



JSK PRECISION TOOLS LTD

MILLING TOOLS



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Performance

Premium quality tools for high performance.

The premium quality tools from the 'JSK' product line have been designed for specific applications and are distinguished by their outstanding performance. If you make high demands on the performance of your production and want to achieve the very best results, we recommend the Premium tools in this product line.

Symbol explanation

Shank



Shank type



Length: extra short / short / medium / long / extra long



Cutting edge preparation



Sharp



Chamfer (CHW = chamfer width in mm)



Full Radius



Application



Machining example



The red arrows describe the possible feed directions



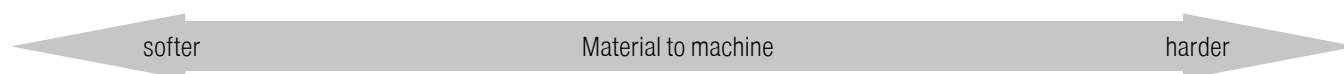
Number of teeth



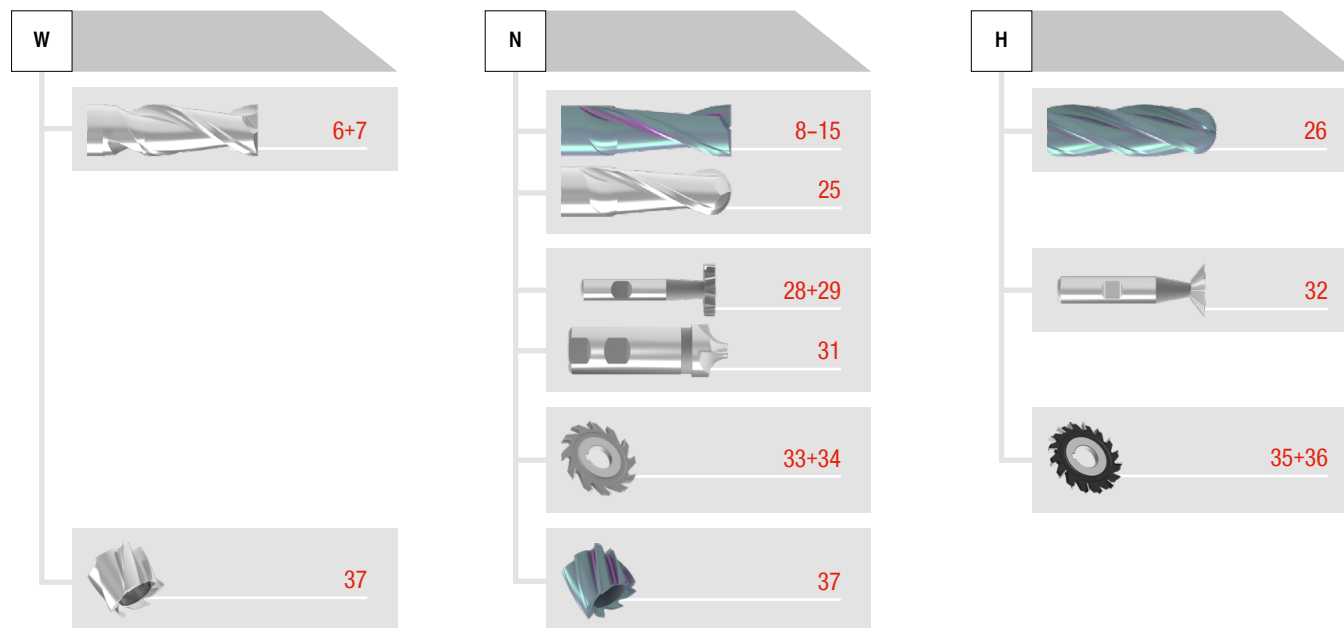
Cutting geometry
 $\lambda_s = 30^\circ$ λ_s = helix angle
 $\gamma_s = 12^\circ$ γ_s = rake angle

- = Main Application
- = Extended application

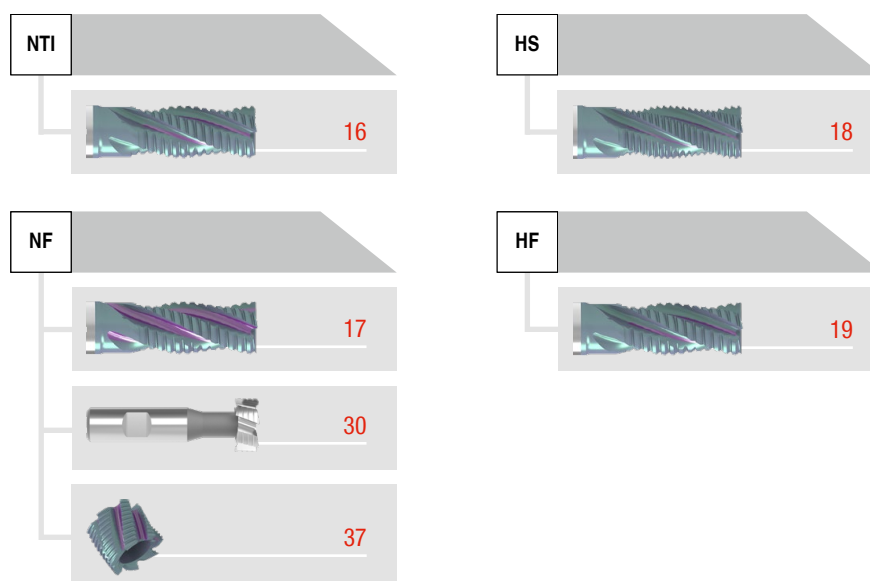
Toolfinder



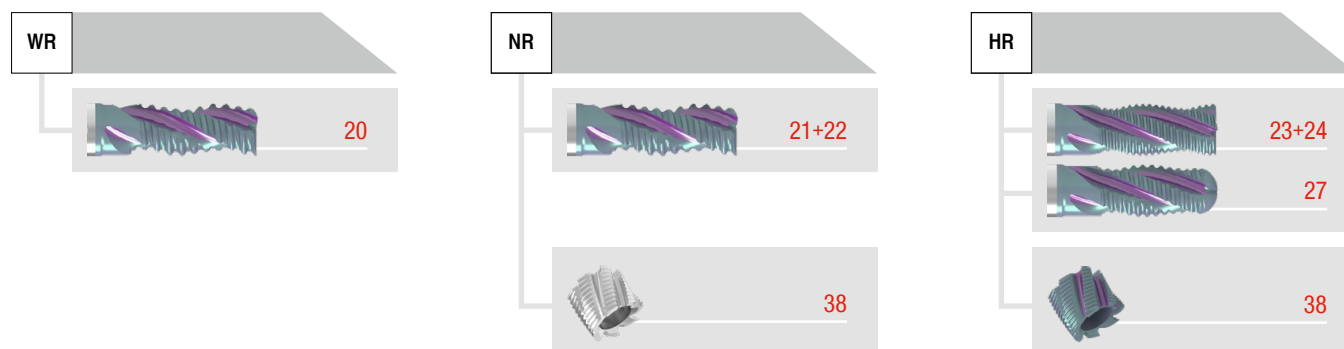
Finish milling



Rough and finish machining




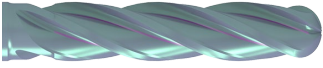

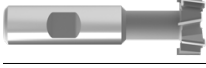



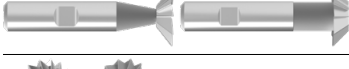



Rough machining



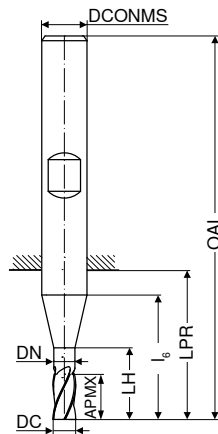
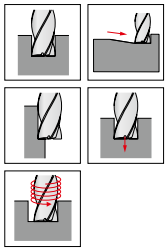
Overview HSS milling cutters

| Tool type | Number of teeth | Diameter in mm Ø DC | Material compatibility | | | | | Edge type | | | | Length | Material, e.g. PM = Powdersteel | Performance | | |
|---|-----------------|------------------------|------------------------|-----------------|-----------|--------------------|-----------------------|--------------------|-------|---------|--------|--------|---------------------------------|-------------------------------------|--------------------------|----------|
| | | | Steel | Stainless steel | Cast iron | Non-ferrous metals | Heat resistant alloys | hardened materials | Sharp | Chamfer | Radius | | | Full Radius | coated | uncoated |
| Finishing cutter | | | | | | | | | | | | | | | | |
| | W | 2 | 2-22 | ■ | ■ | ■ | ● | ■ | ■ | ■ | ■ | ■ | ■ | HSS-E | <input type="checkbox"/> | 6 |
| | W | 3-4 | 2-40 | ■ | ■ | ■ | ● | ■ | ■ | ■ | ■ | ■ | HSS-E | <input type="checkbox"/> | 7 | |
| | N | 2 | 1-26 | ● | ● | ● | ○ | ○ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8+9 |
| | N | 3 | 1-10 | ● | ● | ● | ○ | ○ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 10 |
| | N | 3 | 1,8-24,7 | ● | ● | ● | ○ | ○ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 11+12 |
| | N | 4-5 | 4-25 | ○ | ● | ○ | ● | ● | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 13 |
| | N | 4-8 | 2-50 | ● | ● | ● | ○ | ○ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 14+15 |
| Rough and finish milling cutters | | | | | | | | | | | | | | | | |
| | NTI | 4-6 | 6-40 | ○ | ● | ○ | ○ | ● | ■ | ■ | ■ | ■ | PM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 16 |
| | NF | 4-5 | 6-28 | ● | ○ | ● | ○ | ○ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 17 |
| | HS | 4-6 | 6-40 | ○ | ■ | ● | ● | ■ | ■ | ■ | ■ | ■ | PM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 18 |
| | HF | 4 | 6-25 | ● | ○ | ● | ○ | ○ | ■ | ■ | ■ | ■ | PM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 19 |
| Rough milling cutters | | | | | | | | | | | | | | | | |
| | WR | 3 | 6-32 | ■ | ■ | ■ | ● | ■ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 20 |
| | NR | 3 | 6-25 | ● | ○ | ● | ○ | ○ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 21 |
| | NR | 4-6 | 6-40 | ● | ○ | ● | ○ | ○ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 22 |
| | HR | 4-6 | 6-32 | ● | ● | ● | ○ | ○ | ■ | ■ | ■ | ■ | PM | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 23 |
| | HR | 3-6 | 4-32 | ● | ● | ● | ○ | ○ | ■ | ■ | ■ | ■ | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 24 |

Overview HSS milling cutters

| Tool type | Number of teeth | Diameter in mm | Material | | | | | Geometry | | | | Material, e.g. PM = Powdersteel | Performance | | | |
|---|-----------------|----------------|-----------|-----------------|-----------|--------------------|-----------------------|--------------------|-------|---------|--------|---------------------------------|-------------|-------------------------------------|--------------------------|----------|
| | | | Steel | Stainless steel | Cast iron | Non-ferrous metals | Heat resistant alloys | hardened materials | Sharp | Chamfer | Radius | | Full Radius | Length | coated | uncoated |
| Ball nose end milling cutters | | | | | | | | | | | | | | | | |
|  | N | 2 | 2-30 | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 25 |
|  | H | 4-5 | 6-25 | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 26 |
|  | HR | 4 | 6-20 | ● | ○ | ● | ○ | ○ | | | | | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 27 |
| Form / Side and Face / Shell milling cutters | | | | | | | | | | | | | | | | |
|  | N | 6-10 | 11-60 | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input type="checkbox"/> | <input type="checkbox"/> | 28 |
|  | N | 6-12 | 10,5-45,5 | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input type="checkbox"/> | <input type="checkbox"/> | 29 |
|  | NF | 6-8 | 21-45 | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input type="checkbox"/> | <input type="checkbox"/> | 30 |
|  | N | 4-6 | 1-16 | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input type="checkbox"/> | <input type="checkbox"/> | 31 |
|  | H | 10 | 16-25 | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input type="checkbox"/> | <input type="checkbox"/> | 32 |
|  | N | 14-28 | | ● | ○ | ○ | ○ | ○ | | | | | HSS | <input type="checkbox"/> | <input type="checkbox"/> | 33 |
|  | | 12-52 | | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input type="checkbox"/> | <input type="checkbox"/> | 34-36 |
|  | | 6-12 | | ● | ○ | ○ | ○ | ○ | | | | | HSS-E | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 37+38 |

Slot milling cutter HSS-E Co 8



DIN 844



| DC _{e8} | APMX | DN | LH | l ₆ | LPR | OAL | DCONMS _{h6} | ZEFP |
|------------------|------|------|----|----------------|-----|-----|----------------------|------|
| mm | mm | mm | mm | mm | mm | mm | mm | |
| 2.0 | 7 | | 7 | 13 | 15 | 51 | 6 | 2 |
| 2.5 | 8 | | 8 | 14 | 16 | 52 | 6 | 2 |
| 3.0 | 8 | | 8 | 14 | 16 | 52 | 6 | 2 |
| 3.5 | 10 | | 10 | 16 | 18 | 54 | 6 | 2 |
| 4.0 | 11 | | 11 | 17 | 19 | 55 | 6 | 2 |
| 4.5 | 11 | | 11 | 17 | 19 | 55 | 6 | 2 |
| 5.0 | 13 | | 13 | 19 | 21 | 57 | 6 | 2 |
| 5.5 | 13 | | 13 | 19 | 21 | 57 | 6 | 2 |
| 6.0 | 13 | | 13 | 19 | 21 | 57 | 6 | 2 |
| 6.5 | 16 | 6.0 | 22 | 24 | 26 | 66 | 10 | 2 |
| 7.0 | 16 | 6.5 | 22 | 24 | 26 | 66 | 10 | 2 |
| 8.0 | 19 | 7.5 | 25 | 27 | 29 | 69 | 10 | 2 |
| 9.0 | 19 | 8.5 | 26 | 27 | 29 | 69 | 10 | 2 |
| 10.0 | 22 | 9.5 | 30 | 30 | 32 | 72 | 10 | 2 |
| 12.0 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 2 |
| 14.0 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 2 |
| 16.0 | 32 | 15.0 | 42 | 42 | 44 | 92 | 16 | 2 |
| 18.0 | 32 | 15.0 | 42 | 42 | 44 | 92 | 16 | 2 |
| 20.0 | 38 | 19.0 | 52 | 52 | 54 | 104 | 20 | 2 |
| 22.0 | 38 | 19.0 | 52 | 52 | 54 | 104 | 20 | 2 |

Steel

Stainless steel

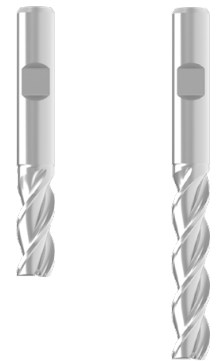
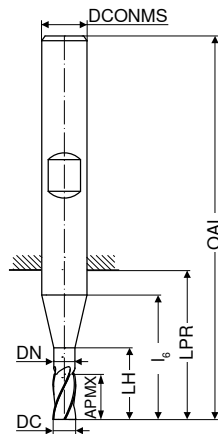
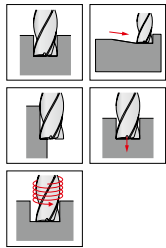
Cast iron

