



| Application  | $v_c$ factor | $f_z$ factor             | Feed width (ae)   | Feed depth (ap) |
|--------------|--------------|--------------------------|-------------------|-----------------|
| Slotting     | 1            | 1 (0.7 for $a_p = 2xd$ ) | 1xd               | 0.5 up to 1xd   |
| Roughing     | 1            | 1 (0.7 for $a_p = 2xd$ ) | 0.4 up to 0.9xd   | 0.5 up to 1xd   |
| Finishing    | 1            | 1                        | 0.01 up to 0.1xd  | 1 up to 2xd     |
| HPC-roughing | 1.3          | 1.5                      | 0.15 up to 0.4xd  | 1 up to 2xd     |
| HSC-roughing | 1.5          | 2                        | 0.05 up to 0.15xd | 1 up to 2xd     |

| Material                                                                                                                                                                                                                                                                                                                                         | Hardness          | Recommended type | Type of application | cut Vc | fz (mm/z) with nom. Ø |       |       |       |       |       |       |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------|---------------------|--------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
|                                                                                                                                                                                                                                                                                                                                                  |                   |                  |                     |        | 3                     | 6     | 8     | 10    | 12    | 16    | 20    | 25    |
| <b>Structural + free-cutting steels, unalloyed heat-treatable + case hardened steels</b><br>1.0035 S185, 1.0486 P275N, 1.0345 P235GH, 1.0050, 1.0070, 1.8937<br>1.0718 11SMnPb30, 1.0736 11SMn37<br>1.0402 C22, 1.1178 C30E<br>1.0503 C45, 1.1191 C30E<br>1.0301 C10, 1.1121 C10E<br>1.1750 C75W, 1.2076 102Cr6, 1.2307 29CrMoV9                 | up to 850 N/mm²   | 2/3 Flute        | Slotting            | 120    | 0,012                 | 0,024 | 0,032 | 0,042 | 0,050 | 0,070 | 0,080 | 0,110 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 140    | 0,014                 | 0,028 | 0,037 | 0,048 | 0,058 | 0,080 | 0,100 | 0,120 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 240    | 0,013                 | 0,026 | 0,035 | 0,046 | 0,055 | 0,070 | 0,090 | 0,120 |
| <b>Free-cutting steels, unalloyed case hardened steels, nitriding steels</b><br>1.0727 46 S20, 1.0728 60 S20, 1.0757 46SPb20<br>1.0601 C60, 1.1221 C60E<br>1.7043 38Cr4<br>1.5752 15NiCr13, 1.7131 16MnCr5, 1.7264 20CrMo5<br>1.8504 34CrAl6<br>1.8519 31CrMoV9, 1.8550 34CrAlNi7                                                                | 850-1.200 N/mm²   | 2/3 Flute        | Slotting            | 110    | 0,012                 | 0,024 | 0,032 | 0,042 | 0,050 | 0,070 | 0,080 | 0,110 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 130    | 0,014                 | 0,028 | 0,037 | 0,048 | 0,058 | 0,080 | 0,100 | 0,120 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 220    | 0,013                 | 0,026 | 0,035 | 0,046 | 0,055 | 0,070 | 0,090 | 0,120 |
