HARTNER

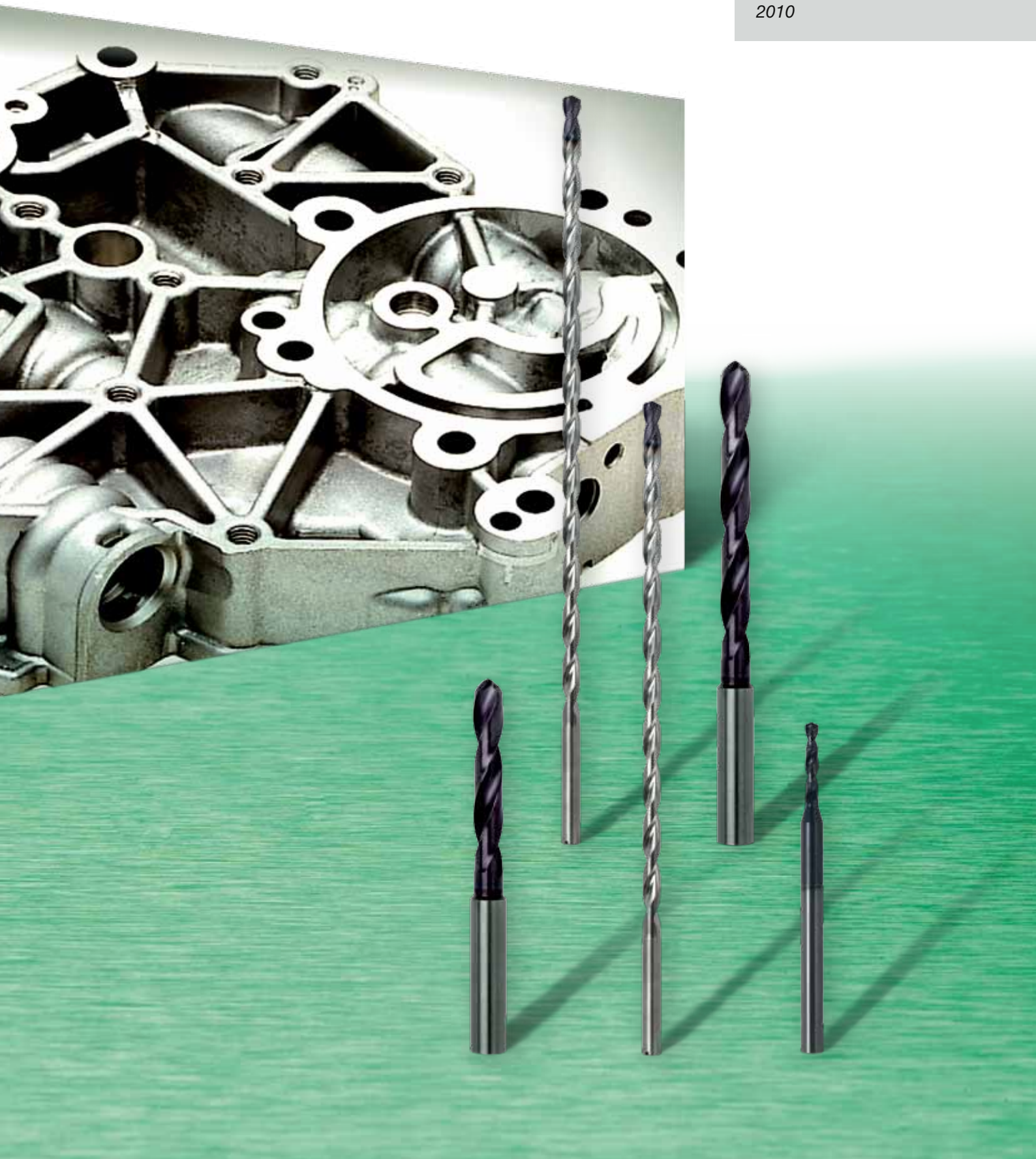
Precision Cutting Tools

Highlights

Tools for
high performance machining

New: Extended range

2010



HARTNER

TS 100 T - Spiral-Flute Deep Hole Drills

The spiral-flute deep hole drills TS 100 T are available as standard drills for drilling depths up to 15 x D, 20 x D, 25 x D, 30 x D and 40 x D. The TS 100 T range is optimised for conventional cooling and offers an outstanding cost-performance-ratio as well as immediate availability. Moreover, the TS 100 T drills permit highest cutting and feed rates and subsequently achieve a considerable reduction in machining time.

These advantages are achieved thanks to the following attributes:

Optimised flute geometry
The spiral-flute deep hole drills possess a special flute geometry that is optimised to the specific demand for optimal chip evacuation from the deep hole.

Maximised coolant duct profile
To provide the cutting edge with an optimum coolant supply, the tools possess a maximised coolant duct profile. It ensures an effecient coolant supply to the cutting edge as well as excellent chip evacuation.

Problem-free swarf
The factors described above – in combination with the cutting parameters optimally adapted to the application task – result in chips that are evacuated problem-free even from deep holes. Chip congestion and a subsequent jamming of the tool is effectively prevented.

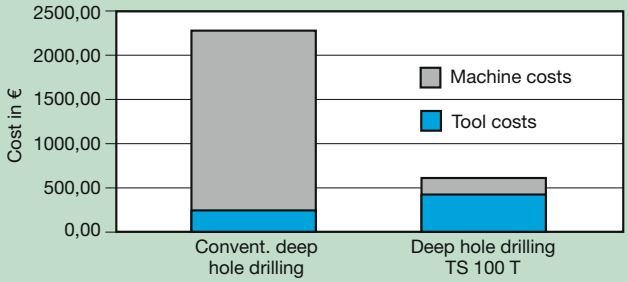
Wear resistant cutting edges
Thanks to the TiAlN-tip coating, the cutting edges, that are exposed to maximum forces, are protected against wear.

Reinforced shank for high precision clamping
Drills from the TS 100 T ex-stock range have a reinforced shank to DIN 6535 HA, tolerance h6. This enables the powerful clamping of the tools with hydraulic expansion chucks and shrink chucks. The combination TS 100 T plus hydraulic expansion or shrink chuck guarantees highest concentricity, extreme clamping forces, minimal imbalance and optimal efficiency.

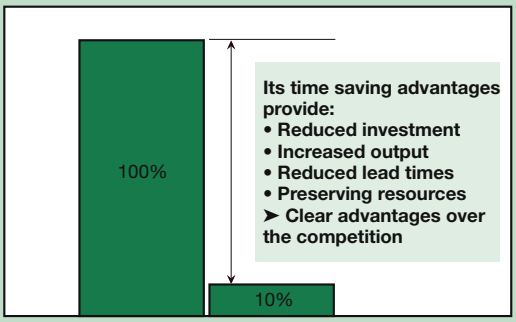
Intermediate diameters/MQL-suitability
In addition to the ex-stock range, Hartner still offers TS 100 T drills as special tools to specific customer requirements. We realise intermediate diameters with maximum drilling depths up to 40 x D or a total length up to max. 400 mm. Please use the request form on page 22!
The modification of the shank to the MQL shank end makes the ex-stock range suitable for MQL machining.

High-pressure cooling - now a matter of course
As in recent years internal cooling has prevailed with drilling tools, today every conventional machine tool is offered with high-pressure internal cooling and is therefore also suitable for deep hole drilling.

Production cost
machining example: drilling oil holes in crank shaft

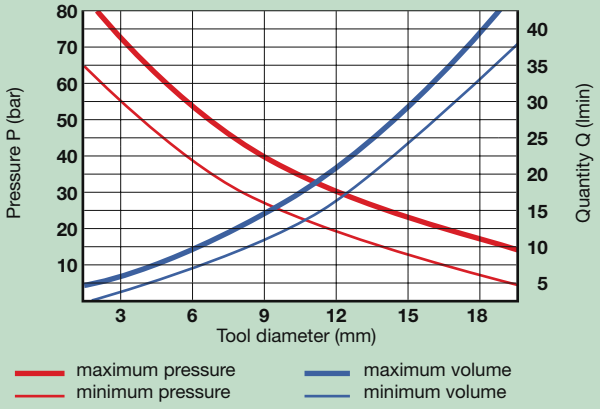


Machining times



Ultimate cost-efficiency:
Applied on machining centres, where the drilling operation is a time relevant criterion, TS 100 T can display its superiority. Its high feed rates lead to a shorter production time, its long tool life reduces the number of tool changes.

Coolant parameters RT 100 T
(Recommendations for soluble oil)



HARTNER

TS 100 T - Spiral-Flute Deep Hole Drills

Order no. 86509

Spiral-flute deep hole drill for drilling depths up to 15xD in unalloyed and alloyed steels, especially crankshaft steel. Optimised flute and coolant duct geometry together with bright finish and particularly smooth flutes provide optimal chip evacuation from deep holes.