Non ferrous metals

Heat resistant alloys

hardened materials

End milling cutter HSS-E Co 8



DIN 69844



DIN 844



| DC _{k10} | APMX | DN | LH | l ₆ | LPR | OAL | DCONMS _{n6} | ZEFP |
|-------------------|------|------|-----|----------------|-----|-----|----------------------|------|
| mm | mm | mm | mm | mm | mm | mm | mm | |
| 2 | 7 | | 7 | 13 | 15 | 51 | 6 | 3 |
| 3 | 8 | | 8 | 14 | 16 | 52 | 6 | 3 |
| 3 | 12 | | 12 | 18 | 20 | 56 | 6 | 3 |
| 4 | 11 | | 11 | 17 | 19 | 55 | 6 | 3 |
| 4 | 19 | | 19 | 25 | 27 | 63 | 6 | 3 |
| 5 | 13 | | 13 | 19 | 21 | 57 | 6 | 3 |
| 5 | 24 | | 24 | 30 | 32 | 68 | 6 | 3 |
| 6 | 13 | 5.5 | 19 | 19 | 21 | 57 | 6 | 3 |
| 6 | 24 | 5.5 | 30 | 30 | 32 | 68 | 6 | 3 |
| 7 | 16 | 6.5 | 22 | 24 | 26 | 66 | 10 | 3 |
| 7 | 30 | 6.5 | 36 | 38 | 40 | 80 | 10 | 3 |
| 8 | 19 | 7.5 | 25 | 27 | 29 | 69 | 10 | 3 |
| 8 | 38 | 7.5 | 44 | 46 | 48 | 88 | 10 | 3 |
| 9 | 19 | 8.5 | 26 | 27 | 29 | 69 | 10 | 3 |
| 9 | 38 | 8.5 | 45 | 46 | 48 | 88 | 10 | 3 |
| 10 | 22 | 9.5 | 30 | 30 | 32 | 72 | 10 | 3 |
| 10 | 45 | 9.5 | 53 | 53 | 55 | 95 | 10 | 3 |
| 12 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 3 |
| 12 | 53 | 11.5 | 63 | 63 | 65 | 110 | 12 | 3 |
| 14 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 3 |
| 14 | 53 | 11.5 | 63 | 63 | 65 | 110 | 12 | 3 |
| 16 | 32 | 15.0 | 42 | 42 | 44 | 92 | 16 | 3 |
| 16 | 63 | 15.0 | 73 | 73 | 75 | 123 | 16 | 3 |
| 18 | 32 | 15.0 | 42 | 42 | 44 | 92 | 16 | 3 |
| 18 | 63 | 15.0 | 73 | 73 | 75 | 123 | 16 | 3 |
| 20 | 38 | 19.0 | 52 | 52 | 54 | 104 | 20 | 3 |
| 20 | 75 | 19.0 | 89 | 89 | 91 | 141 | 20 | 3 |
| 22 | 38 | 19.0 | 52 | 52 | 54 | 104 | 20 | 3 |
| 22 | 75 | 19.0 | 89 | 89 | 91 | 141 | 20 | 3 |
| 24 | 90 | 23.0 | 106 | 108 | 110 | 166 | 25 | 3 |
| 25 | 45 | 24.0 | 63 | 45 | 65 | 121 | 25 | 4 |
| 25 | 90 | 24.0 | 108 | 108 | 110 | 166 | 25 | 4 |
| 28 | 90 | 24.0 | 108 | 108 | 110 | 166 | 25 | 4 |
| 30 | 90 | 24.0 | 108 | 108 | 110 | 166 | 25 | 4 |
| 32 | 106 | 31.0 | 123 | 123 | 126 | 186 | 32 | 4 |
| 36 | 106 | 31.0 | 123 | 123 | 126 | 186 | 32 | 4 |
| 40 | 125 | 38.0 | 142 | 142 | 147 | 217 | 40 | 4 |

Steel

Stainless steel

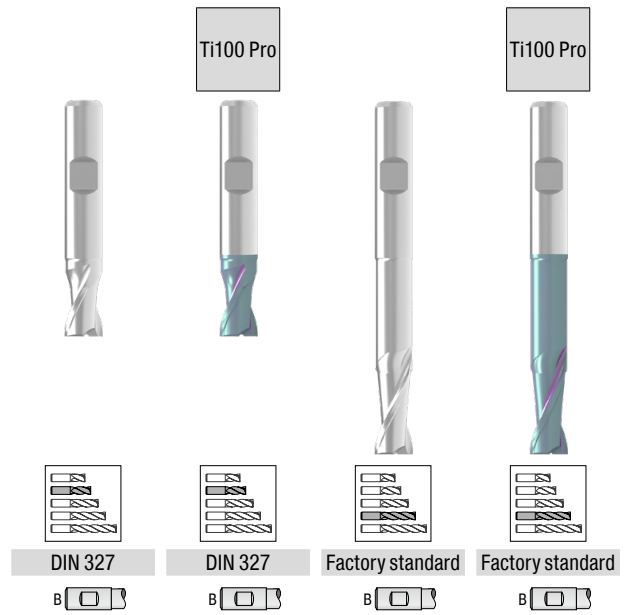
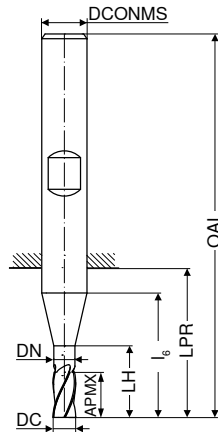
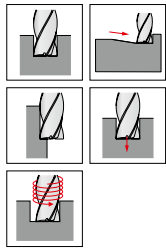
Cast iron

Non ferrous metals

Heat resistant alloys

hardened materials

Slot milling cutter HSS-E Co 8

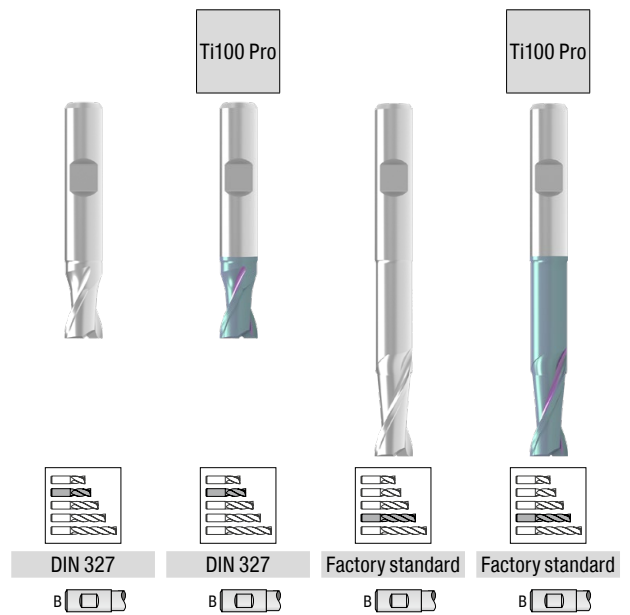
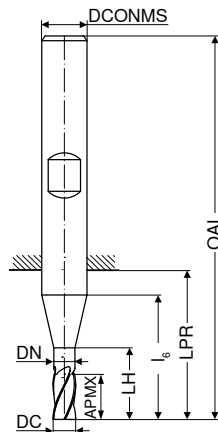
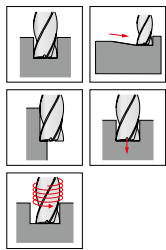
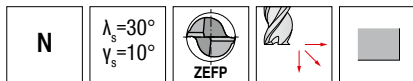


| DC | Tol. | APMX | DN | LH | l ₆ | LPR | OAL | DCONMS _{h6} | ZEFP |
|-------|------|------|-------|------|----------------|-----|-----|----------------------|------|
| mm | | mm | mm | mm | mm | mm | mm | mm | |
| 1.00 | h10 | 2.5 | | 2.5 | 9 | 11 | 47 | 6 | 2 |
| 1.50 | h10 | 3.0 | | 3.0 | 9 | 11 | 47 | 6 | 2 |
| 1.80 | h10 | 4.0 | | 4.0 | 10 | 12 | 48 | 6 | 2 |
| 2.00 | e8 | 4.0 | | 4.0 | 10 | 12 | 48 | 6 | 2 |
| 2.50 | e8 | 5.0 | | 5.0 | 11 | 13 | 49 | 6 | 2 |
| 2.80 | h10 | 5.0 | | 5.0 | 11 | 13 | 49 | 6 | 2 |
| 3.00 | e8 | 5.0 | | 5.0 | 11 | 13 | 49 | 6 | 2 |
| 3.00 | e8 | 8.0 | | 8.0 | 18 | 20 | 56 | 6 | 2 |
| 3.50 | h10 | 6.0 | | 6.0 | 12 | 14 | 50 | 6 | 2 |
| 3.50 | h10 | 10.0 | | 10.0 | 21 | 23 | 59 | 6 | 2 |
| 3.80 | h10 | 7.0 | | 7.0 | 13 | 15 | 51 | 6 | 2 |
| 4.00 | e8 | 7.0 | | 7.0 | 13 | 15 | 51 | 6 | 2 |
| 4.00 | e8 | 11.0 | | 11.0 | 25 | 27 | 63 | 6 | 2 |
| 4.50 | h10 | 7.0 | | 7.0 | 13 | 15 | 51 | 6 | 2 |
| 4.50 | h10 | 11.0 | | 11.0 | 25 | 27 | 63 | 6 | 2 |
| 4.80 | h10 | 8.0 | | 8.0 | 14 | 16 | 52 | 6 | 2 |
| 5.00 | e8 | 8.0 | | 8.0 | 14 | 16 | 52 | 6 | 2 |
| 5.00 | e8 | 13.0 | | 13.0 | 30 | 32 | 68 | 6 | 2 |
| 5.50 | h10 | 8.0 | | 8.0 | 14 | 16 | 52 | 6 | 2 |
| 5.50 | h10 | 13.0 | | 13.0 | 30 | 32 | 68 | 6 | 2 |
| 5.75 | h10 | 8.0 | | 8.0 | 14 | 16 | 52 | 6 | 2 |
| 6.00 | e8 | 8.0 | 5.50 | 14.0 | 14 | 16 | 52 | 6 | 2 |
| 6.00 | e8 | 13.0 | 5.50 | 30.0 | 30 | 32 | 68 | 6 | 2 |
| 6.50 | h10 | 10.0 | 6.00 | 16.0 | 18 | 20 | 60 | 10 | 2 |
| 6.50 | h10 | 16.0 | 6.35 | 36.0 | 38 | 40 | 80 | 10 | 2 |
| 6.75 | h10 | 10.0 | 6.50 | 16.0 | 18 | 20 | 60 | 10 | 2 |
| 7.00 | e8 | 10.0 | 6.50 | 16.0 | 18 | 20 | 60 | 10 | 2 |
| 7.00 | e8 | 16.0 | 6.35 | 36.0 | 38 | 40 | 80 | 10 | 2 |
| 7.50 | h10 | 10.0 | 7.00 | 16.0 | 18 | 20 | 60 | 10 | 2 |
| 7.50 | h10 | 16.0 | 7.35 | 36.0 | 38 | 40 | 80 | 10 | 2 |
| 7.75 | h10 | 11.0 | 7.50 | 17.0 | 19 | 21 | 61 | 10 | 2 |
| 8.00 | e8 | 11.0 | 7.50 | 17.0 | 19 | 21 | 61 | 10 | 2 |
| 8.00 | e8 | 19.0 | 7.35 | 44.0 | 46 | 48 | 88 | 10 | 2 |
| 8.50 | h10 | 11.0 | 8.00 | 18.0 | 19 | 21 | 61 | 10 | 2 |
| 8.50 | h10 | 19.0 | 8.35 | 45.0 | 46 | 48 | 88 | 10 | 2 |
| 8.70 | h10 | 11.0 | 8.50 | 18.0 | 19 | 21 | 61 | 10 | 2 |
| 9.00 | h10 | 11.0 | 8.50 | 18.0 | 19 | 21 | 61 | 10 | 2 |
| 9.00 | h10 | 19.0 | 8.35 | 45.0 | 46 | 48 | 88 | 10 | 2 |
| 9.50 | h10 | 11.0 | 9.00 | 18.0 | 19 | 21 | 61 | 10 | 2 |
| 9.50 | h10 | 19.0 | 9.35 | 45.0 | 46 | 48 | 88 | 10 | 2 |
| 9.70 | h10 | 13.0 | 9.50 | 21.0 | 21 | 23 | 63 | 10 | 2 |
| 10.00 | e8 | 13.0 | 9.50 | 21.0 | 21 | 23 | 63 | 10 | 2 |
| 10.00 | e8 | 22.0 | 9.35 | 53.0 | 53 | 55 | 95 | 10 | 2 |
| 10.50 | h10 | 13.0 | 10.00 | 21.0 | 23 | 25 | 70 | 12 | 2 |
| 10.70 | h10 | 13.0 | 10.50 | 21.0 | 23 | 25 | 70 | 12 | 2 |
| 11.00 | h10 | 13.0 | 10.50 | 21.0 | 23 | 25 | 70 | 12 | 2 |
| 11.00 | h10 | 22.0 | 10.50 | 53.0 | 55 | 57 | 102 | 12 | 2 |
| 11.50 | h10 | 13.0 | 11.00 | 21.0 | 23 | 25 | 70 | 12 | 2 |

| | | | | |
|-----------------------|---|---|---|---|
| Steel | ● | ● | ● | ● |
| Stainless steel | ○ | ● | ○ | ● |
| Cast iron | ● | ● | ● | ● |
| Non ferrous metals | ○ | ○ | ○ | ○ |
| Heat resistant alloys | ○ | ○ | ○ | ○ |
| hardened materials | | | | |

1) Factory standard

Slot milling cutter HSS-E Co 8

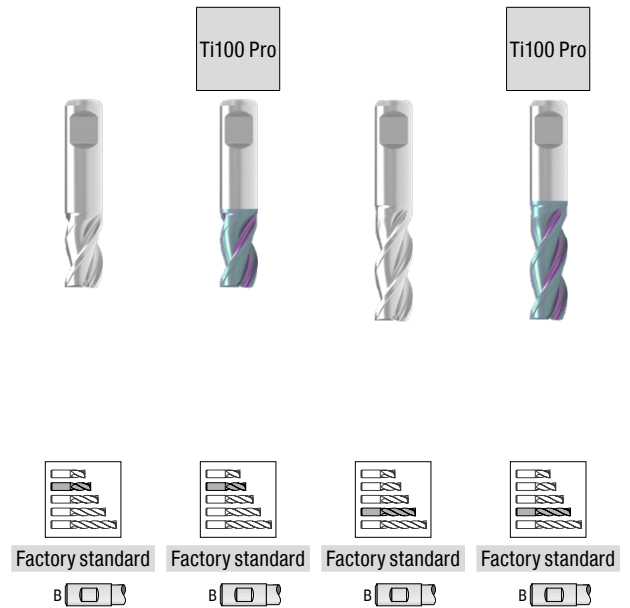
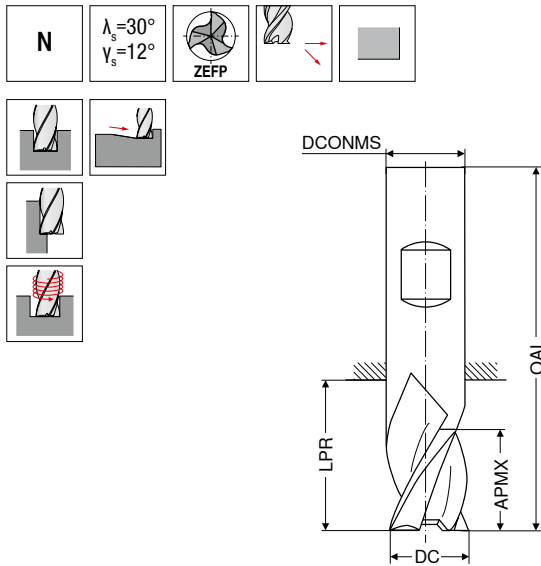


| DC | Tol. | APMX | DN | LH | l ₆ | LPR | OAL | DCONMS _{h6} | ZEFP |
|-------|------|------|-------|-------|----------------|-----|-----|----------------------|------|
| mm | | mm | mm | mm | mm | mm | mm | mm | |
| 11.70 | h10 | 16.0 | 11.50 | 26.0 | 26 | 28 | 73 | 12 | 2 |
| 12.00 | e8 | 16.0 | 11.50 | 26.0 | 26 | 28 | 73 | 12 | 2 |
| 12.00 | e8 | 26.0 | 11.50 | 63.0 | 63 | 65 | 110 | 12 | 2 |
| 12.70 | h10 | 16.0 | 11.50 | 26.0 | 26 | 28 | 73 | 12 | 2 |
| 13.00 | h10 | 16.0 | 11.50 | 26.0 | 26 | 28 | 73 | 12 | 2 |
| 13.00 | h10 | 26.0 | 11.50 | 63.0 | 63 | 65 | 110 | 12 | 2 |
| 13.70 | h10 | 16.0 | 11.50 | 26.0 | 26 | 28 | 73 | 12 | 2 |
| 14.00 | e8 | 16.0 | 11.50 | 26.0 | 26 | 28 | 73 | 12 | 2 |
| 14.00 | e8 | 26.0 | 11.50 | 63.0 | 63 | 65 | 110 | 12 | 2 |
| 14.70 | h10 | 16.0 | 11.50 | 26.0 | 26 | 28 | 73 | 12 | 2 |
| 15.00 | h10 | 16.0 | 11.50 | 26.0 | 26 | 28 | 73 | 12 | 2 |
| 15.00 | h10 | 26.0 | 11.50 | 63.0 | 63 | 65 | 110 | 12 | 2 |
| 15.70 | h10 | 19.0 | 15.00 | 29.0 | 29 | 31 | 79 | 16 | 2 |
| 16.00 | e8 | 19.0 | 15.00 | 29.0 | 29 | 31 | 79 | 16 | 2 |
| 16.00 | e8 | 32.0 | 15.00 | 73.0 | 73 | 75 | 123 | 16 | 2 |
| 16.70 | h10 | 19.0 | 15.00 | 29.0 | 29 | 31 | 79 | 16 | 2 |
| 17.00 | h10 | 19.0 | 15.00 | 29.0 | 29 | 31 | 79 | 16 | 2 |
| 17.00 | h10 | 32.0 | 15.00 | 73.0 | 73 | 75 | 123 | 16 | 2 |
| 17.70 | h10 | 19.0 | 15.00 | 29.0 | 29 | 31 | 79 | 16 | 2 |
| 18.00 | e8 | 19.0 | 15.00 | 29.0 | 29 | 31 | 79 | 16 | 2 |
| 18.00 | e8 | 32.0 | 15.00 | 73.0 | 73 | 75 | 123 | 16 | 2 |
| 19.00 | h10 | 19.0 | 15.00 | 29.0 | 29 | 31 | 79 | 16 | 2 |
| 19.00 | h10 | 32.0 | 15.00 | 73.0 | 73 | 75 | 123 | 16 | 2 |
| 19.70 | h10 | 22.0 | 19.00 | 36.0 | 36 | 38 | 88 | 20 | 2 |
| 20.00 | e8 | 22.0 | 19.00 | 36.0 | 36 | 38 | 88 | 20 | 2 |
| 20.00 | e8 | 38.0 | 19.00 | 89.0 | 89 | 91 | 141 | 20 | 2 |
| 21.70 | h10 | 22.0 | 19.00 | 36.0 | 36 | 38 | 88 | 20 | 2 |
| 22.00 | e8 | 22.0 | 19.00 | 36.0 | 36 | 38 | 88 | 20 | 2 |
| 22.00 | e8 | 38.0 | 19.00 | 89.0 | 89 | 91 | 141 | 20 | 2 |
| 23.70 | h10 | 26.0 | 23.00 | 42.0 | 44 | 46 | 102 | 25 | 2 |
| 24.00 | e8 | 26.0 | 23.00 | 42.0 | 44 | 46 | 102 | 25 | 2 |
| 24.00 | e8 | 45.0 | 23.00 | 106.0 | 108 | 110 | 166 | 25 | 2 |
| 24.70 | h10 | 26.0 | 24.00 | 44.0 | 44 | 46 | 102 | 25 | 2 |
| 25.00 | e8 | 26.0 | 24.00 | 44.0 | 44 | 46 | 102 | 25 | 2 |
| 25.00 | e8 | 45.0 | 24.00 | 108.0 | 108 | 110 | 166 | 25 | 2 |
| 26.00 | h10 | 26.0 | 24.00 | 44.0 | 44 | 46 | 102 | 25 | 2 |

| | | | | |
|-----------------------|---|---|---|---|
| Steel | ● | ● | ● | ● |
| Stainless steel | ○ | ● | ○ | ● |
| Cast iron | ● | ● | ● | ● |
| Non ferrous metals | ○ | ○ | ○ | ○ |
| Heat resistant alloys | ○ | ○ | ○ | ○ |
| hardened materials | | | | |

