



Your technology partner for cost-effective machining

MICRO DRILLING

MICRO DRILLING

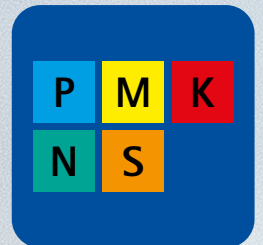
Solid carbide micro drill programme

Precise drilling in the micro range requires tools with the highest accuracy. MAPAL offers a precisely coordinated micro portfolio for maximum process reliability. A perfectly coordinated process is crucial for reliable and cost-effective results – from pilot drilling to deep drilling. MAPAL offers a consistent tool concept made of solid carbide with internal cooling for this purpose. The pilot tools of the MICRO-Drill series, with four guide lands, offer optimal guidance properties and stability.

An optimized geometry and a special flute shape with core taper enable reliable chip evacuation.

The geometry of the Micro-Deep-Drill, specially tailored to small diameters, with a newly designed chip flute and special face grinding, is ideally suited for the highest feed rates and cutting speeds.

The result: a consistent, precise, and cost-effective drilling system for the most demanding applications in the micro range.



PILOTING

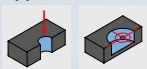


MICRO-Drill-Steel 5xD
Pilot drill specially designed for MICRO-Deep-Drill.

Length version:

5xD

Application:

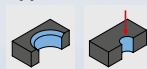


>> See page 6



MICRO-Step-Drill-Steel
For general drilling conditions incl. 90° countersink.

Application:



>> See page 5

MICRO DRILLING



MICRO-Drill-Steel
Drill diameters from 0.80 mm with internal cooling.

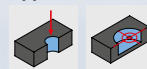
Length version:

5xD

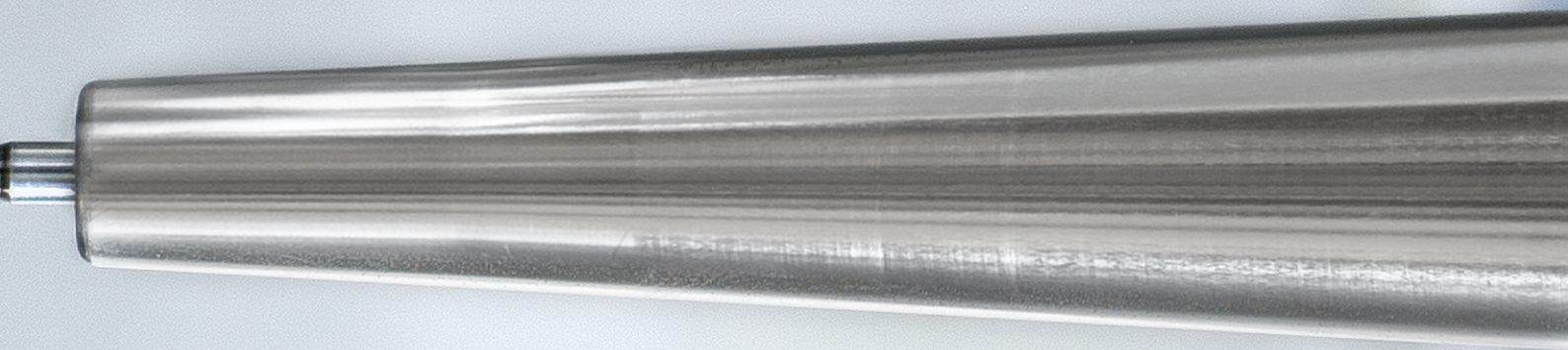
8xD

12xD

Application:



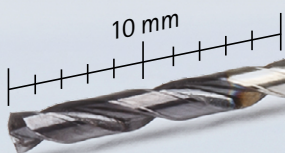
>> See page 6



MICRO DEEP DRILLING

MICRO-Deep-Steel

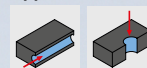
Deep drilling up to 30xD in one operation, without deflashing cycles.



Length version:

20xD **30xD**

Application:



>> See page 9

MICRO-Drill-Steel

Drilling diameters from 0.80 mm with internal cooling

The MICRO drill steel has been specially developed for the efficient machining of small bores in steel. It offers optimal guidance properties and stability thanks to its four marging lands. The geometry and flute design with core tapering allow for ideal chip removal, even with tough steels. Highest performance and tool life are ensured by a new cutting material combination and adapted microgeometries.

1 Four marging lands

- For improved qualities and stability

2 Slot form with back taper

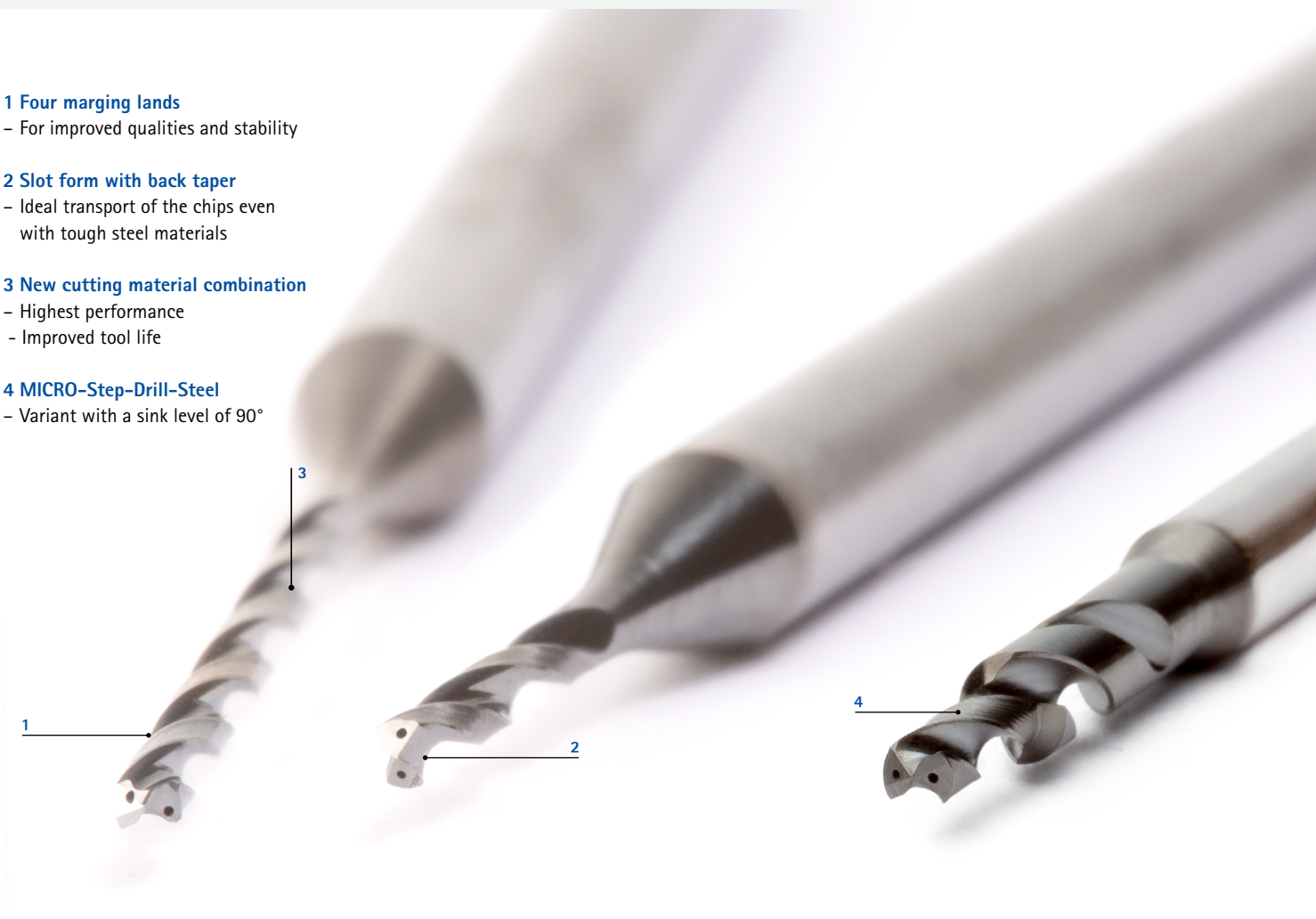
- Ideal transport of the chips even with tough steel materials