NEW

Standard	Hartner std.
Tool material	Solid carbide
Surface	A
Type	TS 100 T
Shank	HA
Cutting direction	rh
Point grinding	Relieved cone
Point angle°	135
Tolerance	h7

Order no. 86511

Spiral-flute deep hole drill for drilling depths up to 20xD in unalloyed and alloyed steels, especially crankshaft steel. Optimised flute and coolant duct geometry together with bright finish and particularly smooth flutes provide optimal chip evacuation from deep holes.

Standard	Hartner std.
Tool material	Solid carbide
Surface	A
Type	TS 100 T
Shank	HA
Cutting direction	rh
Point grinding	Relieved cone
Point angle°	135
Tolerance	h7

Order no. 86512

Spiral-flute deep hole drill for drilling depths up to 25xD in unalloyed and alloyed steels, especially crankshaft steel. Optimised flute and coolant duct geometry together with bright finish and particularly smooth flutes provide optimal chip evacuation from deep holes.

Standard	Hartner std.
Tool material	Solid carbide
Surface	A
Type	TS 100 T
Shank	HA
Cutting direction	rh
Point grinding	Relieved cone
Point angle°	135
Tolerance	h7

Order no. 86513

Spiral-flute deep hole drill for drilling depths up to 30xD in unalloyed and alloyed steels, especially crankshaft steel. Optimised flute and coolant duct geometry together with bright finish and particularly smooth flutes provide optimal chip evacuation from deep holes.

Standard	Hartner std.
Tool material	Solid carbide
Surface	A
Type	TS 100 T
Shank	HA
Cutting direction	rh
Point grinding	Relieved cone
Point angle°	135
Tolerance	h7

A TiAlN-tip-coated

NEW available from 1. quarter 2011

HARTNER

TS 100 T - Spiral-Flute Deep Hole Drills

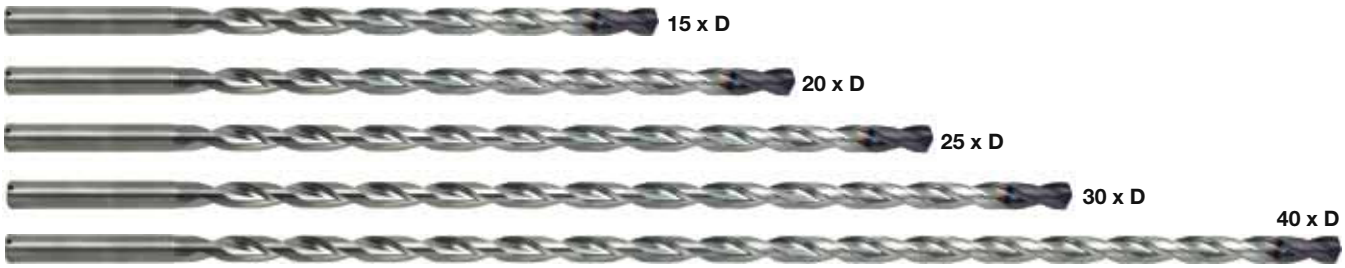
Order no. 86514

Spiral-flute deep hole drill for drilling depths up to 40xD in unalloyed and alloyed steels, especially crankshaft steel. Optimised flute and coolant duct geometry together with bright finish and particularly smooth flutes provide optimal chip evacuation from deep holes.

NEW

Standard	Hartner std.
Tool material	Solid carbide
Surface	Ⓐ
Type	TS 100 T
Shank	HA
Cutting direction	rh
Point grinding	Relieved cone
point angle°	135
Tolerance	h7

Regrinding and recoating

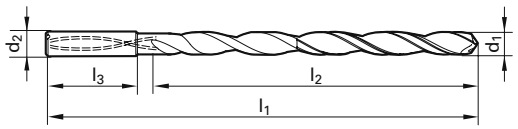


	regrinding and recoating for article no. 86509, 86511, 86512, 86513 and 86514
d1 mm	Availability
3.000 - 6.000	●
6.350 - 7.000	●
7.140 - 8.000	●
8.500 - 10.000	●
12.000	●
14.000	●

Ⓐ TiAlN-tip-coated NEW available from 1. quarter 2011

HARTNER

TS 100 T - Spiral-Flute Deep Hole Drills 15 x D



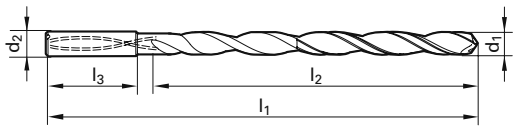
NEW

						86509
						Solid carbide
						165
						■
						HA
						Ⓐ
d1h7	d1h7	d2h6	l1	l2	l3	Availability
inch	mm	mm	mm	mm	mm	
13/64	3,000	6,000	95,00	55,00	36,00	●
1/8	3,170	6,000	106,00	67,00	36,00	●
	3,500	6,000	116,00	76,00	36,00	●
9/64	3,570	6,000	116,00	76,00	36,00	●
5/32	3,970	6,000	116,00	76,00	36,00	●
	4,000	6,000	116,00	76,00	36,00	●
11/64	4,370	6,000	133,00	93,00	36,00	●
	4,500	6,000	133,00	93,00	36,00	●
3/16	4,760	6,000	133,00	93,00	36,00	●
	5,000	6,000	133,00	93,00	36,00	●
	5,100	6,000	150,00	110,00	36,00	●
13/64	5,160	6,000	150,00	110,00	36,00	●
	5,410	6,000	150,00	110,00	36,00	●
	5,500	6,000	150,00	110,00	36,00	●
7/32	5,560	6,000	150,00	110,00	36,00	●
15/64	5,950	6,000	150,00	110,00	36,00	●
	6,000	6,000	150,00	110,00	36,00	●
1/4	6,350	8,000	167,00	127,00	36,00	●
	6,500	8,000	167,00	127,00	36,00	●
17/64	6,750	8,000	167,00	127,00	36,00	●
	7,000	8,000	167,00	127,00	36,00	●
9/32	7,140	8,000	183,00	143,00	36,00	●
	7,500	8,000	183,00	143,00	36,00	●
	7,540	8,000	183,00	143,00	36,00	●
19/64	7,940	8,000	183,00	143,00	36,00	●
	8,000	8,000	183,00	143,00	36,00	●
21/64	8,330	10,000	204,00	160,00	40,00	●
	8,500	10,000	204,00	160,00	40,00	●
11/32	8,730	10,000	204,00	160,00	40,00	●
	9,000	10,000	204,00	160,00	40,00	●
23/64	9,130	10,000	221,00	177,00	40,00	●
3/8	9,520	10,000	221,00	177,00	40,00	●
25/64	9,920	10,000	221,00	177,00	40,00	●
	10,000	10,000	221,00	177,00	40,00	●
13/32	10,320	12,000	247,00	198,00	45,00	●
27/64	10,720	12,000	247,00	198,00	45,00	●
	11,000	12,000	247,00	198,00	45,00	●
7/16	11,110	12,000	263,00	214,00	45,00	●
29/64	11,510	12,000	263,00	214,00	45,00	●
15/32	11,910	12,000	263,00	214,00	45,00	●
	12,000	12,000	263,00	214,00	45,00	●
31/64	12,300	14,000	297,00	248,00	45,00	●
1/2	12,700	14,000	297,00	248,00	45,00	●
33/64	13,100	14,000	297,00	248,00	45,00	●
17/32	13,490	14,000	297,00	248,00	45,00	●
35/64	13,890	14,000	297,00	248,00	45,00	●
	14,000	14,000	297,00	248,00	45,00	●