Throw-away milling cutter, HSS-E Co 8

▲ Shank similar to DIN 1835 B



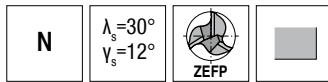
| DC _{es} | APMX | LPR | OAL | DCONMS _{ns} | ZEPF |
|------------------|------|-----|-----|----------------------|------|
| mm | mm | mm | mm | mm | |
| 1.00 | 2 | 8 | 34 | 6 | 3 |
| 1.50 | 3 | 8 | 34 | 6 | 3 |
| 1.50 | 4 | 10 | 35 | 6 | 3 |
| 1.80 | 3 | 8 | 34 | 6 | 3 |
| 2.00 | 4 | 9 | 35 | 6 | 3 |
| 2.00 | 7 | 12 | 38 | 6 | 3 |
| 2.30 | 4 | 9 | 35 | 6 | 3 |
| 2.50 | 5 | 10 | 36 | 6 | 3 |
| 2.50 | 8 | 13 | 39 | 6 | 3 |
| 2.80 | 5 | 10 | 36 | 6 | 3 |
| 3.00 | 5 | 10 | 36 | 6 | 3 |
| 3.00 | 8 | 13 | 39 | 6 | 3 |
| 3.30 | 6 | 11 | 37 | 6 | 3 |
| 3.50 | 6 | 11 | 37 | 6 | 3 |
| 3.50 | 10 | 15 | 41 | 6 | 3 |
| 3.80 | 7 | 12 | 38 | 6 | 3 |
| 4.00 | 7 | 12 | 38 | 6 | 3 |
| 4.00 | 11 | 16 | 42 | 6 | 3 |
| 4.30 | 7 | 12 | 38 | 6 | 3 |
| 4.50 | 7 | 12 | 38 | 6 | 3 |
| 4.50 | 11 | 16 | 42 | 6 | 3 |
| 4.80 | 8 | 13 | 39 | 6 | 3 |
| 5.00 | 8 | 13 | 39 | 6 | 3 |
| 5.00 | 13 | 18 | 44 | 6 | 3 |
| 5.30 | 8 | 13 | 39 | 6 | 3 |
| 5.50 | 8 | 13 | 39 | 6 | 3 |
| 5.50 | 13 | 18 | 44 | 6 | 3 |
| 5.75 | 8 | 13 | 39 | 6 | 3 |
| 6.00 | 8 | 13 | 39 | 6 | 3 |
| 6.00 | 13 | 18 | 44 | 6 | 3 |
| 6.50 | 10 | 14 | 42 | 8 | 3 |
| 6.50 | 16 | 20 | 48 | 8 | 3 |
| 7.00 | 10 | 14 | 42 | 8 | 3 |
| 7.00 | 16 | 20 | 48 | 8 | 3 |
| 7.50 | 10 | 14 | 42 | 8 | 3 |
| 7.50 | 16 | 20 | 48 | 8 | 3 |
| 8.00 | 11 | 15 | 43 | 8 | 3 |
| 8.00 | 19 | 23 | 51 | 8 | 3 |
| 8.50 | 11 | 16 | 48 | 10 | 3 |
| 8.50 | 19 | 24 | 56 | 10 | 3 |
| 9.00 | 11 | 16 | 48 | 10 | 3 |
| 9.00 | 19 | 24 | 56 | 10 | 3 |
| 9.50 | 11 | 16 | 48 | 10 | 3 |
| 9.50 | 19 | 24 | 56 | 10 | 3 |
| 10.00 | 13 | 18 | 50 | 10 | 3 |
| 10.00 | 22 | 27 | 59 | 10 | 3 |

| | | | | |
|-----------------------|---|---|---|---|
| Steel | ● | ● | ● | ● |
| Stainless steel | ○ | ● | ○ | ● |
| Cast iron | ○ | ● | ● | ● |
| Non ferrous metals | ○ | ○ | ○ | ○ |
| Heat resistant alloys | ○ | ○ | ○ | ○ |
| hardened materials | | | | |

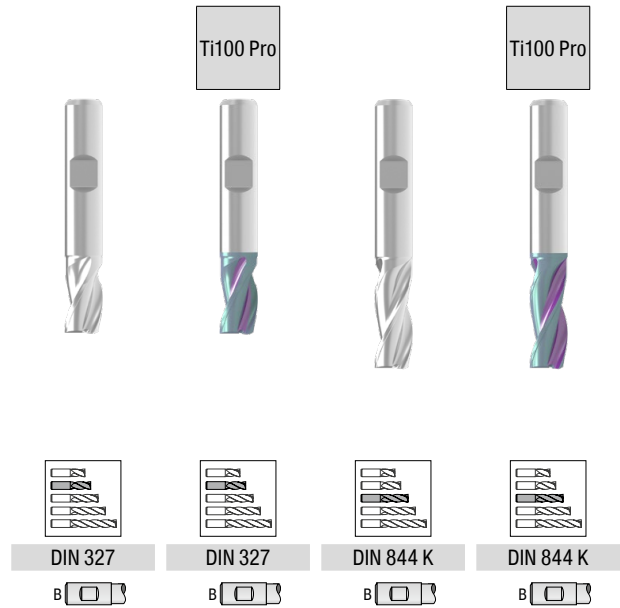
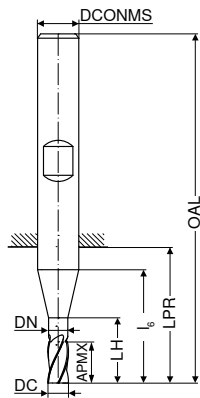
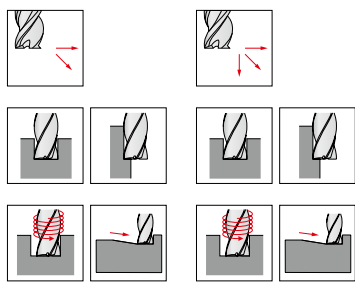
1) Shank tolerance -0,025 / -0,0323

End milling cutter HSS-E Co 8

▲ $\varnothing \leq 6$ mm, 3 teeth cutting to centre



$\leq \varnothing$ DC 6.0 mm $> \varnothing$ DC 6.0 mm



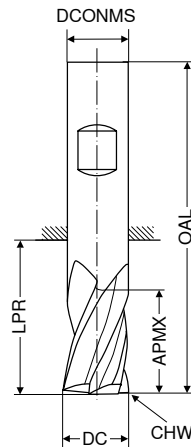
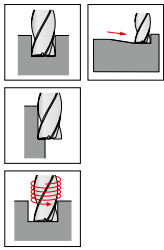
| DC | Tol. | APMX | DN | LH | l_6 | LPR | OAL | DCONMS _{h6} | ZEFP |
|-------|------|------|------|----|-------|-----|-----|----------------------|------|
| mm | | mm | mm | mm | mm | mm | mm | mm | |
| 1.80 | h10 | 4 | | 4 | 10 | 12 | 48 | 6 | 3 |
| 2.00 | e8 | 4 | | 4 | 10 | 12 | 48 | 6 | 3 |
| 2.50 | e8 | 5 | | 5 | 11 | 13 | 49 | 6 | 3 |
| 2.80 | h10 | 5 | | 5 | 11 | 13 | 49 | 6 | 3 |
| 2.80 | h10 | 8 | | 8 | 18 | 20 | 56 | 6 | 3 |
| 3.00 | e8 | 5 | | 5 | 11 | 13 | 49 | 6 | 3 |
| 3.00 | e8 | 8 | | 8 | 14 | 16 | 52 | 6 | 3 |
| 3.50 | h10 | 6 | | 6 | 12 | 14 | 50 | 6 | 3 |
| 3.50 | h10 | 10 | | 10 | 16 | 18 | 54 | 6 | 3 |
| 3.80 | h10 | 7 | | 7 | 13 | 15 | 51 | 6 | 3 |
| 3.80 | h10 | 11 | | 11 | 25 | 27 | 63 | 6 | 3 |
| 4.00 | e8 | 7 | | 7 | 13 | 15 | 51 | 6 | 3 |
| 4.00 | e8 | 11 | | 11 | 17 | 19 | 55 | 6 | 3 |
| 4.50 | h10 | 7 | | 7 | 13 | 15 | 51 | 6 | 3 |
| 4.50 | h10 | 11 | | 11 | 17 | 19 | 55 | 6 | 3 |
| 4.80 | h10 | 8 | | 8 | 14 | 16 | 52 | 6 | 3 |
| 5.00 | e8 | 8 | | 8 | 14 | 16 | 52 | 6 | 3 |
| 5.00 | e8 | 13 | | 13 | 19 | 21 | 57 | 6 | 3 |
| 5.50 | h10 | 8 | | 8 | 14 | 16 | 52 | 6 | 3 |
| 5.50 | h10 | 13 | | 13 | 19 | 21 | 57 | 6 | 3 |
| 5.75 | h10 | 8 | | 8 | 14 | 16 | 52 | 6 | 3 |
| 6.00 | e8 | 8 | 5.5 | 14 | 14 | 16 | 52 | 6 | 3 |
| 6.00 | e8 | 13 | 5.5 | 19 | 19 | 21 | 57 | 6 | 3 |
| 6.50 | h10 | 10 | 6.0 | 16 | 18 | 20 | 60 | 10 | 3 |
| 6.50 | h10 | 16 | 6.0 | 22 | 24 | 26 | 66 | 10 | 3 |
| 6.75 | h10 | 10 | 6.5 | 16 | 18 | 20 | 60 | 10 | 3 |
| 7.00 | e8 | 10 | 6.5 | 16 | 18 | 20 | 60 | 10 | 3 |
| 7.00 | e8 | 16 | 6.5 | 22 | 24 | 26 | 66 | 10 | 3 |
| 7.50 | h10 | 10 | 7.0 | 16 | 18 | 20 | 60 | 10 | 3 |
| 7.50 | h10 | 16 | 7.0 | 22 | 24 | 26 | 66 | 10 | 3 |
| 7.75 | h10 | 11 | 7.5 | 17 | 19 | 21 | 61 | 10 | 3 |
| 8.00 | e8 | 11 | 7.5 | 17 | 19 | 21 | 61 | 10 | 3 |
| 8.00 | e8 | 19 | 7.5 | 25 | 27 | 29 | 69 | 10 | 3 |
| 8.50 | h10 | 11 | 8.0 | 18 | 19 | 21 | 61 | 10 | 3 |
| 8.50 | h10 | 19 | 8.0 | 26 | 27 | 29 | 69 | 10 | 3 |
| 8.70 | h10 | 11 | 8.5 | 18 | 19 | 21 | 61 | 10 | 3 |
| 9.00 | h10 | 11 | 8.5 | 18 | 19 | 21 | 61 | 10 | 3 |
| 9.00 | h10 | 19 | 8.5 | 26 | 27 | 29 | 69 | 10 | 3 |
| 9.50 | h10 | 11 | 9.0 | 18 | 19 | 21 | 61 | 10 | 3 |
| 9.50 | h10 | 19 | 9.0 | 26 | 27 | 29 | 69 | 10 | 3 |
| 9.70 | h10 | 13 | 9.5 | 21 | 21 | 23 | 63 | 10 | 3 |
| 10.00 | e8 | 13 | 9.5 | 21 | 21 | 23 | 63 | 10 | 3 |
| 10.00 | e8 | 22 | 9.5 | 30 | 30 | 32 | 72 | 10 | 3 |
| 10.50 | h10 | 13 | 10.0 | 21 | 23 | 25 | 70 | 12 | 3 |
| 10.70 | h10 | 13 | 10.5 | 21 | 23 | 25 | 70 | 12 | 3 |
| 11.00 | h10 | 13 | 10.5 | 21 | 23 | 25 | 70 | 12 | 3 |

| | | | | |
|-----------------------|---|---|---|---|
| Steel | ● | ● | ● | ● |
| Stainless steel | ○ | ● | ○ | ● |
| Cast iron | ● | ● | ● | ● |
| Non ferrous metals | ○ | ○ | ○ | ○ |
| Heat resistant alloys | ○ | ○ | ○ | ○ |
| hardened materials | | | | |

1) Factory standard

→ v_c/f_z Page 40-42

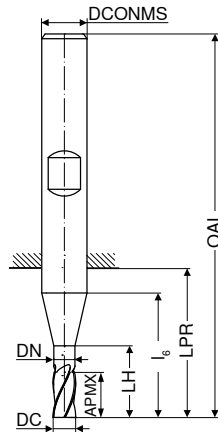
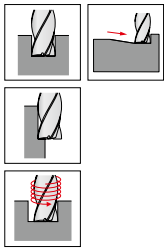
Powdersteel roughing finishing cutter



| DC _{k12} | APMX | LPR | OAL | DCONMS _{n6} | CHW | ZEFP |
|-------------------|------|-----|-----|----------------------|-----|------|
| mm | mm | mm | mm | mm | mm | |
| 6 | 13 | 21 | 57 | 6 | 0.3 | 4 |
| 6 | 24 | 32 | 68 | 6 | 0.3 | 4 |
| 7 | 16 | 26 | 66 | 10 | 0.3 | 4 |
| 8 | 19 | 29 | 69 | 10 | 0.3 | 4 |
| 8 | 38 | 48 | 88 | 10 | 0.3 | 4 |
| 9 | 19 | 29 | 69 | 10 | 0.5 | 4 |
| 10 | 22 | 32 | 72 | 10 | 0.5 | 4 |
| 10 | 45 | 55 | 95 | 10 | 0.5 | 4 |
| 12 | 26 | 38 | 83 | 12 | 0.7 | 4 |
| 12 | 53 | 65 | 110 | 12 | 0.7 | 4 |
| 14 | 26 | 38 | 83 | 12 | 0.8 | 4 |
| 14 | 53 | 65 | 110 | 12 | 0.8 | 4 |
| 16 | 32 | 44 | 92 | 16 | 0.8 | 4 |
| 16 | 63 | 75 | 123 | 16 | 0.8 | 4 |
| 18 | 32 | 44 | 92 | 16 | 0.8 | 4 |
| 18 | 63 | 75 | 123 | 16 | 0.8 | 4 |
| 20 | 38 | 54 | 104 | 20 | 0.8 | 4 |
| 20 | 75 | 91 | 141 | 20 | 0.8 | 4 |
| 25 | 45 | 65 | 121 | 25 | 1.0 | 5 |
| 25 | 90 | 110 | 166 | 25 | 1.0 | 4 |
| 30 | 90 | 110 | 166 | 25 | 1.3 | 5 |
| 32 | 53 | 73 | 133 | 32 | 1.3 | 6 |
| 32 | 106 | 126 | 186 | 32 | 1.3 | 5 |
| 40 | 63 | 85 | 155 | 40 | 1.3 | 6 |
| 40 | 125 | 147 | 217 | 40 | 1.3 | 6 |

| | | |
|-----------------------|----------------------------------|----------------------------------|
| Steel | <input type="radio"/> | <input type="radio"/> |
| Stainless steel | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Cast iron | <input type="radio"/> | <input type="radio"/> |
| Non ferrous metals | <input type="radio"/> | <input type="radio"/> |
| Heat resistant alloys | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| hardened materials | <input type="radio"/> | <input type="radio"/> |