| <b>Alloyed heat-treatable, tool and high speed steels</b><br>1.5131 50MnSi4, 1.7003 38Cr2, 1.7030 28Cr4<br>1.5710 36NiCr6, 1.7035 41Cr4, 1.7225 42CrMo4<br>1.2080 X210Cr12, 1.2083 X42Cr13, 1.2419 105WCr6, 1.2379 X155CrVMo12-1<br>1.3243 S 6-5-2-5, 1.3343 S 6-5-2, 1.3344 S 6-5-3<br>Spring steel = 1.5026 55Si7, 1.7176 55Cr3, 1.8159 51CrV4 | 850-1.400 N/mm²   | 2/3 Flute        | Slotting            | 90     | 0,011                 | 0,021 | 0,028 | 0,039 | 0,047 | 0,060 | 0,080 | 0,100 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 110    | 0,012                 | 0,024 | 0,032 | 0,045 | 0,054 | 0,070 | 0,090 | 0,110 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 180    | 0,012                 | 0,023 | 0,031 | 0,043 | 0,051 | 0,070 | 0,090 | 0,110 |
| <b>Hardened steel</b><br>Tool steel, heat-treatable steel, spring steel, high-speed steel, case hardened steel, etc.<br>Z.B.: 1.2344 X40CrMoV5-1; 1.2767 X45NiCrMo4; 1.2379 X155CrVMo12-1; 1.2080 X210Cr12 1.3343 S 6-5-2                                                                                                                        | up to 54 HRC      | 2/3 Flute        | Slotting            | 35     | 0,007                 | 0,013 | 0,018 | 0,024 | 0,029 | 0,040 | 0,050 | 0,060 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 50     | 0,009                 | 0,017 | 0,023 | 0,031 | 0,037 | 0,050 | 0,060 | 0,080 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 70     | 0,007                 | 0,013 | 0,018 | 0,024 | 0,029 | 0,040 | 0,050 | 0,060 |
| <b>Stainless steel</b><br>1.4104 X14CrMoS17, 1.4105 X6CrMoS17, 1.4305 X10CrNiS18-9<br>USA = 303, 410, 420F, 430, 430F                                                                                                                                                                                                                            | up to 750 N/mm²   | 2/3 Flute        | Slotting            | 80     | 0,008                 | 0,017 | 0,022 | 0,030 | 0,036 | 0,050 | 0,060 | 0,080 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 100    | 0,009                 | 0,019 | 0,026 | 0,035 | 0,041 | 0,060 | 0,070 | 0,090 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 160    | 0,009                 | 0,018 | 0,025 | 0,033 | 0,040 | 0,050 | 0,070 | 0,080 |
| <b>Stainless steel</b><br>1.4301X5CrNi18-10, 1.4303 X5CrNi18-12 1.4310 XCrNi18-8<br>USA = 304, 304L, 420                                                                                                                                                                                                                                         | 750-850 N/mm²     | 2/3 Flute        | Slotting            | 55     | 0,007                 | 0,014 | 0,019 | 0,027 | 0,032 | 0,040 | 0,050 | 0,070 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 70     | 0,008                 | 0,017 | 0,022 | 0,031 | 0,037 | 0,050 | 0,060 | 0,080 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 110    | 0,008                 | 0,016 | 0,021 | 0,030 | 0,036 | 0,050 | 0,060 | 0,070 |
| <b>Stainless steel</b><br>1.4438 X2CrNiMo18-15-4, 1.4404 X2CrNiMo17-12-2, 1.4571 X6CrNiTi18-10<br>USA = 310, 316, 316B, 316L, 317                                                                                                                                                                                                                | above 850 N/mm²   | 2/3 Flute        | Slotting            | 50     | 0,006                 | 0,013 | 0,017 | 0,024 | 0,029 | 0,040 | 0,050 | 0,060 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 70     | 0,008                 | 0,015 | 0,020 | 0,029 | 0,035 | 0,050 | 0,060 | 0,070 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 100    | 0,006                 | 0,013 | 0,017 | 0,024 | 0,029 | 0,040 | 0,050 | 0,060 |