Ⓐ TiAIN-tip-coated ■ with internal cooling NEW available from 1. quarter 2011

HARTNER

TS 100 T - Spiral-Flute Deep Hole Drills 20 x D

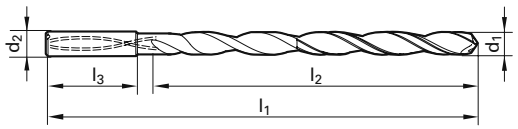


						86511
						Solid carbide
						165
						■
						HA
						Ⓐ
d1h7	d1h7	d2h6	l1	l2	l3	Availability
inch	mm	mm	mm	mm	mm	
	3,00	6,00	110,00	70,00	36,00	●
1/8	3,17	6,00	123,00	83,00	36,00	●
	3,50	6,00	136,00	96,00	36,00	●
9/64	3,57	6,00	136,00	96,00	36,00	● NEW
5/32	3,97	6,00	136,00	96,00	36,00	●
	4,00	6,00	136,00	96,00	36,00	●
11/64	4,37	6,00	158,00	118,00	36,00	● NEW
	4,50	6,00	158,00	118,00	36,00	●
3/16	4,76	6,00	158,00	118,00	36,00	●
	5,00	6,00	158,00	118,00	36,00	●
	5,10	6,00	180,00	140,00	36,00	● NEW
13/64	5,16	6,00	180,00	140,00	36,00	● NEW
	5,41	6,00	180,00	140,00	36,00	● NEW
	5,50	6,00	180,00	140,00	36,00	●
7/32	5,56	6,00	180,00	140,00	36,00	●
15/64	5,95	6,00	180,00	140,00	36,00	● NEW
	6,00	6,00	180,00	140,00	36,00	●
1/4	6,35	8,00	202,00	162,00	36,00	●
	6,50	8,00	202,00	162,00	36,00	●
17/64	6,75	8,00	202,00	162,00	36,00	● NEW
	7,00	8,00	202,00	162,00	36,00	●
9/32	7,14	8,00	223,00	183,00	36,00	●
	7,50	8,00	223,00	183,00	36,00	●
	7,54	8,00	223,00	183,00	36,00	● NEW
19/64	7,94	8,00	223,00	183,00	36,00	● NEW
	8,00	8,00	223,00	183,00	36,00	●
21/64	8,33	10,00	249,00	205,00	40,00	● NEW
	8,50	10,00	249,00	205,00	40,00	●
11/32	8,73	10,00	249,00	205,00	40,00	● NEW
	9,00	10,00	249,00	205,00	40,00	●
23/64	9,13	10,00	271,00	227,00	40,00	● NEW
3/8	9,52	10,00	271,00	227,00	40,00	● NEW
25/64	9,92	10,00	271,00	227,00	40,00	● NEW
	10,00	10,00	271,00	227,00	40,00	●
13/32	10,32	12,00	302,00	253,00	45,00	● NEW
27/64	10,72	12,00	302,00	253,00	45,00	● NEW
	11,00	12,00	302,00	253,00	45,00	● NEW
7/16	11,11	12,00	323,00	274,00	45,00	● NEW
29/64	11,51	12,00	323,00	274,00	45,00	● NEW
15/32	11,91	12,00	323,00	274,00	45,00	● NEW
	12,00	12,00	323,00	274,00	45,00	●
31/64	12,30	14,00	367,00	318,00	45,00	● NEW
1/2	12,70	14,00	367,00	318,00	45,00	● NEW
33/64	13,10	14,00	367,00	318,00	45,00	● NEW
17/32	13,49	14,00	367,00	318,00	45,00	● NEW
35/64	13,89	14,00	367,00	318,00	45,00	● NEW
	14,00	14,00	367,00	318,00	45,00	●

Ⓐ TiAlN-tip-coated ■ with internal cooling NEW available from 1. quarter 2011

HARTNER

TS 100 T - Spiral-Flute Deep Hole Drills 25 x D

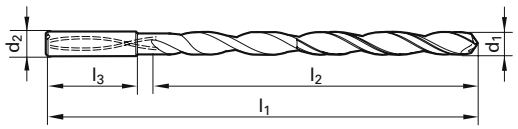


						86512
						Solid carbide
						165
						■
						HA
						Ⓐ
d1h7	d1h7	d2h6	l1	l2	l3	Availability
inch	mm	mm	mm	mm	mm	
	3,00	6,00	125,00	85,00	36,00	●
1/8	3,17	6,00	141,00	101,00	36,00	●
	3,50	6,00	156,00	116,00	36,00	●
9/64	3,57	6,00	156,00	116,00	36,00	● NEW
5/32	3,97	6,00	156,00	116,00	36,00	●
	4,00	6,00	156,00	116,00	36,00	●
11/64	4,37	6,00	183,00	143,00	36,00	● NEW
	4,50	6,00	183,00	143,00	36,00	●
3/16	4,76	6,00	183,00	143,00	36,00	●
	5,00	6,00	183,00	143,00	36,00	●
	5,10	6,00	210,00	170,00	36,00	● NEW
13/64	5,16	6,00	210,00	170,00	36,00	● NEW
	5,41	6,00	210,00	170,00	36,00	● NEW
	5,50	6,00	210,00	170,00	36,00	●
7/32	5,56	6,00	210,00	170,00	36,00	●
15/64	5,95	6,00	210,00	170,00	36,00	● NEW
	6,00	6,00	210,00	170,00	36,00	●
1/4	6,35	8,00	237,00	197,00	36,00	●
	6,50	8,00	237,00	197,00	36,00	●
17/64	6,75	8,00	237,00	197,00	36,00	● NEW
	7,00	8,00	237,00	197,00	36,00	●
9/32	7,14	8,00	263,00	223,00	36,00	●
	7,50	8,00	263,00	223,00	36,00	●
	7,54	8,00	263,00	223,00	36,00	● NEW
19/64	7,94	8,00	263,00	223,00	36,00	● NEW
	8,00	8,00	263,00	223,00	36,00	●
21/64	8,33	10,00	294,00	250,00	40,00	● NEW
	8,50	10,00	294,00	250,00	40,00	●
11/32	8,73	10,00	294,00	250,00	40,00	● NEW
	9,00	10,00	294,00	250,00	40,00	●
23/64	9,13	10,00	321,00	277,00	40,00	● NEW
3/8	9,52	10,00	321,00	277,00	40,00	● NEW
25/64	9,92	10,00	321,00	277,00	40,00	● NEW
	10,00	10,00	321,00	277,00	40,00	●
13/32	10,32	12,00	359,00	310,00	45,00	● NEW
27/64	10,72	12,00	359,00	310,00	45,00	● NEW
	11,00	12,00	359,00	310,00	45,00	● NEW
7/16	11,11	12,00	386,00	337,00	45,00	● NEW
29/64	11,51	12,00	386,00	337,00	45,00	● NEW
15/32	11,91	12,00	386,00	337,00	45,00	● NEW
	12,00	12,00	386,00	337,00	45,00	●

Ⓐ TiAlN-tip-coated ■ with internal cooling NEW available from 1. quarter 2011

HARTNER

TS 100 T - Spiral-Flute Deep Hole Drills 30 x D

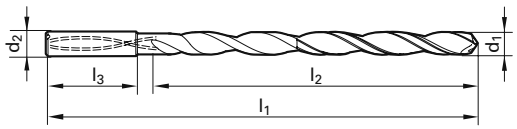


						86513
						Solid carbide
						165
						■
						HA
						Ⓐ
d1h7	d1h7	d2h6	l1	l2	l3	Availability
inch	mm	mm	mm	mm	mm	
	3,00	6,00	140,00	100,00	36,00	●
1/8	3,17	6,00	158,00	118,00	36,00	●
	3,50	6,00	176,00	136,00	36,00	●
9/64	3,57	6,00	176,00	136,00	36,00	● NEW
5/32	3,97	6,00	176,00	136,00	36,00	●
	4,00	6,00	176,00	136,00	36,00	●
11/64	4,37	6,00	208,00	168,00	36,00	● NEW
	4,50	6,00	208,00	168,00	36,00	●
3/16	4,76	6,00	208,00	168,00	36,00	●
	5,00	6,00	208,00	168,00	36,00	●
	5,10	6,00	240,00	200,00	36,00	● NEW
13/64	5,16	6,00	240,00	200,00	36,00	● NEW
	5,41	6,00	240,00	200,00	36,00	● NEW
	5,50	6,00	240,00	200,00	36,00	●
7/32	5,56	6,00	240,00	200,00	36,00	●
15/64	5,95	6,00	240,00	200,00	36,00	● NEW
	6,00	6,00	240,00	200,00	36,00	●
1/4	6,35	8,00	272,00	232,00	36,00	●
	6,50	8,00	272,00	232,00	36,00	●
17/64	6,75	8,00	272,00	232,00	36,00	● NEW
	7,00	8,00	272,00	232,00	36,00	●
9/32	7,14	8,00	303,00	263,00	36,00	●
	7,50	8,00	303,00	263,00	36,00	●
	7,54	8,00	303,00	263,00	36,00	● NEW
19/64	7,94	8,00	303,00	263,00	36,00	● NEW
	8,00	8,00	303,00	263,00	36,00	●
21/64	8,33	10,00	339,00	295,00	40,00	● NEW
	8,50	10,00	339,00	295,00	40,00	●
11/32	8,73	10,00	339,00	295,00	40,00	● NEW
	9,00	10,00	339,00	295,00	40,00	●
23/64	9,13	10,00	371,00	327,00	40,00	● NEW
3/8	9,52	10,00	371,00	327,00	40,00	● NEW
25/64	9,92	10,00	371,00	327,00	40,00	● NEW
	10,00	10,00	371,00	327,00	40,00	●

Ⓐ TiAlN-tip-coated ■ with internal cooling NEW available from 1. quarter 2011

HARTNER

TS 100 T - Spiral-Flute Deep Hole Drills 40 x D



NEW

						86514
						Solid carbide
						165
						■
						HA
						Ⓐ
d1h7	d1h7	d2h6	l1	l2	l3	Availability
inch	mm	mm	mm	mm	mm	
	3,00	6,00	170,00	130,00	36,00	●
1/8	3,17	6,00	193,00	153,00	36,00	●
	3,50	6,00	193,00	153,00	36,00	●
9/64	3,57	6,00	216,00	176,00	36,00	●
5/32	3,97	6,00	216,00	176,00	36,00	●
	4,00	6,00	216,00	176,00	36,00	●
11/64	4,37	6,00	238,00	198,00	36,00	●
	4,50	6,00	238,00	198,00	36,00	●
3/16	4,76	6,00	258,00	218,00	36,00	●
	5,00	6,00	258,00	218,00	36,00	●
	5,10	6,00	280,00	240,00	36,00	●
13/64	5,16	6,00	280,00	240,00	36,00	●
	5,41	6,00	280,00	240,00	36,00	●
	5,50	6,00	280,00	240,00	36,00	●
7/32	5,56	6,00	300,00	260,00	36,00	●
15/64	5,95	6,00	300,00	260,00	36,00	●
	6,00	6,00	300,00	260,00	36,00	●
1/4	6,35	8,00	322,00	282,00	36,00	●
	6,50	8,00	322,00	282,00	36,00	●
17/64	6,75	8,00	342,00	302,00	36,00	●
	7,00	8,00	342,00	302,00	36,00	●
9/32	7,14	8,00	363,00	323,00	36,00	●
	7,50	8,00	363,00	323,00	36,00	●
	7,54	8,00	383,00	343,00	36,00	●
19/64	7,94	8,00	383,00	343,00	36,00	●
	8,00	8,00	383,00	343,00	36,00	●