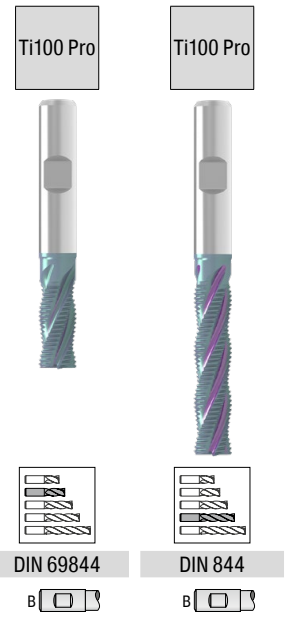
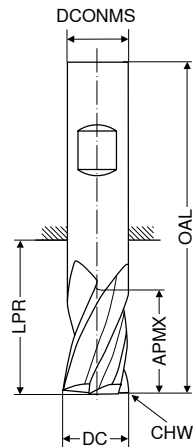
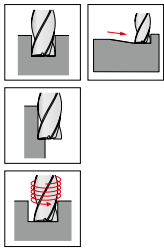
Roughing-finishing milling cutter HSS-E Co 5



| DC _{k12} | APMX | DN | LH | l ₆ | LPR | OAL | DCONMS _{n6} | ZEFP |
|-------------------|------|------|-----|----------------|-----|-----|----------------------|------|
| mm | mm | mm | mm | mm | mm | mm | mm | |
| 6 | 13 | 5.5 | 19 | 19 | 21 | 57 | 6 | 4 |
| 6 | 24 | 5.5 | 30 | 30 | 32 | 68 | 6 | 4 |
| 7 | 16 | 6.5 | 22 | 24 | 26 | 66 | 10 | 4 |
| 8 | 19 | 7.5 | 25 | 27 | 29 | 69 | 10 | 4 |
| 8 | 38 | 7.5 | 44 | 46 | 48 | 88 | 10 | 4 |
| 9 | 19 | 8.5 | 26 | 27 | 29 | 69 | 10 | 4 |
| 10 | 22 | 9.5 | 30 | 30 | 32 | 72 | 10 | 4 |
| 10 | 45 | 9.5 | 53 | 53 | 55 | 95 | 10 | 4 |
| 11 | 22 | 10.5 | 30 | 32 | 32 | 79 | 12 | 4 |
| 11 | 45 | 10.5 | 53 | 55 | 57 | 102 | 12 | 4 |
| 12 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 4 |
| 12 | 53 | 11.5 | 63 | 63 | 65 | 110 | 12 | 4 |
| 13 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 4 |
| 14 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 4 |
| 15 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 4 |
| 15 | 53 | 11.5 | 63 | 63 | 65 | 110 | 12 | 4 |
| 16 | 32 | 15.0 | 42 | 42 | 44 | 92 | 16 | 4 |
| 16 | 63 | 15.0 | 73 | 73 | 75 | 123 | 16 | 4 |
| 18 | 32 | 15.0 | 42 | 42 | 44 | 92 | 16 | 4 |
| 20 | 38 | 19.0 | 52 | 52 | 54 | 104 | 20 | 4 |
| 20 | 75 | 19.0 | 89 | 89 | 91 | 141 | 20 | 4 |
| 22 | 75 | 19.0 | 89 | 89 | 91 | 141 | 20 | 4 |
| 22 | 38 | 19.0 | 52 | 52 | 54 | 104 | 20 | 4 |
| 25 | 90 | 24.0 | 108 | 108 | 110 | 166 | 25 | 4 |
| 25 | 45 | 24.0 | 63 | 63 | 65 | 121 | 25 | 4 |
| 28 | 90 | 24.0 | 108 | 108 | 110 | 166 | 25 | 5 |

| | | |
|-----------------------|---|---|
| Steel | ● | ● |
| Stainless steel | ○ | ○ |
| Cast iron | ● | ● |
| Non ferrous metals | ○ | ○ |
| Heat resistant alloys | ○ | ○ |
| hardened materials | | |

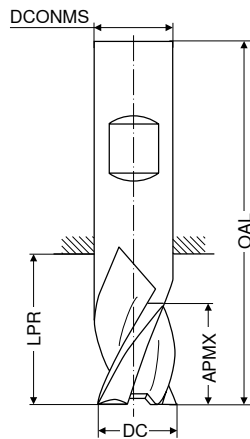
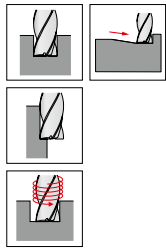
Powdersteel roughing finishing cutter



| DC _{k12} | APMX | LPR | OAL | DCONMS _{n6} | CHW | ZEFP |
|-------------------|------|-----|-----|----------------------|------|------|
| mm | mm | mm | mm | mm | mm | |
| 6 | 13 | 21 | 57 | 6 | 0.45 | 4 |
| 6 | 24 | 32 | 68 | 6 | 0.45 | 4 |
| 8 | 19 | 29 | 69 | 10 | 0.45 | 4 |
| 8 | 38 | 48 | 88 | 10 | 0.45 | 4 |
| 10 | 22 | 32 | 72 | 10 | 0.45 | 4 |
| 10 | 45 | 55 | 95 | 10 | 0.45 | 4 |
| 12 | 26 | 38 | 83 | 12 | 0.45 | 4 |
| 12 | 53 | 65 | 110 | 12 | 0.45 | 4 |
| 14 | 26 | 38 | 83 | 12 | 0.45 | 4 |
| 14 | 53 | 65 | 110 | 12 | 0.45 | 4 |
| 16 | 32 | 44 | 92 | 16 | 0.60 | 4 |
| 16 | 63 | 75 | 123 | 16 | 0.60 | 4 |
| 18 | 32 | 44 | 92 | 16 | 0.60 | 4 |
| 18 | 63 | 75 | 123 | 16 | 0.60 | 4 |
| 20 | 38 | 54 | 104 | 20 | 0.60 | 4 |
| 20 | 75 | 91 | 141 | 20 | 0.60 | 4 |
| 22 | 38 | 54 | 104 | 20 | 0.60 | 5 |
| 25 | 45 | 65 | 121 | 25 | 0.75 | 5 |
| 25 | 90 | 110 | 166 | 25 | 0.75 | 5 |
| 28 | 45 | 65 | 121 | 25 | 0.75 | 5 |
| 28 | 90 | 110 | 166 | 25 | 0.75 | 5 |
| 30 | 45 | 65 | 121 | 25 | 0.75 | 5 |
| 30 | 90 | 110 | 166 | 25 | 0.75 | 5 |
| 32 | 53 | 73 | 133 | 32 | 0.75 | 6 |
| 32 | 106 | 126 | 186 | 32 | 0.75 | 5 |
| 40 | 63 | 85 | 155 | 40 | 0.90 | 6 |

| | | |
|-----------------------|---|---|
| Steel | ○ | ○ |
| Stainless steel | | |
| Cast iron | ● | ● |
| Non ferrous metals | | |
| Heat resistant alloys | ● | ● |
| hardened materials | | |

Powdersteel roughing finishing cutter



Ti100 Pro



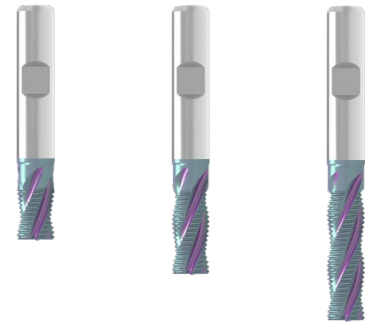
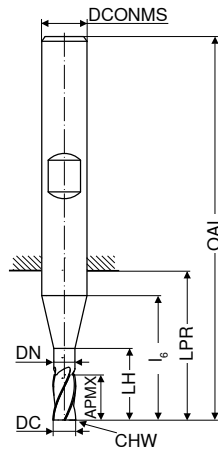
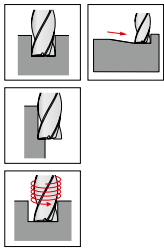
DIN 844



| DC _{k12} | APMX | LPR | OAL | DCONMS _{h6} | ZEFP |
|-------------------|------|-----|-----|----------------------|------|
| mm | mm | mm | mm | mm | |
| 6 | 13 | 21 | 57 | 6 | 4 |
| 8 | 19 | 29 | 69 | 10 | 4 |
| 10 | 22 | 32 | 72 | 10 | 4 |
| 12 | 26 | 38 | 83 | 12 | 4 |
| 14 | 26 | 38 | 83 | 12 | 4 |
| 16 | 32 | 44 | 92 | 16 | 4 |
| 18 | 32 | 44 | 92 | 16 | 4 |
| 20 | 38 | 54 | 104 | 20 | 4 |
| 25 | 45 | 65 | 121 | 25 | 4 |

| | |
|-----------------------|---|
| Steel | ● |
| Stainless steel | ○ |
| Cast iron | ● |
| Non ferrous metals | ○ |
| Heat resistant alloys | ○ |
| hardened materials | ○ |

Powdersteel Fine rough milling cutter



Factory standard



DIN 844



Factory standard

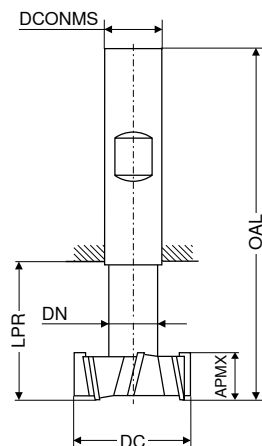
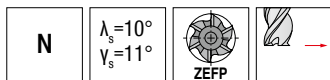


| DC _{k12} | APMX | DN | LH | l ₆ | LPR | OAL | DCONMS _{n6} | CHW | ZEFP |
|-------------------|------|------|----|----------------|-----|-----|----------------------|------|------|
| mm | mm | mm | mm | mm | mm | mm | mm | mm | |
| 6 | 8 | 5.5 | 14 | 14 | 16 | 52 | 6 | 0.35 | 4 |
| 6 | 13 | 5.5 | 19 | 19 | 21 | 57 | 6 | 0.35 | 4 |
| 8 | 11 | 7.5 | 17 | 19 | 21 | 61 | 10 | 0.45 | 4 |
| 8 | 19 | 7.5 | 25 | 27 | 29 | 69 | 10 | 0.45 | 4 |
| 8 | 28 | 7.5 | 34 | 36 | 38 | 78 | 10 | 0.45 | 4 |
| 10 | 13 | 9.5 | 21 | 21 | 23 | 63 | 10 | 0.45 | 4 |
| 10 | 22 | 9.5 | 30 | 30 | 32 | 72 | 10 | 0.45 | 4 |
| 10 | 34 | 9.5 | 42 | 42 | 44 | 84 | 10 | 0.45 | 4 |
| 12 | 16 | 11.5 | 26 | 26 | 28 | 73 | 12 | 0.60 | 4 |
| 12 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 0.60 | 4 |
| 12 | 40 | 11.5 | 50 | 50 | 52 | 97 | 12 | 0.60 | 4 |
| 14 | 16 | 11.5 | 26 | 26 | 28 | 73 | 12 | 0.60 | 4 |
| 14 | 26 | 11.5 | 36 | 36 | 38 | 83 | 12 | 0.60 | 4 |
| 14 | 40 | 11.5 | 50 | 50 | 52 | 97 | 12 | 0.60 | 4 |
| 16 | 19 | 15.0 | 29 | 29 | 31 | 79 | 16 | 0.70 | 4 |
| 16 | 32 | 15.0 | 42 | 42 | 44 | 92 | 16 | 0.70 | 4 |
| 16 | 48 | 15.0 | 58 | 58 | 60 | 108 | 16 | 0.70 | 4 |
| 18 | 19 | 15.0 | 29 | 29 | 31 | 79 | 16 | 0.70 | 4 |
| 18 | 32 | 15.0 | 42 | 42 | 44 | 92 | 16 | 0.70 | 4 |
| 18 | 48 | 15.0 | 58 | 58 | 60 | 108 | 16 | 0.70 | 4 |
| 20 | 22 | 19.0 | 36 | 36 | 38 | 88 | 20 | 0.70 | 4 |
| 20 | 38 | 19.0 | 52 | 52 | 54 | 104 | 20 | 0.70 | 4 |
| 20 | 56 | 19.0 | 70 | 70 | 72 | 122 | 20 | 0.70 | 4 |
| 22 | 22 | 19.0 | 36 | 36 | 38 | 88 | 20 | 0.70 | 4 |
| 22 | 38 | 19.0 | 52 | 52 | 54 | 104 | 20 | 0.70 | 4 |
| 22 | 56 | 19.0 | 70 | 70 | 72 | 122 | 20 | 0.70 | 4 |
| 25 | 26 | 24.0 | 44 | 44 | 46 | 102 | 25 | 0.70 | 4 |
| 25 | 45 | 24.0 | 63 | 63 | 65 | 121 | 25 | 0.70 | 4 |
| 25 | 68 | 24.0 | 86 | 86 | 88 | 144 | 25 | 0.70 | 4 |
| 28 | 26 | 24.0 | 44 | 44 | 46 | 102 | 25 | 0.90 | 5 |
| 30 | 45 | 24.0 | 63 | 63 | 65 | 121 | 25 | 0.90 | 5 |
| 32 | 32 | 31.0 | 49 | 49 | 52 | 112 | 32 | 0.90 | 6 |
| 32 | 53 | 31.0 | 70 | 70 | 73 | 133 | 32 | 0.90 | 6 |

| | | | |
|-----------------------|---|---|---|
| Steel | ● | ● | ● |
| Stainless steel | ● | ● | ● |
| Cast iron | ● | ● | ● |
| Non ferrous metals | ○ | ○ | ○ |
| Heat resistant alloys | ○ | ○ | ○ |
| hardened materials | | | |

T-slot milling cutter HSS-E Co 5, cross pitched

▲ for slots according to DIN 650



DIN 851 A



| DC _{d11} | APMX _{d11} | DN _{h12} | LPR | OAL | DCONMS _{h6} | ZEFP |
|-------------------|---------------------|-------------------|------|-------|----------------------|------|
| mm | mm | mm | mm | mm | mm | |
| 11.0 | 4 | 4 | 13.5 | 53.5 | 10 | 6 |
| 12.5 | 6 | 5 | 17.0 | 57.0 | 10 | 6 |
| 16.0 | 8 | 7 | 22.0 | 62.0 | 10 | 6 |
| 18.0 | 8 | 8 | 25.0 | 70.0 | 12 | 6 |
| 19.0 | 9 | 8 | 26.0 | 71.0 | 12 | 6 |
| 21.0 | 9 | 10 | 29.0 | 74.0 | 12 | 6 |
| 22.0 | 10 | 10 | 30.0 | 75.0 | 12 | 6 |
| 25.0 | 11 | 12 | 34.0 | 82.0 | 16 | 8 |
| 28.0 | 12 | 13 | 37.0 | 85.0 | 16 | 8 |
| 32.0 | 14 | 15 | 42.0 | 90.0 | 16 | 8 |
| 36.0 | 16 | 17 | 47.0 | 103.0 | 25 | 8 |
| 40.0 | 18 | 19 | 52.0 | 108.0 | 25 | 10 |
| 45.0 | 20 | 21 | 57.0 | 113.0 | 25 | 10 |
| 50.0 | 22 | 25 | 64.0 | 124.0 | 32 | 10 |
| 60.0 | 28 | 30 | 79.0 | 139.0 | 32 | 10 |

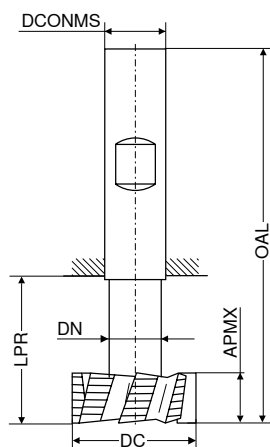
| | |
|-----------------------|---|
| Steel | ● |
| Stainless steel | ○ |
| Cast iron | ● |
| Non ferrous metals | ○ |
| Heat resistant alloys | ○ |
| hardened materials | |