| <b>Special alloys (nickel based "Ni")</b><br>Nimonic, Inconel, Monel, Hastelloy                                                                                                                                                                                                                                                                  | up to 1.300 N/mm² | 2/3 Flute        | Slotting            | 25     | 0,005                 | 0,009 | 0,012 | 0,018 | 0,022 | 0,030 | 0,040 | 0,050 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 40     | 0,005                 | 0,011 | 0,014 | 0,022 | 0,026 | 0,030 | 0,040 | 0,050 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 50     | 0,005                 | 0,009 | 0,012 | 0,018 | 0,022 | 0,030 | 0,040 | 0,050 |
| <b>Titanium alloys ("Ti")</b><br>3.7024 Ti99,5, 3.7114 TiAl5Sn2,5, 3.7124 TiCu2<br>3.7154 TiAl6Zr5, 3.7164 TiAl6V4, 3.7184 TiAl4Mo4Sn2,5                                                                                                                                                                                                         | up to 1.300 N/mm² | 2/3 Flute        | Slotting            | 40     | 0,008                 | 0,017 | 0,022 | 0,030 | 0,036 | 0,050 | 0,060 | 0,080 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 50     | 0,010                 | 0,020 | 0,027 | 0,036 | 0,043 | 0,060 | 0,070 | 0,090 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 80     | 0,009                 | 0,018 | 0,025 | 0,033 | 0,040 | 0,050 | 0,070 | 0,080 |
| <b>Cast iron, grey cast iron, spheroidal graphite and malleable cast iron</b><br>0.6010 EN-GL100 (GG10), 0.6020 EN-GJL-200 (GG20), 0.7050 EN-GJS-500-7 (GGG50), 0.8535 EN-GJMW-350-4 (GTW35)                                                                                                                                                     | up to 240 HB 30   | 2/3 Flute        | Slotting            | 110    | 0,011                 | 0,022 | 0,030 | 0,039 | 0,047 | 0,060 | 0,080 | 0,100 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 130    | 0,013                 | 0,026 | 0,034 | 0,045 | 0,054 | 0,070 | 0,090 | 0,110 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 220    | 0,012                 | 0,024 | 0,033 | 0,043 | 0,051 | 0,070 | 0,090 | 0,110 |
| <b>Cast iron, grey cast iron, spheroidal graphite and malleable cast iron</b><br>0.6025 EN-GL250 (GG25), 0.6035 EN-GJL-350 (GG35), 0.7070 EN-GJS-700-2 (GGG70), 0.8170 EN-GJMB-700-2 (GTS70)                                                                                                                                                     | above 240 HB 30   | 2/3 Flute        | Slotting            | 95     | 0,009                 | 0,019 | 0,025 | 0,033 | 0,040 | 0,050 | 0,070 | 0,080 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Roughing            | 110    | 0,011                 | 0,021 | 0,029 | 0,038 | 0,046 | 0,060 | 0,080 | 0,090 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 4 Flute          | Finishing           | 190    | 0,010                 | 0,020 | 0,027 | 0,036 | 0,044 | 0,060 | 0,070 | 0,090 |