3 New cutting material combination

- Highest performance
- Improved tool life

4 MICRO-Step-Drill-Steel

- Variant with a sink level of 90°



Features

Dimensions:

- Number of cutting edges: 2
- Shank form: HA
- Internal coolant supply

Preferred series in stock:

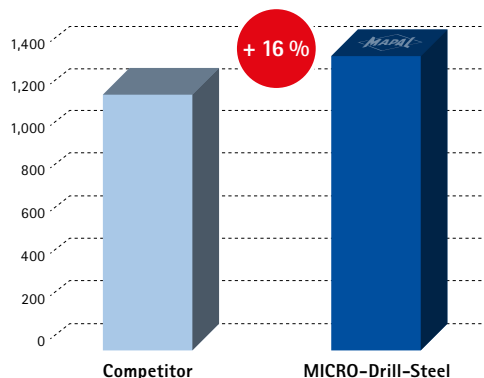
- $\varnothing$ -range: 0.80 to 2.0 mm

Configurable features:

- $\varnothing$ -range: 0.80 to 2.99 mm

Tool life comparison MICRO-Drill-Steel

Number of bores:



MICRO-Drill-Steel 5xD
 Material: ST52 (1.0570)
 Tool- $\varnothing$: 1.00 mm
 v_c : 60 m/min
 f_u : 0.030 mm/rev.

MICRO-Step-Drill-Steel

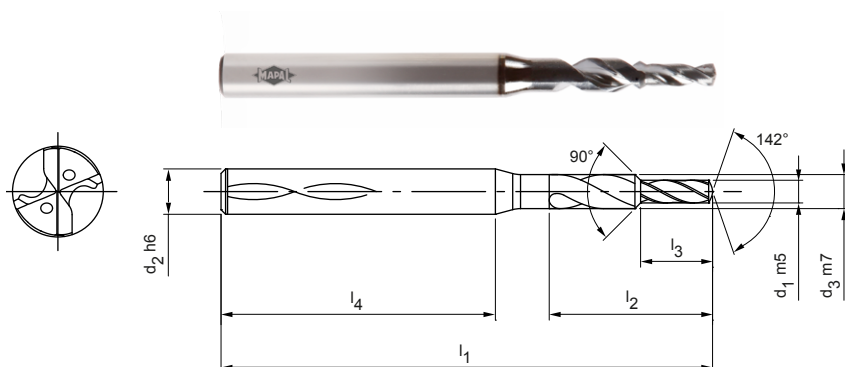
Solid carbide step drill
SCD581, internal coolant supply

Design:

Drill diameter: 1.00 – 3.00 mm
Bore tolerance: IT9 (achievable)
Cutting material: HP246
Number of cutting edges: 2
Number of guiding chamfers: 2
Tip angle: 142°

Application:

Pilot drill specially adapted to MICRO-Deep-Drill.
Can be used to a maximum of < 3.00 mm diameter with countersink step for optimum insertion of the following deep drill.



Dimensions							Shank form HA	
d_1 m5	d_2 h6	d_3 m7	l_1	l_2	l_3	l_4	Specification	Order No.
1,00	3,00	1,50	50	7,2	3,0	38	SCD581-0100-2-2-142HA-HP246	31080870
1,10	3,00	1,65	50	7,9	3,3	37,5	SCD581-0110-2-2-142HA-HP246	31080871
1,20	3,00	1,80	50	8,6	3,6	36,9	SCD581-0120-2-2-142HA-HP246	31080872
1,30	3,00	1,95	50	9,4	3,9	36,3	SCD581-0130-2-2-142HA-HP246	31080873
1,40	3,00	2,10	50	10,1	4,2	35,7	SCD581-0140-2-2-142HA-HP246	31080874
1,50	3,00	2,25	50	10,8	4,5	35,1	SCD581-0150-2-2-142HA-HP246	31080875
1,60	3,00	2,40	50	11,5	4,8	34,6	SCD581-0160-2-2-142HA-HP246	31080876
1,70	3,00	2,55	50	12,2	5,1	34	SCD581-0170-2-2-142HA-HP246	31080877
1,80	3,00	2,70	50	13,0	5,4	33,4	SCD581-0180-2-2-142HA-HP246	31080878
1,90	4,00	2,85	55	13,7	5,7	35,9	SCD581-0190-2-2-142HA-HP246	31080879
2,00	4,00	3,00	55	14,4	6,0	35,3	SCD581-0200-2-2-142HA-HP246	31080880
2,10	4,00	3,15	55	15,1	6,3	34,8	SCD581-0210-2-2-142HA-HP246	31080881
2,20	4,00	3,30	55	15,8	6,6	34,2	SCD581-0220-2-2-142HA-HP246	31080882
2,30	4,00	3,45	55	16,6	6,9	33,6	SCD581-0230-2-2-142HA-HP246	31080883
2,40	4,00	3,60	55	17,3	7,2	33	SCD581-0240-2-2-142HA-HP246	31080884
2,50	4,00	3,75	55	18,0	7,5	32,4	SCD581-0250-2-2-142HA-HP246	31080885
2,60	6,00	3,90	66	18,7	7,8	39,1	SCD581-0260-2-2-142HA-HP246	31080886
2,70	6,00	4,05	66	19,4	8,1	38,5	SCD581-0270-2-2-142HA-HP246	31080887
2,80	6,00	4,20	66	20,2	8,4	37,9	SCD581-0280-2-2-142HA-HP246	31080888
2,90	6,00	4,35	66	20,9	8,7	37,4	SCD581-0290-2-2-142HA-HP246	31080889
3,00	6,00	4,50	66	21,6	9,0	36,8	SCD581-0300-2-2-142HA-HP246	31080890

Dimensions in mm.