Ⓐ TiAIN-tip-coated ■ with internal cooling NEW available from 1. quarter 2011

HARTNER

TS 100 T - Recommendations

Procedure:

- Initial milling of surface. The surface must be machined at right angles to the entry angle of the drilling operation.
- Production of a cylindrical pilot hole (tolerance F9) with a minimum drilling depth of 1 x D.
- Entry in the pilot hole at a speed of approx. 300 rev./min and with a feed rate of approx. 500 mm/min.
- Setting of coolant pressure and speed.
- Continuous drilling to complete hole depth without wood pecking.
- For through holes with plain - i.e. 90° - exit, reduce the feed rate v_f to 50% approx. 1 mm prior to break-through.
- For through holes with oblique exit, reduce the feed rate v_f to 40% approx. 1 mm prior to break-through.
- After reaching hole depth, stop machine spindle and coolant supply, withdrawal in top gear.

TS 100 T - on deep hole drilling machines

After checking the clamping and the total length, the application of TS 100 T is possible on deep hole drilling machines with a guide bush.

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

All deep hole drills must have support for the pilot hole.
Deep hole drills must never operate at full speed without support in the machine shop.

Material group	Material examples, **new description** (old description in brackets) *Figures in bold = material no. to DIN EN*	Tensile strength MPa (N/mm^2) Hardness
Common structural steels	**1.0035** S185, **1.0486** StE P275N, **1.0345** P235GH, **1.0425** P265GH **1.0050** E295, **1.0070** E360, **1.8937** P500NH	≤ 500 > 500-850
Free-cutting steels	**1.0718** 11SMnPb30, **1.0736** 115Mn37 **1.0727** 46 S20, **1.0728** 60 S20, **1.0757** 46SPb20	≤850 850-1000
Unalloyed heat-treatable steels	**1.0402** C22, **1.1178** C30E **1.0503** C45, **1.1191** C45E **1.0601** C60, **1.1221** C60E	≤700 700-850 850-1000
Alloyed heat-treatable steels	**1.5131** 50MnSi4, **1.7003** 38Cr2, **1.7030** 28Cr4 **1.5710** 36NiCr6, **1.7035** 41Cr4, **1.7225** 42CrMo4	850-1000 1000-1200
Unalloyed case hardened steels	**1.0301** C10, **1.1121** C10E	≤750
Alloyed case hardened steels	**1.7043** 38Cr4 **1.5752** 14NiCr14, **1.7131** 16MnCr5, **1.7264** 20CrMo5	850-1000 1000-1200
Nitriding steels	**1.8504** 34CrAl6 **1.8519** 31CrMoV9, **1.8550** 34CrAlNi7	850-1000 1000-1200
Tool steels	**1.1750** C75W, **1.2067** 102Cr6, **1.2307** 29CrMoV9 **1.2080** X210Cr12, **1.2083** X42Cr13, **1.2419** 105WCr6, **1.2767** X45NiCrMo4	≤850 850-1000
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 austenitic martensitic	**1.4005** X12CrS13, **1.4104** X14CrMoS17, **1.4105** X6CrMoS17, **1.4301** X5CrNi18 10, **1.4541** X6CrNiTi18 10, **1.4571** X6CrNiMoTi 17 12 2 **1.4057** X17CrNi16-1, **1.4122** X39CrMo17-1, **1.4521** X2CrMoTi18 2	≤850 ≤850 ≤850
Hardened steels	–	≤40-48 HRC <48-60 HRC
Special alloys	Nimonic, Inconel, Monel, Hastelloy	≤1200
Cast iron	**0.6010** EN-GJL-100 (GG10), **0.6020** EN-GJL-200 (GG20) **0.6025** EN-GJL-250 (GG25), **0.6035** EN-GJL-350 (GG35)	≤240 HB <300 HB
New cast materials CGI	**EN-GJV250** (GGV25), **EN-GJV350** (GGV35) **EN-GJV400** (GGV40), **EN-GJV500** (GGV50), SiMo 6	
New cast materials ADI	**EN-GJS-800-8** (ADI800), **EN-GJS-1000-5** (ADI1000) **EN-GJS-1200-2** (ADI1200), **EN-GJS-1400-1** (ADI1400)	800-1000 1200-1400
Spheroidal graphite iron and malleable cast iron	**0.7050** EN-GJS-500-7 (GGG50), **0.8035** EN-GJMW-350-4 (GTW35) **0.7070** EN-GJS-700-2 (GGG70), **0.8170** EN-GJMB-700-2 (GTS70)	≤240 HB <300 HB
Chilled cast iron	–	≤350 HB
Ti and Ti-alloys	**3.7024** Ti99,5, **3.7114** TiAl5Sn2,5, **3.7124** TiCu2 **3.7154** TiAl6Zr5, **3.7164** TiAl6V4, **3.7184** TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 850-1200
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	≤450
Al cast alloys ≤ 10 % Si > 10 % Si	**3.2131** G-AlSi5Cu1, **3.2153** G-AlSi7Cu3, **3.2573** G-AlSi9 **3.2581** G-AlSi12, **3.2583** G-AlSi12Cu, - G-AlSi12CuNiMg	≤600 ≤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 long-chipping	**2.0380** CuZn39Pb2, **2.0401** CuZn39Pb3, **2.0410** CuZn43Pb2 **2.0250** CuZn20, **2.0280** CuZn33, **2.0332** CuZn37Pb0,5	≤600 ≤600
Bronze, short-chipping	**2.0380** CuZn39Pb2, **2.0401** CuZn39Pb3, **2.0410** CuZn43Pb2 **2.0250** CuZn20, **2.0280** CuZn33, **2.0332** CuZn37Pb0,5	≤600 >600-850
Bronze, long-chipping	**2.0380** CuZn39Pb2, **2.0401** CuZn39Pb3, **2.0410** CuZn43Pb2 **2.0250** CuZn20, **2.0280** CuZn33, **2.0332** CuZn37Pb0,5	≤850 850-1000

HARTNER

TS 100 T - Recommendations

Order no.	86509				86511				86512				86513				86514	
Standard	Hartner std.				Hartner std.				Hartner std.				Hartner std.				Hartner std.	
Tool material	Solid carbide				Solid carbide				Solid carbide				Solid carbide				Solid carbide	
Carbide grade	K30/K40				K30/K40				K30/K40				K30/K40				K30/K40	
Surface finish	A TiAlN-tip-coated				A TiAlN-tip-coated				A TiAlN-tip-coated				A TiAlN-tip-coated				A TiAlN-tip-coated	
Drilling depth	15 x D				20 x D				25 x D				30 x D				40 x D	
	NEW 																NEW 	
	conventional cooling min. 40 bar		MQL		conventional cooling min. 40 bar		MQL		conventional cooling min. 40 bar		MQL		conventional cooling min. 40 bar		MQL		conventional cooling min. 40 bar	
	Vc (m/min)	Feed col. no.	Vc (m/min)	Feed col. no.	Vc (m/min)	Feed col. no.	Vc (m/min)	Feed col. no.	Vc (m/min)	Feed col. no.	Vc (m/min)	Feed col. no.	Vc (m/min)	Feed col. no.	Vc (m/min)	Feed col. no.	Vc (m/min)	Feed col. no.
	110	8			110	8			100	8			80	7			80	7
	110	8			110	8			100	8			80	7			80	7
	120	8			120	8			120	8			100-120	8			100	8
	120	8			120	8			100	8			100	8			100	8
	110	6			110	6			110	6			110	6			110	6
	110	8			110	8			100	8			80	7			80	7
	100	7			100	7			100	7			80	7			80	7
	110	**7**	*80*	**7**	**110**	**7**	*80*	**7**	**100**	**7**	*70*	**7**	**80**	**7**	*60*	**6-7**	**80**	**6-7**
	110	**6**	*80*	**7**	**110**	**6**	*80*	**7**	**100**	**6**	*70*	**7**	**80**	**6**	*60*	**6**	**80**	**6**
	110	8			110	8			100	8			80	7			80	7
	110	7	80	6-7	110	7	80	6-7	100	7	70	6-7	80	6	60	6-7	80	6
	110	6	80	6-7	110	6	80	6-7	100	6	70	6-7	80	6	60	6-7	80	6
	100	5			100	5			80	5			80	5			80	5
	80	5			80	5			60	5			60	5			60	5
	100	6-7			100	6-7			90	6-7			80	6-7			80	6-7
	80	5			80	5			70	4			70	4			70	4
	50	5			50	5			50	4			50	4			50	4
	50	5			50	5			50	4			50	4			50	4
	100	5			100	5			100	5			80	5			80	5
	60-80	2-3			60-80	2-3			60-80	2-3			60-80	2-3			60-80	2-3
	100	5			100	5			100	5			80	5			80	5
	50	4			50	4			50	4			50	4			50	4
	30	2			30	2			30	2			30	2			30	2
	140	8			140	8			130	8			120	8			120	8
	100	8			100	8			90	8			80	8			80	8
	100	6			100	6			90	6			80	6			80	6
	100	6			100	6			90	6			80	6			80	6
	90	8	90	8	90	8	90	8	80	8	80	8	70	8	70	8	70	8
	140	8			140	8			130	8			120	8			120	8
	100	8			100	8			90	8			80	8	65	8	80	8
	120	1			120	1			120	1			120	1			120	1
	120	8			120	8			110	8			100	8			100	8

