	36	●
7.50	8	116	76	36	●
7.54	8	116	76	36	●
7.60	8	116	76	36	●
7.70	8	116	76	36	●
7.80	8	116	76	36	●
7.90	8	116	76	36	●
7.94	8	116	76	36	●
8.00	8	116	76	36	●
8.10	10	131	87	40	●
8.20	10	131	87	40	●
8.30	10	131	87	40	●
8.33	10	131	87	40	●
8.40	10	131	87	40	●
8.50	10	131	87	40	●
8.60	10	131	87	40	●
8.70	10	131	87	40	●
8.73	10	131	87	40	●
8.80	10	131	87	40	●
8.90	10	131	87	40	●
9.00	10	131	87	40	●
9.10	10	139	95	40	●
9.13	10	139	95	40	●
9.20	10	139	95	40	●
9.25	10	139	95	40	●
9.30	10	139	95	40	●
9.40	10	139	95	40	●
9.50	10	139	95	40	●
9.52	10	139	95	40	●
9.60	10	139	95	40	●
9.70	10	139	95	40	●
9.80	10	139	95	40	●
9.90	10	139	95	40	●
9.92	10	139	95	40	●
10.00	10	139	95	40	●
10.10	12	155	106	45	●
10.20	12	155	106	45	●
10.30	12	155	106	45	●
10.32	12	155	106	45	●
10.40	12	155	106	45	●
10.50	12	155	106	45	●
10.60	12	155	106	45	●
10.70	12	155	106	45	●
10.72	12	155	106	45	●
10.80	12	155	106	45	●
10.90	12	155	106	45	●
11.00	12	155	106	45	●
11.10	12	163	114	45	●
11.11	12	163	114	45	●
11.20	12	163	114	45	●
11.30	12	163	114	45	●
11.40	12	163	114	45	●
11.50	12	163	114	45	●
11.60	12	163	114	45	●
11.70	12	163	114	45	●
11.80	12	163	114	45	●
11.90	12	163	114	45	●
11.91	12	163	114	45	●

Tool material	Sol. carb.
Surface finish	F
Cooling	■
Discount group	65
Guhring no.	**6502**

d_1	d_2	l_1	l_2	l_3	Availability
12.00	12	163	114	45	●
12.10	14	182	133	45	●
12.20	14	182	133	45	●
12.30	14	182	133	45	●
12.40	14	182	133	45	●
12.50	14	182	133	45	●
12.60	14	182	133	45	●
12.70	14	182	133	45	●
12.80	14	182	133	45	●
12.90	14	182	133	45	●
13.00	14	182	133	45	●
13.10	14	182	133	45	●
13.30	14	182	133	45	●
13.40	14	182	133	45	●
13.50	14	182	133	45	●
13.70	14	182	133	45	●
13.80	14	182	133	45	●
13.90	14	182	133	45	●
14.00	14	182	133	45	●
14.10	16	204	152	48	●
14.20	16	204	152	48	●
14.29	16	204	152	48	●
14.30	16	204	152	48	●
14.40	16	204	152	48	●
14.50	16	204	152	48	●
14.60	16	204	152	48	●
14.70	16	204	152	48	●
14.90	16	204	152	48	●
15.00	16	204	152	48	●
15.10	16	204	152	48	●
15.20	16	204	152	48	●
15.30	16	204	152	48	●
15.40	16	204	152	48	●
15.50	16	204	152	48	●
15.60	16	204	152	48	●
15.70	16	204	152	48	●
15.80	16	204	152	48	●
15.87	16	204	152	48	●
15.90	16	204	152	48	●
16.00	16	204	152	48	●
16.50	18	223	171	48	●
16.67	18	223	171	48	●
17.00	18	223	171	48	●
17.50	18	223	171	48	●
18.00	18	223	171	48	●
18.50	20	244	190	50	●
19.00	20	244	190	50	●
19.50	20	244	190	50	●
20.00	20	244	190	50	●

FIRE-coated F ■ with internal cooling

RT 100 R-Application recommendations

General hints:
Powerful machines, no play in spindle bearings, alignment accurate tool holders. Max. concentricity error of clamped tools 0.02 mm, high coolant pressures. We recommend the application of hydraulic chucks or shrink fit chucks.

Coolant hints:
We recommend lubrication by soluble oil or neat oil.
Under special conditions cooling just by air is possible. But instead of air cooling we would always prefer minimal quantity lubrication, that the tools are especially suited for. With MQL we recommend the conical shank end and the Guhring MQL components. Please contact our technical service department for more information.

