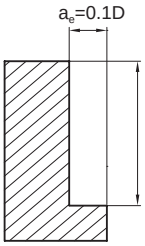
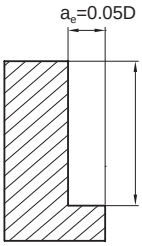
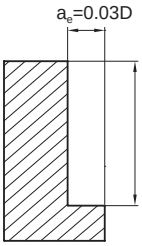
## UM-4E★UM-4EL(general cutting)

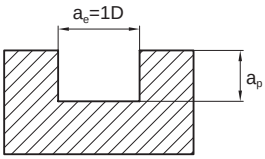
| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **4** | 10800 | 1000 | 5500 | 180 | 8000 | 770 | 6500 | 605 | 5570 | 440 |
| **5** | 8200 | 1050 | 4500 | 180 | 6400 | 810 | 5000 | 635 | 4460 | 465 |
| **6** | 7000 | 1080 | 3700 | 195 | 5300 | 825 | 4200 | 645 | 3710 | 465 |
| **8** | 5200 | 1065 | 2800 | 195 | 4000 | 815 | 3200 | 665 | 2785 | 485 |
| **10** | 4200 | 1050 | 2200 | 195 | 3200 | 810 | 2500 | 630 | 2230 | 450 |
| **12** | 3500 | 1050 | 1850 | 195 | 2650 | 810 | 2100 | 630 | 1855 | 450 |
| **14** | 3000 | 975 | 1600 | 180 | 2300 | 755 | 1800 | 595 | 1590 | 430 |
| **16** | 2600 | 975 | 1400 | 170 | 2000 | 755 | 1600 | 595 | 1390 | 430 |
| **18** | 2300 | 960 | 1250 | 150 | 1800 | 745 | 1400 | 580 | 1240 | 420 |
| **20** | 2050 | 960 | 1100 | 150 | 1600 | 745 | 1250 | 580 | 1115 | 420 |

Maximum cutting depth



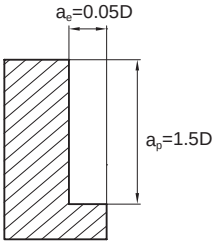
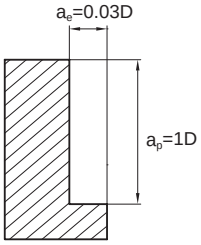

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

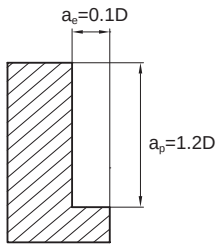
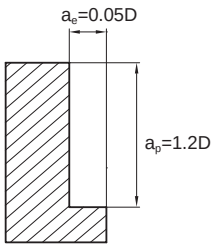
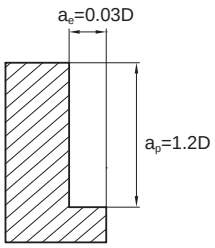
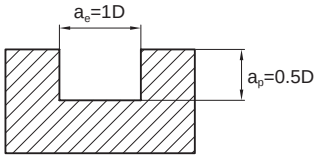
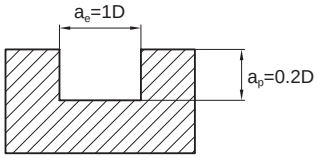
## Cutting parameters for UM series end mills

### UM-4E★UM-4EL(high speed side milling)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Carbon steel, Alloy steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~45HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 250 m/min | | 200 m/min | | 150 m/min | | 100 m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 15915 | 2045 | 13260 | 1700 | 10600 | 1360 | 7960 | 1020 | 5300 | 680 |
| **8** | 11935 | 2040 | 9950 | 1680 | 7960 | 1355 | 5970 | 1020 | 3980 | 680 |
| **10** | 9550 | 1990 | 7960 | 1655 | 6370 | 1330 | 4775 | 995 | 3180 | 660 |
| **12** | 7960 | 1990 | 6630 | 1655 | 5300 | 1330 | 3980 | 995 | 2650 | 660 |
| **14** | 6820 | 1850 | 5685 | 1545 | 4550 | 1235 | 3410 | 1080 | 2275 | 615 |
| **16** | 5970 | 1850 | 4975 | 1545 | 3980 | 1235 | 2985 | 1080 | 1990 | 615 |
| **18** | 5305 | 1850 | 4420 | 1545 | 3540 | 1235 | 2650 | 1080 | 1770 | 615 |
| **20** | 4775 | 1850 | 3980 | 1545 | 3180 | 1235 | 2390 | 1080 | 1590 | 615 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | | | | | |   Maximum $a_e$=0.5mm | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or MQL( minimum oil mist cooling).
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

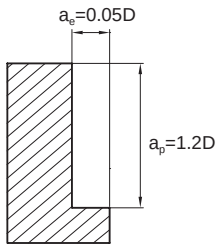
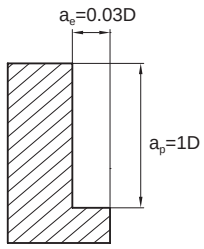
## UM-4EFP(general cutting)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 7000 | 1400 | 3700 | 250 | 5300 | 1080 | 4200 | 845 | 3710 | 610 |
| **8** | 5200 | 1385 | 2800 | 250 | 4000 | 1060 | 3200 | 865 | 2785 | 630 |
| **10** | 4200 | 1365 | 2200 | 250 | 3200 | 1050 | 2500 | 815 | 2230 | 585 |
| **12** | 3500 | 1365 | 1850 | 250 | 2650 | 1050 | 2100 | 815 | 1855 | 585 |
| **16** | 2600 | 1270 | 1400 | 220 | 2000 | 975 | 1600 | 770 | 1390 | 560 |
| **20** | 2050 | 1255 | 1100 | 195 | 1600 | 965 | 1250 | 755 | 1115 | 545 |
| Maximum cutting depth |   | | | | | |   | |   | |
| |   | | | | | |   | | | |

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for UM series end mills

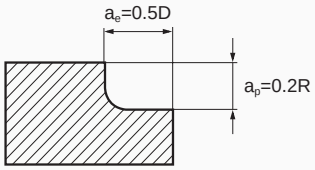
### UM-4EFP(high speed side milling)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Carbon steel, Alloy steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~45HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 250 m/min | | 200 m/min | | 150 m/min | | 100 m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 15915 | 2655 | 13260 | 2210 | 10600 | 1770 | 7960 | 1325 | 5300 | 885 |
| **8** | 11935 | 2650 | 9950 | 2180 | 7960 | 1760 | 5970 | 1295 | 3980 | 885 |
| **10** | 9550 | 2590 | 7960 | 2150 | 6370 | 1730 | 4775 | 1295 | 3180 | 855 |
| **12** | 7960 | 2590 | 6630 | 2150 | 5300 | 1730 | 3980 | 1400 | 2650 | 855 |
| **16** | 5970 | 2410 | 4975 | 2015 | 3980 | 1605 | 2985 | 1400 | 1990 | 800 |
| **20** | 4775 | 2410 | 3980 | 2375 | 3180 | 1605 | 2390 | 1325 | 1590 | 800 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | | | | | |   Maximum $a_e$=0.5mm | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or MQL( minimum oil mist cooling).
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

## UM-4R★UM-4RL(Standard)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Quenched and tempered steel ~40HRC | | Quenched and tempered steel ~45HRC | | Quenched and tempered steel ~50HRC | | Quenched and tempered steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter× Corner radius | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **4.0×R0.3**<br>**4.0×R0.5** | 7950 | 3960 | 6350 | 2880 | 5550 | 2520 | 4000 | 1650 | 2400 | 755 |
| **5.0×R0.5**<br>**5.0×R1.0** | 6350 | 4200 | 5100 | 3060 | 4450 | 2670 | 3200 | 1710 | 1900 | 690 |
| **6.0×R0.5**<br>**6.0×R1.0** | 5300 | 4200 | 4250 | 3060 | 3700 | 2670 | 2650 | 1710 | 1600 | 690 |
| **8.0×R0.5**<br>**8.0×R1.0** | 4550 | 4200 | 3200 | 3060 | 2800 | 2670 | 2000 | 1710 | 1200 | 690 |
| **10.0×R0.5**<br>**10.0×R1.0**<br>**10.0×R2.0**<br>**10.0×R3.0** | 3200 | 4200 | 2550 | 3060 | 2250 | 2670 | 1600 | 1710 | 955 | 690 |
| **12.0×R0.5**<br>**12.0×R1.0**<br>**12.0×R2.0**<br>**12.0×R3.0** | 2650 | 4200 | 2100 | 3060 | 1850 | 2670 | 1350 | 1710 | 795 | 690 |
| **16.0×R1.0**<br>**16.0×R2.0**<br>**16.0×R3.0** | 2200 | 3485 | 1745 | 2540 | 1535 | 2215 | 1140 | 1420 | 660 | 570 |
| **20.0×R1.0**<br>**20.0×R2.0**<br>**20.0×R3.0** | 1825 | 2895 | 1450 | 2110 | 1275 | 1840 | 960 | 1180 | 550 | 475 |
| Maximum cutting depth | Maximum $a_p$=0.5mm | | | | | | Maximum $a_p$=0.4mm | | Maximum $a_p$=0.2mm | |




1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.
6.The above cutting parameters are based on contour machining when overhang L/D≤4. Please make adjustments according to the table below when overhang is different.

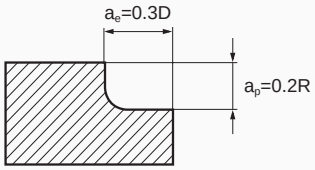
Different cutting parameters under different overhang of tool:

| Overhang | Cutting speed(m/min) | Axial cutting depth (mm) | Feed speed (mm/min) |
|---|---|---|---|
| L/D⩽4 | 100% | 100% | 100% |
| L/D=5 | 60%~80% | 60%~80% | 60%~80% |
| L/D=6 | 40%~60% | 40%~60% | 40%~60% |

## Cutting parameters for UM series end mills

### UM-4R★UM-4RL(High speed)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Quenched and tempered steel ~40HRC | | Quenched and tempered steel ~45HRC | | Quenched and tempered steel ~50HRC | | Quenched and tempered steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter× Corner radius | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **4.0×R0.3**<br>**4.0×R0.5** | 16000 | 7800 | 16000 | 7200 | 12000 | 5400 | 12000 | 4920 | 7950 | 2130 |
| **5.0×R0.5**<br>**5.0×R1.0** | 12500 | 8400 | 12500 | 7500 | 9550 | 5730 | 9550 | 5160 | 6350 | 2280 |
| **6.0×R0.5**<br>**6.0×R1.0** | 10600 | 8400 | 10600 | 7620 | 7950 | 5730 | 7950 | 5160 | 5300 | 2280 |
| **8.0×R0.5**<br>**8.0×R1.0** | 7950 | 8400 | 7950 | 7620 | 5950 | 5730 | 5950 | 5160 | 4000 | 2280 |
| **10.0×R0.5**<br>**10.0×R1.0**<br>**10.0×R2.0**<br>**10.0×R3.0** | 6350 | 8400 | 6350 | 7620 | 4750 | 5730 | 4750 | 5160 | 3200 | 2280 |
| **12.0×R0.5**<br>**12.0×R1.0**<br>**12.0×R2.0**<br>**12.0×R3.0** | 5300 | 8400 | 5300 | 7620 | 4000 | 5730 | 4000 | 5160 | 2650 | 2280 |
| **16.0×R1.0**<br>**16.0×R2.0**<br>**16.0×R3.0** | 3980 | 6970 | 3980 | 6320 | 2985 | 4755 | 2985 | 4280 | 1990 | 1890 |
| **20.0×R1.0**<br>**20.0×R2.0**<br>**20.0×R3.0** | 3185 | 5785 | 3185 | 5245 | 2385 | 3945 | 2385 | 3550 | 1590 | 1570 |
| Maximum cutting depth | Maximum $a_p$=0.4mm | | | | | | Maximum $a_p$=0.2mm | | Maximum $a_p$=0.1mm | |




1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.
6.The above cutting parameters are based on contour machining when overhang L/D≤4. Please make adjustments according to the table below when overhang is different.

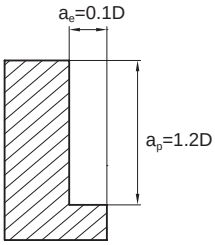
Different cutting parameters under different overhang of tool:

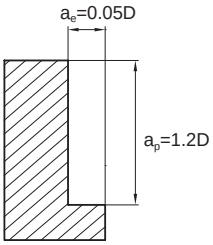
| Ratio of neck length to diameter | Cutting speed(m/min) | Axial cutting depth(mm) | Feed speed (mm/min) |
|---|---|---|---|
| L/D⩽4 | 100% | 100% | 100% |
| L/D=5 | 60%~80% | 60%~80% | 60%~80% |
| L/D=6 | 40%~60% | 40%~60% | 40%~60% |

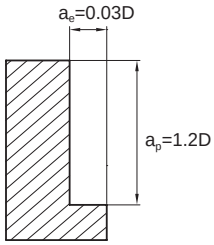
## UM-4RFP

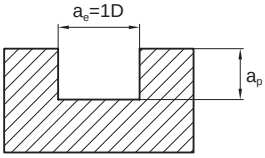
| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **4** | 10800 | 1210 | 5500 | 210 | 8000 | 925 | 6500 | 720 | 5570 | 530 |
| **5** | 8200 | 1265 | 4500 | 210 | 6400 | 965 | 5000 | 765 | 4460 | 560 |
| **6** | 7000 | 1295 | 3700 | 235 | 5300 | 995 | 4200 | 780 | 3710 | 560 |
| **8** | 5200 | 1285 | 2800 | 235 | 4000 | 975 | 3200 | 790 | 2785 | 580 |
| **10** | 4200 | 1265 | 2200 | 235 | 3200 | 965 | 2500 | 750 | 2230 | 540 |
| **12** | 3500 | 1265 | 1850 | 235 | 2650 | 965 | 2100 | 750 | 1855 | 540 |
| **16** | 2600 | 1180 | 1400 | 210 | 2000 | 925 | 1600 | 705 | 1390 | 520 |

Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

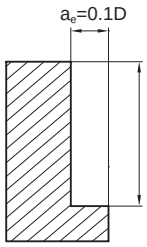
1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

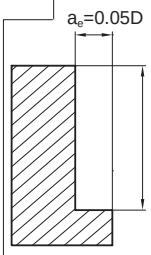
## Cutting parameters for PML/PM series end mills

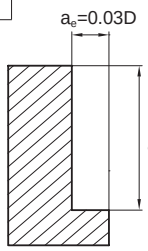
### PML-2E★PM-2E★PML-2EL★PM-2EL

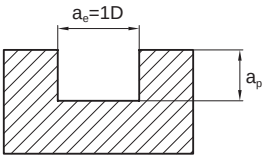
| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 200 | 20000 | 60 | 20000 | 165 | 20000 | 120 | 20000 | 90 |
| **2** | 15000 | 320 | 11150 | 85 | 15000 | 285 | 13000 | 180 | 11140 | 130 |
| **3** | 14000 | 545 | 7500 | 120 | 10600 | 420 | 8500 | 330 | 7430 | 240 |
| **4** | 10800 | 560 | 5500 | 135 | 8000 | 425 | 6500 | 335 | 5570 | 245 |
| **5** | 8200 | 585 | 4500 | 135 | 6400 | 445 | 5000 | 355 | 4460 | 260 |
| **6** | 7000 | 600 | 3700 | 140 | 5300 | 465 | 4200 | 360 | 3710 | 260 |
| **8** | 5200 | 595 | 2800 | 140 | 4000 | 455 | 3200 | 365 | 2785 | 270 |
| **10** | 4200 | 585 | 2200 | 140 | 3200 | 445 | 2500 | 350 | 2230 | 250 |
| **12** | 3500 | 585 | 1850 | 140 | 2650 | 445 | 2100 | 350 | 1855 | 250 |
| **14** | 3000 | 545 | 1600 | 135 | 2300 | 420 | 1800 | 330 | 1590 | 240 |
| **16** | 2600 | 545 | 1400 | 120 | 2000 | 420 | 1600 | 330 | 1390 | 240 |
| **18** | 2300 | 535 | 1250 | 120 | 1800 | 415 | 1400 | 325 | 1240 | 235 |
| **20** | 2050 | 535 | 1100 | 120 | 1600 | 415 | 1250 | 325 | 1115 | 235 |

Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

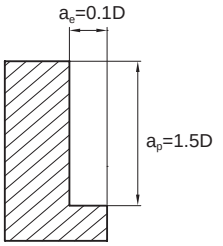
1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

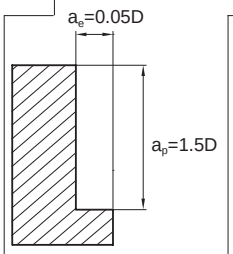
## Cutting parameters for PML/PM series end mills

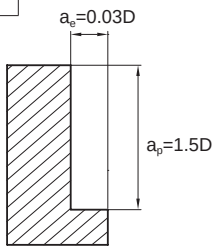
## PML-2F★PM-2F★PML-2FL★PM-2FL

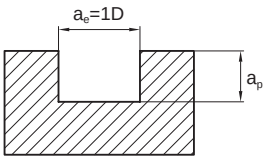
| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 140 | 20000 | 45 | 20000 | 115 | 20000 | 85 | 20000 | 65 |
| **2** | 15000 | 225 | 11150 | 60 | 15000 | 200 | 13000 | 125 | 11140 | 90 |
| **3** | 14000 | 385 | 7500 | 85 | 10600 | 295 | 8500 | 230 | 7430 | 170 |
| **4** | 10800 | 390 | 5500 | 95 | 8000 | 300 | 6500 | 235 | 5570 | 170 |
| **5** | 8200 | 410 | 4500 | 95 | 6400 | 315 | 5000 | 245 | 4460 | 180 |
| **6** | 7000 | 420 | 3700 | 95 | 5300 | 325 | 4200 | 255 | 3710 | 180 |
| **8** | 5200 | 415 | 2800 | 95 | 4000 | 320 | 3200 | 255 | 2785 | 190 |
| **10** | 4200 | 410 | 2200 | 95 | 3200 | 315 | 2500 | 240 | 2230 | 175 |
| **12** | 3500 | 410 | 1850 | 95 | 2650 | 315 | 2100 | 240 | 1855 | 175 |
| **14** | 3000 | 385 | 1600 | 95 | 2300 | 295 | 1800 | 230 | 1590 | 170 |
| **16** | 2600 | 385 | 1400 | 85 | 2000 | 295 | 1600 | 230 | 1390 | 170 |
| **18** | 2300 | 375 | 1250 | 85 | 1800 | 290 | 1400 | 230 | 1240 | 165 |
| **20** | 2050 | 375 | 1100 | 85 | 1600 | 290 | 1250 | 230 | 1115 | 165 |

Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

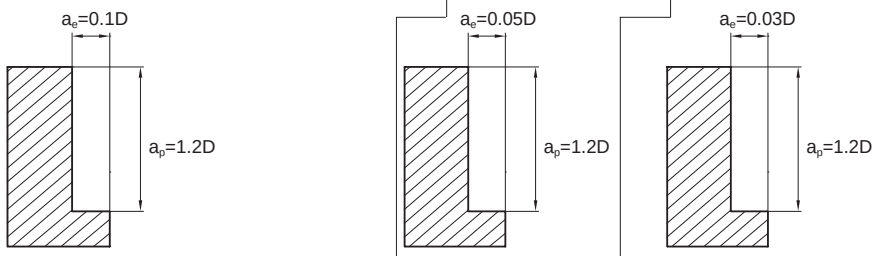
1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

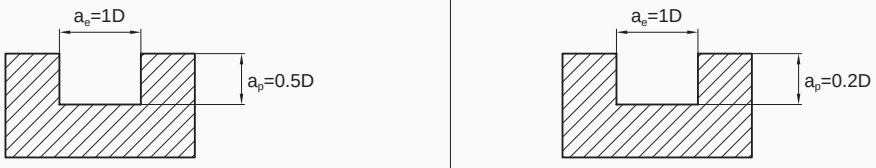
## Cutting parameters for PML/PM series end mills

### PML-2EFP★PM-2EFP

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 7000 | 780 | 3700 | 180 | 5300 | 600 | 4200 | 470 | 3710 | 340 |
| **8** | 5200 | 775 | 2800 | 180 | 4000 | 595 | 3200 | 475 | 2785 | 350 |
| **10** | 4200 | 755 | 2200 | 180 | 3200 | 575 | 2500 | 455 | 2230 | 325 |
| **12** | 3500 | 755 | 1850 | 180 | 2650 | 575 | 2100 | 455 | 1855 | 325 |
| **16** | 2600 | 710 | 1400 | 155 | 2000 | 545 | 1600 | 425 | 1390 | 310 |
| **20** | 2050 | 700 | 1100 | 155 | 1600 | 540 | 1250 | 420 | 1115 | 305 |

Maximum cutting depth



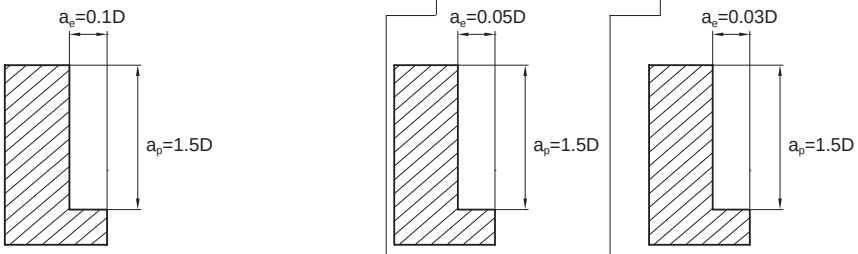

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

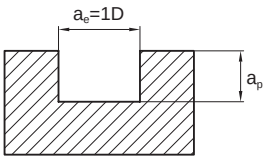
## Cutting parameters for PML/PM series end mills

## PML-3E-H★PM-3E-H★PML-3EL-H★PM-3EL-H

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 200 | 20000 | 75 | 20000 | 160 | 20000 | 100 | 20000 | 90 |
| **2** | 15000 | 325 | 11150 | 80 | 15000 | 285 | 13000 | 150 | 11140 | 130 |
| **3** | 14000 | 550 | 7500 | 100 | 10600 | 425 | 8500 | 280 | 7430 | 245 |
| **4** | 10800 | 565 | 5500 | 105 | 8000 | 430 | 6500 | 285 | 5570 | 250 |
| **5** | 8200 | 600 | 4500 | 105 | 6400 | 455 | 5000 | 300 | 4460 | 260 |
| **6** | 7000 | 605 | 3700 | 110 | 5300 | 465 | 4200 | 305 | 3710 | 260 |
| **8** | 5200 | 600 | 2800 | 110 | 4000 | 460 | 3200 | 310 | 2785 | 275 |
| **10** | 4200 | 600 | 2200 | 110 | 3200 | 455 | 2500 | 290 | 2230 | 255 |
| **12** | 3500 | 600 | 1850 | 110 | 2650 | 455 | 2100 | 290 | 1855 | 255 |
| **14** | 3000 | 550 | 1600 | 105 | 2300 | 425 | 1800 | 280 | 1590 | 245 |
| **16** | 2600 | 550 | 1400 | 100 | 2000 | 425 | 1600 | 280 | 1390 | 245 |
| **18** | 2300 | 540 | 1250 | 85 | 1800 | 415 | 1400 | 275 | 1240 | 240 |
| **20** | 2050 | 540 | 1100 | 85 | 1600 | 415 | 1250 | 275 | 1115 | 240 |

Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

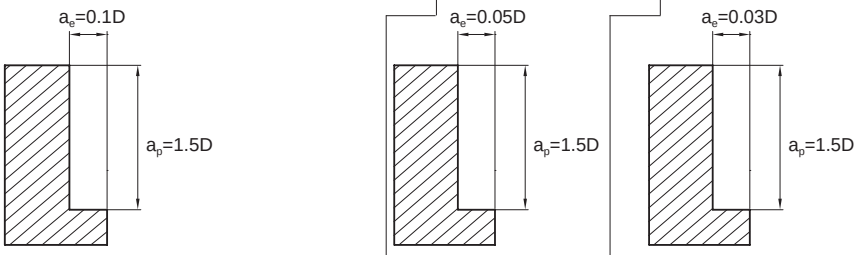
1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

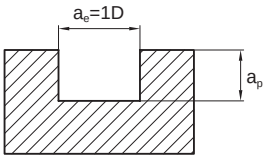
## Cutting parameters for PML/PM series end mills

### PML-4E-G★PM-4E-G★PML-4EL-G★PM-4EL-G
### PML-4E-H★PM-4E-H★PML-4EL-H★PM-4EL-H(general cutting)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 270 | 20000 | 95 | 20000 | 215 | 20000 | 135 | 20000 | 120 |
| **2** | 15000 | 435 | 11150 | 110 | 15000 | 380 | 13000 | 200 | 11140 | 175 |
| **3** | 14000 | 735 | 7500 | 135 | 10600 | 565 | 8500 | 370 | 7430 | 325 |
| **4** | 10800 | 755 | 5500 | 140 | 8000 | 575 | 6500 | 380 | 5570 | 335 |
| **5** | 8200 | 795 | 4500 | 140 | 6400 | 605 | 5000 | 400 | 4460 | 350 |
| **6** | 7000 | 810 | 3700 | 145 | 5300 | 620 | 4200 | 405 | 3710 | 350 |
| **8** | 5200 | 800 | 2800 | 145 | 4000 | 615 | 3200 | 415 | 2785 | 365 |
| **10** | 4200 | 795 | 2200 | 145 | 3200 | 605 | 2500 | 390 | 2230 | 340 |
| **12** | 3500 | 795 | 1850 | 145 | 2650 | 605 | 2100 | 390 | 1855 | 340 |
| **14** | 3000 | 735 | 1600 | 140 | 2300 | 565 | 1800 | 370 | 1590 | 325 |
| **16** | 2600 | 735 | 1400 | 135 | 2000 | 565 | 1600 | 370 | 1390 | 325 |
| **18** | 2300 | 720 | 1250 | 115 | 1800 | 555 | 1400 | 365 | 1240 | 315 |
| **20** | 2050 | 720 | 1100 | 115 | 1600 | 555 | 1250 | 365 | 1115 | 315 |

Maximum cutting depth



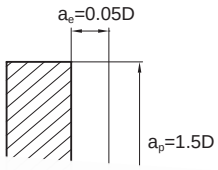
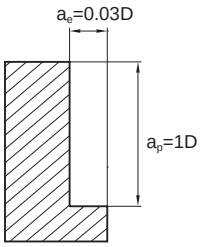

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for PML/PM series end mills

### PML-4E-G★PM-4E-G★PML-4EL-G★PM-4EL-G★PML-4E-H PM-4E-H★PML-4EL-H★PM-4EL-H(high speed side milling)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Carbon steel, Alloy steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~45HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 250 m/min | | 200 m/min | | 150 m/min | | 100 m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 15915 | 1535 | 13260 | 1280 | 10600 | 1020 | 7960 | 765 | 5300 | 515 |
| **8** | 11935 | 1530 | 9950 | 1260 | 7960 | 1020 | 5970 | 765 | 3980 | 515 |
| **10** | 9550 | 1450 | 7960 | 1245 | 6370 | 1000 | 4775 | 750 | 3180 | 495 |
| **12** | 7960 | 1450 | 6630 | 1245 | 5300 | 1000 | 3980 | 750 | 2650 | 495 |
| **14** | 6820 | 1390 | 5685 | 1160 | 4550 | 930 | 3410 | 810 | 2275 | 465 |
| **16** | 5970 | 1390 | 4975 | 1160 | 3980 | 930 | 2985 | 810 | 1990 | 465 |
| **18** | 5305 | 1390 | 4420 | 1160 | 3540 | 930 | 2650 | 810 | 1770 | 465 |
| **20** | 4775 | 1390 | 3980 | 1160 | 3180 | 930 | 2390 | 810 | 1590 | 465 |
| Maximum |   | | | | | |   Maximum $a_e$=0.5mm | | | |

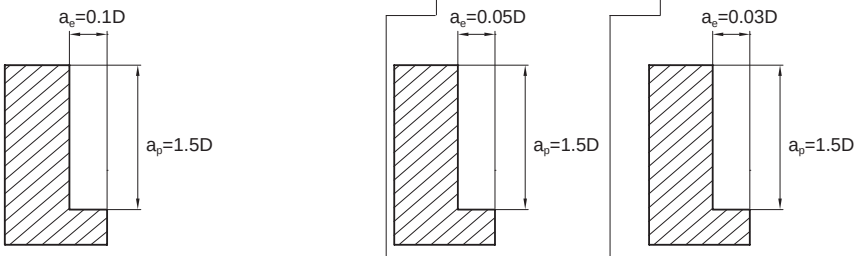
ormal noise may be generated. Please reduce the rotating

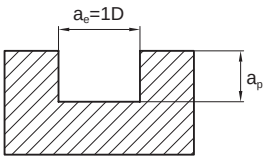
## Cutting parameters for PML/PM series end mills

### PML-4F-G★PM-4F-G★PML-4FL-G★PM-4FL-G(general cutting)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 190 | 20000 | 70 | 20000 | 150 | 20000 | 95 | 20000 | 85 |
| **2** | 15000 | 305 | 11150 | 80 | 15000 | 265 | 13000 | 140 | 11140 | 125 |
| **3** | 14000 | 515 | 7500 | 95 | 10600 | 395 | 8500 | 260 | 7430 | 230 |
| **4** | 10800 | 530 | 5500 | 100 | 8000 | 4055 | 6500 | 265 | 5570 | 235 |
| **5** | 8200 | 555 | 4500 | 100 | 6400 | 425 | 5000 | 280 | 4460 | 245 |
| **6** | 7000 | 570 | 3700 | 100 | 5300 | 435 | 4200 | 283 | 3710 | 245 |
| **8** | 5200 | 560 | 2800 | 100 | 4000 | 430 | 3200 | 290 | 2785 | 255 |
| **10** | 4200 | 555 | 2200 | 100 | 3200 | 425 | 2500 | 275 | 2230 | 240 |
| **12** | 3500 | 555 | 1850 | 100 | 2650 | 425 | 2100 | 275 | 1855 | 240 |
| **14** | 3000 | 515 | 1600 | 100 | 2300 | 395 | 1800 | 260 | 1590 | 230 |
| **16** | 2600 | 515 | 1400 | 95 | 2000 | 395 | 1600 | 260 | 1390 | 230 |
| **18** | 2300 | 505 | 1250 | 80 | 1800 | 390 | 1400 | 255 | 1240 | 220 |
| **20** | 2050 | 505 | 1100 | 80 | 1600 | 390 | 1250 | 255 | 1115 | 220 |

Maximum cutting depth



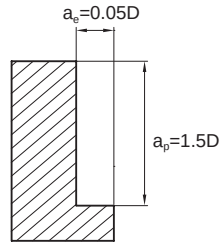
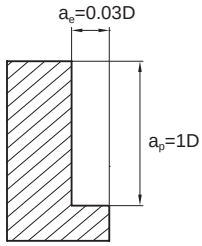




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

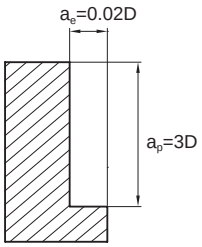
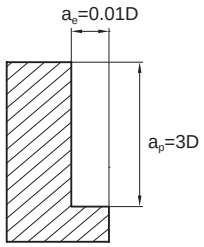
## PML-4F-G★PM-4F-G★PML-4FL-G★PM-4FL-G(high speed side milling)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Carbon steel, Alloy steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~45HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 250 m/min | | 200 m/min | | 150 m/min | | 100 m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 15915 | 1075 | 13260 | 900 | 10600 | 715 | 7960 | 535 | 5300 | 360 |
| **8** | 11935 | 1070 | 9950 | 885 | 7960 | 715 | 5970 | 535 | 3980 | 360 |
| **10** | 9550 | 1015 | 7960 | 870 | 6370 | 700 | 4775 | 525 | 3180 | 345 |
| **12** | 7960 | 1015 | 6630 | 870 | 5300 | 700 | 3980 | 525 | 2650 | 345 |
| **14** | 6820 | 975 | 5685 | 815 | 4550 | 650 | 3410 | 570 | 2275 | 325 |
| **16** | 5970 | 975 | 4975 | 815 | 3980 | 650 | 2985 | 570 | 1990 | 325 |
| **18** | 5305 | 975 | 4420 | 815 | 3540 | 650 | 2650 | 570 | 1770 | 325 |
| **20** | 4775 | 975 | 3980 | 815 | 3180 | 650 | 2390 | 570 | 1590 | 325 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | | | | | |   Maximum $a_e$=0.5mm | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or MQL( minimum oil mist cooling).
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for PML/PM series end mills

### PML-4EX-G★PM-4EX-G

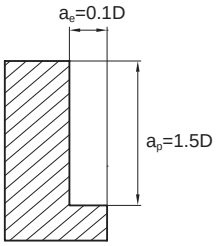
| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 5800 | 570 | 2650 | 85 | 4250 | 410 | 3600 | 345 | 3180 | 305 |
| **8** | 4400 | 570 | 2000 | 85 | 3180 | 410 | 2700 | 350 | 2390 | 310 |
| **10** | 3500 | 555 | 1600 | 85 | 2550 | 400 | 2150 | 340 | 1910 | 300 |
| **12** | 2900 | 555 | 1350 | 85 | 2120 | 400 | 1800 | 340 | 1590 | 300 |
| **16** | 2200 | 520 | 1000 | 80 | 1590 | 380 | 1350 | 315 | 1195 | 280 |
| **20** | 1750 | 510 | 800 | 75 | 1270 | 375 | 1050 | 310 | 955 | 280 |
| Maximum cutting depth |   | | | | | |   | | | |

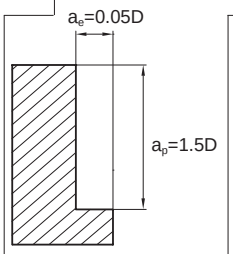
1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

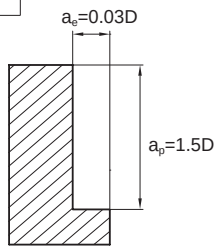
## PML-4E★PM-4E★PML-4EL★PM-4EL(general cutting)

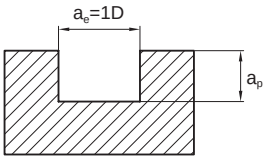
| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 300 | 20000 | 108 | 20000 | 240 | 20000 | 180 | 20000 | 135 |
| **2** | 15000 | 480 | 11150 | 120 | 15000 | 420 | 13000 | 270 | 11140 | 195 |
| **3** | 14000 | 815 | 7500 | 145 | 10600 | 630 | 8500 | 495 | 7430 | 360 |
| **4** | 10800 | 840 | 5500 | 150 | 8000 | 645 | 6500 | 505 | 5570 | 370 |
| **5** | 8200 | 875 | 4500 | 150 | 6400 | 675 | 5000 | 530 | 4460 | 390 |
| **6** | 7000 | 900 | 3700 | 165 | 5300 | 690 | 4200 | 540 | 3710 | 390 |
| **8** | 5200 | 890 | 2800 | 165 | 4000 | 680 | 3200 | 555 | 2785 | 405 |
| **10** | 4200 | 875 | 2200 | 165 | 3200 | 675 | 2500 | 525 | 2230 | 375 |
| **12** | 3500 | 875 | 1850 | 165 | 2650 | 675 | 2100 | 525 | 1855 | 375 |
| **14** | 3000 | 815 | 1600 | 150 | 2300 | 630 | 1800 | 495 | 1590 | 360 |
| **16** | 2600 | 815 | 1400 | 145 | 2000 | 630 | 1600 | 495 | 1390 | 360 |
| **18** | 2300 | 805 | 1250 | 125 | 1800 | 620 | 1400 | 485 | 1240 | 350 |
| **20** | 2050 | 805 | 1100 | 125 | 1600 | 620 | 1250 | 485 | 1115 | 350 |

Maximum cutting depth



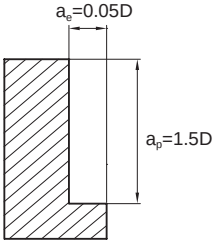
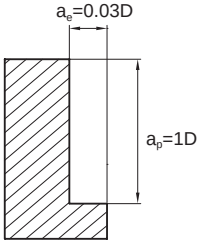

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for PML/PM series end mills

### PML-4E★PM-4E★PML-4EL★PM-4EL(high speed side milling)

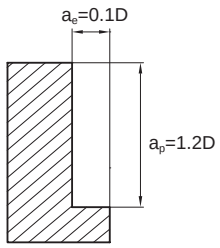
| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Carbon steel, Alloy steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~45HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 250 m/min | | 200 m/min | | 150 m/min | | 100 m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 15915 | 1705 | 13260 | 1420 | 10600 | 1135 | 7960 | 850 | 5300 | 570 |
| **8** | 11935 | 1700 | 9950 | 1400 | 7960 | 1130 | 5970 | 850 | 3980 | 570 |
| **10** | 9550 | 1660 | 7960 | 1380 | 6370 | 1110 | 4775 | 830 | 3180 | 550 |
| **12** | 7960 | 1660 | 6630 | 1380 | 5300 | 1110 | 3980 | 830 | 2650 | 550 |
| **14** | 6820 | 1545 | 5685 | 1290 | 4550 | 1030 | 3410 | 900 | 2275 | 515 |
| **16** | 5970 | 1545 | 4975 | 1290 | 3980 | 1030 | 2985 | 900 | 1990 | 515 |
| **18** | 5305 | 1545 | 4420 | 1290 | 3540 | 1030 | 2650 | 900 | 1770 | 515 |
| **20** | 4775 | 1545 | 3980 | 1290 | 3180 | 1030 | 2390 | 900 | 1590 | 515 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | | | | | |   Maximum $a_e$=0.5mm | | | |

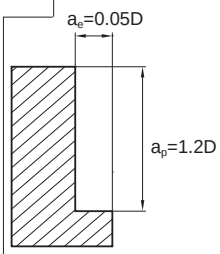
1.Please select high-precision machine and tool holder.
2.Please use air blow or MQL( minimum oil mist cooling).
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

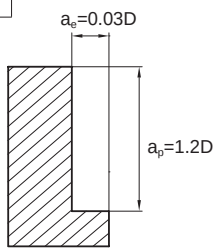
## PML-4EFP★PM-4EFP(general cutting)

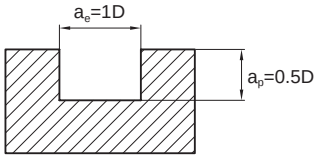
| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 7000 | 1170 | 3700 | 210 | 5300 | 900 | 4200 | 705 | 3710 | 510 |
| **8** | 5200 | 1155 | 2800 | 210 | 4000 | 885 | 3200 | 720 | 2785 | 525 |
| **10** | 4200 | 1140 | 2200 | 210 | 3200 | 875 | 2500 | 680 | 2230 | 490 |
| **12** | 3500 | 1140 | 1850 | 210 | 2650 | 875 | 2100 | 680 | 1855 | 490 |
| **16** | 2600 | 1065 | 1400 | 185 | 2000 | 815 | 1600 | 645 | 1390 | 470 |
| **20** | 2050 | 1045 | 1100 | 165 | 1600 | 805 | 1250 | 630 | 1115 | 455 |

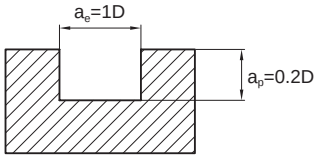
Maximum cutting depth



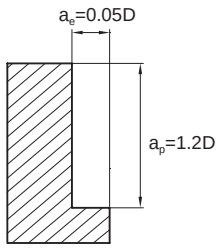
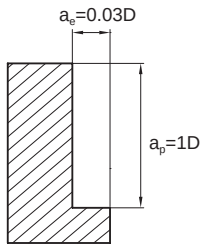




1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for PML/PM series end mills

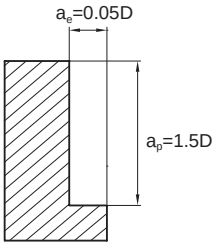
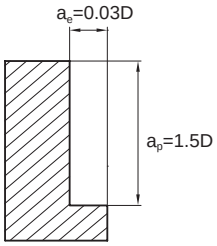
### PML-4EFP★PM-4EFP(high speed side milling)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Carbon steel, Alloy steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~45HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 250 m/min | | 200 m/min | | 150 m/min | | 100 m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 15915 | 2215 | 13260 | 1845 | 10600 | 1475 | 7960 | 1105 | 5300 | 740 |
| **8** | 11935 | 2210 | 9950 | 1820 | 7960 | 1470 | 5970 | 1080 | 3980 | 740 |
| **10** | 9550 | 2160 | 7960 | 1795 | 6370 | 1445 | 4775 | 1080 | 3180 | 715 |
| **12** | 7960 | 2160 | 6630 | 1795 | 5300 | 1445 | 3980 | 1170 | 2650 | 715 |
| **16** | 5970 | 2010 | 4975 | 1680 | 3980 | 1340 | 2985 | 1170 | 1990 | 670 |
| **20** | 4775 | 2010 | 3980 | 1980 | 3180 | 1340 | 2390 | 1105 | 1590 | 670 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | | | | | |   Maximum $a_e$=0.5mm | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or MQL( minimum oil mist cooling).
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for PML/PM series end mills

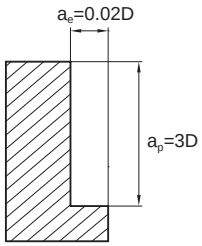
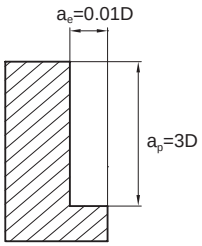
### PML-6E★PM-6E

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 7000 | 1070 | 3700 | 195 | 5300 | 815 | 4200 | 650 | 3710 | 470 |
| **8** | 5200 | 1070 | 2800 | 195 | 4000 | 815 | 3200 | 660 | 2785 | 485 |
| **10** | 4200 | 1035 | 2200 | 195 | 3200 | 800 | 2500 | 630 | 2230 | 450 |
| **12** | 3500 | 1035 | 1850 | 195 | 2650 | 800 | 2100 | 630 | 1855 | 450 |
| **16** | 2600 | 975 | 1400 | 180 | 2000 | 750 | 1600 | 590 | 1390 | 435 |
| **20** | 2050 | 960 | 1100 | 150 | 1600 | 740 | 1250 | 580 | 1115 | 420 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | | | | | |   Maximum $a_e$=0.5mm | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

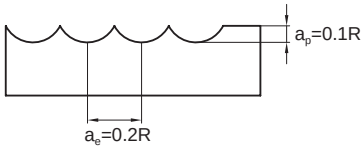
## Cutting parameters for PML/PM series end mills

### PML-6EL★PM-6EL

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 5800 | 900 | 2650 | 140 | 4250 | 655 | 3600 | 555 | 3180 | 490 |
| **8** | 4400 | 900 | 2000 | 140 | 3180 | 655 | 2700 | 560 | 2390 | 495 |
| **10** | 3500 | 875 | 1600 | 140 | 2550 | 635 | 2150 | 530 | 1910 | 470 |
| **12** | 2900 | 875 | 1350 | 140 | 2120 | 635 | 1800 | 530 | 1590 | 470 |
| **16** | 2200 | 825 | 1000 | 125 | 1590 | 600 | 1350 | 500 | 1195 | 445 |
| **20** | 1750 | 810 | 800 | 110 | 1270 | 590 | 1050 | 495 | 955 | 440 |
| Maximum cutting depth |   | | | | | |   | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

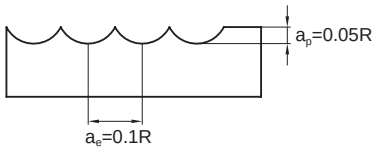
## PML-2B★PM-2B★PML-2BL★PM-2BL PML-2BFP★PM-2BFP(general cutting)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **R0.5** | 40000 | 960 | 22300 | 240 | 32000 | 385 | 25000 | 330 | 22280 | 295 |
| **R1.0** | 24000 | 1080 | 11150 | 275 | 16000 | 480 | 13000 | 330 | 11140 | 295 |
| **R1.5** | 15500 | 1150 | 7400 | 350 | 10600 | 545 | 8500 | 335 | 7430 | 295 |
| **R2.0** | 11500 | 1150 | 5550 | 445 | 8000 | 665 | 6500 | 450 | 5570 | 385 |
| **R2.5** | 9500 | 1270 | 4450 | 445 | 6400 | 665 | 5000 | 455 | 4455 | 405 |
| **R3.0** | 8000 | 1270 | 3700 | 470 | 5300 | 700 | 4200 | 470 | 3715 | 420 |
| **R4.0** | 6000 | 1575 | 2750 | 550 | 4000 | 850 | 3200 | 535 | 2785 | 465 |
| **R5.0** | 4800 | 1455 | 2200 | 520 | 3200 | 785 | 2500 | 535 | 2230 | 465 |
| **R6.0** | 4000 | 1330 | 1850 | 520 | 2650 | 740 | 2100 | 505 | 1855 | 450 |
| **R8.0** | 3000 | 1270 | 1350 | 455 | 2000 | 725 | 1600 | 455 | 1395 | 395 |
| **R10.0** | 2400 | 1150 | 1100 | 445 | 1600 | 675 | 1250 | 400 | 1115 | 360 |
| Maximum cutting depth |   | | | | | | | | | |

