

277 / 277N / 277W Recommended Cutting Data - Profile Milling Inch

| Workpiece Material Group | ISO | Hardness | Coolant ● Preferred ○ Possible x Not Possible | | | Profiling (ae) | | | | End Mill Diameter | | | | | | | | |
|--|-----|--------------|--|-----|-----|----------------|------|-----|-----|---|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | | | | | | | | 1/8* | 3/16* | 1/4* | 5/16 | 3/8 | 1/2 | 5/8 | 3/4 | 1 |
| | | | | | | 5% | 10% | 25% | 50% | *Profile milling at ≥ 50% ap is not recommended for diameters 1/4" and below. ← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing. | | | | | | | | |
| | | | | | | 2.3 | 1.8 | 1.2 | 1.0 | | | | | | | | | |
| | | | Max. | Air | MMS | vc - SFM | | | | | | | | | | | | |
| Low Carbon Steels 1018, 1020 | P | up to 28 Rc | ● | ● | ● | 1475 | 1150 | 980 | 500 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |
| Medium Carbon Steels 1140, 1145 | P | 28 to 38 Rc | ● | ● | ● | 1130 | 900 | 840 | 250 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |
| Alloy Steels 4140, 4145 | P | 28 to 44 Rc | ● | ● | ● | 1035 | 840 | 755 | 250 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |
| Die / Tool Steels A2, D2, H13, P20 | P | 28 to 44 Rc | ● | ● | ● | 900 | 725 | 615 | 200 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |
| Hardened Steels A2, D2 | H | 45 to 50 Rc | ● | ○ | ○ | 610 | 495 | 325 | 250 | .0006 | 0.001 | .0012 | .0016 | .0020 | .0024 | .0030 | .0040 | .0050 |
| Hardened Steels A2, D2 | H | 50 to 55 Rc | ● | ○ | ○ | 510 | 410 | 280 | 200 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430 | M | up to 28 Rc | ● | x | ○ | 675 | 545 | 425 | 360 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |
| Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH | M | up to 28 Rc | ● | x | ○ | 525 | 430 | 400 | 210 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |
| Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321 | M | up to 28 Rc | ● | x | ○ | 410 | 330 | 295 | 210 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |
| Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics | M | over 28 Rc | ● | x | ○ | 525 | 430 | 395 | 110 | .0006 | .0010 | .0012 | .0016 | .0020 | .0024 | .0030 | .0040 | .0050 |
| Cobalt Chrome Alloys | M | over 28 Rc | ● | x | ○ | 410 | 325 | 295 | 130 | .0006 | .0010 | .0012 | .0016 | .0020 | .0024 | .0030 | .0040 | .0050 |
| Duplex (22%) | M | over 28 Rc | ● | x | ○ | 245 | 195 | 180 | 130 | .0006 | .0010 | .0012 | .0016 | .0020 | .0024 | .0030 | .0040 | .0050 |
| Super Duplex (25%) | M | over 28 Rc | ● | x | ○ | 245 | 195 | 180 | 110 | .0006 | .0010 | .0012 | .0016 | .0020 | .0024 | .0030 | .0040 | .0050 |
| High Temp Alloys | S | up to 42 Rc | ● | x | x | 180 | 150 | 130 | 85 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Inconel | S | up to 42 Rc | ● | x | x | 180 | 150 | 130 | 85 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al | S | up to 42 Rc | ● | x | x | 375 | 350 | 330 | 175 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Cast Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40 | K | up to 240 HB | ● | ○ | ○ | 1625 | 1295 | 870 | 350 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |
| Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450 | K | over 240 HB | ● | ○ | ○ | 675 | 540 | 510 | 260 | .0012 | .0020 | .0024 | .0031 | .0039 | .0047 | .0060 | .0078 | .0100 |

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
 (Calculated Feed x Spindle Maximum)/Calculated Speed

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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277 / 277N / 277W Recommended Cutting Data - Profile Milling Metric