	Tool material	VHM	
	Carbide grade	K20	
	Surface finish	F	
	Cooling	■	
	Drilling depth	~ 5 x D	~ 7 x D
Guh. no.	DIN 6537	6501	
	Guhring std.		6502

F FIRE-coated
■ with coolant ducts

drill-Ø mm	Feed column no. 1	2	3	4	5	6	7	8	9
	f (mm/rev.)								
2.50	0.025	0.032	0.040	0.050	0.063	0.080	0.100	0.125	0.160
3.15	0.032	0.040	0.050	0.063	0.080	0.100	0.125	0.160	0.160
4.00	0.040	0.050	0.063	0.080	0.100	0.125	0.160	0.200	0.200
5.00	0.040	0.050	0.063	0.080	0.100	0.125	0.160	0.200	0.250
6.30	0.050	0.063	0.080	0.100	0.125	0.160	0.200	0.250	0.315
8.00	0.063	0.080	0.100	0.125	0.160	0.200	0.250	0.315	0.315
10.00	0.080	0.100	0.125	0.160	0.200	0.250	0.315	0.400	0.400
12.50	0.080	0.100	0.125	0.160	0.200	0.250	0.315	0.400	0.500
16.00	0.100	0.125	0.160	0.200	0.250	0.315	0.400	0.500	0.630
20.00	0.125	0.160	0.200	0.250	0.315	0.400	0.500	0.630	0.630
25.00	0.160	0.200	0.250	0.315	0.400	0.500	0.630	0.800	0.800

Material	Material example *Figures in bold = material no. to DIN EN 10 027*	Tens. strength Hard- MPa (N/mm²) ness	v_c m/min	Feed column no.	
Common structural steels	**1.0035** S185, **1.0486** StE P275N, **1.0345** P235GH, **1.0425** P265GH	≤ 500			
	1.0050 E295, **1.0070** E360, **1.8937** P500NH	> 500-850			
Free-cutting steels	**1.0718** 11SMnPb30, **1.0736** 115Mn37	≤850			
	1.0727 46 S20, **1.0728** 60 S20, **1.0757** 46SPb20	850-1000			
Unalloyed heat-treatable steels	**1.0402** C22, **1.1178** C30E	≤700			
	1.0503 C45, **1.1191** C45E	700-850			
	1.0601 C60, **1.1221** C60E	850-1000			
Alloyed heat-treatable steels	**1.5131** 50MnSi4, **1.7003** 38Cr2, **1.7030** 28Cr4	850-1000			
	1.5710 36NiCr6, **1.7035** 41Cr4, **1.7225** 42CrMo4	1000-1200			
Unalloyed case hardened steels	**1.0301** C10, **1.1121** C10E	≤750			
Alloyed case hardened steels	**1.7043** 38Cr4	850-1000			
	1.5752 14NiCr14, **1.7131** 16MnCr5, **1.7264** 20CrMo5	1000-1200			
Nitriding steels	**1.8504** 34CrAl6	850-1000			
	1.8519 31CrMoV9, **1.8550** 34CrAlNi7	1000-1200			
Tool steels	**1.1750** C75W, **1.2067** 102Cr6, **1.2307** 29CrMoV9	≤850			
	1.2080 X210Cr12, **1.2083** X42Cr13, **1.2419** 105WCr6, **1.2767** X45NiCrMo4	850-1000			
High speed steels	**1.3243** S 6-5-2-5, **1.3343** S 6-5-2, **1.3344** 61CrV4	≥650-1000			
Spring steels	**1.5026** 55Si7, **1.7176** 55Cr3, **1.8159** 51CrV4	≤330 HB			
Stainless steels, sulphured	**1.4005** X12CrS13, **1.4104** X14CrMoS17, **1.4105** X6CrMoS17, **1.4305** X8CrNiS18 9	≤850			
austenitic	**1.4301** X5CrNi18 10, **1.4541** X6CrNiTi18 10, **1.4571** X6CrNiMoTi 17 12 2	≤850			
martensitic	**1.4057** X17CrNi16-1, **1.4122** X39CrMo17-1, **1.4521** X2CrMoTi18 2	≤850			
Hardened steels	–	≤40-60 HRC			
Special alloys	Nimonic, Inconel, Monel, Hastelloy	≤1200			
Cast iron	**0.6010** EN-GJL-100 (GG10). **0.6020** EN-GJL-200 (GG20)	≤240 HB	210	**9**	**8**
	0.6025 EN-GJL-250 (GG25). **0.6035** EN-GJL-350 (GG35)	<300 HB	160	**9**	**8**
New cast materials GGV	**EN-GJV250** (GGV25). **EN-GJV350** (GGV35)		130	**8**	**7**
	EN-GJV400 (GGV40). **EN-GJV500** (GGV50). SiMo 6		100	**8**	**7**
New cast materials ADI	**EN-GJS-800-8** (ADI800). **EN-GJS-1000-5** (ADI1000)	800-1000	80	**8**	**7**
	EN-GJS-1200-2 (ADI1200). **EN-GJS-1400-1** (ADI1400)	1200-1400	60	**8**	**7**
Spheroidal graphite and	**0.7050** EN-GJS-500-7 (GGG50). **0.8035** EN-GJMW-350-4 (GTW35)	≤240 HB	160	**9**	**8**
malleable cast iron	**0.7070** EN-GJS-700-2 (GGG70). **0.8170** EN-GJMB-700-2 (GTS70)	<300 HB	130	**8**	**7**
Chilled cast iron	–	≤350 HB			
Ti and Ti-alloys	**3.7024** Ti99,5, **3.7114** TiAl5Sn2,5, **3.7124** TiCu2	≤850			
	3.7154 TiAl6Zr5, **3.7164** TiAl6V4, **3.7184** TiAl4Mo4Sn2,5, - TiAl8Mo1V1	850-1200			
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	≤450			
Al cast iron ≤ 10 % Si	**3.2131** G-AlSi5Cu1, **3.2153** G-AlSi7Cu3, **3.2573** G-AlSi9	≤600			
> 10 % Si	**3.2581** G-AlSi12, **3.2583** G-AlSi12Cu, - G-AlSi12CuNiMg	≤600			
Magnesium alloys	MgMn2, G-MgAl8Zn1, G-MgAl6Zn3	≤450			
Copper, low-alloyed	**2.0070** SE-Cu, **2.1020** CuSn6, **2.1096** G-CuSn5ZnPb	≤400			
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	**2.0380** CuZn39Pb2, **2.0401** CuZn39Pb3, **2.0410** CuZn43Pb2	≤600			
	2.0250 CuZn20, **2.0280** CuZn33, **2.0332** CuZn37Pb0,5	>600-850			
Bronze, long-chipping	**2.0380** CuZn39Pb2, **2.0401** CuZn39Pb3, **2.0410** CuZn43Pb2	≤850			
	2.0250 CuZn20, **2.0280** CuZn33, **2.0332** CuZn37Pb0,5	850-1000			