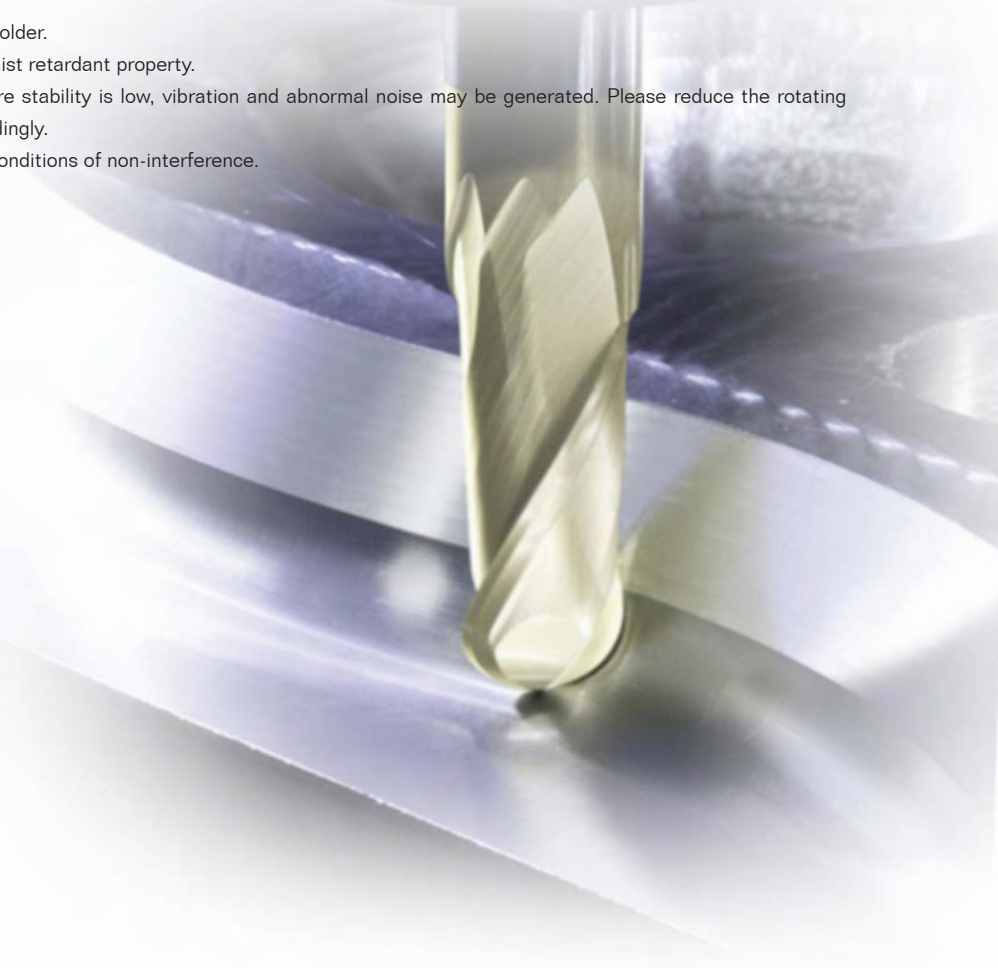
1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
4.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for PML/PM series end mills

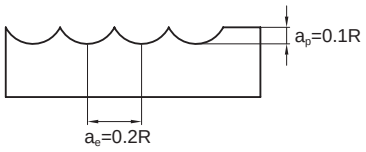
### PML-2B★PM-2B★PML-2BL★PM-2BL PML-2BFP★PM-2BFP(high speed cutting)

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Carbon steel, Alloy steel ~400HRC | | Pre-hardened steel, quenched and tempered steel ~45HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **R3.0** | 15000 | 4800 | 11500 | 2750 | 9500 | 2250 | 7960 | 1885 | 6370 | 1510 |
| **R4.0** | 11500 | 3650 | 8950 | 2100 | 7150 | 1700 | 5970 | 1420 | 4775 | 1135 |
| **R5.0** | 9500 | 3000 | 7150 | 1700 | 5700 | 1350 | 4775 | 1130 | 3820 | 905 |
| **R6.0** | 7950 | 2500 | 5950 | 1400 | 4750 | 1100 | 3980 | 920 | 3180 | 735 |
| **R8.0** | 5950 | 1900 | 4450 | 1050 | 3550 | 850 | 2985 | 760 | 2390 | 610 |
| **R10.0** | 4750 | 1500 | 3550 | 850 | 2850 | 680 | 2390 | 570 | 1910 | 455 |
| Maximum cutting depth |   | | | | | | | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
4.Make overhang of tool as short as possible in conditions of non-interference.



## PML-4B★PM-4B★PML-4BL★PM-4BL

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **R1.5** | 15500 | 2055 | 7400 | 625 | 10600 | 975 | 8500 | 600 | 7430 | 525 |
| **R2.0** | 11500 | 2055 | 5550 | 795 | 8000 | 1190 | 6500 | 800 | 5570 | 685 |
| **R2.5** | 9500 | 2270 | 4450 | 795 | 6400 | 1190 | 5000 | 810 | 4455 | 720 |
| **R3.0** | 8000 | 2270 | 3700 | 840 | 5300 | 1245 | 4200 | 840 | 3715 | 745 |
| **R4.0** | 6000 | 2810 | 2750 | 985 | 4000 | 1515 | 3200 | 950 | 2785 | 825 |
| **R5.0** | 4800 | 2595 | 2200 | 925 | 3200 | 1405 | 2500 | 950 | 2230 | 825 |
| **R6.0** | 4000 | 2375 | 1850 | 925 | 2650 | 1320 | 2100 | 905 | 1855 | 800 |
| **R8.0** | 3000 | 2270 | 1350 | 815 | 2000 | 1295 | 1600 | 810 | 1395 | 705 |
| **R10.0** | 2400 | 2055 | 1100 | 795 | 1600 | 1200 | 1250 | 715 | 1115 | 640 |
| Maximum cutting depth |   | | | | | | | | | |

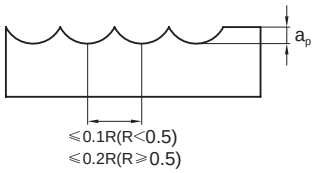
1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
4.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for PML/PM series end mills

### PM-2BC

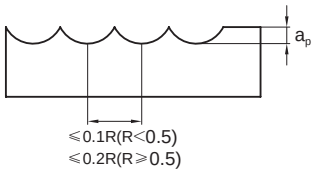
| Workpiece material | | | Pre-hardened steel, quenched and tempered steel ~40HRC | | | Pre-hardened steel, quenched and tempered steel ~50HRC | | | Hardened steel ~55HRC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Taper half angle (°) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) |
| R0.25 | 0.5° | 3 | 30000 | 300 | 0.03 | 30000 | 270 | 0.03 | 30000 | 240 | 0.03 |
| | | 5 | 30000 | 250 | 0.02 | 30000 | 225 | 0.02 | 30000 | 200 | 0.02 |
| | 1.0° | 3 | 30000 | 330 | 0.03 | 30000 | 300 | 0.03 | 30000 | 265 | 0.03 |
| | | 5 | 30000 | 270 | 0.02 | 30000 | 245 | 0.02 | 30000 | 215 | 0.02 |
| | 1.5° | 3 | 30000 | 350 | 0.03 | 30000 | 315 | 0.03 | 30000 | 280 | 0.03 |
| | | 5 | 30000 | 300 | 0.02 | 30000 | 270 | 0.02 | 30000 | 240 | 0.02 |
| R0.30 | 0.5° | 5 | 30000 | 300 | 0.03 | 30000 | 270 | 0.03 | 30000 | 240 | 0.03 |
| | | 8 | 30000 | 250 | 0.02 | 30000 | 225 | 0.02 | 30000 | 200 | 0.02 |
| | 1.0° | 5 | 30000 | 350 | 0.03 | 30000 | 315 | 0.03 | 30000 | 280 | 0.03 |
| | | 8 | 30000 | 300 | 0.02 | 30000 | 270 | 0.02 | 30000 | 240 | 0.02 |
| | | 10 | 30000 | 270 | 0.02 | 30000 | 245 | 0.02 | 30000 | 215 | 0.02 |
| | | 12 | 30000 | 250 | 0.015 | 30000 | 225 | 0.015 | 30000 | 200 | 0.015 |
| | | 15 | 30000 | 250 | 0.01 | 30000 | 225 | 0.01 | 30000 | 200 | 0.01 |
| | 1.5° | 8 | 30000 | 350 | 0.03 | 30000 | 315 | 0.03 | 30000 | 280 | 0.03 |
| | | 15 | 30000 | 300 | 0.01 | 30000 | 270 | 0.01 | 30000 | 240 | 0.01 |
| R0.40 | 0.5° | 8 | 30000 | 350 | 0.05 | 30000 | 315 | 0.05 | 30000 | 280 | 0.05 |
| | | 12 | 30000 | 300 | 0.04 | 30000 | 270 | 0.04 | 30000 | 240 | 0.04 |
| | 1.0° | 8 | 30000 | 400 | 0.05 | 30000 | 360 | 0.05 | 30000 | 320 | 0.05 |
| | | 12 | 30000 | 350 | 0.04 | 30000 | 315 | 0.04 | 30000 | 280 | 0.04 |
| | 1.5° | 8 | 30000 | 450 | 0.05 | 30000 | 405 | 0.05 | 30000 | 360 | 0.05 |
| | | 12 | 30000 | 400 | 0.04 | 30000 | 360 | 0.04 | 30000 | 320 | 0.04 |
| R0.50 | 0.5° | 10 | 22000 | 450 | 0.05 | 22000 | 405 | 0.05 | 22000 | 360 | 0.05 |
| | | 15 | 22000 | 400 | 0.04 | 22000 | 360 | 0.04 | 22000 | 320 | 0.04 |
| | | 20 | 22000 | 370 | 0.03 | 22000 | 335 | 0.03 | 22000 | 295 | 0.03 |
| | | 25 | 22000 | 350 | 0.01 | 22000 | 315 | 0.01 | 22000 | 280 | 0.01 |
| | | 30 | 22000 | 320 | 0.005 | 22000 | 290 | 0.005 | 22000 | 255 | 0.005 |
| | 1.0° | 10 | 22000 | 500 | 0.05 | 22000 | 450 | 0.05 | 22000 | 400 | 0.05 |
| | | 15 | 22000 | 450 | 0.04 | 22000 | 405 | 0.04 | 22000 | 360 | 0.04 |
| | | 20 | 22000 | 430 | 0.02 | 22000 | 390 | 0.02 | 22000 | 345 | 0.02 |
| | | 25 | 22000 | 400 | 0.015 | 22000 | 360 | 0.015 | 22000 | 320 | 0.015 |
| | | 30 | 22000 | 360 | 0.01 | 22000 | 325 | 0.01 | 22000 | 290 | 0.01 |
| | | 35 | 22000 | 320 | 0.005 | 22000 | 290 | 0.005 | 22000 | 255 | 0.005 |

Maximum cutting depth



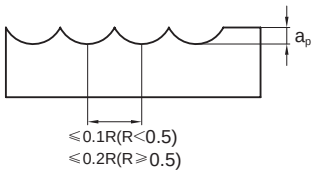
## Cutting parameters for PML/PM series end mills

## PM-2BC

| Workpiece material | | | Pre-hardened steel, quenched and tempered steel ~40HRC | | | Pre-hardened steel, quenched and tempered steel ~50HRC | | | Hardened steel ~55HRC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Taper half angle (°) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) |
| R0.50 | 1.5° | 10 | 22000 | 530 | 0.05 | 22000 | 475 | 0.05 | 22000 | 425 | 0.05 |
| | | 15 | 22000 | 500 | 0.04 | 22000 | 450 | 0.04 | 22000 | 400 | 0.04 |
| | | 20 | 22000 | 460 | 0.02 | 22000 | 415 | 0.02 | 22000 | 370 | 0.02 |
| | 2° | 15 | 22000 | 600 | 0.04 | 22000 | 540 | 0.04 | 22000 | 480 | 0.04 |
| | | 20 | 22000 | 500 | 0.02 | 22000 | 450 | 0.02 | 22000 | 400 | 0.02 |
| | 3° | 20 | 22000 | 550 | 0.03 | 22000 | 495 | 0.03 | 22000 | 440 | 0.03 |
| | 5° | 20 | 22000 | 600 | 0.03 | 22000 | 540 | 0.03 | 22000 | 480 | 0.03 |
| R0.60 | 0.5° | 12 | 22000 | 500 | 0.05 | 22000 | 450 | 0.05 | 22000 | 400 | 0.05 |
| | | 24 | 22000 | 400 | 0.02 | 22000 | 360 | 0.02 | 22000 | 320 | 0.02 |
| | 1.0° | 12 | 22000 | 550 | 0.05 | 22000 | 495 | 0.05 | 22000 | 440 | 0.05 |
| | | 24 | 22000 | 450 | 0.02 | 22000 | 405 | 0.02 | 22000 | 360 | 0.02 |
| | 1.5° | 12 | 22000 | 600 | 0.05 | 22000 | 540 | 0.05 | 22000 | 480 | 0.05 |
| | | 24 | 22000 | 550 | 0.02 | 22000 | 495 | 0.02 | 22000 | 440 | 0.02 |
| R0.75 | 0.5° | 10 | 20000 | 600 | 0.1 | 20000 | 540 | 0.1 | 20000 | 480 | 0.1 |
| | | 15 | 20000 | 550 | 0.08 | 20000 | 495 | 0.08 | 20000 | 440 | 0.08 |
| | | 30 | 20000 | 500 | 0.02 | 20000 | 450 | 0.02 | 20000 | 400 | 0.02 |
| | 1.0° | 10 | 20000 | 650 | 0.1 | 20000 | 585 | 0.1 | 20000 | 520 | 0.1 |
| | | 15 | 20000 | 600 | 0.08 | 20000 | 540 | 0.08 | 20000 | 480 | 0.08 |
| | | 20 | 20000 | 550 | 0.05 | 20000 | 495 | 0.05 | 20000 | 440 | 0.05 |
| | | 30 | 20000 | 530 | 0.02 | 20000 | 480 | 0.02 | 20000 | 425 | 0.02 |
| | 1.5° | 10 | 20000 | 700 | 0.1 | 20000 | 630 | 0.1 | 20000 | 560 | 0.1 |
| | | 15 | 20000 | 650 | 0.08 | 20000 | 585 | 0.08 | 20000 | 520 | 0.08 |
| | | 30 | 20000 | 600 | 0.02 | 20000 | 540 | 0.02 | 20000 | 480 | 0.02 |
| R1.0 | 0.5° | 20 | 18000 | 800 | 0.05 | 18000 | 720 | 0.05 | 18000 | 640 | 0.05 |
| | | 30 | 18000 | 650 | 0.03 | 18000 | 585 | 0.03 | 18000 | 520 | 0.03 |
| | | 40 | 18000 | 500 | 0.02 | 18000 | 450 | 0.02 | 18000 | 400 | 0.02 |
| | 1.0° | 20 | 18000 | 900 | 0.05 | 18000 | 810 | 0.05 | 18000 | 720 | 0.05 |
| | | 25 | 18000 | 850 | 0.04 | 18000 | 765 | 0.04 | 18000 | 680 | 0.04 |
| | | 30 | 18000 | 800 | 0.03 | 18000 | 720 | 0.03 | 18000 | 640 | 0.03 |
| | | 35 | 18000 | 750 | 0.03 | 18000 | 675 | 0.03 | 18000 | 600 | 0.03 |
| | | 40 | 18000 | 600 | 0.02 | 18000 | 540 | 0.02 | 18000 | 480 | 0.02 |
| | | 50 | 18000 | 550 | 0.02 | 18000 | 495 | 0.02 | 18000 | 440 | 0.02 |
| Maximum cutting depth | | |   | | | | | | | | |

## Cutting parameters for PML/PM series end mills

### PM-2BC

| Workpiece material | | | Pre-hardened steel, quenched and tempered steel ~40HRC | | | Pre-hardened steel, quenched and tempered steel ~50HRC | | | Hardened steel ~55HRC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Taper half angle (°) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) |
| R1.0 | 1.5° | 20 | 18000 | 1000 | 0.05 | 18000 | 900 | 0.05 | 18000 | 800 | 0.05 |
| | | 30 | 18000 | 900 | 0.03 | 18000 | 810 | 0.03 | 18000 | 720 | 0.03 |
| | | 40 | 18000 | 750 | 0.03 | 18000 | 675 | 0.03 | 18000 | 600 | 0.03 |
| | 2° | 30 | 18000 | 900 | 0.04 | 18000 | 810 | 0.04 | 18000 | 720 | 0.04 |
| | | 40 | 18000 | 850 | 0.03 | 18000 | 765 | 0.03 | 18000 | 680 | 0.03 |
| | 3° | 30 | 18000 | 1000 | 0.04 | 18000 | 900 | 0.04 | 18000 | 800 | 0.04 |
| | | 40 | 18000 | 900 | 0.03 | 18000 | 810 | 0.03 | 18000 | 720 | 0.03 |
| R1.5 | 0.5° | 30 | 16000 | 1100 | 0.1 | 16000 | 990 | 0.1 | 16000 | 880 | 0.1 |
| | | 40 | 16000 | 950 | 0.06 | 16000 | 855 | 0.06 | 16000 | 760 | 0.06 |
| | | 50 | 16000 | 800 | 0.03 | 16000 | 720 | 0.03 | 16000 | 640 | 0.03 |
| | 1.0° | 30 | 16000 | 1200 | 0.1 | 16000 | 1080 | 0.1 | 16000 | 960 | 0.1 |
| | | 40 | 16000 | 1000 | 0.06 | 16000 | 900 | 0.06 | 16000 | 800 | 0.06 |
| | | 50 | 16000 | 850 | 0.03 | 16000 | 765 | 0.03 | 16000 | 680 | 0.03 |
| R1.5 | 1.5° | 30 | 16000 | 1300 | 0.1 | 16000 | 1170 | 0.1 | 16000 | 1040 | 0.1 |
| | | 40 | 16000 | 1100 | 0.06 | 16000 | 990 | 0.06 | 16000 | 880 | 0.06 |
| | | 50 | 16000 | 950 | 0.03 | 16000 | 855 | 0.03 | 16000 | 760 | 0.03 |
| R2.0 | 0.5° | 60 | 14000 | 1100 | 0.1 | 14000 | 990 | 0.1 | 14000 | 880 | 0.1 |
| | 1.0° | 60 | 14000 | 1100 | 0.1 | 14000 | 990 | 0.1 | 14000 | 880 | 0.1 |
| Maximum cutting depth | | |   | | | | | | | | |

1.Please select high-precision machine and tool holder. When vibration and abnormal noise occur during machining, please reduce axial cutting depth ap.

2.Please use air blow or cutting liquid with high mist retardant property.

3.Reduce feed speed correspondingly when rotating speed is low.

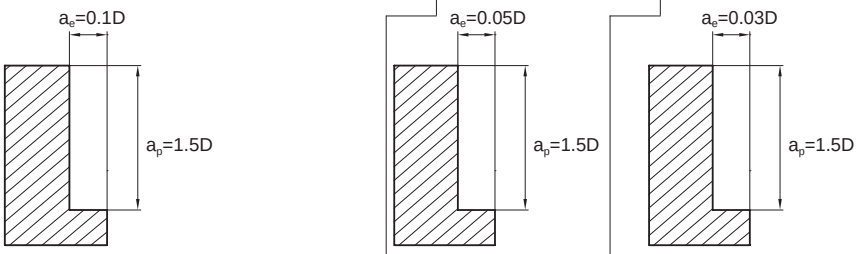
4.Because machining conditions such as machine and allowance for machining may vary, please adjust the parameters based on actual requirements.

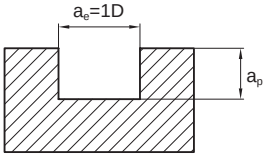
## Cutting parameters for PML/PM series end mills

## PML-2R★PM-2R

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 240 | 20000 | 75 | 20000 | 195 | 20000 | 145 | 20000 | 95 |
| **2** | 15000 | 385 | 11150 | 100 | 15000 | 335 | 13000 | 215 | 11140 | 130 |
| **3** | 14000 | 655 | 7500 | 145 | 10600 | 505 | 8500 | 395 | 7430 | 245 |
| **4** | 10800 | 675 | 5500 | 155 | 8000 | 515 | 6500 | 405 | 5570 | 245 |
| **5** | 8200 | 695 | 4500 | 155 | 6400 | 540 | 5000 | 425 | 4460 | 260 |
| **6** | 7000 | 720 | 3700 | 170 | 5300 | 555 | 4200 | 435 | 3710 | 260 |
| **8** | 5200 | 720 | 2800 | 170 | 4000 | 555 | 3200 | 440 | 2785 | 275 |
| **10** | 4200 | 695 | 2200 | 170 | 3200 | 535 | 2500 | 420 | 2230 | 255 |
| **12** | 3500 | 695 | 1850 | 170 | 2650 | 535 | 2100 | 420 | 1855 | 255 |

Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

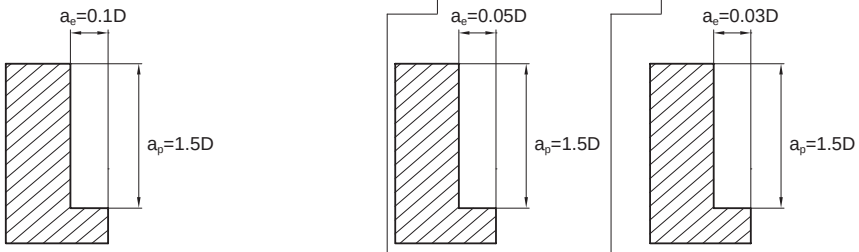
1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

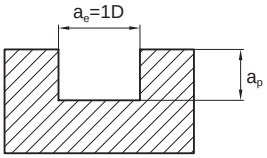
## Cutting parameters for PML/PM series end mills

### PML-4R★PML-4R-H★PM-4R★PM-4R-H★PML-4RFP★PM-4RFP

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Pre-hardened steel, quenched and tempered steel ~50HRC | | Hardened steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **3** | 14000 | 985 | 7500 | 175 | 10600 | 755 | 8500 | 590 | 7430 | 435 |
| **4** | 10800 | 1010 | 5500 | 175 | 8000 | 770 | 6500 | 600 | 5570 | 445 |
| **5** | 8200 | 1055 | 4500 | 175 | 6400 | 805 | 5000 | 640 | 4460 | 470 |
| **6** | 7000 | 1080 | 3700 | 195 | 5300 | 830 | 4200 | 650 | 3710 | 470 |
| **8** | 5200 | 1070 | 2800 | 195 | 4000 | 815 | 3200 | 660 | 2785 | 485 |
| **10** | 4200 | 1055 | 2200 | 195 | 3200 | 805 | 2500 | 625 | 2230 | 450 |
| **12** | 3500 | 1055 | 1850 | 195 | 2650 | 805 | 2100 | 625 | 1855 | 450 |
| **16** | 2600 | 985 | 1400 | 175 | 2000 | 755 | 1600 | 590 | 1390 | 435 |

Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D<Ø6 | 0.3D |
| Ø6⩽D<Ø20 | 0.5D |

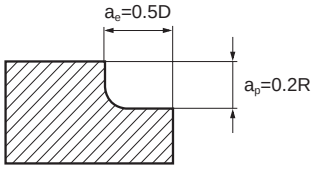
| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.1D |
| Ø3⩽D | 0.2D |

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

## PM-4H★PM-4HL

Standard:

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Quenched and tempered steel ~40HRC | | Quenched and tempered steel ~45HRC | | Quenched and tempered steel ~50HRC | | Quenched and tempered steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter× Corner radius | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **3.0×R0.8** | 10500 | 6250 | 8500 | 4500 | 7450 | 3900 | 5300 | 2600 | 3200 | 995 |
| **4.0×R1.0** | 7950 | 6600 | 6350 | 4800 | 5550 | 4200 | 4000 | 2750 | 2400 | 1050 |
| **5.0×R1.2** | 6350 | 7000 | 5100 | 5100 | 4450 | 4450 | 3200 | 2850 | 1900 | 1150 |
| **6.0×R1.0**<br>**6.0×R1.5** | 5300 | 7000 | 4250 | 5100 | 3700 | 4450 | 2650 | 2850 | 1600 | 1150 |
| **8.0×R1.0**<br>**8.0×R2.0** | 4550 | 7000 | 3200 | 5100 | 2800 | 4450 | 2000 | 2850 | 1200 | 1150 |
| **10.0×R1.0**<br>**10.0×R2.0** | 3200 | 7000 | 2550 | 5100 | 2250 | 4450 | 1600 | 2850 | 955 | 1150 |
| **12.0×R2.0**<br>**12.0×R3.0** | 2650 | 7000 | 2100 | 5100 | 1850 | 4450 | 1350 | 2850 | 795 | 1150 |
| Maximum cutting depth | Maximum $a_p$=0.5mm | | | | | | Maximum $a_p$=0.4mm | | Maximum $a_p$=0.2mm | |




1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.
6.The above cutting parameters are based on contour machining when overhang L/D≤4. Please make adjustments according to the table below when overhang is different.