| Workpiece Material Group | ISO | Hardness | Coolant | | | | Profiling (ae) | | | | End Mill Diameter (mm) | | | | | | | |
|--|-----|--------------|---|-----|-----|-----------|----------------|-----|-----|--|------------------------|-------|-------|-------|-------|-------|-------|--|
| | | | ● Preferred ○ Possible x Not Possible | | | | | | | 3* | 5* | 6* | 8 | 10 | 12 | 16 | 20 | |
| | | | | | | 2.3 | 1.8 | 1.2 | 1.0 | *Profile milling at ≥ 50% ap is not recommended for diameters 6mm and below. | | | | | | | | |
| | | | Max. | Air | MMS | vc- m/min | | | | ← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing. | | | | | | | | |
| | | | | | | | | | | | fz - mm/tooth | | | | | | | |
| Low Carbon Steels 1018, 1020 | P | up to 28 Rc | ● | ● | ● | 450 | 350 | 300 | 150 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |
| Medium Carbon Steels 1140, 1145 | P | 28 to 38 Rc | ● | ● | ● | 345 | 275 | 255 | 75 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |
| Alloy Steels 4140, 4145 | P | 28 to 44 Rc | ● | ● | ● | 315 | 255 | 230 | 75 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |
| Die / Tool Steels A2, D2, H13, P20 | P | 28 to 44 Rc | ● | ● | ● | 275 | 220 | 187 | 60 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |
| Hardened Steels A2, D2 | H | 45 to 50 Rc | ● | ○ | ○ | 185 | 150 | 100 | 75 | .0150 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 | |
| Hardened Steels A2, D2 | H | 50 to 55 Rc | ● | ○ | ○ | 155 | 125 | 85 | 60 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 | |
| Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430 | M | up to 28 Rc | ● | x | ○ | 205 | 165 | 130 | 110 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |
| Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH | M | up to 28 Rc | ● | x | ○ | 160 | 130 | 120 | 65 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |
| Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321 | M | up to 28 Rc | ● | x | ○ | 125 | 100 | 90 | 65 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |
| Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics | M | over 28 Rc | ● | x | ○ | 160 | 130 | 120 | 35 | .0150 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 | |
| Cobalt Chrome Alloys | M | over 28 Rc | ● | x | ○ | 125 | 100 | 90 | 40 | .0150 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 | |
| Duplex (22%) | M | over 28 Rc | ● | x | ○ | 75 | 60 | 55 | 40 | .0150 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 | |
| Super Duplex (25%) | M | over 28 Rc | ● | x | ○ | 75 | 60 | 55 | 35 | .0150 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 | |
| High Temp Alloys | S | up to 42 Rc | ● | x | x | 55 | 45 | 40 | 25 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 | |
| Inconel | S | up to 42 Rc | ● | x | x | 55 | 45 | 40 | 25 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 | |
| Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al | S | up to 42 Rc | ● | x | x | 115 | 105 | 100 | 55 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 | |
| Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40 | K | up to 240 HB | ● | ○ | ○ | 495 | 395 | 265 | 110 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |
| Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450 | K | over 240 HB | ● | ○ | ○ | 205 | 165 | 155 | 80 | .0300 | .0500 | .0600 | .0800 | .1000 | .1200 | .1600 | .2000 | |

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
 (Calculated Feed x Spindle Maximum)/Calculated Speed

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

For product information, call your local distributor.

277 / 277N / 277W Recommended Cutting Data - Slotting Inch

| Workpiece Material Group | ISO | Hardness | Coolant | | | Slotting | | | End Mill Diameter | | | | | | | | |
|--|-----|--------------|---|---|---|---|---|---|--|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | ● Preferred ○ Possible x Not Possible | | |  |  |  | 1/8* | 3/16* | 1/4* | 5/16 | 3/8 | 1/2 | 5/8 | 3/4 | 1 |
| | | |  |  |  | 25% | 50% | 100% | *Slotting at > 25% ap is not recommended for diameters 1/4" and below. | | | | | | | | |
| | | | Max. | Air | MMS | vc - SFM | | | | | | | | | | | |
| Low Carbon Steels 1018, 1020 | P | up to 28 Rc | ● | ● | ● | 550 | 500 | 475 | .0004 | .0010 | .0012 | .0016 | .0020 | .0025 | .0031 | .0040 | .0050 |
| Medium Carbon Steels 1140, 1145 | P | 28 to 38 Rc | ● | ● | ● | 275 | 250 | 225 | .0004 | .0010 | .0012 | .0016 | .0020 | .0025 | .0031 | .0040 | .0050 |
| Alloy Steels 4140, 4145 | P | 28 to 44 Rc | ● | ● | ● | 275 | 250 | 225 | .0004 | .0010 | .0012 | .0016 | .0020 | .0025 | .0031 | .0040 | .0050 |
| Die / Tool Steels A2, D2, H13, P20 | P | 28 to 44 Rc | ● | ● | ● | 225 | 200 | 175 | .0004 | .0010 | .0012 | .0016 | .0020 | .0025 | .0031 | .0040 | .0050 |
| Hardened Steels A2, D2 | H | 45 to 50 Rc | ● | ○ | ○ | 275 | 250 | 225 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Hardened Steels A2, D2 | H | 50 to 55 Rc | ● | ○ | ○ | 225 | 200 | 175 | .0001 | .0002 | .0003 | .0004 | .0005 | .0006 | .0008 | .0010 | .0015 |
| Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430 | M | up to 28 Rc | ● | x | ○ | 385 | 360 | 350 | .0004 | .0010 | .0012 | .0016 | .0020 | .0024 | .0031 | .0040 | .0050 |
| Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH | M | up to 28 Rc | ● | x | ○ | 225 | 210 | 200 | .0004 | .0010 | .0012 | .0016 | .0020 | .0024 | .0031 | .0040 | .0050 |
| Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321 | M | up to 28 Rc | ● | x | ○ | 225 | 210 | 200 | .0004 | .0010 | .0012 | .0016 | .0020 | .0024 | .0031 | .0040 | .0050 |
| Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics | M | over 28 Rc | ● | x | ○ | 125 | 110 | 100 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Cobalt Chrome Alloys | M | over 28 Rc | ● | x | ○ | 150 | 130 | 120 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Duplex (22%) | M | over 28 Rc | ● | x | ○ | 150 | 130 | 120 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Super Duplex (25%) | M | over 28 Rc | ● | x | ○ | 120 | 110 | 100 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| High Temp Alloys | S | up to 42 Rc | ● | x | x | 100 | 85 | 75 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Inconel | S | up to 42 Rc | ● | x | x | 95 | 85 | 75 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr-4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al | S | up to 42 Rc | ● | x | x | 180 | 175 | 160 | .0003 | .0005 | .0006 | .0008 | .0010 | .0012 | .0016 | .0020 | .0024 |
| Cast Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40 | K | up to 240 HB | ● | ○ | ○ | 375 | 350 | 325 | .0004 | .0010 | .0012 | .0016 | .0020 | .0024 | .0031 | .0040 | .0050 |
| Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450 | K | over 240 HB | ● | ○ | ○ | 275 | 260 | 250 | .0004 | .0010 | .0012 | .0016 | .0020 | .0024 | .0031 | .0040 | .0050 |

**Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed**

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277 / 277N / 277W Recommended Cutting Data - Slotting Metric

| Workpiece Material Group | ISO | Hardness | Coolant | | | Slotting | | | End Mill Diameter (mm) | | | | | | | |
|--|-----|--------------|---|-----|-----|-----------|-----|------|---|-------|-------|-------|-------|-------|-------|-------|
| | | | ● Preferred ○ Possible x Not Possible | | | | | | 3* | 5* | 6* | 8 | 10 | 12 | 16 | 20 |
| | | | | | | 25% | 50% | 100% | *Slotting at > 25% ap is not recommended for diameters 6mm and below. | | | | | | | |
| | | | Max. | Air | MMS | vc -m/min | | | fz - mm/tooth | | | | | | | |
| Low Carbon Steels 1018, 1020 | P | up to 28 Rc | ● | ● | ● | 170 | 150 | 145 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |
| Medium Carbon Steels 1140, 1145 | P | 28 to 38 Rc | ● | ● | ● | 85 | 75 | 70 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |
| Alloy Steels 4140, 4145 | P | 28 to 44 Rc | ● | ● | ● | 85 | 75 | 70 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |
| Die / Tool Steels A2, D2, H13, P20 | P | 28 to 44 Rc | ● | ● | ● | 70 | 60 | 55 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |
| Hardened Steels A2, D2 | H | 45 to 50 Rc | ● | ○ | ○ | 85 | 75 | 70 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 |
| Hardened Steels A2, D2 | H | 50 to 55 Rc | ● | ○ | ○ | 70 | 60 | 55 | .0030 | .0060 | .0070 | .0100 | .0120 | .0150 | .0200 | .0250 |
| Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430 | M | up to 28 Rc | ● | x | ○ | 120 | 110 | 110 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |
| Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH | M | up to 28 Rc | ● | x | ○ | 70 | 65 | 60 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |
| Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321 | M | up to 28 Rc | ● | x | ○ | 70 | 65 | 60 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |
| Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics | M | over 28 Rc | ● | x | ○ | 40 | 35 | 30 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 |
| Cobalt Chrome Alloys | M | over 28 Rc | ● | x | ○ | 45 | 40 | 40 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 |
| Duplex (22%) | M | over 28 Rc | ● | x | ○ | 45 | 40 | 40 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 |
| Super Duplex (25%) | M | over 28 Rc | ● | x | ○ | 40 | 35 | 30 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 |
| High Temp Alloys | S | up to 42 Rc | ● | x | x | 30 | 25 | 25 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 |
| Inconel | S | up to 42 Rc | ● | x | x | 30 | 25 | 25 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 |
| Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al | S | up to 42 Rc | ● | x | x | 55 | 55 | 50 | .0070 | .0120 | .0150 | .0200 | .0250 | .0300 | .0400 | .0500 |
| Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40 | K | up to 240 HB | ● | ○ | ○ | 115 | 105 | 100 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |
| Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450 | K | over 240 HB | ● | ○ | ○ | 85 | 80 | 75 | .0100 | .0250 | .0300 | .0400 | .0500 | .0600 | .0800 | .1000 |

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:

$$\frac{\text{Calculated Feed} \times \text{Spindle Maximum}}{\text{Calculated Speed}}$$

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

For product information, call your local distributor.