HARTNER

TS 100 R - The specialist for cast materials

New materials require new tooling solutions. As an innovative tool manufacturer, Hartner 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 TS Drill type TS 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.

Hartner has therefore developed the new TS Drill type TS 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.

Drilling depths
The two drilling depths 5 x D and 7 x D with internal cooling are suitable for a wide range of applications. Furthermore, the TS 100 R is available as a special tool with or without internal cooling to fit your specific application. Hartner can, for example, provide applicationorientated coatings or even modify the design of a step drill. For the special tool request form please see page 21.

Our recommendation:
The TS 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 Hartner‘s MQL screw and components. Please contact our technical service department for more information.

Selected machining results with TS 100 R drills

Diameter	16	17
Coating	FIRE	Super A
Material	GGG50	GGG40
Drilling depth (mm)	20	50
Cooling	IC	IC
Lubricant	neat oil	soluble oil
v_c [m/min]	120	160
f [mm/rev.]	0.5	0.6
Tool life [m]	615	305

HARTNER

TS 100 R - The specialist for cast materials

Order no. 89420

Special drill with patented radius geometry for CGI and ADI as well as all cast materials.
Suitable for drilliing depths ≤ 5 x D.

Advantages:
Optimal performance and economical efficiency.
Extremely rigid, dimensionally accurate and process reliable thanks to unique adaptation of face contour and flute geometry.

Preconditions for use:
Powerful machines. No play in spindle bearings. Alignment accurate tool holders. Max. concentricity error of clamped tools: 0.02 mm. Chatterfree, mechanical feeds. The tool is available without whistle notch flat for application in shrink fit/hydraulic chucks.

Standard	DIN 6537L
Tool material	Solid carbide
Surface	F
Type	TS 100 R
Shank	HA
Cutting direction	rh
Point grinding	Relieved cone
Point angle°	
Tolerance	m7

Order no. 89421

Special drill with patented radius geometry for CGI and ADI as well as all cast materials.
Suitable for drilliing depths ≤ 7 x D.

Advantages:
Optimal performance and economical efficiency.
Extremely rigid, dimensionally accurate and process reliable thanks to unique adaptation of face contour and flute geometry.

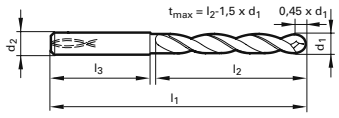
Preconditions for use:
Powerful machines. No play in spindle bearings. Alignment accurate tool holders. Max. concentricity error of clamped tools: 0.02 mm. Chatterfree, mechanical feeds. The tool is available without whistle notch flat for application in shrink fit/hydraulic chucks.

Standard	Hartner std.
Tool material	Solid carbide
Surface	F
Type	TS 100 R
Shank	HA
Cutting direction	rh
Point grinding	Relieved cone
Point angle°	
Tolerance	m7

F FIRE-coated

HARTNER

TS 100 R 5 x D



					89420
					Solid carbide/K20
					DIN 6537L
					165
					■
					F
d1	d2	l1	l2	l3	Availability
mm	mm	mm	mm	mm	
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	●
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	●

F FIRE-coated ■ with internal cooling

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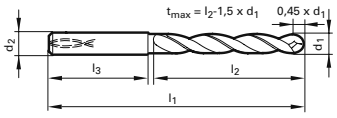
TS 100 R 5 x D

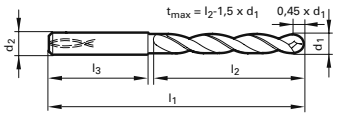


					89420
					Solid carbide/K20
					DIN 6537L
					165
					■
					F
d1	d2	l1	l2	l3	Availability
mm	mm	mm	mm	mm	
7,30	8	91	53	36	●
7,40	8	91	53	36	●
7,50	8	91	53	36	●
7,54	8	91	53	36	●
7,60	8	91	53	36	●
7,70	8	91	53	36	●
7,80	8	91	53	36	●
7,90	8	91	53	36	●
7,94	8	91	53	36	●
8,00	8	91	53	36	●
8,10	10	103	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	●
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	●

F FIRE-coated ■ with internal cooling

HARTNER

TS 100 R 5 x D

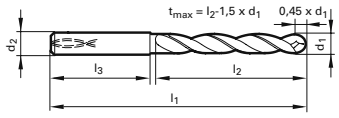


					89420
					Solid carbide/K20
					DIN 6537L
					165
					■
					F
d1	d2	l1	l2	l3	Availability
mm	mm	mm	mm	mm	
11,90	12	118	71	45	●
11,91	12	118	71	45	●
12,00	12	118	71	45	●
12,10	14	124	77	45	●
12,20	14	124	77	45	●
12,30	14	124	77	45	●
12,40	14	124	77	45	●
12,50	14	124	77	45	●
12,60	14	124	77	45	●
12,70	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	●

F FIRE-coated ■ with internal cooling

HARTNER

TS 100 R 7 x D

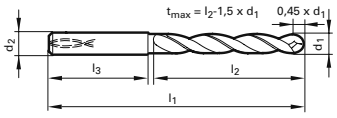


					89421
					Solid carbide/K20
					Hartner std.
					165
					■
					F
d1	d2	l1	l2	l3	Availability
mm	mm	mm	mm	mm	
4,00	6	75	37,5	36	●
4,10	6	75	37,5	36	●
4,20	6	75	37,5	36	●
4,30	6	85	45	36	●
4,37	6	85	45	36	●
4,40	6	85	45	36	●
4,50	6	85	45	36	●
4,60	6	85	45	36	●
4,65	6	85	45	36	●
4,70	6	85	45	36	●
4,76	6	90	50	36	●
4,80	6	90	50	36	●
4,90	6	90	50	36	●
5,00	6	90	50	36	●
5,10	6	90	50	36	●
5,16	6	90	50	36	●
5,20	6	90	50	36	●
5,30	6	90	50	36	●
5,40	6	97	57	36	●
5,50	6	97	57	36	●
5,55	6	97	57	36	●
5,56	6	97	57	36	●
5,60	6	97	57	36	●
5,70	6	97	57	36	●
5,80	6	97	57	36	●
5,90	6	97	57	36	●
5,95	6	97	57	36	●
6,00	6	97	57	36	●
6,10	8	106	66	36	●
6,20	8	106	66	36	●
6,30	8	106	66	36	●
6,35	8	106	66	36	●
6,40	8	106	66	36	●
6,50	8	106	66	36	●
6,60	8	106	66	36	●
6,70	8	106	66	36	●
6,75	8	106	66	36	●
6,80	8	106	66	36	●
6,90	8	116	76	36	●
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	●

F FIRE-coated ■ with internal cooling

HARTNER

TS 100 R 7 x D

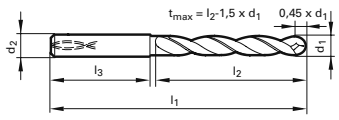


					89421
					Solid carbide/K20
					Hartner std.
					165
					■
					Ⓕ
d1	d2	l1	l2	l3	Availability
mm	mm	mm	mm	mm	
8,40	10	131	87	40	●
8,50	10	131	87	40	●
8,60	10	131	87	40	●
8,70	10	131	87	40	●
8,73	10	131	87	40	●
8,80	10	131	87	40	●
8,90	10	131	87	40	●
9,00	10	131	87	40	●
9,10	10	139	95	40	●
9,13	10	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	●
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	●

Ⓕ FIRE-coated ■ with internal cooling

HARTNER

TS 100 R 7 x D



					89421
					Solid carbide/K20
					Hartner std.
					165
					■
					Ⓕ
d1	d2	l1	l2	l3	Availability
mm	mm	mm	mm	mm	
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 ■ with internal cooling

HARTNER

TS 100 R - 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 Hartner MQL components. Please contact our technical service department for more information.