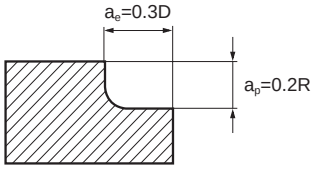
Different cutting parameters under different overhang of tool:

| Overhang | Cutting speed(m/min) | Axial cutting depth (mm) | Feed speed (mm/min) |
|---|---|---|---|
| L/D⩽4 | 100% | 100% | 100% |
| L/D=5 | 80%~90% | 70%~90% | 80%~90% |
| L/D=6 | 60%~80% | 50%~70% | 60%~80% |

## PM-4H★PM-4HL

High speed:

| Workpiece material | Cast iron, Carbon steel, Alloy steel ~30HRC | | Quenched and tempered steel ~40HRC | | Quenched and tempered steel ~45HRC | | Quenched and tempered steel ~50HRC | | Quenched and tempered steel ~55HRC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter× Corner radius | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **3.0×R0.8** | 21000 | 12500 | 21000 | 12000 | 16000 | 8400 | 16000 | 7850 | 10500 | 3300 |
| **4.0×R1.0** | 16000 | 13000 | 16000 | 12000 | 12000 | 9000 | 12000 | 8200 | 7950 | 3550 |
| **5.0×R1.2** | 12500 | 14000 | 12500 | 12500 | 9550 | 9550 | 9550 | 8600 | 6350 | 3800 |
| **6.0×R1.0**<br>**6.0×R1.5** | 10600 | 14000 | 10600 | 12700 | 7950 | 9550 | 7950 | 8600 | 5300 | 3800 |
| **8.0×R1.0**<br>**8.0×R2.0** | 7950 | 14000 | 7950 | 12700 | 5950 | 9550 | 5950 | 8600 | 4000 | 3800 |
| **10.0×R1.0**<br>**10.0×R2.0** | 6350 | 14000 | 6350 | 12700 | 4750 | 9550 | 4750 | 8600 | 3200 | 3800 |
| **12.0×R2.0**<br>**12.0×R3.0** | 5300 | 14000 | 5300 | 12700 | 4000 | 9550 | 4000 | 8600 | 2650 | 3800 |
| Maximum cutting depth | Maximum $a_p$=0.4mm | | | | | | Maximum $a_p$=0.2mm | | Maximum $a_p$=0.1mm | |




1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.
6.The above cutting parameters are based on contour machining when overhang L/D≤4. Please make adjustments according to the table below when overhang is different.

Different cutting parameters under different overhang of tool:

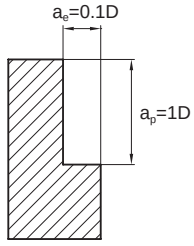
| Ratio of neck length to diameter | Cutting speed(m/min) | Axial cutting depth(mm) | Feed speed (mm/min) |
|---|---|---|---|
| L/D⩽4 | 100% | 100% | 100% |
| L/D=5 | 60%~80% | 60%~80% | 60%~80% |
| L/D=6 | 40%~60% | 40%~60% | 40%~60% |

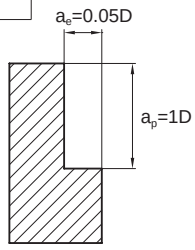
## Cutting parameters for GM series end mills

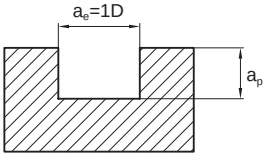
### GM-2E★GM-2EL

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm² | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 165 | 20000 | 165 | 20000 | 135 | 20000 | 135 | 20000 | 50 | 20000 | 100 |
| **2** | 15000 | 265 | 15000 | 265 | 15000 | 240 | 15000 | 235 | 11150 | 70 | 13000 | 150 |
| **3** | 14000 | 455 | 14000 | 455 | 13000 | 420 | 10600 | 350 | 7500 | 100 | 8500 | 275 |
| **4** | 10800 | 465 | 10800 | 465 | 10000 | 430 | 8000 | 355 | 5500 | 110 | 6500 | 280 |
| **5** | 8200 | 485 | 8200 | 485 | 7600 | 450 | 6400 | 370 | 4500 | 110 | 5000 | 295 |
| **6** | 7000 | 500 | 7000 | 500 | 6400 | 460 | 5300 | 385 | 3700 | 115 | 4200 | 300 |
| **8** | 5200 | 495 | 5200 | 495 | 4800 | 455 | 4000 | 380 | 2800 | 115 | 3200 | 305 |
| **10** | 4200 | 485 | 4200 | 485 | 3800 | 450 | 3200 | 370 | 2200 | 115 | 2500 | 290 |
| **12** | 3500 | 485 | 3500 | 485 | 3200 | 450 | 2650 | 370 | 1850 | 115 | 2100 | 290 |
| **14** | 3000 | 455 | 3000 | 455 | 2700 | 420 | 2300 | 350 | 1600 | 110 | 1800 | 275 |
| **16** | 2600 | 455 | 2600 | 455 | 2400 | 420 | 2000 | 350 | 1400 | 100 | 1600 | 275 |
| **18** | 2300 | 445 | 2300 | 445 | 2100 | 410 | 1800 | 345 | 1250 | 100 | 1400 | 270 |
| **20** | 2050 | 445 | 2050 | 445 | 1900 | 410 | 1600 | 345 | 1100 | 100 | 1250 | 270 |

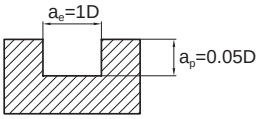
Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D | 0.3D |



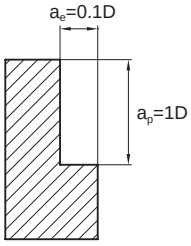

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

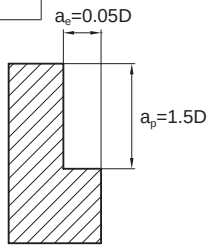
## Cutting parameters for GM series end mills

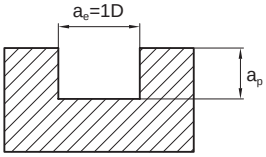
### GM-3E★GM-3EL

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm² | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 215 | 20000 | 215 | 20000 | 175 | 20000 | 175 | 20000 | 65 | 20000 | 130 |
| **2** | 15000 | 345 | 15000 | 345 | 15000 | 310 | 15000 | 305 | 11150 | 90 | 13000 | 195 |
| **3** | 14000 | 590 | 14000 | 590 | 13000 | 546 | 10600 | 455 | 7500 | 130 | 8500 | 360 |
| **4** | 10800 | 600 | 10800 | 605 | 10000 | 560 | 8000 | 460 | 5500 | 145 | 6500 | 365 |
| **5** | 8200 | 630 | 8200 | 630 | 7600 | 585 | 6400 | 480 | 4500 | 145 | 5000 | 380 |
| **6** | 7000 | 650 | 7000 | 650 | 6400 | 600 | 5300 | 500 | 3700 | 150 | 4200 | 390 |
| **8** | 5200 | 645 | 5200 | 645 | 4800 | 590 | 4000 | 495 | 2800 | 150 | 3200 | 400 |
| **10** | 4200 | 630 | 4200 | 630 | 3800 | 585 | 3200 | 480 | 2200 | 150 | 2500 | 380 |
| **12** | 3500 | 630 | 3500 | 630 | 3200 | 585 | 2650 | 480 | 1850 | 150 | 2100 | 380 |
| **14** | 3000 | 590 | 3000 | 590 | 2700 | 545 | 2300 | 455 | 1600 | 145 | 1800 | 360 |
| **16** | 2600 | 590 | 2600 | 590 | 2400 | 545 | 2000 | 455 | 1400 | 130 | 1600 | 360 |
| **18** | 2300 | 580 | 2300 | 580 | 2100 | 530 | 1800 | 450 | 1250 | 130 | 1400 | 350 |
| **20** | 2050 | 580 | 2050 | 580 | 1900 | 530 | 1600 | 450 | 1100 | 130 | 1250 | 350 |

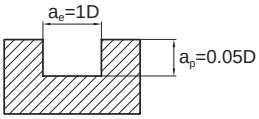
Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D | 0.3D |

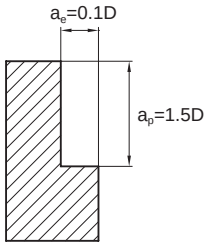


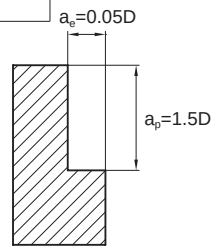

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

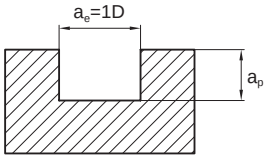
## GM-4E-G★GM-4EL-G

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 225 | 20000 | 225 | 20000 | 180 | 20000 | 180 | 20000 | 80 | 20000 | 135 |
| **2** | 15000 | 360 | 15000 | 360 | 15000 | 325 | 15000 | 315 | 11150 | 90 | 13000 | 200 |
| **3** | 14000 | 610 | 14000 | 610 | 13000 | 570 | 10600 | 470 | 7500 | 110 | 8500 | 370 |
| **4** | 10800 | 630 | 10800 | 630 | 10000 | 575 | 8000 | 480 | 5500 | 115 | 6500 | 380 |
| **5** | 8200 | 660 | 8200 | 660 | 7600 | 600 | 6400 | 505 | 4500 | 115 | 5000 | 400 |
| **6** | 7000 | 675 | 7000 | 675 | 6400 | 620 | 5300 | 515 | 3700 | 120 | 4200 | 405 |
| **8** | 5200 | 665 | 5200 | 665 | 4800 | 610 | 4000 | 510 | 2800 | 120 | 3200 | 415 |
| **10** | 4200 | 660 | 4200 | 660 | 3800 | 600 | 3200 | 505 | 2200 | 120 | 2500 | 390 |
| **12** | 3500 | 660 | 3500 | 660 | 3200 | 600 | 2650 | 505 | 1850 | 120 | 2100 | 390 |
| **14** | 3000 | 610 | 3000 | 610 | 2700 | 570 | 2300 | 470 | 1600 | 115 | 1800 | 370 |
| **16** | 2600 | 610 | 2600 | 610 | 2400 | 570 | 2000 | 470 | 1400 | 110 | 1600 | 370 |
| **18** | 2300 | 600 | 2300 | 600 | 2100 | 560 | 1800 | 460 | 1250 | 95 | 1400 | 365 |
| **20** | 2050 | 600 | 2050 | 600 | 1900 | 560 | 1600 | 460 | 1100 | 95 | 1250 | 365 |

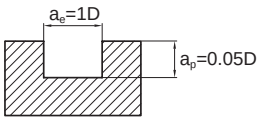
Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D | 0.3D |



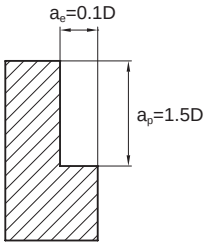

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

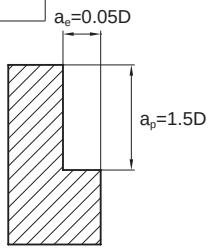
## Cutting parameters for GM series end mills

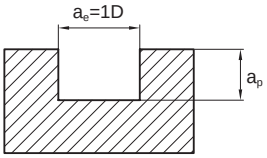
### GM-4E★GM-4EL

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm² | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 250 | 20000 | 250 | 20000 | 200 | 20000 | 200 | 20000 | 90 | 20000 | 150 |
| **2** | 15000 | 400 | 15000 | 400 | 15000 | 360 | 15000 | 350 | 11150 | 100 | 13000 | 225 |
| **3** | 14000 | 680 | 14000 | 680 | 13000 | 630 | 10600 | 525 | 7500 | 120 | 8500 | 410 |
| **4** | 10800 | 700 | 10800 | 700 | 10000 | 640 | 8000 | 535 | 5500 | 125 | 6500 | 420 |
| **5** | 8200 | 730 | 8200 | 730 | 7600 | 670 | 6400 | 560 | 4500 | 125 | 5000 | 440 |
| **6** | 7000 | 750 | 7000 | 750 | 6400 | 690 | 5300 | 575 | 3700 | 135 | 4200 | 450 |
| **8** | 5200 | 740 | 5200 | 740 | 4800 | 680 | 4000 | 565 | 2800 | 135 | 3200 | 460 |
| **10** | 4200 | 730 | 4200 | 730 | 3800 | 670 | 3200 | 560 | 2200 | 135 | 2500 | 435 |
| **12** | 3500 | 730 | 3500 | 730 | 3200 | 670 | 2650 | 560 | 1850 | 135 | 2100 | 435 |
| **14** | 3000 | 680 | 3000 | 680 | 2700 | 630 | 2300 | 525 | 1600 | 125 | 1800 | 410 |
| **16** | 2600 | 680 | 2600 | 680 | 2400 | 630 | 2000 | 525 | 1400 | 120 | 1600 | 410 |
| **18** | 2300 | 670 | 2300 | 670 | 2100 | 620 | 1800 | 515 | 1250 | 105 | 1400 | 405 |
| **20** | 2050 | 670 | 2050 | 670 | 1900 | 620 | 1600 | 515 | 1100 | 105 | 1250 | 405 |

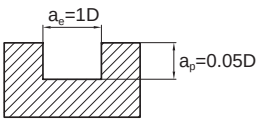
Maximum cutting depth



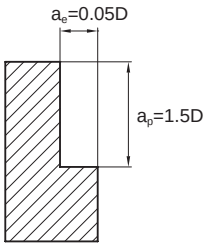

| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D | 0.3D |




1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for GM series end mills

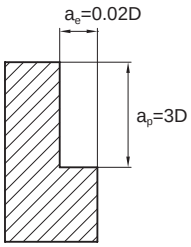
## GM-6E

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **6** | 7000 | 890 | 7000 | 890 | 6400 | 820 | 5300 | 680 | 3700 | 160 | 4200 | 540 |
| **8** | 5200 | 890 | 5200 | 890 | 4800 | 820 | 4000 | 680 | 2800 | 160 | 3200 | 550 |
| **10** | 4200 | 860 | 4200 | 860 | 3800 | 800 | 3200 | 665 | 2200 | 160 | 2500 | 520 |
| **12** | 3500 | 860 | 3500 | 860 | 3200 | 800 | 2650 | 665 | 1850 | 160 | 2100 | 520 |
| **14** | 3000 | 810 | 3000 | 810 | 2700 | 750 | 2300 | 625 | 1600 | 150 | 1800 | 490 |
| **16** | 2600 | 810 | 2600 | 810 | 2400 | 750 | 2000 | 625 | 1400 | 150 | 1600 | 490 |
| **18** | 2300 | 800 | 2300 | 800 | 2100 | 740 | 1800 | 615 | 1250 | 125 | 1400 | 485 |
| **20** | 2050 | 800 | 2050 | 800 | 1900 | 740 | 1600 | 615 | 1100 | 125 | 1250 | 485 |
| Maximum cutting depth |   | | | | | | | | | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for GM series end mills

### GM-6EL

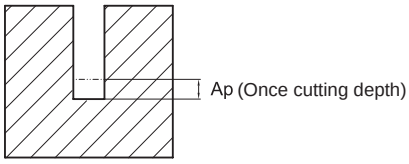
| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **6** | 5800 | 750 | 5800 | 750 | 5300 | 685 | 4250 | 545 | 2650 | 115 | 3600 | 460 |
| **8** | 4400 | 750 | 4400 | 750 | 4000 | 685 | 3180 | 545 | 2000 | 115 | 2700 | 465 |
| **10** | 3500 | 730 | 3500 | 730 | 3200 | 665 | 2550 | 530 | 1600 | 115 | 2150 | 440 |
| **12** | 2900 | 730 | 2900 | 730 | 2650 | 665 | 2120 | 530 | 1350 | 115 | 1800 | 440 |
| **14** | 2500 | 685 | 2500 | 685 | 2300 | 625 | 1820 | 500 | 1150 | 105 | 1550 | 415 |
| **16** | 2200 | 685 | 2200 | 685 | 2000 | 625 | 1590 | 500 | 1000 | 105 | 1350 | 415 |
| **18** | 1950 | 675 | 1950 | 675 | 1800 | 615 | 1420 | 490 | 900 | 90 | 1200 | 410 |
| **20** | 1750 | 675 | 1750 | 675 | 1600 | 615 | 1270 | 490 | 800 | 90 | 1050 | 410 |
| Maximum cutting depth |   | | | | | | | | | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

## GM-2EP

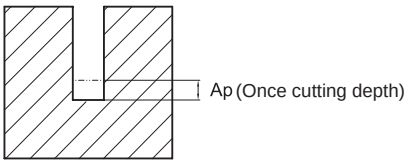
| Workpiece material | | Cast iron, Carbon steel, Alloy steel ~750N/mm$^2$ | | | Carbon steel, Alloy steel ~30HRC | | | Pre-hardened steel, quenched and tempered steel ~40HRC | | | Stainless steel | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Effective length (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) |
| 0.5 | 4 | 28000 | 500 | 0.023 | 28000 | 400 | 0.021 | 28000 | 250 | 0.018 | 25000 | 200 | 0.014 |
| | 6 | 22000 | 400 | 0.007 | 22000 | 350 | 0.06 | 22000 | 150 | 0.005 | 20000 | 150 | 0.004 |
| | 8 | 18000 | 300 | 0.005 | 18000 | 300 | 0.005 | 18000 | 150 | 0.004 | 20000 | 150 | 0.003 |
| 0.8 | 4 | 32000 | 900 | 0.057 | 32000 | 600 | 0.053 | 32000 | 600 | 0.044 | 25000 | 400 | 0.035 |
| | 6 | 26000 | 700 | 0.036 | 26000 | 450 | 0.034 | 26000 | 400 | 0.028 | 21000 | 300 | 0.022 |
| | 8 | 22000 | 500 | 0.026 | 22000 | 350 | 0.024 | 22000 | 300 | 0.02 | 18000 | 200 | 0.016 |
| | 10 | 22000 | 500 | 0.01 | 22000 | 350 | 0.01 | 22000 | 300 | 0.008 | 18000 | 200 | 0.006 |
| 1.0 | 4 | 2900 | 1300 | 0.08 | 27000 | 1000 | 0.08 | 26000 | 900 | 0.07 | 20000 | 600 | 0.05 |
| | 6 | 29000 | 1300 | 0.07 | 27000 | 1000 | 0.07 | 26000 | 900 | 0.06 | 20000 | 600 | 0.04 |
| | 8 | 24000 | 900 | 0.05 | 23000 | 800 | 0.04 | 22000 | 700 | 0.04 | 18000 | 400 | 0.03 |
| | 10 | 20000 | 700 | 0.03 | 19000 | 600 | 0.03 | 18000 | 500 | 0.03 | 15000 | 300 | 0.02 |
| | 12 | 20000 | 700 | 0.02 | 19000 | 600 | 0.02 | 18000 | 500 | 0.02 | 15000 | 300 | 0.01 |
| | 14 | 18000 | 500 | 0.015 | 15000 | 400 | 0.01 | 15000 | 360 | 0.01 | 12000 | 200 | 0.008 |
| 1.2 | 6 | 25000 | 1100 | 0.09 | 23000 | 1000 | 0.08 | 22000 | 900 | 0.07 | 17000 | 600 | 0.05 |
| | 8 | 21000 | 900 | 0.07 | 20000 | 700 | 0.07 | 19000 | 700 | 0.05 | 14000 | 400 | 0.04 |
| | 10 | 21000 | 900 | 0.06 | 20000 | 700 | 0.05 | 19000 | 700 | 0.04 | 14000 | 400 | 0.03 |
| | 12 | 18000 | 700 | 0.04 | 17000 | 600 | 0.04 | 16000 | 500 | 0.03 | 11000 | 300 | 0.02 |
| 1.5 | 6 | 20000 | 1200 | 0.15 | 18000 | 1000 | 0.14 | 18000 | 900 | 0.11 | 14000 | 600 | 0.09 |
| | 8 | 19000 | 900 | 0.11 | 16000 | 800 | 0.1 | 15000 | 700 | 0.08 | 12000 | 400 | 0.07 |
| | 10 | 19000 | 900 | 0.09 | 16000 | 800 | 0.08 | 15000 | 700 | 0.06 | 12000 | 400 | 0.05 |
| | 12 | 19000 | 900 | 0.07 | 16000 | 800 | 0.06 | 15000 | 700 | 0.05 | 12000 | 400 | 0.04 |
| | 14 | 19000 | 700 | 0.06 | 16000 | 650 | 0.05 | 15000 | 630 | 0.04 | 12000 | 360 | 0.03 |
| 2.0 | 6 | 16000 | 1300 | 0.34 | 15000 | 1100 | 0.31 | 14000 | 1000 | 0.26 | 11000 | 700 | 0.21 |
| | 8 | 16000 | 1300 | 0.29 | 15000 | 1100 | 0.26 | 14000 | 1000 | 0.22 | 11000 | 700 | 0.18 |
| | 10 | 14000 | 900 | 0.26 | 1300 | 800 | 0.24 | 12000 | 700 | 0.20 | 9000 | 500 | 0.16 |
| | 12 | 14000 | 900 | 0.14 | 13000 | 800 | 0.13 | 12000 | 700 | 0.11 | 9000 | 500 | 0.09 |
| | 14 | 14000 | 900 | 0.10 | 13000 | 800 | 0.11 | 12000 | 700 | 0.09 | 9000 | 500 | 0.07 |
| | 16 | 14000 | 900 | 0.08 | 13000 | 800 | 0.08 | 12000 | 700 | 0.07 | 9000 | 500 | 0.06 |