For recommended cutting values, see page 14/15.

Special designs and other coatings on request.

MICRO-Drill-Steel

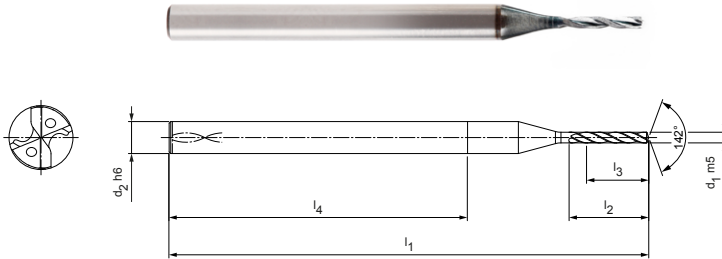
Solid carbide twist drill
SCD371 (5xD), internal coolant supply

Design:

Drill diameter: 0.80 – 2.99 mm
Bore tolerance: IT9 (achievable)
Cutting material: HP246
Number of cutting edges: 2
Number of guiding chamfers: 4
Tip angle: 142°
Helix angle: 30°

Application:

Spotting drill specifically designed for the MICRO-Deep-Drill.
Maximum use up to < diameter 3.00 mm.



Stocked preferred series in shank form HA

Dimensions						Shank form HA	
d ₁ m5	d ₂ h6	l ₁	l ₂	l ₃	l ₄	Specification	Order no.
0,80	3	45	6	4	28	SCD371-0080-2-4-142HA05-HP246	31238823
1,00	3	45	7,5	5	28	SCD371-0100-2-4-142HA05-HP246	31238825
1,10	3	45	8,3	5	28	SCD371-0110-2-4-142HA05-HP246	31238826
1,20	3	45	9	6	28	SCD371-0120-2-4-142HA05-HP246	31238827
1,50	3	45	11,3	7,5	28	SCD371-0150-2-4-142HA05-HP246	31238890
1,60	3	50	12	8	28	SCD371-0160-2-4-142HA05-HP246	31238891
1,70	3	50	12,8	8	28	SCD371-0170-2-4-142HA05-HP246	31238892
1,80	3	50	13,5	8	28	SCD371-0180-2-4-142HA05-HP246	31238893
1,90	3	50	14,3	9,5	28	SCD371-0190-2-4-142HA05-HP246	31238894
2,00	3	50	15	10	28	SCD371-0200-2-4-142HA05-HP246	31238895
2,10	3	50	28	9,5	28	SCD371-0210-2-4-142HA05-HP246	31238896
2,20	3	52	16,5	11	28	SCD371-0220-2-4-142HA05-HP246	31238897
2,40	3	52	18	12	28	SCD371-0240-2-4-142HA05-HP246	31238899
2,50	3	52	18,8	12,5	28	SCD371-0250-2-4-142HA05-HP246	31238900
2,60	3	55	19,5	13	28	SCD371-0260-2-4-142HA05-HP246	31238901
2,70	3	55	20,3	13	28	SCD371-0270-2-4-142HA05-HP246	31238902
2,80	3	55	21	14	28	SCD371-0280-2-4-142HA05-HP246	31238903
2,90	3	55	21,8	13	28	SCD371-0290-2-4-142HA05-HP246	31238904

Configurable features



Diameter:
Diameter in increments of
0.01 mm freely selectable



Specification:

SCD371-[diameter]-2-4-142HA05-HP246

Example:

SCD371-0221-2-4-142HA05-HP246

Tool diameter d₁ = 2.21 mm

Dimensions of configurable series

d ₁ min.	d ₁ max.	d ₂ h6	l ₁	l ₂	l ₃	l ₄
0,80	0,99	3	45	l ₂ = l ₃ x 1.5	l ₃ = d ₁ x Drill depth	28
1,00	1,29	3	45			28
1,30	1,59	3	45			28
1,60	1,89	3	50			28
1,90	2,19	3	50			28
2,20	2,59	3	52			28
2,60	2,99	3	55			28

Dimensions in mm.

For recommended cutting values, see page 16/17.

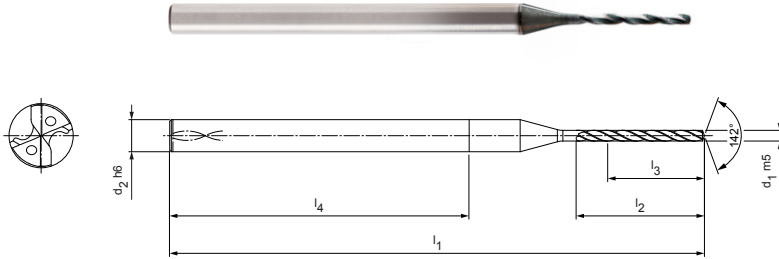
Special designs and other coatings on request.

MICRO-Drill-Steel

Solid carbide twist drill
SCD371 (8xD), internal coolant supply

Design:

Drill diameter: 1.00 – 2.99 mm
Bore tolerance: IT9 (achievable)
Cutting material: HP246
Number of cutting edges: 2
Number of guiding chamfers: 4
Tip angle: 142°
Helix angle: 30°



Stocked preferred series in shank form HA

Dimensions						Shank form HA	
d ₁ m5	d ₂ h6	l ₁	l ₂	l ₃	l ₄	Specification	Order no.
1,00	3	50	12	8	28	SCD371-0100-2-4-142HA08-HP246	31238905
1,20	3	50	14,4	9,6	28	SCD371-0120-2-4-142HA08-HP246	31238907
1,50	3	52	18	12	28	SCD371-0150-2-4-142HA08-HP246	31238910
1,60	3	55	19,2	12,8	28	SCD371-0160-2-4-142HA08-HP246	31238911
1,80	3	55	21,6	12,8	28	SCD371-0180-2-4-142HA08-HP246	31238913
1,90	3	60	22,8	15,2	28	SCD371-0190-2-4-142HA08-HP246	31238914
2,00	3	60	24	16	28	SCD371-0200-2-4-142HA08-HP246	31238915
2,10	3	60	25,2	15,2	28	SCD371-0210-2-4-142HA08-HP246	31238916
2,20	3	62	26,4	17,6	28	SCD371-0220-2-4-142HA08-HP246	31238917
2,50	3	62	30	20	28	SCD371-0250-2-4-142HA08-HP246	31238920
2,80	3	66	33,6	20,8	28	SCD371-0280-2-4-142HA08-HP246	31238923
2,90	3	66	34,8	20,8	28,0	SCD371-0290-2-4-142HA08-HP246	31238924