1) Factory standard

→ v_c/f_z Page 43

T-slot milling cutter HSS-E Co 5

▲ for slots according to DIN 650



DIN 851 A



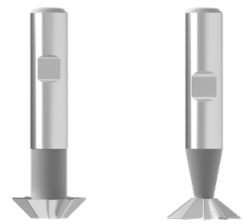
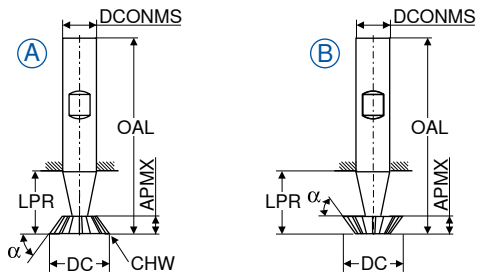
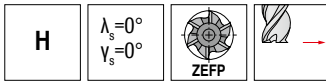
| DC _{d11} | APMX | DN _{h12} | LPR | OAL | DCONMS _{h6} | ZEFP |
|-------------------|------|-------------------|-----|-----|----------------------|------|
| mm | mm | mm | mm | mm | mm | |
| 21 | 9 | 10 | 29 | 74 | 12 | 6 |
| 22 | 10 | 10 | 30 | 75 | 12 | 6 |
| 25 | 11 | 12 | 34 | 82 | 16 | 6 |
| 28 | 12 | 13 | 37 | 85 | 16 | 6 |
| 32 | 14 | 15 | 42 | 90 | 16 | 6 |
| 36 | 16 | 17 | 47 | 103 | 25 | 6 |
| 40 | 18 | 19 | 52 | 108 | 25 | 8 |
| 45 | 20 | 21 | 57 | 113 | 25 | 8 |

| | |
|-----------------------|---|
| Steel | ● |
| Stainless steel | ○ |
| Cast iron | ● |
| Non ferrous metals | ○ |
| Heat resistant alloys | ○ |
| hardened materials | ○ |

1) Factory standard

→ v_c/f_z Page 43

Single angle milling cutters HSS-E Co 5



| α° | DC | APMX | LPR | OAL | DCONMS _{n6} | CHW | ZEFP | Fig. |
|----------------|----|------|-----|-----|----------------------|-----|------|------|
| | mm | mm | mm | mm | mm | mm | | |
| 45 | 16 | 4.0 | 15 | 60 | 12 | 0.3 | 10 | A |
| | 16 | 4.0 | 15 | 60 | 12 | | 10 | B |
| | 20 | 5.0 | 18 | 63 | 12 | 0.3 | 10 | A |
| | 20 | 5.0 | 18 | 63 | 12 | | 10 | B |
| | 25 | 6.3 | 22 | 67 | 12 | 0.3 | 10 | A |
| | 25 | 6.3 | 22 | 67 | 12 | | 10 | B |
| 60 | 16 | 6.3 | 15 | 60 | 12 | 0.3 | 10 | A |
| | 16 | 6.3 | 15 | 60 | 12 | | 10 | B |
| | 20 | 8.0 | 18 | 63 | 12 | 0.3 | 10 | A |
| | 20 | 8.0 | 18 | 63 | 12 | | 10 | B |
| | 25 | 10.0 | 22 | 67 | 12 | 0.3 | 10 | A |
| | 25 | 10.0 | 22 | 67 | 12 | | 10 | B |
| 70 | 16 | 7.0 | 15 | 60 | 12 | 0.3 | 10 | A |
| | 20 | 9.0 | 18 | 63 | 12 | 0.3 | 10 | A |
| | 25 | 11.0 | 19 | 67 | 16 | 0.3 | 10 | A |

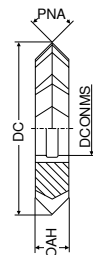
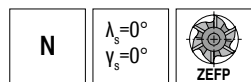
| | | |
|-----------------------|---|---|
| Steel | ● | ● |
| Stainless steel | ○ | ○ |
| Cast iron | ● | ● |
| Non ferrous metals | ○ | ○ |
| Heat resistant alloys | ○ | ○ |
| hardened materials | | |

1) Factory standard

→ v_c/f_z Page 44

Double angle milling cutter HSS

▲ with keyway to DIN 138



| PNA | DC | OAH | DCONMS | ZEFP |
|-----|-----|-----|--------|------|
| ° | mm | mm | mm | |
| 45 | 50 | 8 | 16 | 22 |
| | 63 | 10 | 22 | 24 |
| | 80 | 12 | 27 | 26 |
| | 100 | 18 | 32 | 28 |
| 60 | 50 | 10 | 16 | 18 |
| | 63 | 14 | 22 | 20 |
| | 80 | 18 | 27 | 22 |
| | 100 | 25 | 32 | 24 |
| 90 | 50 | 14 | 16 | 16 |
| | 63 | 20 | 22 | 18 |
| | 80 | 22 | 27 | 20 |
| | 100 | 32 | 32 | 24 |
| 120 | 50 | 14 | 16 | 16 |
| | 63 | 20 | 22 | 16 |

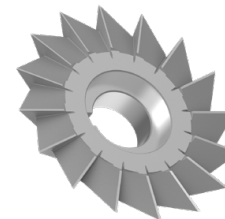
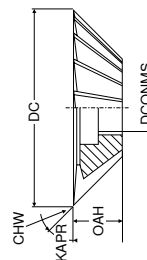
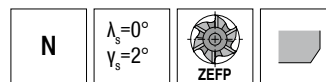
| | |
|-----------------------|---|
| Steel | ● |
| Stainless steel | ○ |
| Cast iron | ● |
| Non ferrous metals | ○ |
| Heat resistant alloys | ○ |
| hardened materials | |

1) Factory standard

→ v_c/f_z Page 44

Shell type single angle milling cutter HSS

▲ with keyway to DIN 138



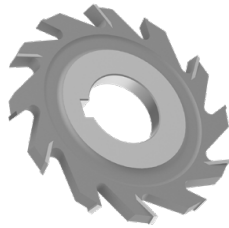
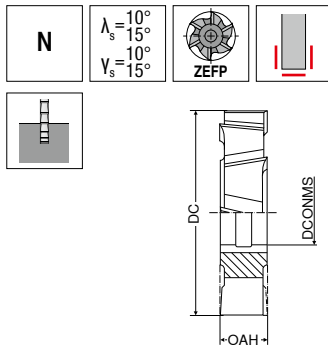
| KAPR | DC | OAH | DCONMS | CHW | ZEFP |
|------|-----|-----|--------|-----|------|
| ° | mm | mm | mm | mm | |
| 45 | 40 | 10 | 10 | 0.3 | 14 |
| | 50 | 13 | 13 | 0.3 | 16 |
| | 63 | 18 | 16 | 0.3 | 18 |
| | 80 | 22 | 22 | 0.3 | 20 |
| | 100 | 28 | 27 | 0.3 | 22 |
| 50 | 50 | 16 | 13 | 0.3 | 16 |
| 60 | 40 | 13 | 10 | 0.3 | 14 |
| | 50 | 16 | 13 | 0.3 | 16 |
| | 63 | 20 | 16 | 0.3 | 18 |
| | 80 | 25 | 22 | 0.3 | 20 |
| | 100 | 32 | 27 | 0.3 | 22 |
| | 125 | 40 | 32 | 0.3 | 28 |

| | |
|-----------------------|---|
| Steel | ● |
| Stainless steel | ○ |
| Cast iron | ● |
| Non ferrous metals | ○ |
| Heat resistant alloys | ○ |
| hardened materials | |

→ v_c/f_z Page 44

Side and face milling cutter HSS-E Co 5

- ▲ Coarse cross-pitched
- ▲ with keyway to DIN 138



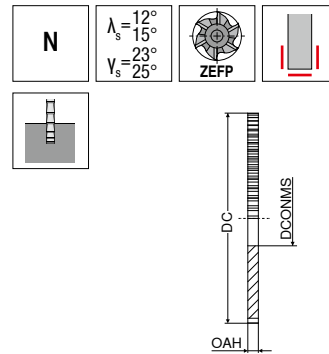
| DC _{js16} | OAH _{k11} | DCONMS _{H7} | ZEFF |
|--------------------|--------------------|----------------------|------|
| mm | mm | mm | |
| 50 | 4 | 16 | 12 |
| 50 | 5 | 16 | 12 |
| 50 | 6 | 16 | 12 |
| 50 | 8 | 16 | 12 |
| 50 | 10 | 16 | 12 |
| 63 | 4 | 22 | 12 |
| 63 | 5 | 22 | 12 |
| 63 | 6 | 22 | 12 |
| 63 | 8 | 22 | 12 |
| 63 | 10 | 22 | 12 |
| 63 | 12 | 22 | 12 |
| 63 | 14 | 22 | 12 |
| 80 | 5 | 27 | 14 |
| 80 | 6 | 27 | 14 |
| 80 | 8 | 27 | 14 |
| 80 | 10 | 27 | 14 |
| 80 | 12 | 27 | 14 |
| 80 | 14 | 27 | 14 |
| 80 | 16 | 27 | 14 |
| 80 | 18 | 27 | 14 |
| 80 | 20 | 27 | 14 |
| 100 | 6 | 32 | 14 |
| 100 | 8 | 32 | 14 |
| 100 | 10 | 32 | 14 |
| 100 | 12 | 32 | 14 |
| 100 | 14 | 32 | 14 |
| 100 | 16 | 32 | 14 |
| 100 | 18 | 32 | 14 |
| 100 | 20 | 32 | 14 |
| 100 | 25 | 32 | 14 |
| 125 | 8 | 32 | 16 |
| 125 | 10 | 32 | 16 |
| 125 | 12 | 32 | 16 |
| 125 | 14 | 32 | 16 |
| 125 | 16 | 32 | 16 |
| 125 | 18 | 32 | 16 |
| 125 | 20 | 32 | 16 |
| 125 | 25 | 32 | 16 |
| 160 | 10 | 40 | 18 |
| 160 | 12 | 40 | 18 |
| 160 | 14 | 40 | 18 |
| 160 | 16 | 40 | 18 |
| 160 | 18 | 40 | 18 |
| 160 | 20 | 40 | 18 |
| 160 | 25 | 40 | 18 |
| 160 | 32 | 40 | 18 |

| | |
|-----------------------|---|
| Steel | ○ |
| Stainless steel | ● |
| Cast iron | ● |
| Non ferrous metals | ● |
| Heat resistant alloys | ○ |
| hardened materials | |

→ v_c/f_z Page 45

Narrow side and face milling cutter HSS-E Co 5

- ▲ Coarse cross-pitched
- ▲ with keyway to DIN 138



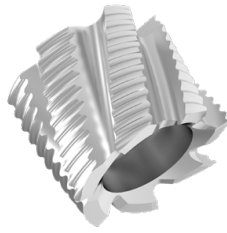
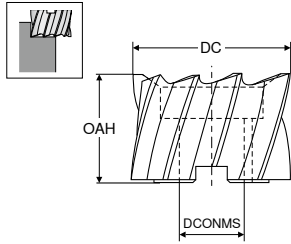
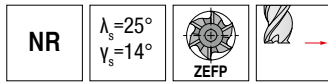
| DC _{js16} | OAH _{k11} | DCONMS _{H7} | ZEFF |
|--------------------|--------------------|----------------------|------|
| mm | mm | mm | |
| 63 | 1.6 | 22 | 16 |
| 63 | 2.0 | 22 | 16 |
| 63 | 2.5 | 22 | 16 |
| 63 | 3.0 | 22 | 16 |
| 80 | 1.6 | 27 | 20 |
| 80 | 2.0 | 27 | 20 |
| 80 | 2.5 | 27 | 20 |
| 80 | 3.0 | 27 | 20 |
| 80 | 4.0 | 27 | 20 |
| 100 | 1.6 | 32 | 24 |
| 100 | 2.0 | 32 | 24 |
| 100 | 2.5 | 32 | 24 |
| 100 | 3.0 | 32 | 24 |
| 100 | 4.0 | 32 | 24 |
| 100 | 5.0 | 32 | 24 |
| 125 | 1.6 | 32 | 26 |
| 125 | 2.0 | 32 | 26 |
| 125 | 2.5 | 32 | 26 |
| 125 | 3.0 | 32 | 26 |
| 125 | 4.0 | 32 | 26 |
| 125 | 5.0 | 32 | 26 |
| 125 | 6.0 | 32 | 26 |
| 160 | 2.0 | 40 | 30 |
| 160 | 2.5 | 40 | 30 |
| 160 | 3.0 | 40 | 30 |
| 160 | 4.0 | 40 | 30 |
| 160 | 5.0 | 40 | 30 |
| 160 | 6.0 | 40 | 30 |
| 160 | 8.0 | 40 | 22 |

| | |
|-----------------------|---|
| Steel | |
| Stainless steel | ● |
| Cast iron | |
| Non ferrous metals | ● |
| Heat resistant alloys | ○ |
| hardened materials | |

→ v_c/f_z Page 45

Roughing face milling cutters HSS-E Co 5

- ▲ with keyway to DIN 138
- ▲ Manufacturing tolerance lies on the plus range of the tolerance js14



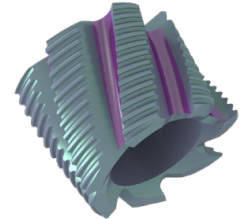
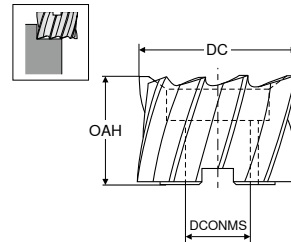
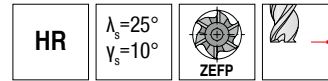
| DC _{js14} | OAH | DCONMS | ZEPF |
|--------------------|-----|--------|------|
| mm | mm | mm | |
| 40 | 32 | 16 | 7 |
| 50 | 36 | 22 | 8 |
| 63 | 40 | 27 | 8 |
| 80 | 45 | 27 | 10 |
| 100 | 50 | 32 | 12 |

| | |
|-----------------------|---|
| Steel | ● |
| Stainless steel | ● |
| Cast iron | ● |
| Non ferrous metals | ● |
| Heat resistant alloys | ○ |
| hardened materials | |

→ v_c/f_z Page 46+47

Roughing-finishing face milling cutters HSS-E Co 8

- ▲ with keyway to DIN 138
- ▲ Manufacturing tolerance lies on the plus range of the tolerance js14



Ti100
Pro

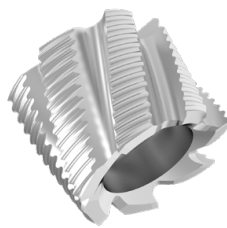
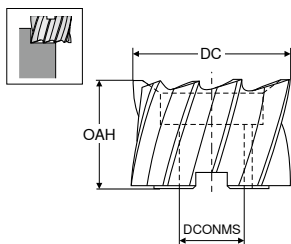
| DC _{js14} | OAH | DCONMS | ZEPF |
|--------------------|-----|--------|------|
| mm | mm | mm | |
| 40 | 32 | 16 | 7 |
| 50 | 36 | 22 | 8 |
| 63 | 40 | 27 | 8 |
| 80 | 45 | 27 | 10 |
| 100 | 50 | 32 | 12 |

| | |
|-----------------------|---|
| Steel | ● |
| Stainless steel | ● |
| Cast iron | ● |
| Non ferrous metals | ● |
| Heat resistant alloys | ○ |
| hardened materials | |

→ v_c/f_z Page 46+47

Roughing-finishing face milling cutters HSS-E Co 8

- ▲ with keyway to DIN 138
- ▲ Manufacturing tolerance lies on the plus range of the tolerance js14



| DC _{js14} | OAH | DCONMS | ZEPF |
|--------------------|-----|--------|------|
| mm | mm | mm | |
| 40 | 32 | 16 | 7 |
| 50 | 36 | 22 | 8 |
| 63 | 40 | 27 | 8 |
| 80 | 45 | 27 | 10 |
| 100 | 50 | 32 | 12 |

| | |
|-----------------------|---|
| Steel | ● |
| Stainless steel | ● |
| Cast iron | ● |
| Non ferrous metals | ● |
| Heat resistant alloys | ○ |
| hardened materials | |