Maximum cutting depth



## Cutting parameters for GM series end mills

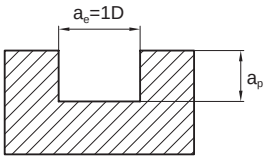
### GM-2EP

| Workpiece material | | Cast iron, Carbon steel, Alloy steel ~750N/mm² | | | Carbon steel, Alloy steel ~30HRC | | | Pre-hardened steel, quenched and tempered steel ~40HRC | | | Stainless steel | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) |
| 2.5 | 8 | 13000 | 1300 | 0.42 | 12000 | 1100 | 0.39 | 11000 | 1000 | 0.33 | 9000 | 700 | 0.26 |
| | 10 | 13000 | 1300 | 0.36 | 12000 | 1100 | 0.33 | 11000 | 1000 | 0.28 | 9000 | 700 | 0.22 |
| | 12 | 13000 | 1300 | 0.24 | 12000 | 1100 | 0.23 | 11000 | 1000 | 0.19 | 9000 | 700 | 0.15 |
| | 14 | 12000 | 900 | 0.18 | 10000 | 800 | 0.17 | 9000 | 700 | 0.14 | 7000 | 500 | 0.11 |
| | 16 | 12000 | 900 | 0.13 | 10000 | 800 | 0.12 | 9000 | 700 | 0.09 | 7000 | 500 | 0.08 |
| | 18 | 12000 | 800 | 0.11 | 10000 | 720 | 0.10 | 9000 | 630 | 0.07 | 7000 | 450 | 0.07 |
| | 20 | 12000 | 800 | 0.09 | 10000 | 720 | 0.08 | 9000 | 630 | 0.05 | 7000 | 450 | 0.05 |
| 3.0 | 6 | 11000 | 1300 | 0.42 | 10000 | 1100 | 0.39 | 10000 | 1000 | 0.32 | 8000 | 700 | 0.27 |
| | 8 | 11000 | 1300 | 0.39 | 10000 | 1100 | 0.36 | 10000 | 1000 | 0.30 | 8000 | 700 | 0.24 |
| | 10 | 11000 | 1300 | 0.31 | 10000 | 1100 | 0.29 | 10000 | 1000 | 0.24 | 8000 | 700 | 0.19 |
| | 12 | 11000 | 1100 | 0.29 | 10000 | 1000 | 0.27 | 10000 | 900 | 0.22 | 8000 | 650 | 0.16 |
| | 14 | 11000 | 1100 | 0.27 | 10000 | 1000 | 0.25 | 10000 | 900 | 0.20 | 8000 | 650 | 0.15 |
| | 16 | 10000 | 850 | 0.22 | 10000 | 750 | 0.20 | 9000 | 650 | 0.17 | 6000 | 450 | 0.13 |
| | 18 | 10000 | 850 | 0.16 | 10000 | 750 | 0.14 | 9000 | 650 | 0.12 | 6000 | 450 | 0.10 |
| | 20 | 10000 | 850 | 0.12 | 10000 | 750 | 0.10 | 9000 | 650 | 0.08 | 6000 | 450 | 0.07 |
| 4.0 | 12 | 8000 | 1300 | 0.42 | 7000 | 1100 | 0.38 | 7000 | 1000 | 0.32 | 6000 | 700 | 0.26 |
| | 16 | 8000 | 1100 | 0.39 | 7000 | 1000 | 0.35 | 7000 | 900 | 0.30 | 6000 | 650 | 0.24 |
| | 20 | 7000 | 900 | 0.34 | 7000 | 800 | 0.30 | 6000 | 700 | 0.27 | 5000 | 500 | 0.20 |
| | 25 | 7000 | 900 | 0.30 | 7000 | 800 | 0.27 | 6000 | 700 | 0.24 | 5000 | 500 | 0.15 |
| 5.0 | 16 | 6000 | 1200 | 0.49 | 6000 | 1000 | 0.45 | 5000 | 1000 | 0.38 | 5000 | 600 | 0.30 |
| | 25 | 5000 | 800 | 0.45 | 5000 | 720 | 0.42 | 5000 | 700 | 0.35 | 5000 | 600 | 0.25 |
| Maximum cutting depth | |   | | | | | | | | | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Make overhang of tool as short as possible in conditions of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

## GM-2ES

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **0.3** | 32000 | 115 | 32000 | 115 | 32000 | 115 | 32000 | 80 | 32000 | 40 |
| **0.4** | 32000 | 125 | 32000 | 125 | 32000 | 125 | 32000 | 90 | 27500 | 50 |
| **0.5** | 32000 | 125 | 32000 | 125 | 29500 | 125 | 25000 | 90 | 22000 | 50 |
| **0.6** | 32000 | 125 | 32000 | 125 | 24500 | 125 | 21000 | 90 | 18500 | 50 |
| **0.7** | 32000 | 125 | 32000 | 125 | 24500 | 125 | 21000 | 90 | 18500 | 50 |
| **0.8** | 24500 | 125 | 24500 | 125 | 18500 | 125 | 15500 | 90 | 13500 | 50 |
| **0.9** | 24500 | 125 | 24500 | 125 | 18500 | 125 | 15500 | 90 | 13500 | 50 |
| **1.0** | 21000 | 140 | 25000 | 165 | 16800 | 130 | 14500 | 90 | 10000 | 50 |
| **1.5** | 13000 | 140 | 15000 | 165 | 11800 | 130 | 10000 | 90 | 7000 | 50 |
| **2.0** | 13000 | 160 | 15000 | 185 | 11800 | 145 | 10000 | 100 | 7000 | 60 |
| **2.5** | 8700 | 200 | 10000 | 240 | 8200 | 185 | 6600 | 100 | 4700 | 60 |
| **3.0** | 8700 | 235 | 10000 | 270 | 8200 | 220 | 6600 | 100 | 4700 | 75 |
| Maximum cutting depth | | | | | | | | | | |

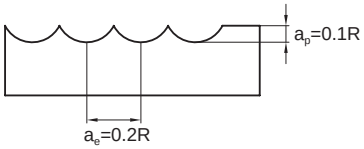
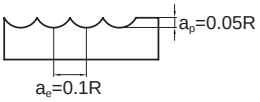



| Diameter range | Cutting depth $a_p$ |
|---|---|
| D<Ø1 | 0.05D |
| Ø1⩽D⩽Ø3 | 0.15D |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
4.Make overhang of tool as short as possible in conditions of non-interference.

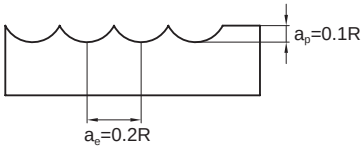
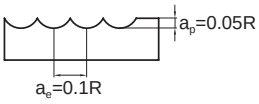
## Cutting parameters for GM series end mills

### GM-2B★GM-2BL

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **R0.5** | 40000 | 800 | 40000 | 800 | 38000 | 700 | 32000 | 320 | 22300 | 200 | 25000 | 275 |
| **R1.0** | 24000 | 900 | 24000 | 900 | 19000 | 760 | 16000 | 400 | 11150 | 230 | 13000 | 275 |
| **R1.5** | 15500 | 950 | 15500 | 950 | 12750 | 760 | 10600 | 450 | 7400 | 290 | 8500 | 280 |
| **R2.0** | 11500 | 950 | 11500 | 950 | 9550 | 760 | 8000 | 550 | 5550 | 370 | 6500 | 370 |
| **R2.5** | 9500 | 1050 | 9500 | 1050 | 7650 | 800 | 6400 | 550 | 4450 | 370 | 5000 | 375 |
| **R3.0** | 8000 | 1050 | 8000 | 1050 | 6400 | 800 | 5300 | 580 | 3700 | 390 | 4200 | 390 |
| **R4.0** | 6000 | 1300 | 6000 | 1300 | 4800 | 950 | 4000 | 700 | 2750 | 455 | 3200 | 440 |
| **R5.0** | 4800 | 1200 | 4800 | 1200 | 3800 | 900 | 3200 | 650 | 2200 | 430 | 2500 | 440 |
| **R6.0** | 4000 | 1100 | 4000 | 1100 | 3200 | 840 | 2650 | 610 | 1850 | 430 | 2100 | 420 |
| **R8.0** | 3000 | 1050 | 3000 | 1050 | 2400 | 800 | 2000 | 600 | 1350 | 380 | 1600 | 375 |
| **R10.0** | 2400 | 950 | 2400 | 950 | 1900 | 680 | 1600 | 560 | 1100 | 370 | 1250 | 330 |
| Maximum cutting depth |   | | | | | | | | |   | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
4.Make overhang of tool as short as possible in conditions of non-interference.

## GM-4B★GM-4BL

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cutting speed | 150 m/min | | 150m/min | | 120m/min | | 100m/min | | 70m/min | | 80m/min | |
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **R1.5** | 15500 | 1710 | 15500 | 1710 | 12750 | 1340 | 10600 | 810 | 7400 | 520 | 8500 | 500 |
| **R2.0** | 11500 | 1710 | 11500 | 1710 | 9550 | 1340 | 8000 | 990 | 5550 | 660 | 6500 | 665 |
| **R2.5** | 9500 | 1890 | 9500 | 1890 | 7650 | 1440 | 6400 | 990 | 4450 | 660 | 5000 | 675 |
| **R3.0** | 8000 | 1890 | 8000 | 1890 | 6400 | 1440 | 5300 | 1040 | 3700 | 700 | 4200 | 700 |
| **R4.0** | 6000 | 2340 | 6000 | 2340 | 4800 | 1710 | 4000 | 1260 | 2750 | 820 | 3200 | 790 |
| **R5.0** | 4800 | 2160 | 4800 | 2160 | 3800 | 1620 | 3200 | 1170 | 2200 | 770 | 2500 | 790 |
| **R6.0** | 4000 | 1980 | 4000 | 1980 | 3200 | 1510 | 2650 | 1100 | 1850 | 770 | 2100 | 755 |
| **R8.0** | 3000 | 1890 | 3000 | 1890 | 2400 | 1440 | 2000 | 1080 | 1350 | 680 | 1600 | 675 |
| **R10.0** | 2400 | 1710 | 2400 | 1710 | 1900 | 1220 | 1600 | 1000 | 1100 | 660 | 1250 | 595 |
| Maximum cutting depth |   | | | | | | | | |   | | |

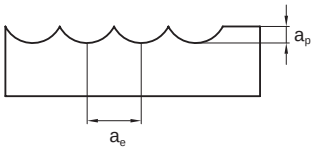
1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
4.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for GM series end mills

### GM-2BS

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **R0.15** | 32000 | 300 | 32000 | 300 | 32000 | 270 | 32000 | 250 | 32000 | 150 |
| **R0.2** | 32000 | 380 | 32000 | 380 | 32000 | 320 | 32000 | 300 | 32000 | 175 |
| **R0.25** | 32000 | 460 | 32000 | 460 | 32000 | 410 | 32000 | 330 | 32000 | 205 |
| **R0.3** | 32000 | 535 | 32000 | 535 | 32000 | 500 | 32000 | 420 | 32000 | 265 |
| **R0.35** | 32000 | 550 | 32000 | 550 | 32000 | 520 | 32000 | 440 | 32000 | 270 |
| **R0.4** | 32000 | 610 | 32000 | 610 | 32000 | 560 | 32000 | 460 | 27500 | 285 |
| **R0.45** | 32000 | 700 | 32000 | 700 | 32000 | 600 | 25000 | 400 | 27500 | 285 |
| **R0.5** | 32000 | 765 | 32000 | 765 | 32000 | 640 | 25000 | 400 | 22000 | 285 |
| **R1.0** | 24000 | 900 | 24000 | 900 | 19000 | 760 | 16000 | 400 | 11150 | 230 |
| **R1.5** | 15500 | 950 | 15500 | 950 | 12750 | 760 | 10600 | 450 | 7400 | 290 |

Maximum cutting depth



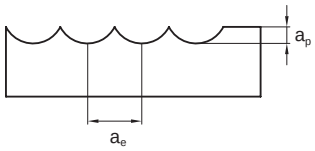

| Diameter range | Cutting depth $a_p$ | Cutting width $a_e$ |
|---|---|---|
| D<Ø1 | 0.05R | 0.2R |
| Ø1⩽D⩽Ø3 | 0.1R | 0.2R |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Make overhang of tool as short as possible in conditions of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

## GM-2BP

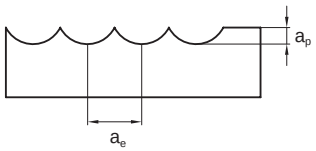
| Workpiece material | | Cast iron, Carbon steel, Alloy steel ~750N/mm² | | | | Carbon steel, Alloy steel ~30HRC | | | | Pre-hardened steel, quenched and tempered steel ~40HRC | | | | Stainless steel | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| R0.25 | 4 | 27000 | 400 | 0.02 | 0.025 | 27000 | 380 | 0.02 | 0.025 | 27000 | 300 | 0.02 | 0.025 | 27000 | 200 | 0.02 | 0.025 |
| | 6 | 21000 | 200 | 0.01 | 0.015 | 21000 | 180 | 0.01 | 0.015 | 21000 | 160 | 0.01 | 0.015 | 21000 | 150 | 0.01 | 0.015 |
| R0.3 | 4 | 27000 | 400 | 0.03 | 0.12 | 27000 | 380 | 0.03 | 0.12 | 25000 | 250 | 0.03 | 012 | 24000 | 200 | 0.03 | 0.12 |
| | 6 | 25000 | 300 | 0.03 | 0.12 | 25000 | 280 | 0.03 | 0.12 | 20000 | 150 | 0.03 | 0.12 | 20000 | 140 | 0.03 | 0.12 |
| | 8 | 25000 | 240 | 0.03 | 0.12 | 25000 | 225 | 0.03 | 0.12 | 20000 | 120 | 0.03 | 0.12 | 20000 | 110 | 0.03 | 0.12 |
| R0.4 | 4 | 27000 | 600 | 0.04 | 0.16 | 27000 | 550 | 0.04 | 0.16 | 23000 | 450 | 0.04 | 0.16 | 21000 | 300 | 0.04 | 0.16 |
| | 6 | 24000 | 400 | 0.04 | 0.12 | 24000 | 360 | 0.04 | 0.12 | 21000 | 250 | 0.04 | 0.12 | 19000 | 200 | 0.04 | 0.12 |
| | 8 | 22000 | 300 | 0.04 | 0.12 | 22000 | 270 | 0.04 | 0.12 | 19000 | 150 | 0.04 | 0.12 | 19000 | 140 | 0.04 | 0.12 |
| | 10 | 22000 | 270 | 0.03 | 0.09 | 22000 | 250 | 0.03 | 0.09 | 19000 | 135 | 0.03 | 0.09 | 19000 | 120 | 0.03 | 0.09 |
| R0.5 | 4 | 28000 | 600 | 0.05 | 0.20 | 28000 | 550 | 0.05 | 0.20 | 25000 | 500 | 0.05 | 0.20 | 21000 | 300 | 0.05 | 0.20 |
| | 6 | 21000 | 400 | 0.05 | 0.20 | 21000 | 360 | 0.05 | 0.20 | 19000 | 300 | 0.05 | 0.20 | 16000 | 200 | 0.05 | 0.2 |
| | 8 | 21000 | 360 | 0.05 | 0.15 | 21000 | 320 | 0.05 | 0.15 | 19000 | 270 | 0.05 | 0.15 | 16000 | 180 | 0.05 | 0.15 |
| | 10 | 18000 | 300 | 0.03 | 0.10 | 18000 | 270 | 0.03 | 0.10 | 17000 | 200 | 0.03 | 0.10 | 14000 | 150 | 0.03 | 0.10 |
| | 12 | 18000 | 270 | 0.03 | 0.10 | 18000 | 250 | 0.03 | 0.10 | 17000 | 180 | 0.03 | 0.10 | 14000 | 135 | 0.03 | 0.10 |
| R0.6 | 6 | 20000 | 600 | 0.06 | 0.24 | 20000 | 540 | 0.06 | 0.24 | 17000 | 300 | 0.06 | 0.24 | 14000 | 200 | 0.06 | 0.24 |
| | 8 | 20000 | 540 | 0.06 | 0.24 | 20000 | 500 | 0.06 | 0.24 | 17000 | 270 | 0.06 | 0.24 | 14000 | 170 | 0.06 | 0.24 |
| | 12 | 16000 | 300 | 0.06 | 0.18 | 16000 | 270 | 0.06 | 0.18 | 14000 | 200 | 0.06 | 0.18 | 11000 | 150 | 0.06 | 0.18 |
| | 16 | 16000 | 270 | 0.03 | 0.12 | 16000 | 230 | 0.03 | 0.12 | 14000 | 175 | 0.03 | 0.12 | 11000 | 135 | 0.03 | 0.12 |
| R0.75 | 8 | 17000 | 600 | 0.08 | 0.30 | 17000 | 540 | 0.08 | 0.30 | 15000 | 300 | 0.08 | 0.30 | 12000 | 250 | 0.08 | 0.30 |
| | 12 | 17000 | 540 | 0.06 | 0.24 | 17000 | 500 | 0.06 | 0.24 | 15000 | 275 | 0.06 | 0.24 | 12000 | 225 | 0.06 | 0.24 |
| | 16 | 13000 | 300 | 0.04 | 0.16 | 13000 | 275 | 0.04 | 0.16 | 12000 | 200 | 0.04 | 0.16 | 9500 | 150 | 0.04 | 0.16 |
| R1.0 | 6 | 16500 | 800 | 0.10 | 0.40 | 16500 | 750 | 0.10 | 0.40 | 16500 | 560 | 0.10 | 0.40 | 13500 | 450 | 0.10 | 0.40 |
| | 8 | 16500 | 800 | 0.10 | 0.32 | 16500 | 750 | 0.10 | 0.32 | 16500 | 560 | 0.10 | 0.32 | 13500 | 450 | 0.10 | 0.32 |
| | 10 | 14000 | 630 | 0.08 | 0.30 | 14000 | 600 | 0.08 | 0.30 | 13000 | 450 | 0.08 | 0.30 | 10000 | 270 | 0.08 | 0.30 |
| | 12 | 14000 | 630 | 0.06 | 0.30 | 14000 | 600 | 0.06 | 0.30 | 13000 | 450 | 0.06 | 0.30 | 10000 | 270 | 0.06 | 0.30 |
| | 16 | 14000 | 550 | 0.06 | 0.24 | 14000 | 530 | 0.06 | 0.24 | 13000 | 400 | 0.06 | 0.24 | 10000 | 270 | 0.06 | 0.24 |
| | 20 | 11000 | 360 | 0.06 | 0.16 | 11000 | 330 | 0.06 | 0.16 | 10000 | 225 | 0.06 | 0.16 | 8000 | 175 | 0.06 | 0.16 |

Maximum cutting depth



## Cutting parameters for GM series end mills

### GM-2BP

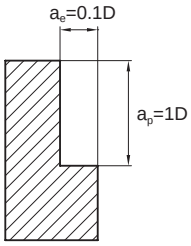
| Workpiece material | | Cast iron, Carbon steel, Alloy steel ~750N/mm² | | | | Carbon steel, Alloy steel ~30HRC | | | | Pre-hardened steel, quenched and tempered steel ~40HRC | | | | Stainless steel | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| R1.25 | 8 | 14000 | 800 | 0.10 | 0.32 | 14000 | 750 | 0.10 | 0.32 | 14000 | 560 | 0.10 | 0.32 | 12500 | 450 | 0.10 | 0.32 |
| | 12 | 13000 | 630 | 0.06 | 0.30 | 13000 | 600 | 0.06 | 0.30 | 12000 | 450 | 0.06 | 0.30 | 10000 | 270 | 0.06 | 0.30 |
| | 16 | 13000 | 550 | 0.06 | 0.24 | 13000 | 530 | 0.06 | 0.24 | 12000 | 400 | 0.06 | 0.24 | 10000 | 270 | 0.06 | 0.24 |
| | 20 | 10000 | 360 | 0.06 | 0.16 | 10000 | 330 | 0.06 | 0.16 | 8000 | 225 | 0.06 | 0.16 | 7000 | 175 | 0.06 | 0.16 |
| R1.5 | 10 | 12000 | 800 | 0.15 | 0.40 | 12000 | 720 | 0.15 | 0.40 | 9500 | 600 | 0.15 | 0.40 | 7500 | 400 | 0.15 | 0.40 |
| | 12 | 12000 | 720 | 0.15 | 0.40 | 12000 | 650 | 0.15 | 0.40 | 9500 | 540 | 0.15 | 0.40 | 7500 | 360 | 0.15 | 0.40 |
| | 16 | 10000 | 600 | 0.15 | 0.40 | 10000 | 540 | 0.15 | 0.40 | 8500 | 300 | 0.15 | 0.40 | 6500 | 250 | 0.15 | 0.40 |
| | 20 | 10000 | 600 | 0.10 | 0.32 | 10000 | 540 | 0.10 | 0.32 | 8500 | 300 | 0.10 | 0.32 | 6500 | 250 | 0.10 | 0.32 |
| R2.0 | 10 | 9000 | 800 | 0.20 | 0.80 | 9000 | 720 | 0.20 | 0.80 | 7500 | 600 | 0.20 | 0.80 | 6000 | 400 | 0.20 | 0.80 |
| | 16 | 9000 | 800 | 0.20 | 0.60 | 9000 | 720 | 0.20 | 0.60 | 7500 | 600 | 0.20 | 0.60 | 6000 | 400 | 0.20 | 0.60 |
| | 20 | 7000 | 600 | 0.20 | 0.40 | 7000 | 540 | 0.20 | 0.40 | 6000 | 400 | 0.20 | 0.40 | 5000 | 250 | 0.20 | 0.40 |
| | 25 | 7000 | 600 | 0.15 | 0.40 | 7000 | 540 | 0.15 | 0.40 | 6000 | 400 | 0.15 | 0.40 | 5000 | 250 | 0.15 | 0.40 |
| R2.5 | 16 | 7000 | 600 | 0.25 | 1.00 | 7000 | 540 | 0.25 | 0.10 | 6500 | 500 | 0.25 | 1.0 | 5000 | 400 | 0.25 | 1.00 |
| | 25 | 6000 | 500 | 0.25 | 1.00 | 6000 | 450 | 0.25 | 1.00 | 5000 | 500 | 0.25 | 1.00 | 4000 | 250 | 0.25 | 1.00 |
| Maximum cutting depth | |   | | | | | | | | | | | | | | | |