Configurable features



Diameter:
Diameter in increments of
0.01 mm freely selectable



Specification:

SCD371-[diameter]-2-4-142HA08-HP246

Example:

SCD371-0221-2-4-142HA08-HP246

Tool diameter d₁ = 2.21 mm

Dimensions of configurable series

d ₁ min.	d ₁ max.	d ₂ h6	l ₁	l ₂	l ₃	l ₄
1,00	1,29	3	50	l ₂ = l ₃ x 1.5	l ₃ = d ₁ x Drill depth	28
1,30	1,59	3	52			28
1,60	1,89	3	55			28
1,90	2,19	3	60			28
2,20	2,59	3	62			28
2,60	2,99	3	66			28

Dimensions in mm.

For recommended cutting values, see page 16/17.

Special designs and other coatings on request.

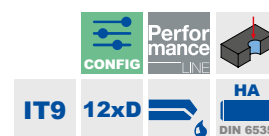
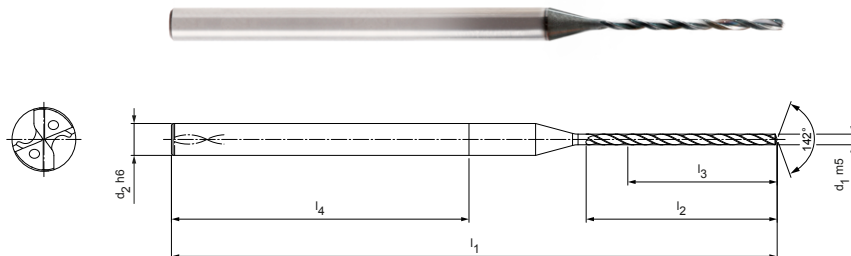
MICRO-Drill-Steel

Solid carbide twist drill

SCD371 (12xD), internal coolant supply

Design:

Drill diameter:	1.00 – 2.99 mm
Bore tolerance:	IT9 (achievable)
Cutting material:	HP246
Number of cutting edges:	2
Number of guiding chamfers:	4
Tip angle:	142°
Helix angle:	30°



Stocked preferred series in shank form HA

Dimensions						Shank form HA	
d ₁ m5	d ₂ h6	l ₁	l ₂	l ₃	l ₄	Specification	Order no.
1,00	3	57	18	12	28	SCD371-0100-2-4-142HA12-HP246	31238925
1,20	3	57	21,6	14,4	28	SCD371-0120-2-4-142HA12-HP246	31238927
1,30	3	62	23,4	15,6	28	SCD371-0130-2-4-142HA12-HP246	31238928
1,50	3	62	27	18	28	SCD371-0150-2-4-142HA12-HP246	31238930
2,00	3	72	36	24	28	SCD371-0200-2-4-142HA12-HP246	31238935
2,10	3	72	37,8	22,8	28	SCD371-0210-2-4-142HA12-HP246	31238936
2,50	3	79	45	30	28	SCD371-0250-2-4-142HA12-HP246	31238940
2,80	3	85	50,4	31,2	28	SCD371-0280-2-4-142HA12-HP246	31238943
2,90	3	85	52,2	31,2	28	SCD371-0290-2-4-142HA12-HP246	31238944

Configurable features



Diameter:

Diameter in increments of 0.01 mm freely selectable



Specification:

SCD371-[diameter]-2-4-142HA12-HP246

Example:

SCD371-0221-2-4-142HA12-HP246

Tool diameter d₁ = 2.21 mm

Dimensions of configurable series

d ₁ min.	d ₁ max.	d ₂ h6	l ₁	l ₂	l ₃	l ₄
1,00	1,29	3	57	l ₂ = l ₃ x 1.5	l ₃ = d ₁ x Drill depth	28
1,30	1,59	3	62			28
1,60	1,89	3	66			28
1,90	2,19	3	72			28
2,20	2,59	3	79			28
2,60	2,99	3	85			28

Dimensions in mm.

For recommended cutting values, see page 16/17.

Special designs and other coatings on request.

MICRO-Deep-Drill

Deep drill also for smallest diameters

The geometry of the micro deep drill has been specifically tailored to the small diameter range. Thanks to the newly designed flute and special face geometry, the highest feed rates and cutting speeds can be achieved during deep drilling. With the innovative cooling channel design, the drills are also suitable for the use of minimum quantity lubrication. Despite lengths of up to 30xD, the gas-oil mixture reaches the cutting edges reliably. Instead of a full coating, the new tools are coated only at the head for greater efficiency.

1 Head coating

- Economic coating for longer tool life

2 Innovative cooling channel management

- Suitable for minimum quantity lubrication

3 Newly designed groove

- Highest feed rates and cutting speeds



Features

Dimensions:

- Number of cutting edges: 2
- Shank form: HA
- Internal coolant supply

Preferred series in stock:

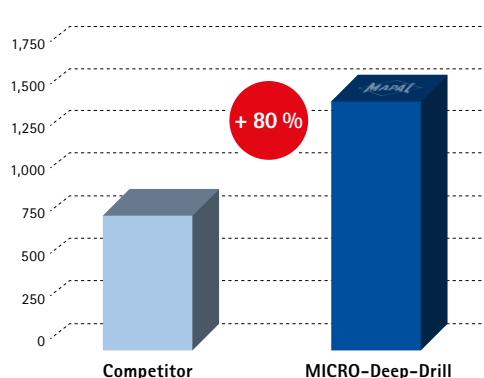
- ϕ -range: 1.00 to 2.90 mm

Configurable features:

- ϕ -range: 1.00 to 2.99 mm

Tool life comparison MICRO-Deep-Drill

Number of bores:



MICRO-Deep-Drill 30xD
 Material: 42CrMo4
 Nominal- ϕ : 2.50 mm
 v_c : 80 m/min
 f_u : 0.060 mm/rev.