→ v_c/f_z Page 46+47

Material examples referring to the cutting data tables

| | Index | Material | Strength N/mm ² / HB / HRC | Material number | Material designation | Material number | Material designation | Material number | Material designation |
|---|-------|--|--|--------------------|---------------------------|--------------------|---------------------------|--------------------|---------------------------|
| P | 1.1 | General construction steel | < 800 N/mm ² | 1.0402 | EN3B | | | | |
| | 1.2 | Free cutting steel | < 800 N/mm ² | 1.0711 | EN1A | | | | |
| | 1.3 | Hardened steel, non alloyed | < 800 N/mm ² | 1.0401 | EN32C | | | | |
| | 1.4 | Alloyed hardened steel | < 1000 N/mm ² | 1.7325 | 25 CD4 | | | | |
| | 1.5 | Tempering steel, unalloyed | < 850 N/mm ² | 1.5752 | EN36 | 1.0535 | EN9 | | |
| | 1.6 | Tempering steel, unalloyed | < 1000 N/mm ² | 1.6582 | EN24 | | | | |
| | 1.7 | Tempering steel, alloyed | < 800 N/mm ² | 1.7225 | EN19 | | | | |
| | 1.8 | Tempering steel, alloyed | < 1300 N/mm ² | 1.8515 | EN40B | | | | |
| | 1.9 | Steel castings | < 850 N/mm ² | 0.9650 | G-X 260 Cr 27 | 1.6750 | GS-20 NiCrMo 3.7 | 1.6582 | GS-34 CrNiMo 6 |
| | 1.10 | Nitriding steel | < 1000 N/mm ² | 1.8509 | EN41B | | | | |
| | 1.11 | Nitriding steel | < 1200 N/mm ² | 1.1186 | EN8 | 1.1160 | EN14A | | |
| | 1.12 | Roller bearing steel | < 1200 N/mm ² | 1.3505 | 534A99 | | | | |
| | 1.13 | Spring steel | < 1200 N/mm ² | | EN45 | | EN47 | | EN43 |
| | 1.14 | High-speed steel | < 1300 N/mm ² | 1.3343 | M2 | 1.3249 | M34 | | |
| | 1.15 | Cold working tool steel | < 1300 N/mm ² | 1.2379 | D2 | 1.2311 | P20 | | |
| | 1.16 | Hot working tool steel | < 1300 N/mm ² | 1.2344 | H13 | | | | |
| M | 2.1 | Cast steel and sulphured stainless steel | < 850 N/mm ² | 1.4581 | 318 | | | | |
| | 2.2 | Stainless steel, ferritic | < 750 N/mm ² | 1.4000 | 403 | | | | |
| | 2.3 | Stainless steel, martensitic | < 900 N/mm ² | 1.4057 | EN57 | | | | |
| | 2.4 | Stainless steel, ferritic / martensitic | < 1100 N/mm ² | 1.4028 | EN56B | | | | |
| | 2.5 | Stainless steel, austenitic / ferritic | < 850 N/mm ² | 1.4542 | 17-4PH | | | | |
| | 2.6 | Stainless steel, austenitic | < 750 N/mm ² | 1.4305 | 303 | 1.4401 | 316 | 1.4301 | 304 |
| | 2.7 | Heat resistant steel | < 1100 N/mm ² | 1.4876 | Incoloy 800 | | | | |
| K | 3.1 | Grey cast iron with lamellar graphite | 100–350 N/mm ² | 0.6015 | Grade 150 | 0.6020 | Grade 220 | 0.6025 | Grade 260 |
| | 3.2 | Grey cast iron with lamellar graphite | 300–500 N/mm ² | 0.6030 | Grade 300 | 0.6035 | Grade 350 | 0.6040 | Grade 400 |
| | 3.3 | Gray cast iron with spheroidal graphite | 300–500 N/mm ² | 0.7040 | SG 400-12 | 0.7043 | SG 370-17 | 0.7050 | SG 500-7 |
| | 3.4 | Gray cast iron with spheroidal graphite | 500–900 N/mm ² | 0.7060 | SG 600-3 | 0.7070 | SG 700-2 | 0.7080 | SG 800-2 |
| | 3.5 | White malleable cast iron | 270–450 N/mm ² | 0.8035 | GTW-35 | 0.8045 | GTW-45 | | |
| | 3.6 | White malleable cast iron | 500–650 N/mm ² | 0.8055 | GTW-55 | 0.8065 | GTW-65 | | |
| | 3.7 | Black malleable cast iron | 300–450 N/mm ² | 0.8135 | GTS-35 | 0.8145 | GTS-45 | | |
| | 3.8 | Black malleable cast iron | 500–800 N/mm ² | 0.8155 | GTS-55 | 0.8170 | GTS-70 | | |
| N | 4.1 | Aluminium (non alloyed, low alloyed) | < 350 N/mm ² | 3.0255 | 1050 A | 3.0275 | 1070 A | 3.0285 | 1080 A (A8) |
| | 4.2 | Aluminium alloys < 0.5 % Si | < 500 N/mm ² | 3.1325 | 2017 A (AU4G) | 3.4335 | 7005 (AZ5G) | 3.4365 | 7075 (AZ5GU) |
| | 4.3 | Aluminium alloy 0.5–10 % Si | < 400 N/mm ² | 3.2315 | A-G S1 | 3.2373 | A-S9 G | 3.2151 | A-S6 U4 |
| | 4.4 | Aluminium alloys 10–15 % Si | < 400 N/mm ² | 3.2581 | A-S12 | 3.2583 | A-S12 U | | |
| | 4.5 | Aluminum alloys > 15 % Si | < 400 N/mm ² | | A-S18 | | A-S17 U4 | | |
| | 4.6 | Copper (non alloyed, low alloyed) | < 350 N/mm ² | 2.0040 | Cu-c1 | 2.0060 | Cu-a1 | 2.0090 | Cu-b1 |
| | 4.7 | Copper wrought alloys | < 700 N/mm ² | 2.1247 | Cub2 (Beryllium Copper) | 2.0855 | CuN2S (Nickel Copper) | 2.1310 | CU-Fe2P |
| | 4.8 | Special copper alloys | < 200 HB | 2.0916 | Cu-A5 | 2.1525 | Cu-S3 M | | Ampco 8 (Cu-A6Fe2) |
| | 4.9 | Special copper alloys | < 300 HB | 2.0978 | Cu-Ai11 Fe5 Ni5) | | Ampco 18 (Cu-A10 Fe3) | | |
| | 4.10 | Special copper alloys | > 300 HB | 2.1247 | Cu Be2 | | Ampco M4 | | |
| | 4.11 | Short-chipping brass, bronze, red bronze | < 600 N/mm ² | 2.0331 | Cu Zn36 Pb1,5 | 2.0380 | Cu Zn39 Pb2 (Ms 56) | 2.0410 | Cu Zn44 Pb2 |
| | 4.12 | Long-chipping brass | < 600 N/mm ² | 2.0335 | Cu Zn 36 (Ms63) | 2.1293 | Cu Cr1 Zr | | |
| | 4.13 | Thermoplastics | | | PE | | PS | | Plexiglas |
| | 4.14 | Duroplastics | | | PF | | Bakelite | | Pertinax |
| | 4.15 | Fibre-reinforced plastics | | | Carbon Fibre | | Fibreglass | | Aramid Fibre (Kevlar) |
| | 4.16 | Magnesium and magnesium alloys | < 850 N/mm ² | 3.5812 | Mg A7 Z1 | 3.5662 | Mg A9 | 3.5105 | Mg Tr3 Z2 Zn 1 |
| | 4.17 | Graphite | | | R8500X | | R8650 | | Technograph 15 |
| | 4.18 | Tungsten and tungsten alloys | | | W-Ni Fe (Densimet) | | W- Ni Cu (Inermet) | | Denal |
| | 4.19 | Molybdenum and molybdenum alloys | | | TZM | | MHQ | | Mo W |
| S | 5.1 | Pure nickel | | 2.4066 | Ni99 (Nickel 200) | 2.4068 | Lc Ni99 (Nickel 201) | | |
| | 5.2 | Nickel alloys | | 1.3912 | Fe-Ni36 (Invar) | 1.3917 | Fe-Ni42 (N42) | 1.3922 | Fe-Ni48 (N48) |
| | 5.3 | Nickel alloys | < 850 N/mm ² | 2.4375 | Ni Cu30 Al (Monel K500) | 2.4360 | Ni Cu30Fe (Monel 400) | 2.4668 | |
| | 5.4 | Nickel molybdenum alloys | | 2.4600 | Ni Mo30Cr2 (Hastelloy B4) | 2.4617 | Ni Mo28 (Hastelloy B2) | 2.4819 | Ni Mo16Cr16 Hastell. C276 |
| | 5.5 | Nickel-chromium alloys | < 1300 N/mm ² | 2.4951 | Ni Cr20TiAl (Nimonic 80A) | 2.4858 | Ni Cr21Mo (Inconel 825) | 2.4856 | Ni Cr22Mo9Nb Inconel 625 |
| | 5.6 | Cobalt Chrome Alloys | < 1300 N/mm ² | 2.4964 | Co Cr20 W15 Ni10 | | Co Cr20 Ni16 Mo7 | | Co Cr28 Mo 6 |
| | 5.7 | Heat resistant alloys | < 1300 N/mm ² | 1.4718 | Z45 C S 9-3 | 1.4747 | Z80 CSN 20-02 | 1.4845 | Z12 CN 25-20 |
| | 5.8 | Nickel-cobalt-chromium alloys | < 1400 N/mm ² | 2.4851 | Ni Cr23Fe (Inconel 601) | 2.4668 | Ni Cr19NbMo (Inconel 718) | 2.4602 | Ni Cr21Mo14 Hastelloy C22 |
| | 5.9 | Pure titanium | < 900 N/mm ² | 3.7025 | T35 (Titanium Grade 1) | 3.7034 | T40 (Titanium Grade 2) | 3.7064 | T60 (Titanium Grade 4) |
| | 5.10 | Titanium alloys | < 700 N/mm ² | | T-A6-Nb7 (367) | | T-A5-Sn2-Mo4-Cr4 (Ti17) | | T-A3-V2,5 (Gr18) |
| | 5.11 | Titanium alloys | < 1200 N/mm ² | 3.7165 | T-A6-V4 (Ta6V) | | T-A4-3V-Mo2-Fe2 (SP700) | | T-A5-Sn1-Zr1-V1-Mo (Gr32) |
| H | 6.1 | | < 45 HRC | | | | | | |
| | 6.2 | | 46–55 HRC | | | | | | |
| | 6.3 | Tempered steel | 56–60 HRC | | | | | | |
| | 6.4 | | 61–65 HRC | | | | | | |
| | 6.5 | | 65–70 HRC | | | | | | |

Cutting data – slot and end milling cutters

| Index | Kf f _z | uncoated | Ti100 Pro | Powder steel | | 1st choice | | O suitable | |
|-------|-------------------|----------|-----------|--------------|----------|----------------|-----|-------------------------|--|
| | | | | Ti100 Pro | Emulsion | Compressed air | MMS | | |
| | | | | | | | | v _c in m/min | |
| 1.1 | 1,2 | 30-40 | 60-80 | 65-90 | ● | | | | |
| 1.2 | 1,2 | 25-35 | 50-65 | 55-75 | ● | | | | |
| 1.3 | 1,2 | 20-30 | 45-55 | 50-65 | ● | | | | |
| 1.4 | 1 | 15-25 | 40-55 | 45-65 | ● | | | | |
| 1.5 | 1,2 | 20-30 | 45-55 | 50-60 | ● | | | | |
| 1.6 | 1 | 15-20 | 30-35 | 35-45 | ● | | | | |
| 1.7 | 1,2 | 20-30 | 40-55 | 45-65 | ● | | | | |
| 1.8 | 0,8 | 15-20 | 30-35 | 35-45 | ● | | | | |
| 1.9 | 1,2 | 20-30 | 45-55 | 50-60 | ● | | | | |
| 1.10 | 1 | 15-20 | 30-35 | 35-45 | ● | | | | |
| 1.11 | 0,8 | 15-20 | 30-35 | 35-45 | ● | | | | |
| 1.12 | 0,8 | 15-20 | 30-35 | 35-45 | ● | | | | |
| 1.13 | | | | | | | | | |
| 1.14 | | | | | | | | | |
| 1.15 | 0,8 | 12-18 | 25-30 | 30-40 | ● | | | | |
| 1.16 | 0,8 | 10-15 | 20-25 | 25-35 | ● | | | | |
| 2.1 | 1 | 10-15 | 20-30 | 25-35 | ● | | | | |
| 2.2 | 1 | 10-15 | 20-30 | 25-35 | ● | | | | |
| 2.3 | 1 | 8-12 | 15-25 | 20-30 | ● | | | | |
| 2.4 | 0,9 | 7-10 | 15-20 | 20-30 | ● | | | | |
| 2.5 | 1 | 5-8 | 10-15 | 15-20 | ● | | | | |
| 2.6 | 1 | 10-15 | 20-30 | 25-35 | ● | | | | |
| 2.7 | | | | | | | | | |
| 3.1 | 1 | 18-25 | 35-45 | 40-55 | ● | | | | |
| 3.2 | 1 | 18-25 | 25-30 | 30-40 | ● | | | | |
| 3.3 | 1 | 15-20 | 30-35 | 35-45 | ● | | | | |
| 3.4 | 1 | 15-20 | 30-35 | 35-45 | ● | | | | |
| 3.5 | 1 | 15-25 | 35-40 | 40-50 | ● | | | | |
| 3.6 | 1 | 15-20 | 35-40 | 40-50 | ● | | | | |
| 3.7 | 1 | 15-20 | 30-35 | 35-45 | ● | | | | |
| 3.8 | 0,8 | 12-18 | 25-30 | 30-40 | ● | | | | |
| 4.1 | 1,9 | 150-180 | 240-280 | 260-300 | ● | | | | |
| 4.2 | 1,9 | 100-130 | 130-160 | 150-180 | ● | | | | |
| 4.3 | 1,8 | | 100-140 | 140-160 | ● | | | | |
| 4.4 | 1,7 | | 60-130 | 80-150 | ● | | | | |
| 4.5 | | | | | | | | | |
| 4.6 | 1,2 | 30-50 | 60-80 | 80-100 | ● | | | | |
| 4.7 | 1,1 | | 110-150 | 130-170 | ● | | | | |
| 4.8 | 0,9 | 5-10 | 10-15 | 20-25 | ● | | | | |
| 4.9 | | | | | | | | | |
| 4.10 | | | | | | | | | |
| 4.11 | 1,1 | | 100-140 | 130-170 | ● | | | | |
| 4.12 | 1,1 | 80-120 | 120-150 | 140-180 | ● | | | | |
| 4.13 | 2 | 20-30 | 25-45 | 40-60 | ● | | | | |
| 4.14 | 2 | 30-40 | 50-70 | 70-90 | ● | | | | |
| 4.15 | | | | | | | | | |
| 4.16 | 1,8 | 90-120 | 140-170 | 160-190 | | ● | | | |
| 4.17 | 1 | | 30-40 | 40-50 | | ● | | | |
| 4.18 | 1,1 | | 10-20 | 15-25 | ● | | | | |
| 4.19 | | | | | | | | | |
| 5.1 | 1,1 | 5-10 | 10-15 | 15-20 | ● | | | | |
| 5.2 | | | | | | | | | |
| 5.3 | | | | | | | | | |
| 5.4 | | | | | | | | | |
| 5.5 | | | | | | | | | |
| 5.6 | | | | | | | | | |
| 5.7 | | | | | | | | | |
| 5.8 | | | | | | | | | |
| 5.9 | 1 | 10-15 | 15-25 | 25-35 | ● | | | | |
| 5.10 | 1,1 | 10-15 | 15-20 | 25-35 | ● | | | | |
| 5.11 | | | | | | | | | |
| 6.1 | | | | | | | | | |
| 6.2 | | | | | | | | | |
| 6.3 | | | | | | | | | |
| 6.4 | | | | | | | | | |
| 6.5 | | | | | | | | | |

i For full slot milling reduce the cutting speed (v_c), indicated in this table by approx. 15-20 %!