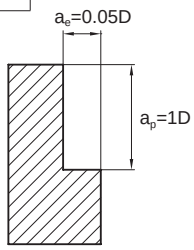
1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Make overhang of tool as short as possible in conditions of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

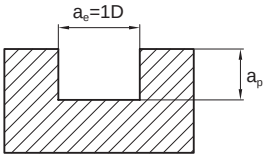
## GM-2R

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **1** | 20000 | 200 | 20000 | 200 | 20000 | 160 | 20000 | 160 | 20000 | 60 | 20000 | 120 |
| **2** | 15000 | 320 | 15000 | 320 | 15000 | 290 | 15000 | 280 | 11150 | 84 | 13000 | 180 |
| **3** | 14000 | 545 | 14000 | 545 | 13000 | 510 | 10600 | 420 | 7500 | 120 | 8500 | 330 |
| **4** | 10800 | 560 | 10800 | 560 | 10000 | 520 | 8000 | 430 | 5500 | 130 | 6500 | 335 |
| **5** | 8200 | 580 | 8200 | 580 | 7600 | 540 | 6400 | 450 | 4500 | 130 | 5000 | 355 |
| **6** | 7000 | 600 | 7000 | 600 | 6400 | 550 | 5300 | 460 | 3700 | 140 | 4200 | 360 |
| **8** | 5200 | 600 | 5200 | 600 | 4800 | 550 | 4000 | 460 | 2800 | 140 | 3200 | 365 |
| **10** | 4200 | 580 | 4200 | 580 | 3800 | 540 | 3200 | 445 | 2200 | 140 | 2500 | 350 |
| **12** | 3500 | 580 | 3500 | 580 | 3200 | 540 | 2650 | 445 | 1850 | 140 | 2100 | 350 |

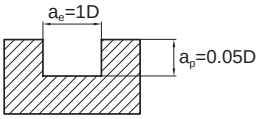
Maximum cutting depth




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D | 0.3D |



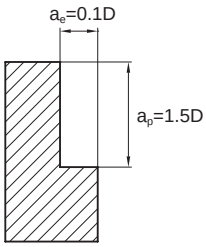

1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

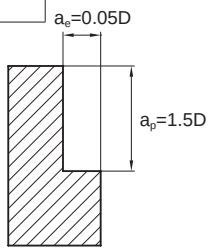
## Cutting parameters for GM series end mills

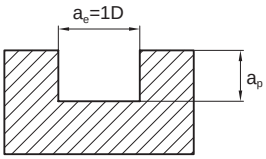
## GM-4R★GM-4RL

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | | Pre-hardened steel, quenched and tempered steel ~50HRC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **3** | 14000 | 820 | 14000 | 820 | 13000 | 755 | 10600 | 630 | 7500 | 145 | 8500 | 490 |
| **4** | 10800 | 840 | 10800 | 840 | 10000 | 770 | 8000 | 640 | 5500 | 145 | 6500 | 500 |
| **5** | 8200 | 880 | 8200 | 880 | 7600 | 810 | 6400 | 670 | 4500 | 145 | 5000 | 530 |
| **6** | 7000 | 900 | 7000 | 900 | 6400 | 830 | 5300 | 690 | 3700 | 160 | 4200 | 540 |
| **8** | 5200 | 890 | 5200 | 890 | 4800 | 815 | 4000 | 680 | 2800 | 160 | 3200 | 550 |
| **10** | 4200 | 880 | 4200 | 880 | 3800 | 810 | 3200 | 670 | 2200 | 160 | 2500 | 520 |
| **12** | 3500 | 880 | 3500 | 880 | 3200 | 810 | 2650 | 670 | 1850 | 160 | 2100 | 520 |
| **16** | 2600 | 680 | 2600 | 680 | 2400 | 630 | 2000 | 525 | 1400 | 120 | 1600 | 490 |

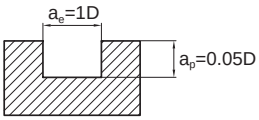
Maximum cutting depth



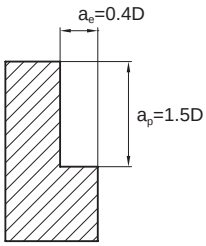
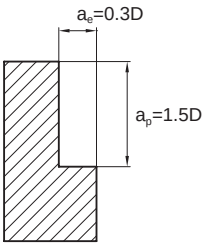




| Diameter range | Cutting depth $a_p$ |
|---|---|
| Ø1⩽D<Ø3 | 0.15D |
| Ø3⩽D | 0.3D |




1.The above table shows the standard value of side milling. When milling slot, 50%~70% of rotating speed and 40%~60% of feed speed stated above are recommended as standard.
2.Please select high-precision machine and tool holder.
3.Please use air blow or cutting liquid with high mist retardant property.
4.Down milling is recommended in the case of side milling.
5.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
6.Make overhang of tool as short as possible in conditions of non-interference.

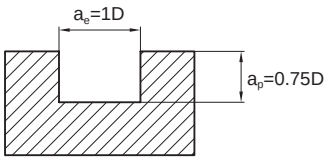
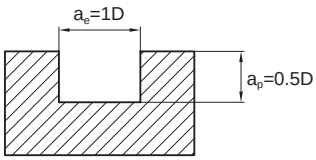
## GM-4W——side cutting

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **6** | 6350 | 760 | 5300 | 640 | 4500 | 360 | 3450 | 280 | 2650 | 210 |
| **7** | 5460 | 760 | 4550 | 640 | 3650 | 360 | 3000 | 280 | 2250 | 310 |
| **8** | 4750 | 760 | 4000 | 640 | 3400 | 410 | 2650 | 310 | 2000 | 240 |
| **9** | 4250 | 760 | 3540 | 640 | 2850 | 410 | 2300 | 310 | 1750 | 240 |
| **10** | 3800 | 760 | 3200 | 640 | 2700 | 430 | 2050 | 330 | 1600 | 260 |
| **11** | 3470 | 760 | 2900 | 640 | 2400 | 430 | 1850 | 330 | 1450 | 260 |
| **12** | 3200 | 770 | 2250 | 650 | 1950 | 470 | 1500 | 360 | 1150 | 280 |
| **16** | 2400 | 770 | 2000 | 640 | 1700 | 480 | 1300 | 360 | 1000 | 280 |
| **20** | 1900 | 760 | 1600 | 610 | 1350 | 470 | 1050 | 350 | 800 | 260 |
| Maximum cutting depth |   | | | | | |   | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Down milling is recommended in the case of side milling.
4.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
5.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for GM series end mills

### GM-4W——slot cutting

| Workpiece material | Cast iron, Nodular cast iron | | Carbon steel, Alloy steel ~750N/mm$^2$ | | Carbon steel, Alloy steel ~30HRC | | Pre-hardened steel, quenched and tempered steel ~40HRC | | Stainless steel | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cutting speed | 80~120 m/min | | 70~100m/min | | 60~90m/min | | 40~70m/min | | 30~60m/min | |
| Diameter (mm) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) | Rotating speed (min$^{-1}$) | Feed speed (mm/min) |
| **6** | 5300 | 640 | 4500 | 540 | 3700 | 300 | 2900 | 230 | 2400 | 190 |
| **7** | 4500 | 630 | 3800 | 540 | 3200 | 300 | 2500 | 230 | 2050 | 190 |
| **8** | 4000 | 640 | 3400 | 540 | 2800 | 340 | 2200 | 260 | 1800 | 220 |
| **9** | 3500 | 630 | 3000 | 540 | 2450 | 340 | 1950 | 260 | 1600 | 220 |
| **10** | 3200 | 640 | 2700 | 540 | 2250 | 360 | 1750 | 280 | 1450 | 230 |
| **11** | 3000 | 630 | 2450 | 540 | 2050 | 360 | 1600 | 280 | 1300 | 230 |
| **12** | 2650 | 640 | 2250 | 540 | 1850 | 370 | 1450 | 290 | 1200 | 240 |
| **16** | 2000 | 640 | 1700 | 540 | 1400 | 390 | 1100 | 310 | 900 | 250 |
| **20** | 1600 | 640 | 1350 | 510 | 1100 | 390 | 900 | 300 | 700 | 230 |
| Maximum cutting depth |   Maximum $a_p$=12mm | | | | | |   | | | |

1.Please select high-precision machine and tool holder.

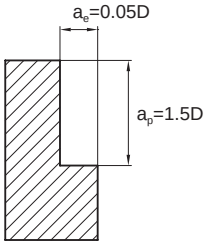
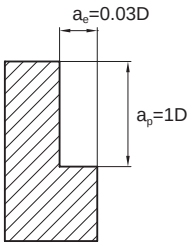
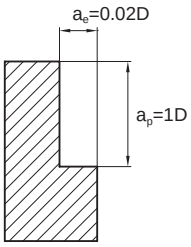
2.Please use air blow or cutting liquid with high mist retardant property.

3.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.

4.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for HMX series end mills

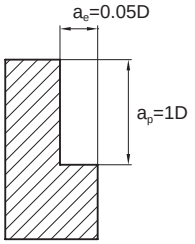
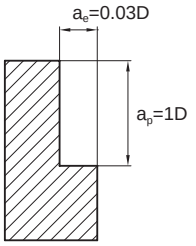
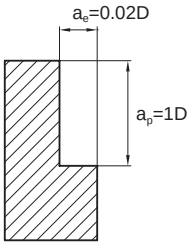
### HMX-2E

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | | Hardened steel 60~68HRC | |
|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 40000 | 160 | 40000 | 160 | 32000 | 130 |
| **2** | 40000 | 400 | 24000 | 240 | 16000 | 160 |
| **3** | 32000 | 510 | 16000 | 255 | 11000 | 175 |
| **4** | 24000 | 625 | 12000 | 310 | 8000 | 210 |
| **5** | 19000 | 685 | 9500 | 340 | 6400 | 230 |
| **6** | 16000 | 770 | 8000 | 385 | 5300 | 255 |
| **8** | 12000 | 770 | 6000 | 385 | 4000 | 255 |
| **10** | 9600 | 770 | 4800 | 385 | 3200 | 255 |
| **12** | 8000 | 800 | 4000 | 400 | 2700 | 270 |
| **14** | 6800 | 680 | 3400 | 340 | 2300 | 230 |
| **16** | 6000 | 600 | 3000 | 300 | 2000 | 200 |
| **18** | 5300 | 530 | 2700 | 270 | 1800 | 180 |
| **20** | 4800 | 480 | 2400 | 240 | 1600 | 160 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | |   Maximum $a_e$=0.5mm | |   Maximum $a_e$=0.3mm | |

1.Please select high-precision and rigidity machine and tool holder.
2.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
3.Please use air blow or MQL( minimum oil mist cooling).
4.Down milling is recommended in the case of side milling.
5.Make overhang of tool as short as possible in conditions of non-interference.

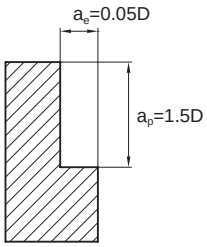
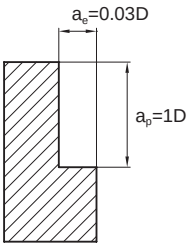
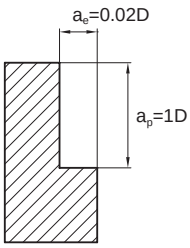
## Cutting parameters for HMX series end mills

### HMX-2EFP

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | | Hardened steel 60~68HRC | |
|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 16000 | 1155 | 8000 | 460 | 5300 | 305 |
| **8** | 12000 | 1155 | 6000 | 460 | 4000 | 305 |
| **10** | 9600 | 1155 | 4800 | 460 | 3200 | 305 |
| **12** | 8000 | 1200 | 4000 | 480 | 2700 | 325 |
| **16** | 6000 | 900 | 3000 | 360 | 2000 | 240 |
| **20** | 4800 | 720 | 2400 | 285 | 1600 | 195 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | |   Maximum $a_e$=0.5mm | |   Maximum $a_e$=0.3mm | |

1.Please select high-precision and rigidity machine and tool holder.
2.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
3.Please use air blow or MQL( minimum oil mist cooling).
4.Down milling is recommended in the case of side milling.
5.Make overhang of tool as short as possible in conditions of non-interference.

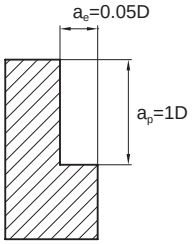
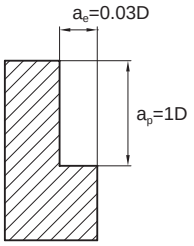
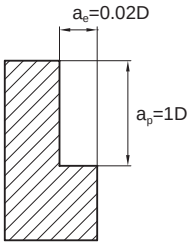
## HMX-4E★HMX-4EL

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | | Hardened steel 60~68HRC | |
|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 40000 | 320 | 40000 | 320 | 32000 | 260 |
| **2** | 40000 | 800 | 24000 | 480 | 16000 | 320 |
| **3** | 32000 | 1020 | 16000 | 510 | 11000 | 350 |
| **4** | 24000 | 1250 | 12000 | 620 | 8000 | 420 |
| **5** | 19000 | 1360 | 9500 | 680 | 6400 | 460 |
| **6** | 16000 | 1540 | 8000 | 770 | 5300 | 510 |
| **8** | 12000 | 1540 | 6000 | 770 | 4000 | 510 |
| **10** | 9600 | 1540 | 4800 | 770 | 3200 | 510 |
| **12** | 8000 | 1600 | 4000 | 800 | 2700 | 540 |
| **14** | 6800 | 1340 | 3400 | 680 | 2300 | 460 |
| **16** | 6000 | 1200 | 3000 | 600 | 2000 | 400 |
| **18** | 5300 | 1060 | 2700 | 530 | 1800 | 360 |
| **20** | 4800 | 960 | 2400 | 480 | 1600 | 320 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | |   Maximum $a_e$=0.5mm | |   Maximum $a_e$=0.3mm | |

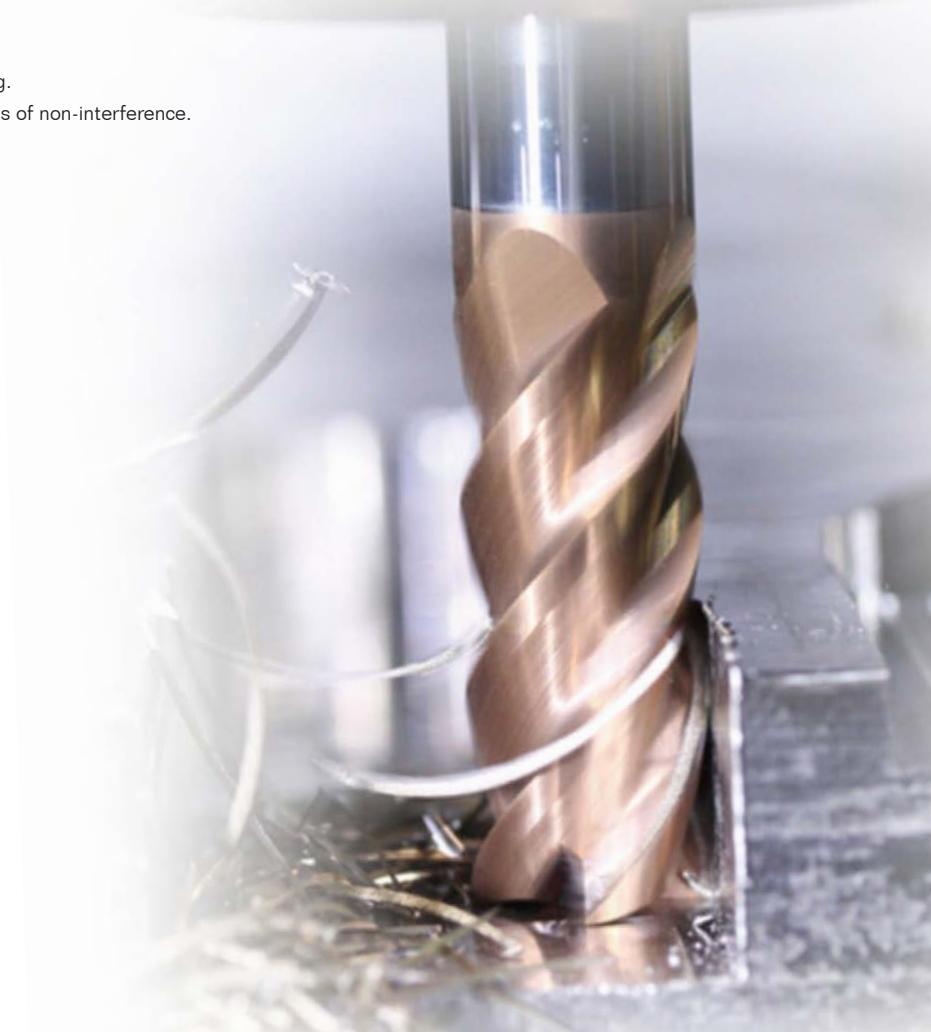
1.Please select high-precision and rigidity machine and tool holder.
2.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
3.Please use air blow or MQL( minimum oil mist cooling).
4.Down milling is recommended in the case of side milling.
5.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for HMX series end mills

### HMX-4EFP

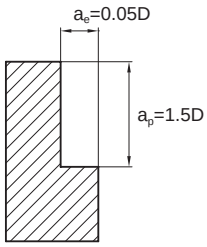
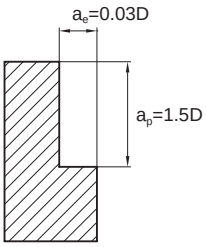
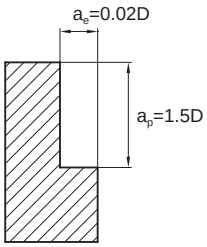
| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | | Hardened steel 60~68HRC | |
|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 16000 | 1730 | 8000 | 920 | 5300 | 610 |
| **8** | 12000 | 1730 | 6000 | 920 | 4000 | 610 |
| **10** | 9600 | 1730 | 4800 | 920 | 3200 | 610 |
| **12** | 8000 | 1800 | 4000 | 960 | 2700 | 650 |
| **16** | 6000 | 1350 | 3000 | 720 | 2000 | 480 |
| **20** | 4800 | 1080 | 2400 | 570 | 1600 | 390 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | |   Maximum $a_e$=0.5mm | |   Maximum $a_e$=0.3mm | |

1.Please select high-precision and rigidity machine and tool holder.
2.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
3.Please use air blow or MQL( minimum oil mist cooling).
4.Down milling is recommended in the case of side milling.
5.Make overhang of tool as short as possible in conditions of non-interference.



## Cutting parameters for HMX series end mills

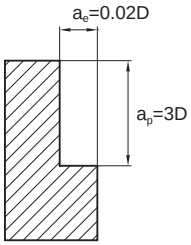
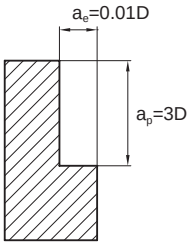
### HMX-6E

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | | Hardened steel 60~68HRC | |
|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 150m/min | | 100m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 16000 | 1850 | 8000 | 925 | 5300 | 610 |
| **8** | 12000 | 1850 | 6000 | 925 | 4000 | 610 |
| **10** | 9600 | 1850 | 4800 | 925 | 3200 | 610 |
| **12** | 8000 | 1920 | 4000 | 960 | 2700 | 650 |
| **14** | 6800 | 1600 | 3400 | 815 | 2300 | 550 |
| **16** | 6000 | 1440 | 3000 | 720 | 2000 | 480 |
| **18** | 5300 | 1270 | 2700 | 635 | 1800 | 430 |
| **20** | 4800 | 1150 | 2400 | 575 | 1600 | 385 |
| Maximum cutting depth |  Maximum $a_e$=1.0mm | |  Maximum $a_e$=0.5mm | |  Maximum $a_e$=0.3mm | |

1.Please select high-precision and rigidity machine and tool holder.
2.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
3.Please use air blow or MQL( minimum oil mist cooling).
4.Down milling is recommended in the case of side milling.
5.Make overhang of tool as short as possible in conditions of non-interference.

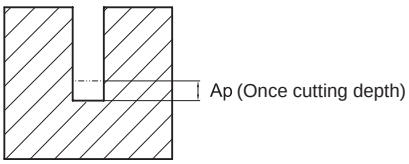
## Cutting parameters for HMX series end mills

### HMX-6EL

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | | Hardened steel 60~68HRC | |
|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 150m/min | | 100m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 16000 | 1300 | 8000 | 650 | 5300 | 430 |
| **8** | 12000 | 1300 | 6000 | 650 | 4000 | 430 |
| **10** | 9600 | 1300 | 4800 | 650 | 3200 | 430 |
| **12** | 8000 | 1350 | 4000 | 670 | 2700 | 460 |
| **14** | 6800 | 1150 | 3400 | 570 | 2300 | 380 |
| **16** | 6000 | 1000 | 3000 | 500 | 2000 | 340 |
| **18** | 5300 | 890 | 2700 | 450 | 1800 | 300 |
| **20** | 4800 | 800 | 2400 | 400 | 1600 | 270 |
| Maximum cutting depth |   Maximum $a_e$=0.3mm | |   | | | |

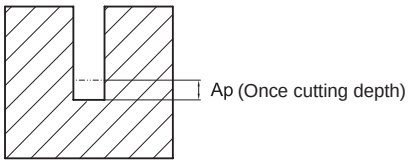
1.Please select high-precision and rigidity machine and tool holder.
2.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
3.Please use air blow or MQL( minimum oil mist cooling).
4.Down milling is recommended in the case of side milling.
5.Make overhang of tool as short as possible in conditions of non-interference.