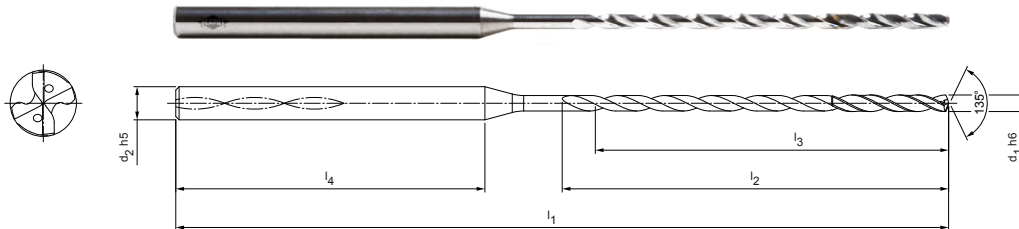
MICRO-Deep-Drill

Solid carbide twist drill

SCD171 (20xD), internal coolant supply

Design:

Drill diameter:	1.00 – 2.99 mm
Bore tolerance:	≥ IT9
Cutting material:	HP246
Number of cutting edges:	2
Number of guiding chamfers:	4
Tip angle:	135°
Helix angle:	30°



Dimensions							Shank form HA	
d ₁ h6	d ₂ h5	l ₁	l ₂	l ₃	L/d relation	l ₄	Specification	Order No.
1,00	3	62	27	25	25	28	SCD171-0100-2-4-135HA20-HP246	30998795
1,10	3	62	27	25	23	28	SCD171-0110-2-4-135HA20-HP246	30998796
1,20	3	62	27	25	21	28	SCD171-0120-2-4-135HA20-HP246	30998798
1,30	3	70	35	33	25	28	SCD171-0130-2-4-135HA20-HP246	30998799
1,40	3	70	35	32	23	28	SCD171-0140-2-4-135HA20-HP246	30998800
1,50	3	70	35	32	21	28	SCD171-0150-2-4-135HA20-HP246	30998801
1,60	3	75	41	38	24	28	SCD171-0160-2-4-135HA20-HP246	30998802
1,70	3	75	41	38	22	28	SCD171-0170-2-4-135HA20-HP246	30998803
1,80	3	75	41	38	21	28	SCD171-0180-2-4-135HA20-HP246	30998804
1,90	3	80	46	43	23	28	SCD171-0190-2-4-135HA20-HP246	30998805
2,00	3	80	46	43	22	28	SCD171-0200-2-4-135HA20-HP246	30998806
2,10	3	80	46	42	20	28	SCD171-0210-2-4-135HA20-HP246	30998807
2,20	3	90	55	51	23	28	SCD171-0220-2-4-135HA20-HP246	30998808
2,30	3	90	55	51	22	28	SCD171-0230-2-4-135HA20-HP246	30998809
2,40	3	90	55	51	21	28	SCD171-0240-2-4-135HA20-HP246	30998810
2,50	3	90	55	51	20	28	SCD171-0250-2-4-135HA20-HP246	30998811
2,60	3	100	66	62	24	28	SCD171-0260-2-4-135HA20-HP246	30998812
2,70	3	100	66	61	23	28	SCD171-0270-2-4-135HA20-HP246	30998813
2,80	3	100	66	61	22	28	SCD171-0280-2-4-135HA20-HP246	30998814
2,90	3	100	66	61	21	28	SCD171-0290-2-4-135HA20-HP246	30998815

Configurable features



Diameter:
Diameter in increments of
0.01 mm freely selectable



Specification:

SCD171-[diameter]-2-4-135HA20-HP246

Example:

SCD171-0221-2-4-135HA20-HP246

Tool diameter d₁ = 2.21 mm

Dimensions of configurable series

d ₁ h6	d ₂ h5	l ₁	l ₂	l ₃	l ₄
1,00 - 1,20	3	62	27	25	28
1,21 - 1,50	3	70	35	32	28
1,51 - 1,80	3	75	41	38	28
1,81 - 2,10	3	80	46	42	28
2,11 - 2,50	3	90	55	51	28
2,51 - 2,99	3	100	66	61	28

Dimensions in mm.

For recommended cutting values, see page 18/19.

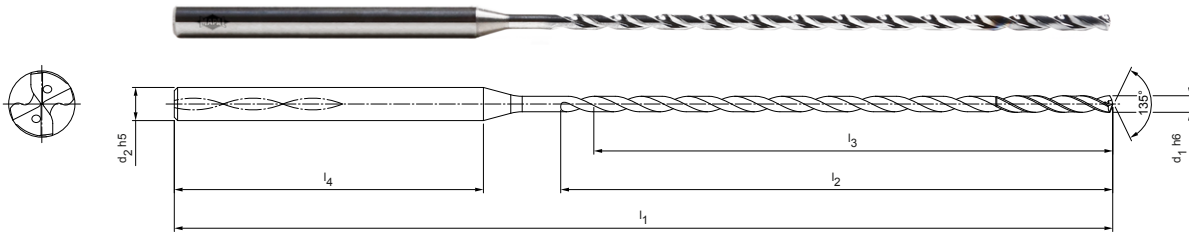
Special designs and other coatings on request.

MICRO-Deep-Drill

Solid carbide twist drill
SCD171 (30xD), internal coolant supply

Design:

Drill diameter: 1.00 – 2.99 mm
Bore tolerance: $\geq$ IT9
Cutting material: HP246
Number of cutting edges: 2
Number of guiding chamfers: 4
Tip angle: 135°
Helix angle: 30°



Dimensions							Shank form HA	
d ₁ h6	d ₂ h5	l ₁	l ₂	l ₃	L/d relation	l ₄	Specification	Order No.
1,00	3	75	38	36	36	28	SCD171-0100-2-4-135HA30-HP246	30998816
1,10	3	75	38	36	33	28	SCD171-0110-2-4-135HA30-HP246	30998817
1,20	3	75	38	36	30	28	SCD171-0120-2-4-135HA30-HP246	30998818
1,30	3	85	50	48	37	28	SCD171-0130-2-4-135HA30-HP246	30998819
1,40	3	85	50	47	34	28	SCD171-0140-2-4-135HA30-HP246	30998820
1,50	3	85	50	47	31	28	SCD171-0150-2-4-135HA30-HP246	30998821
1,60	3	95	59	56	35	28	SCD171-0160-2-4-135HA30-HP246	30998822
1,70	3	95	59	56	33	28	SCD171-0170-2-4-135HA30-HP246	30998823
1,80	3	95	59	56	31	28	SCD171-0180-2-4-135HA30-HP246	30998824
1,90	3	100	66	63	33	28	SCD171-0190-2-4-135HA30-HP246	30998825
2,00	3	100	66	63	32	28	SCD171-0200-2-4-135HA30-HP246	30998826
2,10	3	100	66	62	30	28	SCD171-0210-2-4-135HA30-HP246	30998827
2,20	3	115	80	76	35	28	SCD171-0220-2-4-135HA30-HP246	30998828
2,30	3	115	80	76	33	28	SCD171-0230-2-4-135HA30-HP246	30998829
2,40	3	115	80	76	32	28	SCD171-0240-2-4-135HA30-HP246	30998830
2,50	3	115	80	76	30	28	SCD171-0250-2-4-135HA30-HP246	30451572
2,60	3	130	96	92	35	28	SCD171-0260-2-4-135HA30-HP246	30998832
2,70	3	130	96	91	34	28	SCD171-0270-2-4-135HA30-HP246	30998833
2,80	3	130	96	91	33	28	SCD171-0280-2-4-135HA30-HP246	30998834
2,90	3	130	96	91	31	28	SCD171-0290-2-4-135HA30-HP246	30998835