Tool material		Solid carbide	
Carbide grade		K20	
Surface finish		F	
Cooling		■	
Drilling depth		~ 5 x D	~ 7 x D
Art. no.	DIN 6537L	89420	
	Works Standard		89421

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

F FIRE-coated
■ with coolant ducts

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

HARTNER

TS 100 R - The specialist for cast materials

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Customer no. | New customer | Order no.

Company | Contact

Ansprechpartner

Street no. | Town/post code

Telephone | Fax

Date | Signature

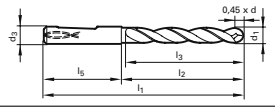
Hartner GmbH
P. O. Box 10 04 27
D-72425 Albstadt
Tel.: +497431 125-0
Fax: +497431 125-547
www.hartner.de

WITHOUT step

TS 100 R

Carbide grade

K20



Relation of nom.-Ø d_2, 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 ■■■■, HE ■■■■	
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 / min. quantity lubrication / dry	
Surface finish/coating	bright// FIRE/MolyGlide / AlTiN	
Workpiece material		
Quantity		

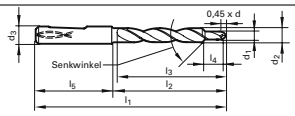
Standard tolerances: nom.-Ø = m7, shank-Ø = h6

WITH step

TS 100 R

Carbide grade

K20



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 ■■■■, HE ■■■■	
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 / AlTiN	
Workpiece material		
Quantity		

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

Solid carbide Micro-precision drills - Outstanding performance for a lot of materials

Small but mighty - with and without internal cooling

Solid carbide micro-precision drills without internal cooling for drilling depths up to 4xD and 7xD are available in the diameter range from 0.8 to 3.0 mm.

Holes up to 8xD and 15xD are the domain of solid carbide micro-precision drills with internal cooling. Thanks to the optimised tool geometry, pecking is not required for holes up to 15xD with Hartner's solid carbide micro-precision drills.

The tool design makes the solid carbide micro-precision drill 4xD without internal cooling optimally suitable as a pilot drill for the 15xD micro-precision drill with internal cooling.

NEW
now with IC for 8xD and 15xD

Superior in every sense

Solid carbide micro-precision drills have proven their exceptional performance capabilities in various volume applications and tool life tests. The tables below document a few application examples with convincing results.

Machining examples of solid carbide micro-precision drills 8xD and 15xD with IC

Hartner no.	86408	86408	86412	86412
Diameter	1.4 mm	2.5 mm	2.5 mm	2.1 mm
Coating	AlTiN	AlTiN	AlTiN	AlTiN
Material group	cast iron	alloyed case hardened steel	alloyed heat-treatable steel	stainless steel
Material description	GG25	16MnCr5	42CrMo4	X6CrNiTi18 10
Drill. depth [mm]	8xD	8xD	15xD	15xD
Hole type	blind hole	blind hole	blind hole	blind hole
Cooling	IC 80 bar	IC 80 bar	IC 80 bar	IC 80 bar
Coolant	soluble oil	soluble oil	soluble oil	soluble oil
Machine type	machining centre	machining centre	machining centre	machining centre
v_c [mm/min]	80	120	100	60
f [mm/rev.]	0.1	0.14	0.1	0.03
Tool life [m]	150	110	60	60

Internal cooling increases tool life considerably!

A comparison between a conventional micro-precision drill w/o internal cooling for holes up to 7xD and a 8xD drill with internal cooling 86408 demonstrates the advantages of internal cooling: Tool life increases considerably.

Hartner no.	Competitor without internal cooling	86408 with internal cooling
Diameter	2.6 mm	2.6 mm
Coating	TiAlN	AlTiN
Material group	stainless steel	stainless steel
Material description	105CrMo17	105CrMo17
Drill. depth [mm]	7xD	8xD
Hole type	blind hole	blind hole
Cooling	external	internal 100 bar
Coolant	neat oil	neat oil
Machine type	machining centre	machining centre
v_c [mm/min]	53	53
f [mm/rev.]	0.06	0.06
Tool life [m]	100 workpieces	500 workpieces, end of tool life not reached!

HARTNER

Solid carbide Micro-precision drills

Order no. 86400

Solid carbide special drill with AlTiN-coating and reinforced shank without internal cooling for drilling small holes up to 4 x D boring depth particularly for steel. Also applicable for machining cast iron.
The special fl ute geometry enables optimal chip break and chip removal also at higher cutting speeds and feeds. The two-facet point grinding on every cutting edge and the special web thinning ensure a good self-centering.

Standard	Hartner std.
Tool material	Solid carbide
Surface	Ⓐ
Type	N
Cutting direction	right-hand
Point grinding	Facet point
Point angle	140
Tolerance	m7

Order no. 86401

Solid carbide special drill with AlTiN-coating and reinforced shank without internal cooling for drilling small holes up to 7 x D boring depth particularly for steel. Also applicable for machining cast iron.
The special fl ute geometry enables optimal chip break and chip removal also at higher cutting speeds and feeds. The two-facet point grinding on every cutting edge and the special web thinning ensure a good self-centering.

Standard	Hartner std.
Tool material	Solid carbide
Surface	Ⓐ
Type	N
Cutting direction	right-hand
Point grinding	Facet point
Point angle	140
Tolerance	m7

Order no. 86408

Solid carbide special drill with AlTiN-coating and reinforced shank with internal cooling for drilling small holes up to 8 x D boring depth particularly for steel. Also applicable for machining cast iron.
The special fl ute geometry enables optimal chip break and chip removal also at higher cutting speeds and feeds. The two-facet point grinding on every cutting edge and the special web thinning ensure a good self-centering.

Hints:
Please apply 86400 for centering (approx. 2/3 x D drilling depth), s. Page 29.
When applying solid carbide micro-precision drills, we recommend constant monitoring of the lubricant‘s filter quality due to the extremely small coolant duct diameters.

Standard	Hartner std.
Tool material	Solid carbide
Surface	Ⓐ
Type	N
Cutting direction	right-hand
Point grinding	Facet point
Point angle	135
Tolerance	h7

Order no. 86412

Solid carbide special drill with AlTiN-coated tip and reinforced shank with internal cooling for drilling small holes up to 15 x D boring depth particularly for steel. Also applicable for machining cast iron.
The special fl ute geometry enables optimal chip break and chip removal also at higher cutting speeds and feeds. The two-facet point grinding on every cutting edge and the special web thinning ensure a good self-centering.

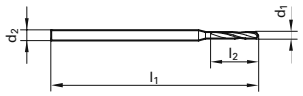
Hints:
Please apply 86400 as pilot drill (approx. 1-2 x D drilling depth), s. Page 29.
When applying solid carbide micro-precision drills, we recommend constant monitoring of the lubricant‘s filter quality due to the extremely small coolant duct diameters.

Norm	Hartner std.
Standard	Solid carbide
Tool material	Ⓐ
Surface	N
Type	right-hand
Cutting direction	Facet point
Point grinding	135
Tolerance	h7

Ⓐ AlTiN-coated ☒ External cooling

HARTNER

Solid carbide micro-precision drills ~ 4 x D

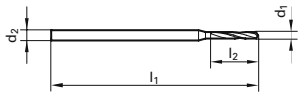


				86400
				Solid carbide
				Hartner std.
				☒
				164
				Ⓐ
d1	d2	l1	l2	Availability
mm	mm	mm	mm	
0,80	3,0	47,0	4,8	●
0,85	3,0	47,0	5,1	●
0,90	3,0	47,0	5,4	●
0,95	3,0	47,0	5,7	●
1,00	3,0	47,0	6,0	●
1,05	3,0	47,0	6,3	●
1,10	3,0	47,0	6,6	●
1,15	3,0	47,0	6,9	●
1,20	3,0	47,0	7,2	●
1,25	3,0	47,0	7,5	●
1,30	3,0	47,0	7,8	●
1,35	3,0	47,0	8,1	●
1,40	3,0	47,0	8,4	●
1,45	3,0	47,0	8,7	●
1,50	3,0	47,0	9,0	●
1,55	3,0	47,0	9,3	●
1,60	3,0	47,0	9,6	●
1,65	3,0	47,0	9,9	●
1,70	3,0	47,0	10,2	●
1,75	3,0	47,0	10,5	●
1,80	3,0	52,0	10,8	●
1,85	3,0	52,0	11,1	●
1,90	3,0	52,0	11,4	●
1,95	3,0	52,0	11,7	●
2,00	4,0	59,0	12,0	●
2,05	4,0	59,0	12,3	●
2,10	4,0	59,0	12,6	●
2,15	4,0	59,0	12,9	●
2,20	4,0	59,0	13,2	●
2,25	4,0	59,0	13,5	●
2,30	4,0	59,0	13,8	●
2,35	4,0	59,0	14,1	●
2,40	4,0	59,0	14,4	●
2,45	4,0	59,0	14,7	●
2,50	4,0	59,0	15,0	●
2,55	4,0	59,0	15,3	●
2,60	4,0	59,0	15,6	●
2,65	4,0	59,0	15,9	●
2,70	4,0	59,0	16,2	●
2,75	4,0	59,0	16,5	●
2,80	4,0	59,0	16,8	●
2,85	4,0	59,0	17,1	●
2,90	4,0	59,0	17,4	●
2,95	4,0	59,0	17,7	●
3,00	4,0	59,0	18,0	●