## HMX-2EP

| Workpiece material | | Pre-hardened steel, Hardened steel 40~50HRC | | | Hardened steel 50~60HRC | | |
|---|---|---|---|---|---|---|---|
| Diameter (mm) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) |
| 0.5 | 4 | 21000 | 100 | 0.009 | 17000 | 50 | 0.009 |
| | 6 | 20000 | 75 | 0.006 | 15000 | 35 | 0.007 |
| | 8 | 20000 | 50 | 0.002 | 15000 | 20 | 0.003 |
| 0.8 | 4 | 20000 | 200 | 0.022 | 14000 | 100 | 0.011 |
| | 6 | 18000 | 150 | 0.014 | 14000 | 75 | 0.009 |
| | 8 | 18000 | 100 | 0.01 | 14000 | 50 | 0.006 |
| | 10 | 18000 | 75 | 0.007 | 14000 | 30 | 0.004 |
| 1.0 | 4 | 17000 | 400 | 0.035 | 12000 | 100 | 0.016 |
| | 6 | 17000 | 400 | 0.03 | 12000 | 100 | 0.014 |
| | 8 | 15000 | 300 | 0.02 | 10000 | 75 | 0.01 |
| | 10 | 15000 | 250 | 0.015 | 10000 | 50 | 0.008 |
| | 12 | 12000 | 150 | 0.01 | 10000 | 50 | 0.006 |
| | 14 | 12000 | 100 | 0.007 | 10000 | 30 | 0.004 |
| 1.2 | 6 | 14000 | 400 | 0.03 | 10000 | 100 | 0.017 |
| | 8 | 12000 | 300 | 0.03 | 10000 | 100 | 0.014 |
| | 10 | 12000 | 300 | 0.02 | 10000 | 75 | 0.01 |
| | 12 | 10000 | 200 | 0.01 | 10000 | 50 | 0.00 |
| 1.5 | 6 | 12000 | 400 | 0.06 | 8000 | 200 | 0.028 |
| | 8 | 10000 | 300 | 0.04 | 7000 | 150 | 0.021 |
| | 10 | 10000 | 300 | 0.03 | 7000 | 150 | 0.017 |
| | 12 | 10000 | 300 | 0.025 | 7000 | 100 | 0.01 |
| | 14 | 10000 | 250 | 0.02 | 7000 | 75 | 0.005 |
| 2.0 | 6 | 9000 | 400 | 0.13 | 6000 | 300 | 0.07 |
| | 8 | 9000 | 400 | 0.11 | 6000 | 300 | 0.06 |
| | 10 | 7000 | 300 | 0.10 | 6000 | 200 | 0.05 |
| | 12 | 7000 | 300 | 0.06 | 6000 | 200 | 0.03 |
| | 14 | 7000 | 250 | 0.04 | 6000 | 150 | 0.015 |
| | 16 | 7000 | 200 | 0.02 | 6000 | 100 | 0.008 |
| Maximum cutting depth | |   | | | | | |

## Cutting parameters for HMX series end mills

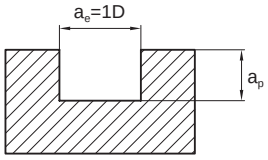
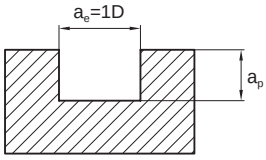
### HMX-2EP

| Workpiece material | | Pre-hardened steel, Hardened steel 40~50HRC | | | Hardened steel 50~60HRC | | |
|---|---|---|---|---|---|---|---|
| Diameter (mm) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) |
| 2.5 | 8 | 8000 | 400 | 0.16 | 5000 | 300 | 0.08 |
| | 10 | 8000 | 400 | 0.14 | 5000 | 300 | 0.07 |
| | 12 | 8000 | 400 | 0.09 | 5000 | 300 | 0.05 |
| | 14 | 6000 | 300 | 0.07 | 5000 | 200 | 0.03 |
| | 16 | 6000 | 300 | 0.05 | 5000 | 200 | 0.025 |
| | 18 | 6000 | 300 | 0.04 | 5000 | 150 | 0.02 |
| | 20 | 6000 | 300 | 0.02 | 5000 | 100 | 0.01 |
| 3.0 | 6 | 7000 | 400 | 0.18 | 5000 | 300 | 0.10 |
| | 8 | 7000 | 400 | 0.15 | 5000 | 300 | 0.08 |
| | 10 | 7000 | 400 | 0.12 | 5000 | 300 | 0.06 |
| | 12 | 7000 | 400 | 0.10 | 5000 | 300 | 0.05 |
| | 14 | 6000 | 300 | 0.08 | 5000 | 200 | 0.04 |
| | 16 | 6000 | 300 | 0.06 | 5000 | 200 | 0.03 |
| | 18 | 6000 | 300 | 0.05 | 5000 | 200 | 0.025 |
| | 20 | 6000 | 250 | 0.04 | 5000 | 150 | 0.01 |
| 4.0 | 12 | 4500 | 400 | 0.16 | 4000 | 300 | 0.08 |
| | 16 | 4500 | 400 | 0.14 | 4000 | 300 | 0.06 |
| | 20 | 4500 | 300 | 0.10 | 4000 | 300 | 0.04 |
| | 25 | 4500 | 300 | 0.08 | 4000 | 300 | 0.03 |
| 5.0 | 16 | 4000 | 400 | 0.19 | 3000 | 300 | 0.09 |
| | 25 | 4000 | 400 | 0.15 | 3000 | 300 | 0.06 |
| Maximum cutting depth | |   | | | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Make overhang of tool as short as possible in conditions of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

## Cutting parameters for HMX series end mills

### HMX-2ES

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **0.3** | 23000 | 30 | 16500 | 25 |
| **0.4** | 17500 | 30 | 12500 | 25 |
| **0.5** | 14000 | 30 | 10000 | 25 |
| **0.6** | 11500 | 30 | 8450 | 25 |
| **0.7** | 10000 | 30 | 7500 | 25 |
| **0.8** | 8750 | 30 | 6350 | 25 |
| **0.9** | 8000 | 30 | 5500 | 25 |
| **1.0** | 7000 | 30 | 5050 | 25 |
| **1.5** | 5050 | 40 | 3550 | 25 |
| **2.0** | 3950 | 40 | 2750 | 25 |
| **2.5** | 3500 | 45 | 2500 | 30 |
| **3.0** | 2750 | 45 | 2000 | 30 |
| Maximum cutting depth |   | |   | |

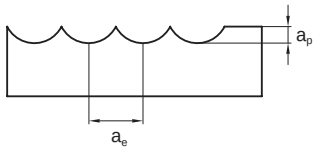
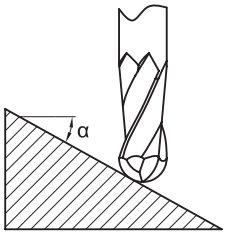
| Diameter range | Cutting depth $a_p$ |
|---|---|
| D<Ø1 | 0.02D |
| Ø1⩽D⩽Ø3 | 0.05D |

| Diameter range | Cutting depth $a_p$ |
|---|---|
| D<Ø1 | 0.01D |
| Ø1⩽D⩽Ø3 | 0.02D |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Make overhang of tool as short as possible in conditions of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

## Cutting parameters for HMX series end mills

### HMX-2B★HMX-2BL★HMX-2BFP

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | | | Hardened steel 50~60HRC | | | | Hardened steel 60~68HRC | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Radius of ball nose (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| **R0.5** | 40000 | 1900 | 0.01 | 0.05 | 36000 | 1500 | 0.01 | 0.05 | 32000 | 1400 | 0.01 | 0.05 |
| **R1.0** | 33000 | 3100 | 0.02 | 0.075 | 26000 | 2100 | 0.02 | 0.075 | 24000 | 2000 | 0.02 | 0.075 |
| **R1.5** | 29000 | 4100 | 0.03 | 0.1 | 23000 | 2900 | 0.03 | 0.1 | 21000 | 2600 | 0.03 | 0.1 |
| **R2.0** | 22000 | 3900 | 0.04 | 0.15 | 17000 | 2500 | 0.04 | 0.15 | 15500 | 2100 | 0.04 | 0.15 |
| **R2.5** | 17500 | 3500 | 0.05 | 0.15 | 13500 | 2200 | 0.05 | 0.15 | 13000 | 2000 | 0.05 | 0.15 |
| **R3.0** | 15000 | 3100 | 0.06 | 0.2 | 11500 | 1700 | 0.06 | 0.2 | 10500 | 1500 | 0.06 | 0.2 |
| **R4.0** | 11000 | 2500 | 0.08 | 0.25 | 8600 | 1600 | 0.08 | 0.25 | 8000 | 1400 | 0.08 | 0.25 |
| **R5.0** | 9000 | 2000 | 0.1 | 0.3 | 7000 | 1400 | 0.1 | 0.3 | 6000 | 1200 | 0.1 | 0.3 |
| **R6.0** | 7500 | 1800 | 0.1 | 0.35 | 5700 | 1300 | 0.1 | 0.35 | 5300 | 1200 | 0.1 | 0.35 |
| **R8.0** | 5500 | 1800 | 0.1 | 0.4 | 4300 | 1300 | 0.1 | 0.4 | 4000 | 1200 | 0.1 | 0.4 |
| **R10.0** | 4500 | 1800 | 0.1 | 0.5 | 3500 | 1300 | 0.1 | 0.5 | 3200 | 1200 | 0.1 | 0.5 |
| Maximum cutting depth |     | | | | | | | | | | | |

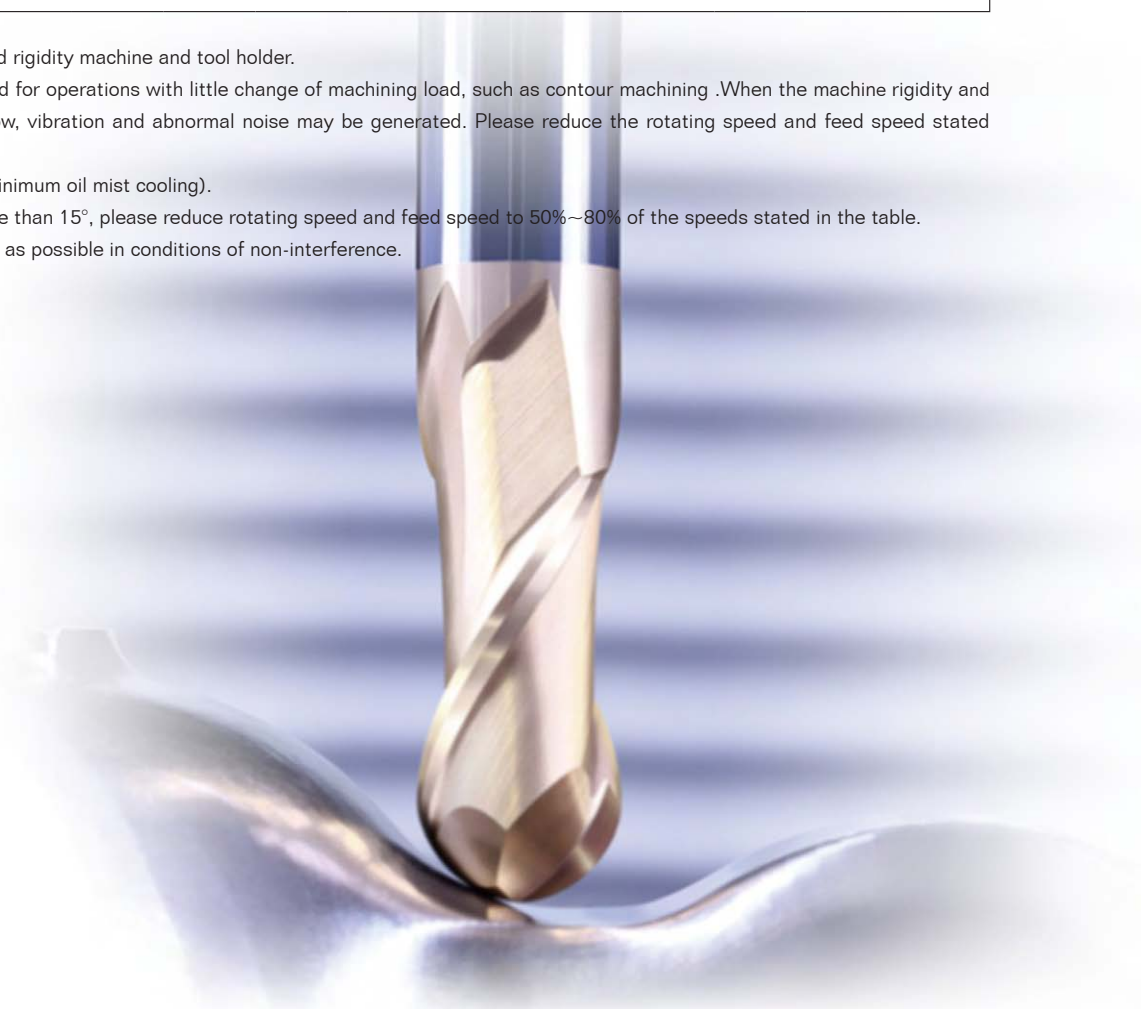
1.Please select high-precision and rigidity machine and tool holder.

2.Above table shows the standard for operations with little change of machining load, such as contour machining .When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.

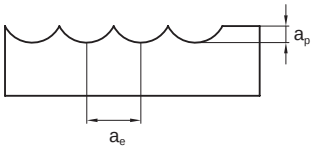
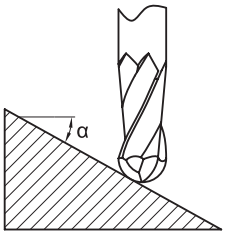
3.Please use air blow or MQL( minimum oil mist cooling).

4.When inclination angle α is more than 15°, please reduce rotating speed and feed speed to 50%~80% of the speeds stated in the table.

5.Make overhang of tool as short as possible in conditions of non-interference.



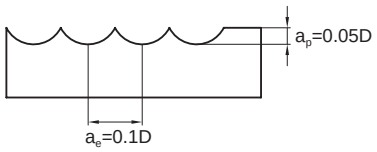
## HMX-4B★HMX-4BL

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | | | Hardened steel 50~60HRC | | | | Hardened steel 60~68HRC | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Radius of ball nose (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| **R1.5** | 29000 | 6560 | 0.03 | 0.1 | 22800 | 4560 | 0.03 | 0.1 | 21100 | 4240 | 0.03 | 0.1 |
| **R2.0** | 22000 | 6250 | 0.04 | 0.15 | 17100 | 4000 | 0.04 | 0.15 | 15800 | 3520 | 0.04 | 0.15 |
| **R2.5** | 17400 | 5600 | 0.05 | 0.15 | 13600 | 3520 | 0.05 | 0.15 | 12700 | 3200 | 0.05 | 0.15 |
| **R3.0** | 14500 | 5000 | 0.06 | 0.2 | 11400 | 3000 | 0.06 | 0.2 | 10600 | 2500 | 0.06 | 0.2 |
| **R4.0** | 10900 | 4200 | 0.08 | 0.25 | 8550 | 2500 | 0.08 | 0.25 | 7950 | 2250 | 0.08 | 0.25 |
| **R5.0** | 8700 | 3500 | 0.1 | 0.3 | 6850 | 2200 | 0.1 | 0.3 | 6350 | 2000 | 0.1 | 0.3 |
| **R6.0** | 7250 | 3000 | 0.1 | 0.35 | 5700 | 2000 | 0.1 | 0.35 | 5300 | 1900 | 0.1 | 0.35 |
| **R8.0** | 5450 | 3000 | 0.1 | 0.4 | 4280 | 2000 | 0.1 | 0.4 | 4000 | 1900 | 0.1 | 0.4 |
| **R10.0** | 4350 | 3000 | 0.1 | 0.5 | 3425 | 2000 | 0.1 | 0.5 | 3200 | 1900 | 0.1 | 0.5 |
| Maximum cutting depth |   | | | | | | | |   | | | |

1.Please select high-precision and rigidity machine and tool holder.
2.Above table shows the standard for operations with little change of machining load, such as contour machining .When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
3.Please use air blow or MQL( minimum oil mist cooling).
4.When inclination angle α is more than 15°, please reduce rotating speed and feed speed to 50%~80% of the speeds stated in the table.
5.Make overhang of tool as short as possible in conditions of non-interference.

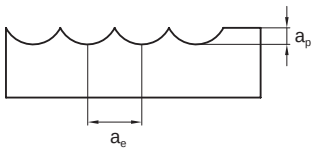
## Cutting parameters for HMX series end mills

### HMX-2BS

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **R0.15** | 25000 | 135 | 25000 | 115 |
| **R0.2** | 25000 | 140 | 25000 | 120 |
| **R0.25** | 25000 | 150 | 25000 | 130 |
| **R0.3** | 25000 | 175 | 24000 | 150 |
| **R0.35** | 25000 | 190 | 24000 | 150 |
| **R0.4** | 24000 | 210 | 18000 | 140 |
| **R0.45** | 21000 | 210 | 15000 | 140 |
| **R0.5** | 19000 | 210 | 14000 | 140 |
| **R1.0** | 9500 | 210 | 7200 | 140 |
| **R1.5** | 6400 | 210 | 4800 | 140 |
| Maximum cutting depth |   | | | |

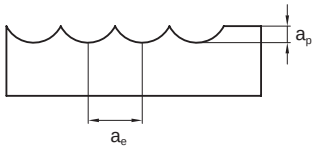
1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Make overhang of tool as short as possible in conditions of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

## HMX-2BP

| Workpiece material | | Pre-hardened steel, Hardened steel 40~50HRC | | | | Hardened steel 50~60HRC | | | |
|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| **R0.25** | **4** | 27000 | 200 | 0.01 | 0.01 | 27000 | 100 | 0.01 | 0.01 |
| | **6** | 20000 | 150 | 0.005 | 0.01 | 20000 | 75 | 0.005 | 0.005 |
| **R0.3** | **4** | 24000 | 200 | 0.03 | 0.06 | 17000 | 150 | 0.02 | 0.04 |
| | **6** | 20000 | 150 | 0.02 | 0.03 | 17000 | 150 | 0.01 | 0.02 |
| | **8** | 20000 | 120 | 0.02 | 0.03 | 17000 | 120 | 0.01 | 0.02 |
| **R0.4** | **4** | 21000 | 300 | 0.04 | 0.08 | 14500 | 200 | 0.03 | 0.08 |
| | **6** | 19000 | 200 | 0.02 | 0.04 | 12000 | 150 | 0.02 | 0.04 |
| | **8** | 17000 | 150 | 0.02 | 0.04 | 12000 | 100 | 0.02 | 0.04 |
| | **10** | 17000 | 135 | 0.02 | 0.03 | 12000 | 75 | 0.01 | 0.02 |
| **R0.5** | **4** | 21000 | 300 | 0.05 | 0.10 | 14500 | 200 | 0.05 | 0.10 |
| | **6** | 16000 | 200 | 0.05 | 0.10 | 11500 | 150 | 0.05 | 0.10 |
| | **8** | 16000 | 180 | 0.03 | 0.05 | 11500 | 135 | 0.03 | 0.05 |
| | **10** | 14000 | 150 | 0.01 | 0.03 | 9800 | 100 | 0.01 | 0.03 |
| | **12** | 14000 | 135 | 0.01 | 0.03 | 9800 | 75 | 0.01 | 0.03 |
| **R0.6** | **6** | 14000 | 200 | 0.06 | 0.12 | 9500 | 175 | 0.06 | 0.12 |
| | **8** | 14000 | 180 | 0.06 | 0.12 | 9500 | 150 | 0.06 | 0.12 |
| | **12** | 11000 | 150 | 0.04 | 0.06 | 7500 | 100 | 0.03 | 0.06 |
| | **16** | 11000 | 135 | 0.02 | 0.04 | 7500 | 75 | 0.02 | 0.03 |
| **R0.75** | **8** | 12000 | 250 | 0.08 | 0.15 | 8000 | 200 | 0.08 | 0.15 |
| | **12** | 12000 | 225 | 0.06 | 0.15 | 8000 | 175 | 0.06 | 0.15 |
| | **16** | 9500 | 150 | 0.01 | 0.05 | 6500 | 100 | 0.01 | 0.03 |
| **R1.0** | **6** | 13500 | 400 | 0.10 | 0.20 | 7500 | 225 | 0.10 | 0.20 |
| | **8** | 13500 | 400 | 0.10 | 0.16 | 7500 | 225 | 0.10 | 0.16 |
| | **10** | 10000 | 275 | 0.08 | 0.16 | 5500 | 175 | 0.08 | 0.16 |
| | **12** | 10000 | 275 | 0.06 | 0.16 | 5500 | 175 | 0.06 | 0.16 |
| | **16** | 10000 | 250 | 0.02 | 0.10 | 5500 | 150 | 0.02 | 0.10 |
| | **20** | 8000 | 175 | 0.02 | 0.05 | 5500 | 125 | 0.01 | 0.05 |
| Maximum cutting depth | |   | | | | | | | |

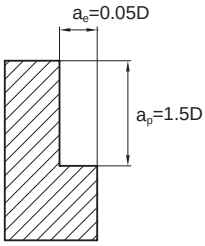
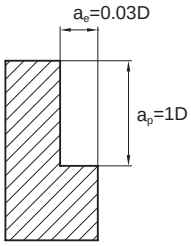
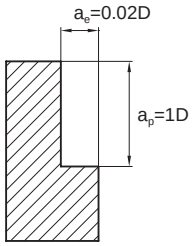
## Cutting parameters for HMX series end mills

### HMX-2BP

| Workpiece material | | Pre-hardened steel, Hardened steel 40~50HRC | | | | Hardened steel 50~60HRC | | | |
|---|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | Effective length (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| R1.25 | 8 | 12500 | 400 | 0.10 | 0.16 | 7000 | 225 | 0.10 | 0.16 |
| | 12 | 9000 | 275 | 0.06 | 0.16 | 5000 | 175 | 0.06 | 0.16 |
| | 16 | 9000 | 250 | 0.02 | 0.10 | 5000 | 150 | 0.02 | 0.10 |
| | 20 | 5500 | 175 | 0.02 | 0.05 | 5000 | 125 | 0.01 | 0.05 |
| R1.5 | 10 | 7500 | 400 | 0.10 | 0.30 | 4000 | 200 | 0.10 | 0.30 |
| | 12 | 7500 | 360 | 0.10 | 0.30 | 4000 | 180 | 0.10 | 0.30 |
| | 16 | 6500 | 250 | 0.05 | 0.20 | 3000 | 150 | 0.05 | 0.20 |
| | 20 | 6500 | 250 | 0.02 | 0.10 | 3000 | 150 | 0.02 | 0.05 |
| R2.0 | 10 | 6000 | 400 | 0.20 | 0.40 | 3000 | 200 | 0.20 | 0.40 |
| | 16 | 6000 | 400 | 0.10 | 0.32 | 3000 | 200 | 0.20 | 0.20 |
| | 20 | 5000 | 250 | 0.10 | 0.20 | 2500 | 100 | 0.10 | 0.20 |
| | 25 | 5000 | 250 | 0.10 | 0.20 | 2500 | 100 | 0.10 | 0.10 |
| R2.5 | 16 | 5000 | 400 | 0.25 | 0.50 | 3000 | 200 | 0.2 | 0.2 |
| | 25 | 4000 | 250 | 0.25 | 0.50 | 3000 | 100 | 0.20 | 0.2 |
| Maximum cutting depth | |   | | | | | | | |

1.Please select high-precision machine and tool holder.
2.Please use air blow or cutting liquid with high mist retardant property.
3.Make overhang of tool as short as possible in conditions of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

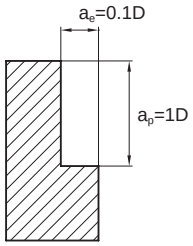
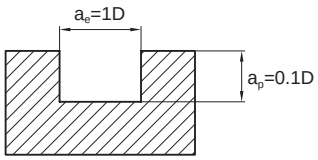
## HMX-4R★HMX-4RP★HMX-4RF

| Workpiece material | Pre-hardened steel, Hardened steel 40~50HRC | | Hardened steel 50~60HRC | | Hardened steel 60~68HRC | |
|---|---|---|---|---|---|---|
| Cutting speed | 300m/min | | 150m/min | | 100m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **3** | 32000 | 1225 | 16000 | 610 | 11000 | 420 |
| **4** | 24000 | 1500 | 12000 | 745 | 8000 | 500 |
| **5** | 19000 | 1630 | 9500 | 815 | 6400 | 550 |
| **6** | 16000 | 1850 | 8000 | 925 | 5300 | 610 |
| **8** | 12000 | 1850 | 6000 | 925 | 4000 | 610 |
| **10** | 9600 | 1850 | 4800 | 925 | 3200 | 610 |
| **12** | 8000 | 1920 | 4000 | 960 | 2700 | 648 |
| **16** | 6000 | 1440 | 3000 | 720 | 2000 | 480 |
| Maximum cutting depth |   Maximum $a_e$=1.0mm | |   Maximum $a_e$=0.5mm | |   Maximum $a_e$=0.3mm | |

1.Please select high-precision and rigidity machine and tool holder.
2.When the machine rigidity and workpiece fixture stability is low, vibration and abnormal noise may be generated. Please reduce the rotating speed and feed speed stated above correspondingly.
3.Please use air blow or MQL( minimum oil mist cooling).
4.Down milling is recommended in the case of side milling.
5.Make overhang of tool as short as possible in conditions of non-interference.