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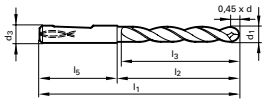
Carbide grade

K20

WITHOUT step



Relation of nom.-Ø d_1, shank-Ø d_3 and shank length l_5

nom.-Ø d_1 min/max	4-6	>6-8	>8-10	>10-12	>12-14	>14-16	>16-18	>18-20
shank-Ø d_3	6	8	10	12	14	16	18	20
shank length l_5	36		40	45		48		50

	Range	Complete
Nom.-Ø d_1	4.0 – 20.0 mm	
Shank-Ø d_3 to DIN 6535	see table above	
Shank design to DIN 6535	HA [redacted] , HE [redacted]	
Drilling depth l_3	max. 7 x D (run out min. 0.01-0.02)	
Flute length l_2	max. 155 mm	
Total length l_1	56 – 205 mm	
Double margins	yes / no	
Cooling	internal / external / soluble oil / minimal quantity lubrication / dry	
Surface finish/coating	bright/ FIRE/MolyGlide / Super A	
Workpiece material		
Quantity		

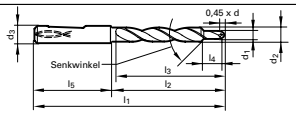
Standard tolerances: nom.-Ø = m7, shank-Ø = h6

Solid carbide Ratio drills RT 100 R

Carbide grade

K20

WITH step



Relation of nom.-Ø d_2, shank-Ø d_3 and shank length l_5

nom.-Ø d_2 min/max	4-6	>6-8	>8-10	>10-12	>12-14	>14-16	>16-18	>18-20
shank-Ø d_3	6	8	10	12	14	16	18	20
shank length l_5	36		40	45		48		50

	Range	Complete
Step-Ø d_1	4.0 – 20.0 mm	
Step-Ø d_2	4.0 – 20.0 mm	
Shank-Ø d_3 to DIN 6535	see table above	
Shank form to DIN 6535	HA [redacted] , HE [redacted]	
Step length l_4	5 – 100 mm	
Drilling depth l_3	max. 7 x D (run out min. 0.01-0.02)	
Flute length l_2	max. 155 mm	
Total length l_1	56 – 205 mm	
Step angle	60°/90°/120° / 180°	
Double margins	yes / no	
Cooling	internal / external / soluble oil / min. quantity lubrication / dry	
Surface finish/coating	bright/ FIRE/MolyGlide / Super A	
Workpiece material		
Quantity		

Standard tolerances: step-Ø d_1 = m7; body-Ø d_2 = h7; shank-Ø d_3 = h6