Configurable features



Diameter:
Diameter in increments of
0.01 mm freely selectable



Specification:

SCD171-[diameter]-2-4-135HA30-HP246

Example:

SCD171-0221-2-4-135HA30-HP246

Tool diameter d₁ = 2.21 mm

Dimensions of configurable series

d ₁ h6	d ₂ h5	l ₁	l ₂	l ₃	l ₄
1,00 - 1,20	3	75	38	36	28
1,21 - 1,50	3	85	50	47	28
1,51 - 1,80	3	95	59	56	28
1,81 - 2,10	3	100	66	62	28
2,11 - 2,50	3	115	80	76	28
2,51 - 2,99	3	130	96	91	28

Dimensions in mm.

For recommended cutting values, see page 18/19.

Special designs and other coatings on request.

Deep drilling in two steps

1 Drilling of pilot hole

Recommendation:

Pilot drill 5xD

MICRO-Step-Drill-Steel

[SCD581]

For general drilling conditions incl. 90° countersink



Alternative:

MICRO-Drill-Steel

[SCD371]



Valid for MICRO-Deep-Drill [SCD171]

Nominal diameter: 1.00 – 2.99 mm

Info:

Pilot bore depth between 3xD – 5xD

2 Deep drilling up to 30xD

Entry into the pilot bore:

- Entering with max. 300 rpm and $v_f = 1,000 \text{ mm/min}$
- Without coolant – down to 1 mm before reaching ground of pilot bore
- Start of coolant → cooling lubricant = 10–40 bar/MQL
- Spot drilling with predefined cutting data according to table

Info:

Another option for spot drilling with the MEGA-Deep-Drill-Steel:

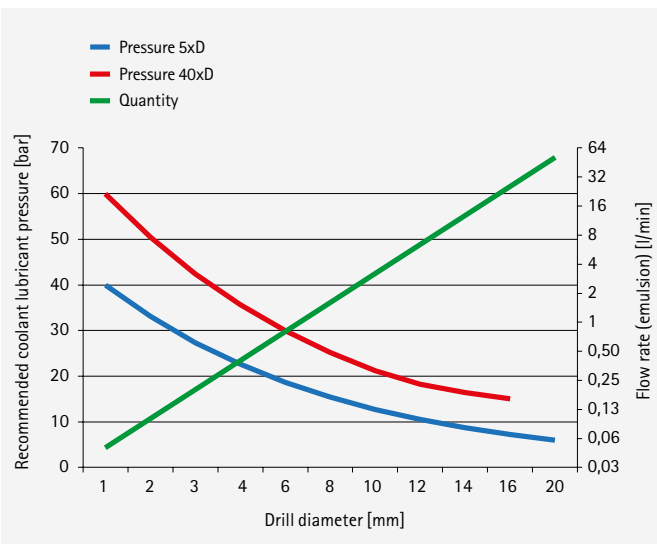
Spot drilling with feed rate 50%, linear acceleration to feed rate 100% up to drilling depth 4xD

- Deep drilling up to 30xD in one step, without chip release cycles

Pulling out:

- Pulling out with max. 300 rpm and double feed ($2 \times v_f$)
- Switch off coolant

Reference values for coolant pressure and quantity



System pressures for MQL for deep drills

MQL systems

Supply pressure

One-channel systems

up to 16 bar

Recommended supply pressure

5–6 bar

High pressure for Deep drilling < nominal Ø 12 mm

8–10 bar

High pressure for Deep drilling < nominal Ø 3 mm

14–16 bar

MICRO-Deep-Drill; SCD171 (nominal Ø range: 1.00 – 2.99 mm)

Two-channel systems

up to 10 bar

Recommended supply pressure

5–6 bar

High pressure for Deep drilling < nominal Ø 6 mm

8–10 bar

1 Drilling of pilot hole

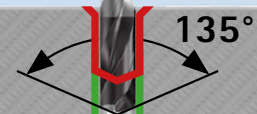


1 Piloting

2 Deep drilling up to $30 \times D$



1



2

Deep drilling up to $30 \times D$

Recommended cutting values for solid carbide drills

Feed and cutting speed

MICRO-Step-Drill-Steel | SCD581

MMG*			Workpiece material	Strength/hardness [N/mm ²] [HRC]	
P	P1	P1.1	Structural, free-cutting, case hardened and heat-treated steels, non-alloy	< 700	
		P1.2	Structural, free-cutting, case hardened and heat-treated steels, non-alloy	< 1,200	
	P2	P2.1	Nitrided, case hardened and heat-treated steels, alloy	< 900	
		P2.2	Nitrided, case hardened and heat-treated steels, alloy	< 1,400	
	P3	P3.1	Tool, bearing, spring and high-speed steels**	< 800	
		P3.2	Tool, bearing, spring and high-speed steels**	< 1,000	
		P3.3	Tool, bearing, spring and high-speed steels**	< 1,500	
	P4	P4.1	Stainless steels, ferritic and martensitic		
	P5	P5.1	Cast steel		
	P6	P6.1	Stainless cast steel, ferritic and martensitic		
M	M1	M1.1	Stainless steels, austenitic	< 700	
		M1.2	Stainless steels, ferritic/austenitic (duplex)	< 1,000	
	M2	M2.1	Stainless/heat-resistant cast steel, austenitic	< 700	
	M3	M3.1	Stainless cast steel, ferritic/austenitic (duplex)	< 1,000	
K	K1	K1.1	Cast iron with lamellar graphite (grey cast iron), GJL	< 300	
		K2.1	Cast iron with spheroidal graphite, GJS	< 500	
	K2	K2.2	Cast iron with spheroidal graphite, GJS	≤ 800	
		K2.3	Cast iron with spheroidal graphite, GJS	> 800	
	K3	K3.1	Cast iron with spheroidal graphite, GJV; malleable cast iron, GJM	< 500	
		K3.2	Cast iron with spheroidal graphite, GJV; malleable cast iron, GJM	> 500	
N	N1	N1.1	Aluminium, non-alloy and alloy < 3 % Si		
		N1.2	Aluminium, alloy ≤ 7 % Si		
		N1.3	Aluminium, alloy > 7-12 % Si		
		N1.4	Aluminium, alloy > 12 % Si		
S	S1	S1.1	Titanium, titanium alloys	< 400	
		S2.1	Titanium, titanium alloys	< 1,200	
	S2	S2.2	Titanium, titanium alloys	> 1,200	
		S3.1	Nickel, unalloyed and alloyed	< 900	
	S3	S3.2	Nickel, unalloyed and alloyed	> 900	

** MAPAL machining groups

** If the alloy components Cr, Mo, Ni, V, W in total > 8 % then select the next higher MAPAL machining group.

The cutting values given are guide values.