| <b>Aluminum, Al-wrought alloys, Al-alloys</b><br>3.0255 Al99,5, 3.2315 AlMgSi1, 3.3515 AlMg1<br>3.0615 AlMgSiPb, 3.1325 AlCuMg1, 3.3245 AlMg3Si, 3.4365 AlZnMgCu1,5                                                                                                                                                                              | up to 3% Si       | 2/3 Flute        | Slotting            | 300    | 0,019                 | 0,037 | 0,050 | 0,065 | 0,078 | 0,100 | 0,130 | 0,160 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 2/3 Flute        | Roughing            | 350    | 0,021                 | 0,043 | 0,057 | 0,075 | 0,090 | 0,120 | 0,150 | 0,190 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Finishing           | 600    | 0,020                 | 0,041 | 0,055 | 0,072 | 0,086 | 0,110 | 0,140 | 0,180 |
| <b>Aluminum-cast alloys</b><br>3.2131 G-AISI5Cu1, 3.2153 G-AISI7Cu3, 3.2573 G-AISI9<br>3.2581 G-AISI12, 3.2583 G-AISI12Cu, - G-AISI12CuNiMg                                                                                                                                                                                                      | above 3% Si       | 2/3 Flute        | Slotting            | 160    | 0,016                 | 0,031 | 0,042 | 0,056 | 0,067 | 0,090 | 0,110 | 0,140 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 2/3 Flute        | Roughing            | 190    | 0,018                 | 0,036 | 0,048 | 0,064 | 0,077 | 0,100 | 0,130 | 0,160 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Finishing           | 320    | 0,017                 | 0,034 | 0,046 | 0,062 | 0,074 | 0,100 | 0,120 | 0,150 |
| <b>Magnesium-alloys</b><br>MgMn2, G-MgAl8Zn1, G-MgAl6Zn3                                                                                                                                                                                                                                                                                         | —                 | 2/3 Flute        | Slotting            | 125    | 0,016                 | 0,031 | 0,042 | 0,056 | 0,067 | 0,090 | 0,110 | 0,140 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 2/3 Flute        | Roughing            | 210    | 0,018                 | 0,036 | 0,048 | 0,064 | 0,077 | 0,100 | 0,130 | 0,160 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Finishing           | 360    | 0,017                 | 0,034 | 0,046 | 0,062 | 0,074 | 0,100 | 0,120 | 0,150 |
| <b>Non-ferrous metals (copper, short- or long-chipping brass or bronze)</b><br>2.0070 SE-Cu, 2.1020 CuSn6, 2.1096 G-CuSn5ZnPB<br>2.0380 CuZn39Pb2, 2.0401 CuZn39Pb3, 2.0410 CuZn43Pb2<br>2.0250 CuZn20, 2.0280 CuZn33, 2.0332 CuZn37Pb0,5<br>2.1090 CuSn7ZnPB, 2.1170 CuPb5Sn5, 2.1176 CuPb10Sn<br>2.0916 CuAl5, 2.0960 CuAl9Mn, 2.1050 CuSn10   | up to 850 N/mm²   | 2/3 Flute        | Slotting            | 175    | 0,013                 | 0,025 | 0,034 | 0,046 | 0,055 | 0,070 | 0,090 | 0,120 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 2/3 Flute        | Roughing            | 290    | 0,014                 | 0,029 | 0,039 | 0,053 | 0,063 | 0,080 | 0,110 | 0,130 |
|                                                                                                                                                                                                                                                                                                                                                  |                   | 3/4 Flute        | Finishing           | 500    | 0,014                 | 0,028 | 0,037 | 0,051 | 0,061 | 0,080 | 0,100 | 0,130 |