Ⓐ AlTiN-coated ☒ External cooling

HARTNER

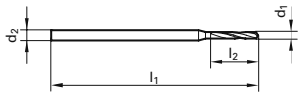
Solid carbide micro-precision drills ~ 7 x D



				86401
				Solid carbide
				Hartner std.
				☒
				164
				Ⓐ
d1	d2	l1	l2	Availability
mm	mm	mm	mm	
0,80	3,0	47,0	6,4	●
0,85	3,0	47,0	6,8	●
0,90	3,0	47,0	7,2	●
0,95	3,0	47,0	7,6	●
1,00	3,0	47,0	8,0	●
1,05	3,0	47,0	8,4	●
1,10	3,0	47,0	8,8	●
1,15	3,0	47,0	9,2	●
1,20	3,0	52,0	10,8	●
1,25	3,0	52,0	11,3	●
1,30	3,0	52,0	11,7	●
1,35	3,0	52,0	12,2	●
1,40	3,0	52,0	12,6	●
1,45	3,0	52,0	13,1	●
1,50	3,0	52,0	13,5	●
1,55	3,0	52,0	14,0	●
1,60	3,0	52,0	14,4	●
1,65	3,0	52,0	14,9	●
1,70	3,0	52,0	15,3	●
1,75	3,0	52,0	15,8	●
1,80	3,0	52,0	16,2	●
1,85	3,0	52,0	16,7	●
1,90	3,0	52,0	17,1	●
1,95	3,0	52,0	17,6	●
2,00	4,0	63,0	18,0	●
2,05	4,0	63,0	18,5	●
2,10	4,0	63,0	18,9	●
2,15	4,0	63,0	19,4	●
2,20	4,0	63,0	19,8	●
2,25	4,0	63,0	20,3	●
2,30	4,0	63,0	20,7	●
2,35	4,0	63,0	21,2	●
2,40	4,0	63,0	21,6	●
2,45	4,0	63,0	22,1	●
2,50	4,0	63,0	22,5	●
2,55	4,0	63,0	23,0	●
2,60	4,0	67,0	23,4	●
2,65	4,0	67,0	23,9	●
2,70	4,0	67,0	24,3	●
2,75	4,0	67,0	24,8	●
2,80	4,0	67,0	25,2	●
2,85	4,0	67,0	25,7	●
2,90	4,0	67,0	26,1	●
2,95	4,0	67,0	26,6	●
3,00	4,0	67,0	27,0	●

Ⓐ AlTiN-coated ☒ External cooling

Solid carbide micro-precision drills ~ 8 x D



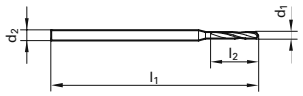
NEW

				86408
				Solid carbide
				Hartner std.
				■
				164
				Ⓐ
d1	d2	l1	l2	Availability
mm	mm	mm	mm	
1,40	4,00	52	15	●
1,45	4,00	52	16	●
1,50	4,00	52	17	●
1,55	4,00	52	17	●
1,59	4,00	52	18	●
1,60	4,00	52	18	●
1,65	4,00	52	18	●
1,70	4,00	56	19	●
1,75	4,00	56	19	●
1,80	4,00	56	20	●
1,85	4,00	56	20	●
1,90	4,00	56	21	●
1,95	4,00	56	21	●
1,98	4,00	56	22	●
2,00	4,00	56	22	●
2,05	4,00	56	23	●
2,10	4,00	62	23	●
2,15	4,00	62	24	●
2,20	4,00	62	24	●
2,25	4,00	62	25	●
2,30	4,00	62	25	●
2,35	4,00	62	26	●
2,38	4,00	62	26	●
2,40	4,00	62	26	●
2,45	4,00	62	27	●
2,50	4,00	62	28	●
2,55	4,00	62	28	●
2,60	4,00	66	29	●
2,65	4,00	66	29	●
2,70	4,00	66	30	●
2,75	4,00	66	30	●
2,78	4,00	66	31	●
2,80	4,00	66	31	●
2,85	4,00	66	31	●
2,90	4,00	66	32	●
2,95	4,00	66	32	●
3,00	4,00	66	33	●

Ⓐ AlTiN-coated ■ with internal cooling

HARTNER

Solid carbide micro-precision drills ~ 15 x D



NEW

				86412
				Solid carbide
				Hartner std.
				■
				164
				Ⓐ
d1	d2	l1	l2	Availability
mm	mm	mm	mm	
1,40	4,00	62	25	●
1,50	4,00	62	27	●
1,59	4,00	62	29	●
1,60	4,00	62	29	●
1,70	4,00	70	31	●
1,80	4,00	70	32	●
1,90	4,00	70	34	●
1,98	4,00	70	36	●
2,00	4,00	70	36	●
2,10	4,00	78	38	●
2,20	4,00	78	40	●
2,30	4,00	78	42	●
2,38	4,00	78	44	●
2,40	4,00	78	44	●
2,50	4,00	78	45	●
2,60	4,00	87	47	●
2,70	4,00	87	48	●
2,78	4,00	87	50	●
2,80	4,00	87	50	●
2,90	4,00	87	52	●
3,00	4,00	87	54	●

Ⓐ AlTiN-coated ■ with internal cooling

HARTNER

Solid carbide Micro-precision drills 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.

External cooling hints:
We recommend lubrication by soluble oil or neat oil.

☒ with external cooling
■ with internal cooling

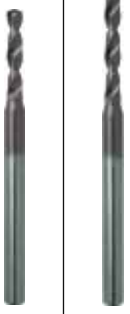
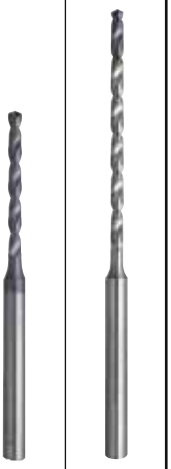
Drill Ø mm	Feed column no.												
	56	57	58	59	60	61	62	63	64	65	66	67	68
	f (mm/rev.)												
0.80	0.008	0.016	0.024	0.032	0.04	0.05	0.06	0.07	0.08	0.08	0.08	0.09	0.09
1.00	0.012	0.022	0.032	0.042	0.06	0.07	0.08	0.09	0.10	0.10	0.11	0.11	0.12
1.50	0.021	0.036	0.051	0.066	0.09	0.10	0.12	0.13	0.15	0.15	0.16	0.17	0.18
2.00	0.032	0.052	0.072	0.092	0.12	0.14	0.16	0.18	0.20	0.21	0.22	0.23	0.24
2.50	0.045	0.070	0.095	0.120	0.15	0.17	0.20	0.22	0.25	0.26	0.27	0.28	0.30
3.00	0.060	0.090	0.120	0.150	0.18	0.21	0.24	0.27	0.30	0.31	0.33	0.34	0.36

STOP All drilling tools from 8xD must be guided during spot drilling. They must never operate at full speed without support in the machine shop