Kf f_z = Correction factor for feed per tooth

Feed per tooth for HSS end mills

Approximate values (in mm) for the feed per tooth (f_z)

| Ø DC mm | Peripheral milling | | | | | | | | | | Full slot milling | |
|------------|--------------------|-------------|-----------------------|-------------|------------------------|-------------|------------------------|-------------|-----------------------|-------------|-------------------|-------------|
| | $a_e = 0,2-0,3$ mm | | $a_e = 0,1 \times DC$ | | $a_e = 0,25 \times DC$ | | $a_e = 0,25 \times DC$ | | $a_e = 0,6 \times DC$ | | $a_e = DC$ | |
| | f_z in mm | f_z in mm | f_z in mm | f_z in mm | f_z in mm | f_z in mm | f_z in mm | f_z in mm | f_z in mm | f_z in mm | f_z in mm | f_z in mm |
| | uncoated | coated | uncoated | coated | uncoated | coated | uncoated | coated | uncoated | coated | uncoated | coated |
| 2 | 0,008 | 0,009 | 0,008 | 0,009 | 0,008 | 0,009 | | | | | | |
| 3 | 0,011 | 0,012 | 0,010 | 0,012 | 0,009 | 0,010 | | | | | | |
| 4 | 0,017 | 0,018 | 0,014 | 0,015 | 0,013 | 0,014 | 0,015 | 0,016 | 0,013 | 0,014 | 0,011 | 0,012 |
| 5 | 0,024 | 0,026 | 0,018 | 0,020 | 0,014 | 0,015 | 0,019 | 0,021 | 0,016 | 0,018 | 0,014 | 0,016 |
| 6 | 0,032 | 0,035 | 0,022 | 0,024 | 0,015 | 0,017 | 0,024 | 0,027 | 0,020 | 0,022 | 0,018 | 0,019 |
| 8 | 0,047 | 0,051 | 0,029 | 0,032 | 0,020 | 0,022 | 0,032 | 0,036 | 0,027 | 0,030 | 0,024 | 0,026 |
| 10 | 0,065 | 0,072 | 0,037 | 0,041 | 0,026 | 0,028 | 0,042 | 0,047 | 0,035 | 0,039 | 0,031 | 0,034 |
| 12 | 0,084 | 0,091 | 0,044 | 0,049 | 0,031 | 0,034 | 0,051 | 0,057 | 0,043 | 0,047 | 0,037 | 0,041 |
| 14 | 0,100 | 0,106 | 0,054 | 0,059 | 0,037 | 0,041 | 0,063 | 0,069 | 0,053 | 0,058 | 0,045 | 0,050 |
| 16 | 0,111 | 0,121 | 0,061 | 0,067 | 0,042 | 0,046 | 0,072 | 0,079 | 0,060 | 0,066 | 0,052 | 0,057 |
| 18 | 0,126 | 0,136 | 0,070 | 0,077 | 0,048 | 0,053 | 0,084 | 0,093 | 0,071 | 0,078 | 0,061 | 0,067 |
| 20 | 0,141 | 0,151 | 0,076 | 0,083 | 0,052 | 0,057 | 0,092 | 0,101 | 0,077 | 0,084 | 0,066 | 0,073 |
| 22 | 0,160 | 0,166 | 0,085 | 0,094 | 0,059 | 0,065 | 0,104 | 0,114 | 0,087 | 0,096 | 0,075 | 0,082 |
| 25 | 0,170 | 0,188 | 0,095 | 0,104 | 0,065 | 0,072 | 0,117 | 0,129 | 0,098 | 0,108 | 0,084 | 0,093 |
| 28 | 0,196 | 0,210 | 0,109 | 0,120 | 0,075 | 0,083 | 0,136 | 0,150 | 0,114 | 0,125 | 0,098 | 0,108 |
| 32 | 0,212 | 0,240 | 0,124 | 0,137 | 0,086 | 0,094 | 0,157 | 0,173 | 0,131 | 0,145 | 0,113 | 0,125 |
| 36 | 0,224 | 0,240 | 0,144 | 0,159 | 0,099 | 0,109 | 0,170 | 0,194 | 0,142 | 0,162 | 0,126 | 0,140 |
| 40 | 0,240 | 0,240 | 0,157 | 0,173 | 0,108 | 0,119 | 0,184 | 0,202 | 0,154 | 0,169 | 0,132 | 0,146 |
| 45 | 0,240 | 0,240 | 0,157 | 0,173 | 0,108 | 0,119 | 0,200 | 0,220 | 0,170 | 0,180 | 0,140 | 0,160 |
| 50 | 0,240 | 0,240 | 0,157 | 0,173 | 0,108 | 0,119 | 0,200 | 0,220 | 0,170 | 0,180 | 0,140 | 0,160 |

i Attention:

In the case of uncoated milling cutters climb milling is preferred to conventional milling. When using coated milling cutters climb milling is necessary in order to achieve optimum results.

i Feed rate correction:

Please multiply the f_z value in the table above with the corresponding **correction factor Kf f_z** from the table on → **page 40**.

In general the following is valid:

$$f_z \text{ (milling)} = f_z \times Kf f_z$$

$$f_z \text{ (drilling)} = f_z \text{ (milling)} \div \text{no. of teeth}$$

Feed per tooth when milling parallel key slots with HSS slot drills

Approximate values (in mm) for the feed per tooth (f_z)

| Ø DC mm | Full slot milling (in one cut) | | Profile slot milling (internal profile milling) | | | | Circular ramping | | | |
|------------|--------------------------------|--------|---|--------|---------------|--------|------------------|--------|----------|--------|
| | | | Roughing cut | | Finishing cut | | | | | |
| | f_z in mm | | f_z in mm | | | | f_z in mm | | | |
| | uncoated | coated | uncoated | coated | uncoated | coated | uncoated | coated | uncoated | coated |
| 2 | 0,005 | 0,006 | 0,005 | 0,006 | 0,008 | 0,009 | 0,003 | 0,003 | 0,002 | 0,002 |
| 3 | 0,009 | 0,010 | 0,009 | 0,010 | 0,015 | 0,016 | 0,004 | 0,005 | 0,003 | 0,003 |
| 4 | 0,012 | 0,013 | 0,012 | 0,013 | 0,022 | 0,024 | 0,006 | 0,007 | 0,004 | 0,004 |
| 5 | 0,016 | 0,017 | 0,016 | 0,017 | 0,030 | 0,033 | 0,008 | 0,009 | 0,005 | 0,006 |
| 6 | 0,020 | 0,022 | 0,020 | 0,022 | 0,039 | 0,043 | 0,010 | 0,011 | 0,007 | 0,007 |
| 8 | 0,026 | 0,029 | 0,026 | 0,029 | 0,055 | 0,061 | 0,013 | 0,014 | 0,009 | 0,010 |
| 10 | 0,034 | 0,037 | 0,034 | 0,037 | 0,075 | 0,082 | 0,017 | 0,019 | 0,011 | 0,012 |
| 12 | 0,040 | 0,044 | 0,040 | 0,044 | 0,093 | 0,101 | 0,020 | 0,022 | 0,013 | 0,015 |
| 14 | 0,049 | 0,054 | 0,049 | 0,054 | 0,117 | 0,118 | 0,024 | 0,027 | 0,016 | 0,018 |
| 16 | 0,056 | 0,062 | 0,056 | 0,062 | 0,135 | 0,135 | 0,028 | 0,031 | 0,019 | 0,021 |
| 18 | 0,065 | 0,072 | 0,065 | 0,072 | 0,151 | 0,151 | 0,033 | 0,036 | 0,022 | 0,024 |
| 20 | 0,071 | 0,078 | 0,071 | 0,078 | 0,167 | 0,167 | 0,035 | 0,039 | 0,024 | 0,026 |
| 22 | 0,080 | 0,088 | 0,080 | 0,088 | 0,184 | 0,184 | 0,040 | 0,044 | 0,027 | 0,029 |
| 25 | 0,089 | 0,098 | 0,089 | 0,098 | 0,208 | 0,208 | 0,044 | 0,049 | 0,030 | 0,033 |
| 28 | 0,103 | 0,113 | 0,103 | 0,113 | 0,233 | 0,233 | 0,051 | 0,056 | 0,034 | 0,037 |
| 32 | 0,118 | 0,130 | 0,118 | 0,130 | 0,260 | 0,260 | 0,060 | 0,065 | 0,040 | 0,043 |
| 36 | 0,130 | 0,143 | 0,130 | 0,143 | 0,260 | 0,260 | 0,060 | 0,065 | 0,040 | 0,043 |
| 40 | 0,130 | 0,143 | 0,130 | 0,143 | 0,260 | 0,260 | 0,060 | 0,065 | 0,040 | 0,043 |
| 45 | 0,130 | 0,143 | 0,130 | 0,143 | 0,260 | 0,260 | 0,060 | 0,065 | 0,040 | 0,043 |
| 50 | 0,130 | 0,143 | 0,130 | 0,143 | 0,260 | 0,260 | 0,060 | 0,065 | 0,040 | 0,043 |

i Attention:

In the case of uncoated milling cutters climb milling is preferred to conventional milling. When using coated milling cutters climb milling is necessary in order to achieve optimum results.

Cutting data – form cutters

| Index | V _c m/min | f _z mm | | | f _z mm | | | | | V _c m/min | f _z mm | | | | f _z mm | | | | ● | | ○ | |
|-------|-------------------------|----------------------|---------------------|---------------------|----------------------|---------------------|---------------------|---------------------|---------------------|-------------------------|----------------------|---------------------|---------------------|---------------------|----------------------|---------------------|---------------------|---------------------|------------|----------|----------|----------------|
| | | Ø DC 21-25 mm | Ø DC 28-36 mm | Ø DC 40-45 mm | Ø DC 11-16 mm | Ø DC 18-22 mm | Ø DC 25-32 mm | Ø DC 36-45 mm | Ø DC 50-60 mm | | Ø DC 10-17 mm | Ø DC 19-26 mm | Ø DC 28-33 mm | Ø DC 33-46 mm | Ø DC 8-11 mm | Ø DC 12-24 mm | Ø DC 26-34 mm | Ø DC 46-48 mm | 1st choice | suitable | Emulsion | Compressed air |
| 1.1 | 28 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 28 | 0,02 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 1.2 | 28 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 28 | 0,02 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 1.3 | 28 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 28 | 0,02 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 1.4 | 28 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 28 | 0,02 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 1.5 | 28 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 28 | 0,02 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 1.6 | 22 | 0,06 | 0,08 | 0,1 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 22 | 0,02 | 0,03 | 0,035 | 0,045 | 0,025 | 0,055 | 0,08 | 0,1 | ● | | | |
| 1.7 | 22 | 0,06 | 0,08 | 0,1 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 22 | 0,02 | 0,03 | 0,035 | 0,045 | 0,025 | 0,055 | 0,08 | 0,1 | ● | | | |
| 1.8 | | | | | | | | | | | | | | | | | | | | | | |
| 1.9 | 20 | 0,06 | 0,08 | 0,1 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 20 | 0,02 | 0,03 | 0,035 | 0,045 | 0,025 | 0,055 | 0,08 | 0,1 | ● | | | |
| 1.10 | | | | | | | | | | | | | | | | | | | | | | |
| 1.11 | | | | | | | | | | | | | | | | | | | | | | |
| 1.12 | | | | | | | | | | | | | | | | | | | | | | |
| 1.13 | | | | | | | | | | | | | | | | | | | | | | |
| 1.14 | | | | | | | | | | | | | | | | | | | | | | |
| 1.15 | | | | | | | | | | | | | | | | | | | | | | |
| 1.16 | | | | | | | | | | | | | | | | | | | | | | |
| 2.1 | 10 | 0,06 | 0,08 | 0,1 | 0,01 | 0,025 | 0,025 | 0,025 | 0,03 | 10 | 0,02 | 0,025 | 0,03 | 0,04 | 0,02 | 0,045 | 0,08 | 0,09 | ● | | | |
| 2.2 | 10 | 0,06 | 0,08 | 0,1 | 0,01 | 0,025 | 0,025 | 0,025 | 0,03 | 10 | 0,02 | 0,025 | 0,03 | 0,04 | 0,02 | 0,045 | 0,08 | 0,09 | ● | | | |
| 2.3 | 10 | 0,06 | 0,08 | 0,1 | 0,01 | 0,025 | 0,025 | 0,025 | 0,03 | 10 | 0,02 | 0,025 | 0,03 | 0,04 | 0,02 | 0,045 | 0,08 | 0,09 | ● | | | |
| 2.4 | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | | | | | | | | | | | | | | | | | | | | | | |
| 2.6 | 10 | 0,06 | 0,08 | 0,1 | 0,01 | 0,025 | 0,025 | 0,025 | 0,03 | 10 | 0,02 | 0,025 | 0,03 | 0,04 | 0,02 | 0,045 | 0,08 | 0,09 | ● | | | |
| 2.7 | | | | | | | | | | | | | | | | | | | | | | |
| 3.1 | 28 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,025 | 0,04 | 0,035 | 24 | 0,025 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 3.2 | | | | | | | | | | | | | | | | | | | | | | |
| 3.3 | 22 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,025 | 0,04 | 0,035 | 22 | 0,025 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 3.4 | 20 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,025 | 0,04 | 0,035 | 20 | 0,025 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 3.5 | 20 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,025 | 0,04 | 0,035 | 20 | 0,025 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 3.6 | 15 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,025 | 0,04 | 0,035 | 15 | 0,025 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 3.7 | 20 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,025 | 0,04 | 0,035 | 20 | 0,025 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 3.8 | 15 | 0,07 | 0,1 | 0,12 | 0,015 | 0,03 | 0,025 | 0,04 | 0,035 | 15 | 0,025 | 0,03 | 0,04 | 0,05 | 0,03 | 0,06 | 0,1 | 0,12 | ● | | | |
| 4.1 | 100 | 0,1 | 0,12 | 0,15 | 0,02 | 0,045 | 0,045 | 0,045 | 0,055 | 90 | 0,03 | 0,04 | 0,06 | 0,07 | 0,035 | 0,07 | 0,14 | 0,15 | | | | |
| 4.2 | 100 | 0,1 | 0,12 | 0,15 | 0,02 | 0,045 | 0,045 | 0,045 | 0,055 | 90 | 0,03 | 0,04 | 0,06 | 0,07 | 0,035 | 0,07 | 0,14 | 0,15 | ● | | | |
| 4.3 | 80 | 0,09 | 0,11 | 0,13 | 0,015 | 0,04 | 0,035 | 0,04 | 0,045 | 80 | 0,03 | 0,035 | 0,045 | 0,055 | 0,03 | 0,06 | 0,12 | 0,12 | ● | | | |
| 4.4 | 60 | 0,09 | 0,11 | 0,13 | 0,015 | 0,04 | 0,035 | 0,04 | 0,045 | 60 | 0,03 | 0,035 | 0,045 | 0,055 | 0,03 | 0,06 | 0,12 | 0,12 | ● | | | |
| 4.5 | | | | | | | | | | | | | | | | | | | | | | |
| 4.6 | 25 | 0,08 | 0,1 | 0,12 | 0,015 | 0,04 | 0,035 | 0,03 | 0,035 | 25 | 0,02 | 0,035 | 0,045 | 0,055 | 0,03 | 0,06 | 0,12 | 0,12 | ● | | | |
| 4.7 | 20 | 0,08 | 0,1 | 0,12 | 0,015 | 0,04 | 0,035 | 0,03 | 0,035 | 20 | 0,02 | 0,035 | 0,045 | 0,055 | 0,03 | 0,06 | 0,12 | 0,12 | ● | | | |
| 4.8 | | | | | | | | | | | | | | | | | | | | | | |
| 4.9 | | | | | | | | | | | | | | | | | | | | | | |
| 4.10 | | | | | | | | | | | | | | | | | | | | | | |
| 4.11 | 50 | 0,09 | 0,11 | 0,13 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 45 | 0,02 | 0,035 | 0,045 | 0,055 | 0,03 | 0,06 | 0,12 | 0,12 | ● | | | |
| 4.12 | 25 | 0,09 | 0,11 | 0,13 | 0,015 | 0,03 | 0,03 | 0,03 | 0,04 | 25 | 0,02 | 0,035 | 0,045 | 0,055 | 0,03 | 0,06 | 0,12 | 0,12 | ● | | | |
| 4.13 | 80 | 0,12 | 0,15 | 0,18 | 0,025 | 0,06 | 0,055 | 0,055 | 0,07 | 80 | 0,04 | 0,05 | 0,07 | 0,09 | 0,045 | 0,1 | 0,18 | 0,18 | ● | | | |
| 4.14 | 65 | 0,12 | 0,15 | 0,18 | 0,025 | 0,06 | 0,055 | 0,055 | 0,07 | 65 | 0,04 | 0,05 | 0,07 | 0,09 | 0,045 | 0,1 | 0,18 | 0,18 | ● | | | |
| 4.15 | | | | | | | | | | | | | | | | | | | | | | |
| 4.16 | 70 | 0,1 | 0,12 | 0,15 | 0,018 | 0,04 | 0,03 | 0,035 | 0,045 | 70 | 0,03 | 0,035 | 0,05 | 0,06 | 0,025 | 0,06 | 0,1 | 0,12 | ● | | | |
| 4.17 | | | | | | | | | | | | | | | | | | | | | | |
| 4.18 | | | | | | | | | | | | | | | | | | | | | | |
| 4.19 | | | | | | | | | | | | | | | | | | | | | | |
| 5.1 | | | | | | | | | | | | | | | | | | | | | | |
| 5.2 | | | | | | | | | | | | | | | | | | | | | | |
| 5.3 | | | | | | | | | | | | | | | | | | | | | | |
| 5.4 | | | | | | | | | | | | | | | | | | | | | | |
| 5.5 | | | | | | | | | | | | | | | | | | | | | | |
| 5.6 | | | | | | | | | | | | | | | | | | | | | | |
| 5.7 | | | | | | | | | | | | | | | | | | | | | | |
| 5.8 | | | | | | | | | | | | | | | | | | | | | | |
| 5.9 | 20 | 0,06 | 0,08 | 0,1 | 0,012 | 0,025 | 0,025 | 0,025 | 0,035 | 20 | 0,015 | 0,025 | 0,035 | 0,045 | 0,02 | 0,05 | 0,07 | 0,09 | | | | |
| 5.10 | | | | | | | | | | | | | | | | | | | | | | |
| 5.11 | | | | | | | | | | | | | | | | | | | | | | |
| 6.1 | | | | | | | | | | | | | | | | | | | | | | |
| 6.2 | | | | | | | | | | | | | | | | | | | | | | |
| 6.3 | | | | | | | | | | | | | | | | | | | | | | |
| 6.4 | | | | | | | | | | | | | | | | | | | | | | |
| 6.5 | | | | | | | | | | | | | | | | | | | | | | |

i The cutting data depends largely on the external conditions, e.g. stability of the tools and tool clamping, material and machine type. The indicated values are possible cutting data which have to be increased or reduced according to the application conditions.