The optimum data for the respective machining case should be determined in trials or during machining.

	Cutting speed v_c [m/min]				Feed f [mm] for drill diameter					
	Internal cooling	External cooling	MQL	Air	1.00	1.25	1.55	1.93	2.41	3.00
	80	70	70		0.04	0.05	0.05	0.06	0.07	0.08
	70	60	60		0.05	0.06	0.06	0.07	0.08	0.1
	80	70	70		0.05	0.05	0.06	0.07	0.08	0.09
	55	50	50		0.05	0.05	0.06	0.06	0.07	0.08
	60	50	50		0.04	0.05	0.05	0.06	0.07	0.08
	50	45	45		0.04	0.04	0.05	0.05	0.06	0.07
	50	35	40		0.04	0.04	0.04	0.05	0.05	0.06
	50	35	40		0.03	0.03	0.04	0.04	0.05	0.06
	80	70	70		0.05	0.05	0.06	0.07	0.08	0.09
	50	35	40		0.03	0.03	0.04	0.04	0.05	0.06
	40	25	25		0.03	0.03	0.04	0.04	0.05	0.06
	40	25	25		0.02	0.03	0.03	0.04	0.04	0.05
	40	25	25		0.03	0.03	0.04	0.04	0.05	0.06
	40	25	25		0.02	0.03	0.03	0.04	0.04	0.05
	95	70	70	70	0.04	0.04	0.06	0.07	0.09	0.11
	130	80	95	95	0.05	0.05	0.06	0.08	0.09	0.11
	80	60	60		0.04	0.05	0.06	0.07	0.08	0.1
	50	30	40		0.04	0.04	0.05	0.05	0.06	0.07
	70	65	65		0.05	0.06	0.07	0.08	0.09	0.11
	65	55	55		0.05	0.05	0.06	0.07	0.08	0.09
	225	150	190		0.04	0.05	0.05	0.06	0.07	0.08
	190	135	150		0.04	0.05	0.06	0.07	0.08	0.1
	165	115	135		0.04	0.05	0.06	0.07	0.08	0.1
	135	90	115		0.04	0.05	0.06	0.07	0.08	0.1
	32	20			0.028	0.032	0.036	0.041	0.048	0.055
	24	16			0.024	0.027	0.031	0.035	0.041	0.047
	20	12			0.02	0.023	0.026	0.029	0.034	0.04
	16	12			0.016	0.018	0.021	0.024	0.027	0.032
	12	8			0.02	0.023	0.026	0.029	0.034	0.04

Recommended cutting values for solid carbide drills

Feed and cutting speed

MICRO-Drill-Steel | SCD371

MMG*		Workpiece material	Strength/hardness [N/mm ²] [HRC]	
P	P1	P1.1 Structural, free-cutting, case hardened and heat-treated steels, non-alloy	< 700	
	P1	P1.2 Structural, free-cutting, case hardened and heat-treated steels, non-alloy	< 1,200	
	P2	P2.1 Nitrided, case hardened and heat-treated steels, alloy	< 900	
	P2	P2.2 Nitrided, case hardened and heat-treated steels, alloy	< 1,400	
	P3	P3.1 Tool, bearing, spring and high-speed steels**	< 800	
	P3	P3.2 Tool, bearing, spring and high-speed steels**	< 1,000	
	P3	P3.3 Tool, bearing, spring and high-speed steels**	< 1,500	
	P4	P4.1 Stainless steels, ferritic and martensitic		
	P5	P5.1 Cast steel		
	P6	P6.1 Stainless cast steel, ferritic and martensitic		
M	M1	M1.1 Stainless steels, austenitic	< 700	
	M1	M1.2 Stainless steels, ferritic/austenitic (duplex)	< 1,000	
	M2	M2.1 Stainless/heat-resistant cast steel, austenitic	< 700	
	M3	M3.1 Stainless cast steel, ferritic/austenitic (duplex)	< 1,000	
K	K1	K1.1 Cast iron with lamellar graphite (grey cast iron), GJL	< 300	
	K1	K2.1 Cast iron with spheroidal graphite, GJS	< 500	
	K2	K2.2 Cast iron with spheroidal graphite, GJS	≤ 800	
	K2	K2.3 Cast iron with spheroidal graphite, GJS	> 800	
	K3	K3.1 Cast iron with spheroidal graphite, GJV; malleable cast iron, GJM	< 500	
	K3	K3.2 Cast iron with spheroidal graphite, GJV; malleable cast iron, GJM	> 500	
N	N1	N1.1 Aluminium, non-alloy and alloy < 3 % Si		
	N1	N1.2 Aluminium, alloy ≤ 7 % Si		
	N1	N1.3 Aluminium, alloy > 7-12 % Si		
	N1	N1.4 Aluminium, alloy > 12 % Si		
S	S1	S1.1 Titanium, titanium alloys	< 400	
	S2	S2.1 Titanium, titanium alloys	< 1,200	
	S2	S2.2 Titanium, titanium alloys	> 1,200	
	S3	S3.1 Nickel, unalloyed and alloyed	< 900	
	S3	S3.2 Nickel, unalloyed and alloyed	> 900	

** MAPAL machining groups

** If the alloy components Cr, Mo, Ni, V, W in total > 8 % then select the next higher MAPAL machining group.

The cutting values given are guide values.

The optimum data for the respective machining case should be determined in trials or during machining.