Ⓐ AlTiN-coated

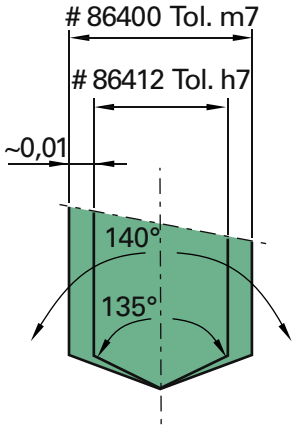
Material	Material example *Figures in bold = material no. to DIN EN 10 027*	Tens. strength MPa N/mm²	Hard-ness
Common structural steels	**1.0035** S185, **1.0486** StE P275N, **1.0345** P235GH, **1.0425** P265GH **1.0050** E295, **1.0070** E360, **1.8937** P500NH	≤500 >500-850	
Free-cutting steels	**1.0718** 11SMnPb30, **1.0736** 115Mn37 **1.0727** 46 S20, **1.0728** 60 S20, **1.0757** 46SPb20	≤850 850-1000	
Unalloyed heat-treatable steels	**1.0402** C22, **1.1178** C30E **1.0503** C45, **1.1191** C45E **1.0601** C60, **1.1221** C60E	≤ 700 700-850 850-1000	
Alloyed heat-treatable steels	**1.5131** 50MnSi4, **1.7003** 38Cr2, **1.7030** 28Cr4 **1.5710** 36NiCr6, **1.7035** 41Cr4, **1.7225** 42CrMo4	850-1000 1000-1200	
Unalloyed case hardened steels	**1.0301** C10, **1.1121** C10E	≤750	
Alloyed case hardened steels	**1.7043** 38Cr4 **1.5752** 14NiCr14, **1.7131** 16MnCr5, **1.7264** 20CrMo5	850-1000 1000-1200	
Nitriding steels	**1.8504** 34CrAl6 **1.8519** 31CrMoV9, **1.8550** 34CrAlNi7	≥850-1000 1000-1200	
Tool steels	**1.1750** C75W, **1.2067** 102Cr6, **1.2307** 29CrMoV9 **1.2080** X210Cr12, **1.2083** X42Cr13, **1.2419** 105WCr6, **1.2767** X45NiCrMo4	≤850 850-1000	
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 austenitic martensitic	**1.4005** X12CrS13, **1.4104** X14CrMoS17, **1.4105** X6CrMoS17, **1.4305** X8CrNiS18 9 **1.4301** X5CrNi18 10, **1.4541** X6CrNiTi18 10, **1.4571** X6CrNiMoTi 17 12 2 **1.4057** X17CrNi16-1, **1.4122** X39CrMo17-1, **1.4521** X2CrMoTi18 2	≤850 ≤850 ≤850	
Hardened steels	–		≤40-48 HRC >48-60 HRC
Special alloys	Nimonic, Inconel, Monel, Hastelloy	≤1200	
Cast iron	EN-GJL-100 ... EN-GJL-200 (bisher GG10 ... GG20) EN-GJL-250 ... EN-GJL-350 (bisher GG25 ... GG45)		≤240 HB <300 HB
Spheroidal graphite and malleable cast iron	EN-GJMW-350-4, EN-GJMB-550-4, EN-GJS-500-7 (bisher GTW35, GTS55, GGG50) EN-GJMB-700-2, EN-GJS-700-2 (bisher GTW65, GTS70, GGG70)		≤240 HB <300 HB
Chilled cast iron	–		≤350 HB
Ti and Ti-alloys	**3.7024** Ti99,5, **3.7114** TiAl5Sn2,5, **3.7124** TiCu2 **3.7154** TiAl6Zr5, **3.7164** TiAl6V4, **3.7184** TiAl4Mo4Sn2,5, **-** TiAl8Mo1V1	≤850 850-1200	
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 > 10 % Si	**3.2131** G-AlSi5Cu1, **3.2153** G-AlSi7Cu3, **3.2573** G-AlSi9 **3.2581** G-AlSi12, **3.2583** G-AlSi12Cu, **-** G-AlSi12CuNiMg	≤600 ≤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 long-chipping	**2.0380** CuZn39Pb2, **2.0401** CuZn39Pb3, **2.0410** CuZn43Pb2 **2.0250** CuZn20, **2.0280** CuZn33, **2.0332** CuZn37Pb0,5	≤600 ≤600	
Bronze, short-chipping	**2.1090** CuSn7ZnPb, **2.1170** CuPb5Sn5, **2.1176** CuPb10Sn **2.0790** CuNi18Zn19Pb	≤600 >600-850	
Bronze, long-chipping	**2.0916** CuAl5, **2.0960** CuAl9Mn, **2.1050** CuSn10 **2.0980** CuAl11Ni, **2.1247** CuBe2	≤850 850-100	
Duroplastics Thermoplastics	Bakelit, Resopal, Pertinax, Moltopren Plexiglass, Hostalen, Novodur, Makralon		– –
Kevlar Glass, carbon concent. plastics	Kevlar GFK/CFK		– –

Solid carbide Micro-precision drills Recommendations

Tool material	Solid carbide		Solid carbide	
Surface finish	A		A	
Cooling	☒		■	
Drilling depth	~ 4 x D	~ 7 x D	~ 8 x D	~ 15 x D
Article no.	**86400**	**86401**	**86408**	**86412**
			NEW	NEW
				
v_c m/min	Feed column no.		Feed column no.	
90-120	**64**	**62**	**58**	**58**
90-110	**64**	**62**	**58**	**58**
90-120	**64**	**62**	**59**	**59**
80-100	**63**	**61**	**59**	**59**
80-110	**64**	**62**	**58**	**58**
80-110	**64**	**62**	**58**	**58**
80-100	**63**	**61**	**58**	**58**
80-100	**63**	**61**	**58**	**58**
60-80	**62**	**60**	**58**	**58**
90-110	**63**	**61**	**57**	**57**
70-100	**63**	**61**	**58**	**58**
60-80	**62**	**60**	**58**	**58**
60-80	**62**	**60**	**57**	**57**
50-70	**62**	**60**	**57**	**57**
40-60	**62**	**60**	**58**	**58**
40-60	**62**	**60**	**58**	**58**
40-60	**57**	**57**	**57**	**57**
40-60	57	57	57	57
30	**57**	**57**	**57**	**57**
15	**56**	**56**	**56**	**56**
30	**57**	**57**	**57**	**57**
10	56	56	*25*	56	56
<150	**68**	**66**	*<150*	**60**	**60**
<140	**68**	**66**	*<140*	**60**	**60**
<140	**68**	**66**	*<140*	**60**	**60**
<130	**67**	**65**	*<130*	**60**	**60**
15	56	56	*35*	56	56
15	56	56	*35*	56	56
60-80	68	68	*60-80*	68	68
60-80	68	68	*60-80*	68	68
120-150	59	59	*120-150*	59	59
120-150	59	59	*120-150*	59	59

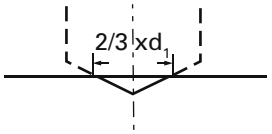
Pilot drilling

For the application of solid carbide micro-precision drills 15xD we recommend a pilot hole 1xD up to 2xD depth.
For this pilot hole, the solid carbide micro-precision drill 4xD is optimally suitable. Its point angle and its diameter tolerance are perfectly adapted.



Centering

In order to achieve full performance with solid carbide micro-precision drills from 8xD drilling depth, we recommend centering.
The solid carbide micro-precision drill up to 4xD, Hartner no. 86400, can be applied for this purpose. The centering diameter should be approximately 2/3xD.



Filter quality

When applying solid carbide micro-precision drills, we recommend constant monitoring of the lubricant's filter quality due to the extremely small coolant duct diameters.

HARTNER

Special tools questionnaire

❑ Inquiry ❑ Order by Fax to: +49 7431 125 - 547

Customer no. | New customer | Order no.

Ansprechpartner | Company | Contact

Hartner GmbH
P. O. Box 10 04 27
D-72425 Albstadt
Tel.: +497431 125-0
Fax: +497431 125-547
www.hartner.de

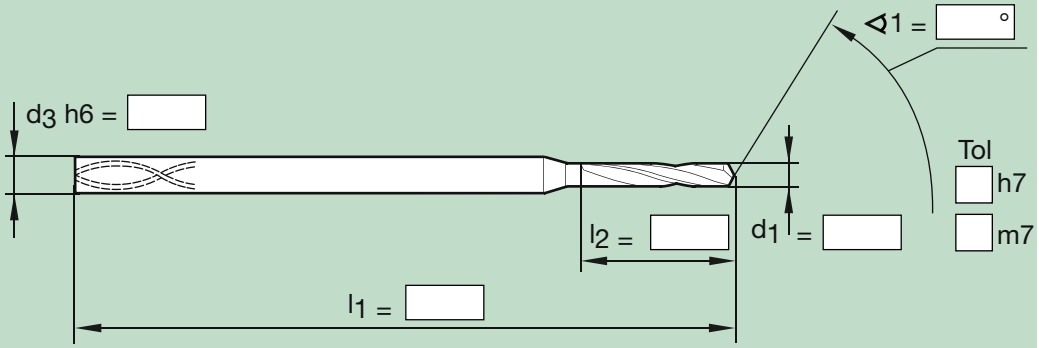
Street no. | Town/post code

Telephone | Fax

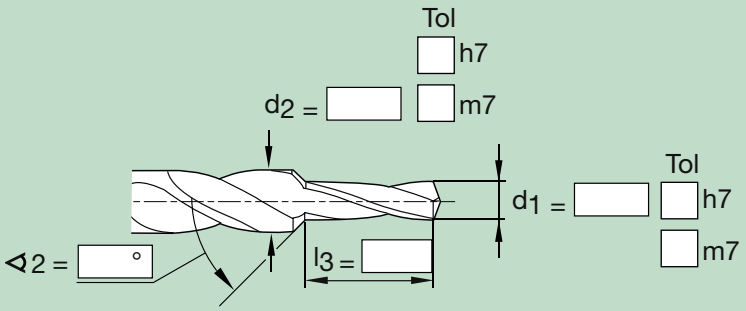
Date | Signature

Quantity

Dimensions



Step



Machining

Step hole

Drilling and countersinking

Shank form

HA

HE

Internal cooling

Yes

No

Coating

bright

SuperA

Sales Partners

Hartner has its own sales network as well in Germany as worldwide. On the spot powerful sales partners offer sales, technical support and service on Hartner tools to our customers.

You always find the up-to-date contact to your next Hartner sales partner on the internet:

www.hartner.de

Of course, you can contact us by phone or mail:

Hartner GmbH
Jakobstraße 10
72458 Albstadt
Phone: +49 74 31 1 25-0
Fax: +49 74 31 1 25-5 47
info@hartner.de

Our Program:

FU 500/FN500

INOX-Drills

Micro-Precision-Drills

TS-Drills

Highlights

Special Drills

Gun-Drills

Standard solid carbide de-burring tools

Multiplex

Standard range

TM vending machines

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