Cutting data – form cutters

| Index | V _c m/min | Ø DC | | | V _c m/min | Ø DC | | | | Ø DC | | | | 1st choice | | suitable | |
|-------|-------------------------|------------------------------|----------------------------|----------------------------|-------------------------|----------------------------|------------------------------|----------------------------|------------------------------|----------------------|-------|-------|--------|------------|----------------|----------|--|
| | | 16 mm a _e =3,2 | 20 mm a _e =4 | 25 mm a _e =5 | | 50 mm a _e =5 | 63 mm a _e =6,3 | 80 mm a _e =8 | 100 mm a _e =10 | 40-50 mm | 63 mm | 80 mm | 100 mm | Emulsion | Compressed air | MMS | |
| | | f _z mm | | | | f _z mm | | | | f _z mm | | | | | | | |
| 1.1 | 28 | 0,01 | 0,015 | 0,018 | 22 | 0,01 | 0,01 | 0,015 | 0,02 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 1.2 | 28 | 0,01 | 0,015 | 0,018 | 22 | 0,01 | 0,01 | 0,015 | 0,02 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 1.3 | 28 | 0,01 | 0,015 | 0,018 | 22 | 0,01 | 0,01 | 0,015 | 0,02 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 1.4 | 28 | 0,01 | 0,015 | 0,018 | 22 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 1.5 | 28 | 0,01 | 0,015 | 0,018 | 22 | 0,01 | 0,01 | 0,015 | 0,02 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 1.6 | 22 | 0,01 | 0,015 | 0,018 | 20 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 1.7 | 22 | 0,01 | 0,015 | 0,018 | 20 | 0,01 | 0,01 | 0,015 | 0,02 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 1.8 | | | | | | | | | | | | | | | | | |
| 1.9 | 20 | 0,01 | 0,015 | 0,015 | 20 | 0,01 | 0,01 | 0,015 | 0,02 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 1.10 | | | | | | | | | | | | | | | | | |
| 1.11 | | | | | | | | | | | | | | | | | |
| 1.12 | | | | | | | | | | | | | | | | | |
| 1.13 | | | | | | | | | | | | | | | | | |
| 1.14 | | | | | | | | | | | | | | | | | |
| 1.15 | | | | | | | | | | | | | | | | | |
| 1.16 | | | | | | | | | | | | | | | | | |
| 2.1 | 10 | 0,007 | 0,01 | 0,012 | 10 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 2.2 | 10 | 0,007 | 0,01 | 0,012 | 10 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 2.3 | 10 | 0,007 | 0,01 | 0,012 | 10 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 2.4 | | | | | | | | | | | | | | | | | |
| 2.5 | | | | | | | | | | | | | | | | | |
| 2.6 | 10 | 0,007 | 0,01 | 0,015 | | | | | | | | | | ● | | | |
| 2.7 | | | | | | | | | | | | | | | | | |
| 3.1 | 24 | 0,01 | 0,012 | 0,015 | 19 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 3.2 | | | | | 12 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 3.3 | 22 | 0,01 | 0,012 | 0,015 | 15 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 3.4 | 20 | 0,01 | 0,012 | 0,015 | 12 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 3.5 | 20 | 0,01 | 0,012 | 0,015 | 16 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 3.6 | 15 | 0,01 | 0,012 | 0,015 | | | | | | | | | | | | | |
| 3.7 | 20 | 0,01 | 0,012 | 0,015 | 13 | 0,008 | 0,01 | 0,012 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 3.8 | 15 | 0,01 | 0,012 | 0,015 | | | | | | | | | | | | | |
| 4.1 | 90 | 0,01 | 0,015 | 0,02 | | | | | | | | | | | | | |
| 4.2 | 90 | 0,01 | 0,015 | 0,02 | 70 | 0,012 | 0,015 | 0,02 | 0,024 | 0,008 | 0,012 | 0,014 | 0,018 | ● | | | |
| 4.3 | 80 | 0,01 | 0,015 | 0,02 | 60 | 0,012 | 0,015 | 0,02 | 0,024 | 0,008 | 0,012 | 0,014 | 0,018 | ● | | | |
| 4.4 | 60 | 0,01 | 0,015 | 0,02 | 60 | 0,012 | 0,015 | 0,02 | 0,024 | 0,008 | 0,012 | 0,014 | 0,018 | ● | | | |
| 4.5 | | | | | | | | | | | | | | | | | |
| 4.6 | 25 | 0,01 | 0,015 | 0,02 | 18 | 0,01 | 0,012 | 0,015 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 4.7 | 20 | 0,01 | 0,015 | 0,02 | 20 | 0,01 | 0,012 | 0,015 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 4.8 | | | | | | | | | | | | | | | | | |
| 4.9 | | | | | | | | | | | | | | | | | |
| 4.10 | | | | | | | | | | | | | | | | | |
| 4.11 | 45 | 0,01 | 0,015 | 0,02 | 40 | 0,01 | 0,012 | 0,015 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 4.12 | 25 | 0,01 | 0,015 | 0,015 | 20 | 0,01 | 0,012 | 0,015 | 0,018 | 0,005 | 0,008 | 0,01 | 0,012 | ● | | | |
| 4.13 | 80 | 0,018 | 0,02 | 0,025 | 65 | 0,015 | 0,02 | 0,025 | 0,03 | 0,008 | 0,012 | 0,018 | 0,022 | ● | | | |
| 4.14 | 65 | 0,018 | 0,02 | 0,025 | 60 | 0,015 | 0,02 | 0,025 | 0,03 | 0,008 | 0,012 | 0,018 | 0,022 | ● | | | |
| 4.15 | | | | | | | | | | | | | | | | | |
| 4.16 | 70 | 0,01 | 0,015 | 0,0175 | 45 | 0,01 | 0,012 | 0,015 | 0,018 | 0,005 | 0,008 | 0,01 | 0,01 | ● | | | |
| 4.17 | | | | | | | | | | | | | | | | | |
| 4.18 | | | | | | | | | | | | | | | | | |
| 4.19 | | | | | | | | | | | | | | | | | |
| 5.1 | | | | | | | | | | | | | | | | | |
| 5.2 | | | | | | | | | | | | | | | | | |
| 5.3 | | | | | | | | | | | | | | | | | |
| 5.4 | | | | | | | | | | | | | | | | | |
| 5.5 | | | | | | | | | | | | | | | | | |
| 5.6 | | | | | | | | | | | | | | | | | |
| 5.7 | | | | | | | | | | | | | | | | | |
| 5.8 | | | | | | | | | | | | | | | | | |
| 5.9 | 20 | 0,008 | 0,01 | 0,015 | 20 | 0,008 | 0,01 | 0,012 | 0,016 | 0,005 | 0,007 | 0,009 | 0,012 | ● | | | |
| 5.10 | | | | | | | | | | | | | | | | | |
| 5.11 | | | | | | | | | | | | | | | | | |
| 6.1 | | | | | | | | | | | | | | | | | |
| 6.2 | | | | | | | | | | | | | | | | | |
| 6.3 | | | | | | | | | | | | | | | | | |
| 6.4 | | | | | | | | | | | | | | | | | |
| 6.5 | | | | | | | | | | | | | | | | | |

i The cutting data depends largely on the external conditions, e.g. stability of the tools and tool clamping, material and machine type. The indicated values are possible cutting data which have to be increased or reduced according to the application conditions.

Cutting data – side and face cutters

| Index | v _c in m/min | uncoated | | | | | | ● | ○ | |
|-------|-------------------------|----------------------|---------------|---------------|----------------|----------------|----------------|------------|----------------|-----|
| | | Ø DC 50 mm | Ø DC 63 mm | Ø DC 80 mm | Ø DC 100 mm | Ø DC 125 mm | Ø DC 160 mm | 1st choice | suitable | |
| | | f _z mm | | | | | | Emulsion | Compressed air | MMS |
| 1.1 | 30-40 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,095-0,11 | 0,1-0,12 | ● | | |
| 1.2 | 30-40 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,095-0,11 | 0,1-0,12 | ● | | |
| 1.3 | 30-40 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,095-0,11 | 0,1-0,12 | ● | | |
| 1.4 | 20-30 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 1.5 | 20-25 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,095-0,11 | 0,1-0,12 | ● | | |
| 1.6 | 15-30 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 1.7 | 20-25 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 1.8 | 10-15 | 0,03-0,04 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | ● | | |
| 1.9 | 18-25 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 1.10 | 15-30 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 1.11 | 12-18 | 0,03-0,04 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | ● | | |
| 1.12 | 15-20 | 0,03-0,04 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | ● | | |
| 1.13 | | | | | | | | | | |
| 1.14 | | | | | | | | | | |
| 1.15 | 10-15 | 0,03-0,04 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | ● | | |
| 1.16 | 10-15 | 0,03-0,04 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | ● | | |
| 2.1 | 12-18 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 2.2 | 10-15 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 2.3 | 8-12 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 2.4 | 7-10 | 0,03-0,04 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | ● | | |
| 2.5 | 5-8 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 2.6 | 10-15 | 0,03-0,04 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | ● | | |
| 2.7 | | | | | | | | | | |
| 3.1 | 20-30 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 3.2 | 18-25 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 3.3 | 18-25 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 3.4 | 15-20 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 3.5 | 25-35 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 3.6 | 18-25 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 3.7 | 25-35 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 3.8 | 18-25 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 4.1 | 150-180 | 0,06-0,075 | 0,075-0,09 | 0,009-0,1 | 0,01-0,12 | 0,12-0,135 | 0,135-0,15 | ● | | |
| 4.2 | 100-130 | 0,06-0,075 | 0,075-0,09 | 0,009-0,1 | 0,01-0,12 | 0,12-0,135 | 0,135-0,15 | ● | | |
| 4.3 | 80-100 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,095-0,11 | 0,1-0,12 | ● | | |
| 4.4 | 40-60 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,095-0,11 | 0,1-0,12 | ● | | |
| 4.5 | | | | | | | | | | |
| 4.6 | 30-50 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,095-0,11 | 0,1-0,12 | ● | | |
| 4.7 | 90-110 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 4.8 | 5-10 | 0,03-0,04 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | ● | | |
| 4.9 | | | | | | | | | | |
| 4.10 | | | | | | | | | | |
| 4.11 | 80-100 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 4.12 | 80-120 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 4.13 | 20-30 | 0,08-0,1 | 0,1-0,12 | 0,12-0,14 | 0,14-0,16 | 0,16-0,18 | 0,18-0,2 | ● | | |
| 4.14 | 30-40 | 0,08-0,1 | 0,1-0,12 | 0,12-0,14 | 0,14-0,16 | 0,16-0,18 | 0,18-0,2 | ● | | |
| 4.15 | | | | | | | | | | |
| 4.16 | 90-120 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,095-0,11 | 0,1-0,12 | | ● | |
| 4.17 | | | | | | | | | | |
| 4.18 | | | | | | | | | | |
| 4.19 | | | | | | | | | | |
| 5.1 | 5-10 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 5.2 | | | | | | | | | | |
| 5.3 | | | | | | | | | | |
| 5.4 | | | | | | | | | | |
| 5.5 | | | | | | | | | | |
| 5.6 | | | | | | | | | | |
| 5.7 | | | | | | | | | | |
| 5.8 | | | | | | | | | | |
| 5.9 | 10-15 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 5.10 | 10-15 | 0,04-0,05 | 0,05-0,06 | 0,06-0,07 | 0,07-0,08 | 0,08-0,09 | 0,09-0,1 | ● | | |
| 5.11 | | | | | | | | | | |
| 6.1 | | | | | | | | | | |
| 6.2 | | | | | | | | | | |
| 6.3 | | | | | | | | | | |
| 6.4 | | | | | | | | | | |
| 6.5 | | | | | | | | | | |

i Feed correction factor (Kf f_z) for side and face cutters in relation to the cutting depth (a_e)

| a _e | Kf f _z |
|----------------|-------------------|
| 0,05 x DC | 1,4 |
| 0,1 x DC | 1,0 |
| 0,15 x DC | 0,8 |
| 0,2 x DC | 0,7 |
| 0,25 x DC | 0,6 |

i The indicated feed rates apply to straight pitched cutters with a cutting depth of 0.1 x DC! With cross-pitched cutters the feed rate is to be reduced by 50 %!

Cutting data – face mills

| Index | Kf f _z | v _c in m/min | | 1st choice | | O suitable | |
|-------|-------------------|-------------------------|-----------|------------|----------------|------------|--|
| | | uncoated | Ti100 Pro | Emulsion | Compressed air | MMS | |
| | | | | | | | |
| 1.1 | 1,2 | 25–30 | 50–60 | ● | | | |
| 1.2 | 1,2 | 25–30 | 45–55 | ● | | | |
| 1.3 | 1,2 | 25–30 | 45–55 | ● | | | |
| 1.4 | 1 | 20–25 | 40–50 | ● | | | |
| 1.5 | 1,2 | 20–25 | 40–50 | ● | | | |
| 1.6 | 1 | 15–30 | 30–40 | ● | | | |
| 1.7 | 1,2 | 20–25 | 40–50 | ● | | | |
| 1.8 | 0,8 | 10–15 | 20–30 | ● | | | |
| 1.9 | 1,2 | 18–25 | 35–45 | ● | | | |
| 1.10 | 1 | 15–30 | 30–40 | ● | | | |
| 1.11 | 0,8 | 12–18 | 25–35 | ● | | | |
| 1.12 | 0,8 | 15–20 | 30–40 | ● | | | |
| 1.13 | | | | | | | |
| 1.14 | | | | | | | |
| 1.15 | 0,8 | 10–15 | 20–30 | ● | | | |
| 1.16 | 0,8 | 10–15 | 20–30 | ● | | | |
| 2.1 | 1 | 12–18 | 20–25 | ● | | | |
| 2.2 | 1 | 10–15 | 15–20 | ● | | | |
| 2.3 | 1 | 8–12 | 20–25 | ● | | | |
| 2.4 | 0,9 | 7–10 | 15–20 | ● | | | |
| 2.5 | 1 | 5–8 | 10–15 | ● | | | |
| 2.6 | 1 | 10–15 | 15–20 | ● | | | |
| 2.7 | | | | | | | |
| 3.1 | 1 | 20–30 | 30–40 | ● | | | |
| 3.2 | 1 | 18–25 | 30–35 | ● | | | |
| 3.3 | 1 | 18–25 | 30–35 | ● | | | |
| 3.4 | 1 | 15–20 | 25–30 | ● | | | |
| 3.5 | 1 | 25–35 | 35–40 | ● | | | |
| 3.6 | 1 | 18–25 | 30–35 | ● | | | |
| 3.7 | 1 | 25–35 | 35–40 | ● | | | |
| 3.8 | 1 | 18–25 | 30–35 | ● | | | |
| 4.1 | 1,5 | 150–180 | | ● | | | |
| 4.2 | 1,5 | 100–130 | | ● | | | |
| 4.3 | 1,3 | 80–100 | | ● | | | |
| 4.4 | 1,3 | 40–60 | | ● | | | |
| 4.5 | | | | | | | |
| 4.6 | 1,2 | 30–50 | 60–80 | ● | | | |
| 4.7 | 1,1 | 90–110 | 120–150 | ● | | | |
| 4.8 | 0,9 | 5–10 | 10–15 | ● | | | |
| 4.9 | | | | | | | |
| 4.10 | | | | | | | |
| 4.11 | 1,1 | 80–100 | 110–140 | ● | | | |
| 4.12 | 1,1 | 80–120 | 120–150 | ● | | | |
| 4.13 | 2 | 20–30 | 25–45 | ● | | | |
| 4.14 | 2 | 30–40 | 50–70 | ● | | | |
| 4.15 | | | | | | | |
| 4.16 | 1,3 | 90–120 | 120–140 | | ● | | |
| 4.17 | 1 | | 30–40 | | ● | | |
| 4.18 | 1,1 | | 15–25 | ● | | | |
| 4.19 | | | | | | | |
| 5.1 | 1,1 | 5–10 | 10–15 | ● | | | |
| 5.2 | | | | | | | |
| 5.3 | | | | | | | |
| 5.4 | | | | | | | |
| 5.5 | | | | | | | |
| 5.6 | | | | | | | |
| 5.7 | | | | | | | |
| 5.8 | | | | | | | |
| 5.9 | 1 | 10–15 | 15–25 | ● | | | |
| 5.10 | 1,1 | 10–15 | 15–20 | ● | | | |
| 5.11 | 0,8 | | 10–15 | ● | | | |
| 6.1 | | | | | | | |
| 6.2 | | | | | | | |
| 6.3 | | | | | | | |
| 6.4 | | | | | | | |
| 6.5 | | | | | | | |