	Cutting speed v_c [m/min]				Feed f [mm] for drill diameter					
	Internal cooling	External cooling	MQL	Air	0.80	1.04	1.36	1.77	2.30	3.00
	80	70	70		0.04	0.04	0.05	0.06	0.07	0.08
	70	60	60		0.04	0.05	0.06	0.07	0.08	0.10
	80	70	70		0.04	0.05	0.06	0.07	0.08	0.09
	55	50	50		0.04	0.05	0.05	0.06	0.07	0.08
	60	50	50		0.04	0.04	0.05	0.06	0.07	0.08
	50	45	45		0.04	0.04	0.04	0.05	0.06	0.07
	50	35	40		0.03	0.04	0.04	0.05	0.05	0.06
	50	35	40		0.03	0.03	0.03	0.04	0.05	0.06
	80	70	70		0.04	0.05	0.06	0.07	0.08	0.09
	50	35	40		0.03	0.03	0.03	0.04	0.05	0.06
	40	25	25		0.03	0.03	0.03	0.04	0.05	0.06
	35	20	20		0.02	0.02	0.03	0.03	0.04	0.05
	40	25	25		0.03	0.03	0.03	0.04	0.05	0.06
	35	20	20		0.02	0.02	0.03	0.03	0.04	0.05
	95	70	70	70	0.03	0.04	0.05	0.06	0.08	0.11
	130	80	95	95	0.04	0.05	0.06	0.07	0.09	0.11
	80	60	60		0.04	0.05	0.05	0.07	0.08	0.10
	50	30	40		0.04	0.04	0.04	0.05	0.06	0.07
	70	65	65		0.04	0.05	0.06	0.07	0.09	0.11
	65	55	55		0.04	0.05	0.06	0.07	0.08	0.09
	210	140	175		0.04	0.04	0.05	0.06	0.07	0.08
	175	125	140		0.04	0.05	0.05	0.07	0.08	0.10
	155	105	125		0.04	0.05	0.05	0.07	0.08	0.10
	125	85	105		0.04	0.05	0.05	0.07	0.08	0.10
	32	20			0.025	0.029	0.033	0.039	0.046	0.055
	24	16			0.022	0.025	0.028	0.033	0.040	0.047
	20	12			0.018	0.020	0.024	0.028	0.033	0.040
	16	12			0.014	0.016	0.019	0.022	0.026	0.032
	12	8			0.018	0.020	0.024	0.028	0.033	0.040

Recommended cutting values for solid carbide drills

Feed and cutting speed

MICRO-Deep-Drill | SCD171

MMG*		Workpiece material	Strength/hardness [N/mm ²] [HRC]	
P	P1	P1.1 Structural, free-cutting, case hardened and heat-treated steels, non-alloy	< 700	
	P1	P1.2 Structural, free-cutting, case hardened and heat-treated steels, non-alloy	< 1,200	
	P2	P2.1 Nitrided, case hardened and heat-treated steels, alloy	< 900	
	P2	P2.2 Nitrided, case hardened and heat-treated steels, alloy	< 1,400	
	P3	P3.1 Tool, bearing, spring and high-speed steels**	< 800	
	P3	P3.2 Tool, bearing, spring and high-speed steels**	< 1,000	
	P3	P3.3 Tool, bearing, spring and high-speed steels**	< 1,500	
	P4	P4.1 Stainless steels, ferritic and martensitic		
	P5	P5.1 Cast steel		
	P6	P6.1 Stainless cast steel, ferritic and martensitic		
M	M1	M1.1 Stainless steels, austenitic	< 700	
	M1	M1.2 Stainless steels, ferritic/austenitic (duplex)	< 1,000	
	M2	M2.1 Stainless/heat-resistant cast steel, austenitic	< 700	
	M3	M3.1 Stainless cast steel, ferritic/austenitic (duplex)	< 1,000	
K	K1	K1.1 Cast iron with lamellar graphite (grey cast iron), GJL	< 300	
	K1	K2.1 Cast iron with spheroidal graphite, GJS	< 500	
	K2	K2.2 Cast iron with spheroidal graphite, GJS	≤ 800	
	K2	K2.3 Cast iron with spheroidal graphite, GJS	> 800	
	K3	K3.1 Cast iron with spheroidal graphite, GJV; malleable cast iron, GJM	< 500	
	K3	K3.2 Cast iron with spheroidal graphite, GJV; malleable cast iron, GJM	> 500	
N	N1	N1.1 Aluminium, non-alloy and alloy < 3 % Si		
	N1	N1.2 Aluminium, alloy ≤ 7 % Si		
	N1	N1.3 Aluminium, alloy > 7-12 % Si		
	N1	N1.4 Aluminium, alloy > 12 % Si		
S	S1	S1.1 Titanium, titanium alloys	< 400	
	S2	S2.1 Titanium, titanium alloys	< 1,200	
	S2	S2.2 Titanium, titanium alloys	> 1,200	
	S3	S3.1 Nickel, unalloyed and alloyed	< 900	
	S3	S3.2 Nickel, unalloyed and alloyed	> 900	

** MAPAL machining groups

** If the alloy components Cr, Mo, Ni, V, W in total > 8 % then select the next higher MAPAL machining group.

The cutting values given are guide values.

The optimum data for the respective machining case should be determined in trials or during machining.

	Cutting speed v_c [m/min]				Feed f [mm] for drill diameter					
	Internal cooling	External cooling	MQL	Air	1.00	1.24	1.53	1.89	2.34	2.90
	70	65	65		0.04	0.05	0.06	0.06	0.07	0.09
	65	55	55		0.04	0.05	0.06	0.06	0.07	0.09
	70	60	60		0.04	0.05	0.05	0.06	0.07	0.08
	50	40	40		0.04	0.04	0.05	0.05	0.06	0.07
	55	45	45		0.04	0.04	0.05	0.05	0.06	0.07
	40	40	40		0.03	0.04	0.04	0.05	0.05	0.06
	40	30	35		0.03	0.04	0.04	0.04	0.05	0.05
	40	30	35		0.02	0.03	0.03	0.04	0.04	0.05
	70	60	60		0.04	0.05	0.05	0.06	0.07	0.08
	40	30	35		0.02	0.03	0.03	0.04	0.04	0.05
	35	20	20		0.02	0.03	0.03	0.04	0.04	0.05
	30	20	20		0.02	0.02	0.03	0.03	0.04	0.04
	35	20	20		0.02	0.03	0.03	0.04	0.04	0.05
	30	20	20		0.02	0.02	0.03	0.03	0.04	0.04
	85	60	60	60	0.03	0.04	0.05	0.06	0.07	0.09
	110	70	85	85	0.04	0.05	0.06	0.07	0.08	0.09
	70	55	55		0.04	0.05	0.05	0.06	0.07	0.08
	40	30	35		0.03	0.04	0.04	0.05	0.05	0.06
	65	55	55		0.04	0.05	0.06	0.07	0.08	0.09
	55	50	50		0.04	0.05	0.05	0.06	0.07	0.08
	180	120	150		0.04	0.04	0.05	0.05	0.06	0.07
	150	110	120		0.04	0.05	0.05	0.06	0.07	0.08
	130	90	110		0.04	0.05	0.05	0.06	0.07	0.08
	110	70	90		0.04	0.05	0.05	0.06	0.07	0.08
	24	15			0.025	0.028	0.032	0.036	0.042	0.048
	18	12			0.021	0.024	0.027	0.031	0.036	0.041
	15	9			0.018	0.020	0.023	0.026	0.030	0.034
	12	9			0.014	0.016	0.018	0.021	0.024	0.027
	9	6			0.018	0.020	0.023	0.026	0.030	0.034



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