All recommendations are valid for coated tools. For bright milling cutters please vc - 40% and fz - 25%

# UNI-PRO End Mills (2-Flute) - Metric - Standard Length



## center cutting



Standard



No. of Flutes



Helix Angle



Chamfer



Rake Angle



Slotting



Roughing



Ramping



Helix



Plunging

Tool material

Surface finish



Solid Carbide

bright



FIREX®

Series

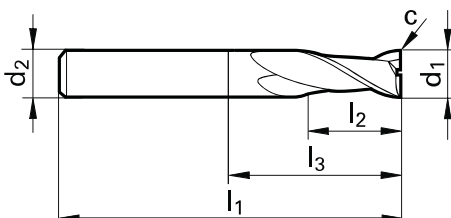
3303

3676

| Application group | Material examples | Ideal for |
|-------------------|-------------------|-----------|
| P                 | Steel             | ●         |
| M                 | Stainless steel   | ●         |
| K                 | Cast iron         | ●         |
| N                 | Aluminum          | ●         |
| S                 | Ni / Ti alloys    | ○         |
| H                 | Hardened steel    | --        |

●=Optimal    ○=Secondary

Speed and Feed data found on page 310



| d1 h10 | d2 h6  | l1     | l2    | l3    | c        | No. of Flutes | Code no. | EDP Number    |               |
|--------|--------|--------|-------|-------|----------|---------------|----------|---------------|---------------|
| mm     | mm     | mm     | mm    | mm    | mm x 45° |               |          |               |               |
| 2.000  | 2.000  | 32.00  | 5.00  | 7.50  | 0.03     | 2             | 2.000    | 9033030020000 | 9036760020000 |
| 2.500  | 2.500  | 32.00  | 6.00  | 8.50  | 0.05     | 2             | 2.500    | 9033030025000 | 9036760025000 |
| 3.000  | 3.000  | 38.00  | 7.00  | 11.00 | 0.05     | 2             | 3.000    | 9033030030000 | 9036760030000 |
| 3.500  | 3.500  | 50.00  | 7.00  | 22.00 | 0.05     | 2             | 3.500    | 9033030035000 | 9036760035000 |
| 4.000  | 4.000  | 50.00  | 8.00  | 22.00 | 0.05     | 2             | 4.000    | 9033030040000 | 9036760040000 |
| 4.500  | 4.500  | 50.00  | 8.00  | 22.00 | 0.05     | 2             | 4.500    | 9033030045000 | 9036760045000 |
| 5.000  | 5.000  | 50.00  | 10.00 | 22.00 | 0.05     | 2             | 5.000    | 9033030050000 | 9036760050000 |
| 5.500  | 5.500  | 57.00  | 10.00 | 21.00 | 0.05     | 2             | 5.500    | 9033030055000 | 9036760055000 |
| 6.000  | 6.000  | 57.00  | 10.00 | 21.00 | 0.05     | 2             | 6.000    | 9033030060000 | 9036760060000 |
| 6.500  | 6.500  | 60.00  | 13.00 | 24.00 | 0.10     | 2             | 6.500    | 9033030065000 | 9036760065000 |
| 7.000  | 7.000  | 60.00  | 13.00 | 24.00 | 0.10     | 2             | 7.000    | 9033030070000 | 9036760070000 |
| 7.500  | 7.500  | 63.00  | 16.00 | 27.00 | 0.10     | 2             | 7.500    | 9033030075000 | 9036760075000 |
| 8.000  | 8.000  | 63.00  | 16.00 | 27.00 | 0.10     | 2             | 8.000    | 9033030080000 | 9036760080000 |
| 8.500  | 8.500  | 67.00  | 16.00 | 27.00 | 0.10     | 2             | 8.500    | 9033030085000 | 9036760085000 |
| 9.000  | 9.000  | 67.00  | 16.00 | 27.00 | 0.10     | 2             | 9.000    | 9033030090000 | 9036760090000 |
| 9.500  | 9.500  | 72.00  | 19.00 | 32.00 | 0.10     | 2             | 9.500    | 9033030095000 | 9036760095000 |
| 10.000 | 10.000 | 72.00  | 19.00 | 32.00 | 0.10     | 2             | 10.000   | 9033030100000 | 9036760100000 |
| 11.000 | 11.000 | 83.00  | 22.00 | 38.00 | 0.10     | 2             | 11.000   | 9033030110000 | 9036760110000 |
| 12.000 | 12.000 | 83.00  | 22.00 | 38.00 | 0.10     | 2             | 12.000   | 9033030120000 | 9036760120000 |
| 13.000 | 13.000 | 83.00  | 22.00 | 38.00 | 0.15     | 2             | 13.000   | 9033030130000 | 9036760130000 |
| 14.000 | 14.000 | 83.00  | 22.00 | 38.00 | 0.15     | 2             | 14.000   | 9033030140000 | 9036760140000 |
| 15.000 | 15.000 | 92.00  | 26.00 | 44.00 | 0.15     | 2             | 15.000   | 9033030150000 | 9036760150000 |
| 16.000 | 16.000 | 92.00  | 26.00 | 44.00 | 0.15     | 2             | 16.000   | 9033030160000 | 9036760160000 |
| 18.000 | 18.000 | 92.00  | 26.00 | 44.00 | 0.15     | 2             | 18.000   | 9033030180000 | 9036760180000 |
| 20.000 | 20.000 | 104.00 | 32.00 | 54.00 | 0.15     | 2             | 20.000   | 9033030200000 | 9036760200000 |