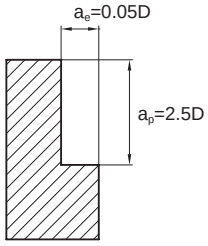
## Cutting parameters for NM series end mills

### NM-2E

| Workpiece material | Copper，Alloy of copper | |
|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 40000 | 1800 |
| **2** | 30000 | 2500 |
| **3** | 20000 | 2300 |
| **4** | 15000 | 2000 |
| **5** | 12000 | 1500 |
| **6** | 10000 | 1400 |
| **8** | 8000 | 1000 |
| **10** | 6500 | 900 |
| **12** | 5500 | 850 |
| Maximum cutting depth |  Maximum $a_e$=1.0mm |  Maximum $a_p$=1.0mm |

1.The above table shows the standard value of side milling.When milling slot,70% of feed speed stated above are recommend as standard.
2.Please select high-rigidity and high-precision machine and tool holder.When the machine rigidity and workpiece fixture stability is low,vibration and abnormal noise may be generated.Please reduce the rotating speed and feed speed above correspondingly.
3.When cutting depth is smaller,rotating speed and feed speed can be increased correspondingly.
4.Please select water-soluble cutting liquid.
5.Down milling is recommended in the case of side milling.
6.Make overhang of tool as short as possible in condition of non-interference.

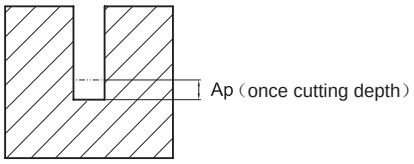
## NM-4E

| Workpiece material | Copper，Alloy of copper | |
|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **3** | 10600 | 250 |
| **4** | 8000 | 300 |
| **5** | 6500 | 400 |
| **6** | 5300 | 400 |
| **8** | 4000 | 450 |
| **10** | 3500 | 450 |
| **12** | 3000 | 450 |
| Maximum cutting depth |   Maximum $a_p$=0.5mm | |

1.Please select high-precision and rigidity machine and tool holder.When the machine rigidity and workpiece fixture stability is low,vibration and abnormal noise may be generated.Please reduce the rotating speed and feed speed above correspondingly.
2.When cutting depth is small,rotating speed and feed speed can be increased correspondingly.
3.Please select water-soluble cutting liquid.
4.Down milling is recommended in the case of side milling.
5.Make overhang of tool as short as possible in condition of non-interference.

## Cutting parameters for NM series end mills

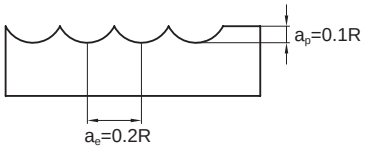
### NM-2EP

| Workpiece material | | Copper，Alloy of copper | | |
|---|---|---|---|---|
| Diameter (mm) | Effective length(mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) |
| 0.5 | 4 | 40000 | 800 | 0.004 |
| | 6 | 40000 | 700 | 0.002 |
| | 8 | 40000 | 500 | 0.001 |
| 0.8 | 4 | 40000 | 1000 | 0.02 |
| | 6 | 40000 | 1000 | 0.015 |
| | 8 | 40000 | 800 | 0.01 |
| | 10 | 40000 | 600 | 0.005 |
| 1.0 | 4 | 40000 | 1800 | 0.04 |
| | 6 | 40000 | 1500 | 0.04 |
| | 8 | 40000 | 1500 | 0.03 |
| | 10 | 30000 | 1000 | 0.02 |
| | 12 | 30000 | 800 | 0.015 |
| | 14 | 30000 | 600 | 0.01 |
| 1.5 | 8 | 40000 | 2000 | 0.09 |
| | 16 | 20000 | 1000 | 0.03 |
| 2.0 | 6 | 40000 | 2400 | 0.18 |
| | 8 | 40000 | 2200 | 0.15 |
| | 10 | 40000 | 2000 | 0.12 |
| | 12 | 30000 | 1500 | 0.10 |
| | 14 | 30000 | 1200 | 0.08 |
| | 16 | 30000 | 1000 | 0.06 |
| 2.5 | 10 | 40000 | 2500 | 0.15 |
| | 20 | 20000 | 1000 | 0.08 |
| 3.0 | 10 | 20000 | 2500 | 0.20 |
| | 20 | 20000 | 2000 | 0.12 |
| 4.0 | 16 | 15000 | 1800 | 0.25 |
| | 25 | 15000 | 1200 | 0.15 |
| 5.0 | 16 | 12000 | 2000 | 0.40 |
| | 25 | 12000 | 1500 | 0.35 |
| Maximum cutting depth | |   | | |

1.Please select high-precision machine and tool holder.
2.Please select water-soluble cutting liquid.
3.Make overhang of tool as short as possible in condition of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

## Cutting parameters for NM series end mills

### NM-2B

| Workpiece material | Copper，Alloy of copper | |
|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **R0.5** | 40000 | 900 |
| **R0.75** | 32000 | 800 |
| **R1.0** | 24000 | 870 |
| **R1.25** | 19000 | 800 |
| **R1.5** | 16000 | 850 |
| **R1.75** | 14000 | 850 |
| **R2.0** | 12000 | 900 |
| **R2.5** | 9600 | 900 |
| **R3.0** | 8000 | 1200 |
| **R4.0** | 7000 | 1500 |
| **R5.0** | 4800 | 1300 |
| **R6.0** | 4000 | 1200 |
| Maximum cutting depth |   | |

1.Please select high-precision and rigidity machine and tool holder.When the machine rigidity and workpiece fixture stability is low,vibration and abnormal noise may be generated.Please reduce the rotating speed and feed speed above correspondingly.

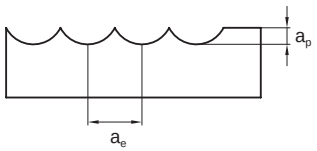
2.When cutting depth is small,rotating speed and feed speed can be increased correspondingly.

3.Please select water-soluble cutting liquid.

4.Make overhang of tool as short as possible in condition of non-interference.

## Cutting parameters for NM series end mills

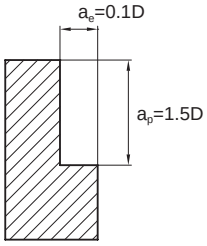
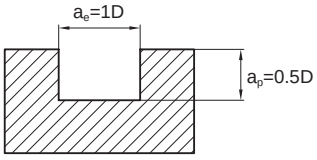
### NM-2BP

| Workpiece material | | Copper，Alloy of copper | | | |
|---|---|---|---|---|---|
| Diameter (mm) | Effective length(mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| R0.25 | 4 | 40000 | 750 | 0.01 | 0.025 |
| | 6 | 36000 | 500 | 0.008 | 0.02 |
| R0.3 | 4 | 40000 | 900 | 0.012 | 0.03 |
| | 6 | 40000 | 750 | 0.010 | 0.02 |
| | 8 | 30000 | 400 | 0.008 | 0.01 |
| R0.4 | 4 | 40000 | 1050 | 0.016 | 0.04 |
| | 6 | 40000 | 800 | 0.012 | 0.03 |
| | 8 | 40000 | 500 | 0.01 | 0.02 |
| | 10 | 30000 | 400 | 0.008 | 0.01 |
| R0.5 | 4 | 40000 | 1050 | 0.02 | 0.05 |
| | 6 | 40000 | 800 | 0.016 | 0.04 |
| | 8 | 40000 | 500 | 0.014 | 0.03 |
| | 10 | 33000 | 400 | 0.012 | 0.02 |
| | 12 | 35000 | 300 | 0.010 | 0.010 |
| R0.75 | 8 | 40000 | 900 | 0.03 | 0.075 |
| | 16 | 20000 | 400 | 0.015 | 0.04 |
| R1.0 | 6 | 40000 | 1100 | 0.04 | 0.10 |
| | 8 | 40000 | 900 | 0.034 | 0.08 |
| | 10 | 40000 | 750 | 0.028 | 0.065 |
| | 12 | 40000 | 500 | 0.022 | 0.05 |
| | 16 | 30000 | 400 | 0.018 | 0.04 |
| | 20 | 20000 | 300 | 0.012 | 0.03 |
| R1.5 | 10 | 40000 | 1100 | 0.06 | 0.15 |
| | 20 | 32000 | 600 | 0.03 | 0.08 |
| R2.0 | 10 | 32000 | 1100 | 0.08 | 0.20 |
| | 16 | 32000 | 900 | 0.06 | 0.16 |
| | 20 | 32000 | 600 | 0.04 | 0.12 |
| | 25 | 20000 | 400 | 0.02 | 0.08 |
| R2.5 | 16 | 25000 | 1250 | 0.10 | 0.25 |
| | 25 | 20000 | 900 | 0.06 | 0.12 |
| Maximum cutting depth | |   | | | |

1.Please select high-precision machine and tool holder.
2.Please select water-soluble cutting liquid.
3.Make overhang of tool as short as possible in condition of non-interference.
4.Reduce feed speed correspondingly when rotating speed is low.

## Cutting parameters for AL series end mills

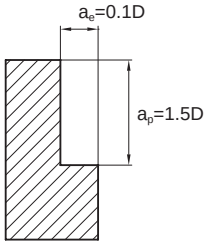
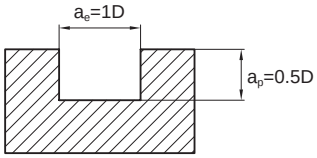
### AL-2E★AL-2EL

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 40000 | 650 | 40000 | 500 |
| **2** | 40000 | 950 | 32000 | 750 |
| **3** | 26500 | 1500 | 21000 | 1100 |
| **4** | 20000 | 1600 | 16000 | 1250 |
| **5** | 16000 | 1500 | 13000 | 1100 |
| **6** | 13000 | 1250 | 10600 | 1000 |
| **8** | 10000 | 1400 | 8000 | 1100 |
| **10** | 8000 | 1600 | 6500 | 1250 |
| **12** | 6600 | 1650 | 5300 | 1300 |
| **14** | 5700 | 1700 | 4600 | 1350 |
| **16** | 5000 | 1700 | 4000 | 1350 |
| **18** | 4400 | 1700 | 3500 | 1350 |
| **20** | 4000 | 1700 | 3200 | 1350 |
| Maximum cutting depth |   | |   | |

1.The above table shows the reference value of side milling. The feed speed in slot milling is 70% of the reference value stated in the table.
2.Please select high rigidity and precision machine and tool holder. Vibration and abnormal noise may be generated if the machine rigidity and workpiece fixture stability is low. Please reduce the rotating speed and feed speed stated above correspondingly.
3.It is possible to increase the rotating speed and feed speed correspondingly if the cutting depth is low.
4.Please use water-soluble cutting liquid.
5.Down milling is recommended in the case of side milling.
6.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for AL series end mills

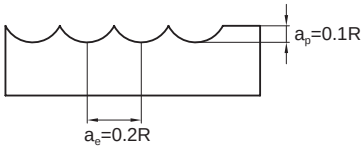
### AL-3E★AL-3EL

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 40000 | 800 | 40000 | 600 |
| **2** | 40000 | 1200 | 32000 | 900 |
| **3** | 26500 | 1800 | 21000 | 1300 |
| **4** | 20000 | 2000 | 16000 | 1500 |
| **5** | 16000 | 1750 | 13000 | 1300 |
| **6** | 13000 | 1500 | 10600 | 1200 |
| **8** | 10000 | 1650 | 8000 | 1300 |
| **10** | 8000 | 1900 | 6500 | 1500 |
| **12** | 6600 | 1950 | 5300 | 1550 |
| **14** | 5700 | 2000 | 4600 | 1600 |
| **16** | 5000 | 2000 | 4000 | 1600 |
| **18** | 4400 | 2000 | 3500 | 1600 |
| **20** | 4000 | 2000 | 3200 | 1600 |
| Maximum cutting depth |   | |   | |

1.The above table shows the reference value of side milling. The feed speed in slot milling is 70% of the reference value stated in the table.
2.Please select high rigidity and precision machine and tool holder. Vibration and abnormal noise may be generated if the machine rigidity and workpiece fixture stability is low. Please reduce the rotating speed and feed speed stated above correspondingly.
3.It is possible to increase the rotating speed and feed speed correspondingly if the cutting depth is low.
4.Please use water-soluble cutting liquid.
5.Down milling is recommended in the case of side milling.
6.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for AL series end mills

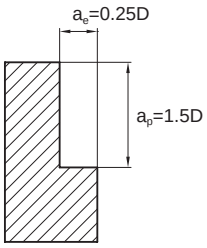
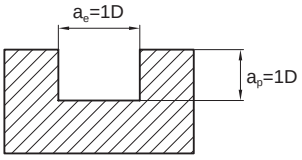
### AL-2B

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **R1.0** | 40000 | 2000 | 32000 | 1600 |
| **R1.5** | 26500 | 1950 | 21000 | 1550 |
| **R2.0** | 20000 | 1950 | 16000 | 1550 |
| **R2.5** | 16000 | 1950 | 13000 | 1550 |
| **R3.0** | 13000 | 2000 | 10600 | 1600 |
| **R4.0** | 10000 | 2450 | 8000 | 2000 |
| **R5.0** | 8000 | 2200 | 6500 | 1750 |
| **R6.0** | 6600 | 2050 | 5300 | 1650 |
| Maximum cutting depth |   | | | |

1.Please select high rigidity and precision machine and tool holder. Vibration and abnormal noise may be generated if the machine rigidity and workpiece fixture stability is low. Please reduce the rotating speed and feed speed stated above correspondingly.
2.If the cutting depth is low, it is possible to increase the rotating speed and feed speed correspondingly.
3.Please use water-soluble cutting liquid.
4.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for AL series end mills

### AL-3W

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Cutting speed | 250m/min | | 200m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 13000 | 3000 | 10600 | 1900 |
| **8** | 10000 | 3000 | 8000 | 1900 |
| **10** | 8000 | 2900 | 6500 | 1850 |
| **12** | 6600 | 2700 | 5300 | 1700 |
| **14** | 5700 | 2600 | 4600 | 1650 |
| **16** | 5000 | 2550 | 4000 | 1600 |
| **18** | 4400 | 2500 | 3500 | 1550 |
| **20** | 4000 | 2400 | 3200 | 1500 |
| Maximum cutting depth |   | |   | |

1.The above table shows the reference value of side milling. The feed speed in slot milling is 70% of the reference value stated in the table, and feed rate 50%.

2.Please select high rigidity and precision machine and tool holder. Vibration and abnormal noise may be generated if the machine rigidity and workpiece fixture stability is low. Please reduce the rotating speed and feed speed stated above correspondingly.

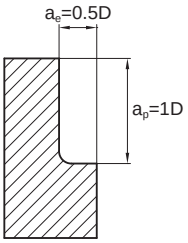
3.It is possible to increase the rotating speed and feed speed correspondingly if the cutting depth is low.

4.Please use water-soluble cutting liquid.

5.Down milling is recommended in the case of side milling.

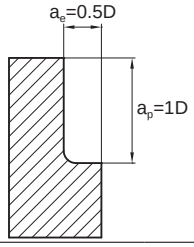
6.Make overhang of tool as short as possible in conditions of non-interference.

## AL-2R-AIR

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Cutting speed | 500~800m/min | | 500~800m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 35000 | 3500 | 35000 | 3500 |
| **8** | 26000 | 3800 | 26000 | 3800 |
| **10** | 21000 | 4000 | 21000 | 4000 |
| **12** | 18000 | 4300 | 18000 | 4300 |
| **16** | 15000 | 4800 | 15000 | 4800 |
| **20** | 12000 | 5500 | 12000 | 5500 |
| Maximum cutting depth |   | | | |

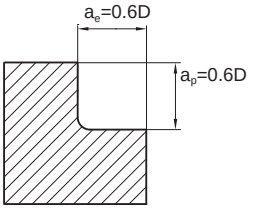
1.Above cutting parameters are suitable for aluminium high speed machining specific CNC.
2.Please select cutting liquid or strong air cooling system for chip flowing out.
3.The sparkle by machining or heat caused by breakage might result in fire or conflagration.Please pay attention to fire prevention.
4.Dynamic balance detection should be done before machining.

## AL-2RL-AIR

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Cutting speed | 500~800m/min | | 500~800m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 30000 | 3000 | 30000 | 3000 |
| **8** | 24000 | 3200 | 24000 | 3200 |
| **10** | 20000 | 3500 | 20000 | 3500 |
| **12** | 16000 | 3800 | 16000 | 3800 |
| **16** | 12000 | 4000 | 12000 | 4000 |
| **20** | 10000 | 4600 | 10000 | 4600 |
| Maximum cutting depth |   | | | |

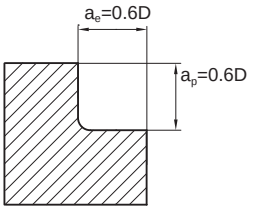
1.Above cutting parameters are suitable for aluminium high speed machining specific CNC.
2.Please select cutting liquid or strong air cooling system for chip flowing out.
3.The sparkle by machining or heat caused by breakage might result in fire or conflagration.Please pay attention to fire prevention.
4.Dynamic balance detection should be done before machining.

## AL-3R-AIR

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Cutting speed | 800~1200m/min | | 800~1200m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **12** | 25000 | 6000 | 25000 | 6000 |
| **16** | 20000 | 6400 | 20000 | 6400 |
| **20** | 15000 | 7000 | 15000 | 7000 |
| Maximum cutting depth |   | | | |

1.Above cutting parameters are suitable for aluminium high speed machining specific CNC.
2.Please select cutting liquid or strong air cooling system for chip flowing out.
3.The sparkle by machining or heat caused by breakage might result in fire or conflagration.Please pay attention to fire prevention.
4.Dynamic balance detection should be done before machining.

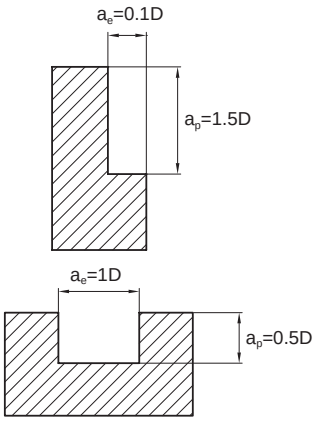
## AL-3RL-AIR

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Cutting speed | 800~1200m/min | | 800~1200m/min | |
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **12** | 22000 | 5300 | 22000 | 5300 |
| **16** | 18000 | 5700 | 18000 | 5700 |
| **20** | 13000 | 6000 | 13000 | 6000 |
| Maximum cutting depth |   | | | |

1.Above cutting parameters are suitable for aluminium high speed machining specific CNC.
2.Please select cutting liquid or strong air cooling system for chip flowing out.
3.The sparkle by machining or heat caused by breakage might result in fire or conflagration.Please pay attention to fire prevention.
4.Dynamic balance detection should be done before machining.

## Cutting parameters for ALGseries end mills

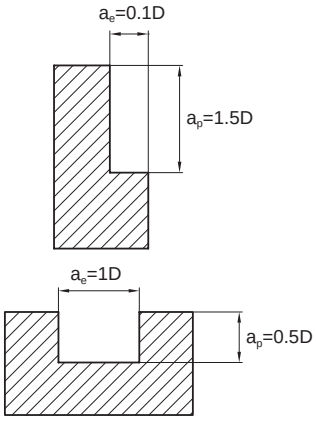
## ALG-2E

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 40000 | 650 | 40000 | 500 |
| **2** | 40000 | 950 | 32000 | 750 |
| **3** | 26500 | 1500 | 21000 | 1100 |
| **4** | 20000 | 1600 | 16000 | 1250 |
| **5** | 16000 | 1500 | 13000 | 1100 |
| **6** | 13000 | 1250 | 10600 | 1000 |
| **8** | 10000 | 1400 | 8000 | 1100 |
| **10** | 8000 | 1600 | 6500 | 1250 |
| **12** | 6600 | 1650 | 5300 | 1300 |
| **14** | 5700 | 1700 | 4600 | 1350 |
| **16** | 5000 | 1700 | 4000 | 1350 |
| **18** | 4400 | 1700 | 3500 | 1350 |
| **20** | 4000 | 1700 | 3200 | 1350 |
| Maximum cutting depth |   | | | |

1.The above table shows the standard value of side milling.When milling slot,70% of feed speed stated above are recommend as standard.
2.Please select high-rigidity and high-precision machine and tool holder.When the machine rigidity and workpiece fixture stability is low,vibration and abnormal noise may be generated.Please reduce the rotating speed and feed speed above correspondingly.
3.When cutting depth is smaller,rotating speed and feed speed can be increased correspondingly.
4.Please select water-soluble cutting liquid.
5.Down milling is recommended in the case of side milling.
6.Make overhang of tool as short as possible in condition of non-interference.

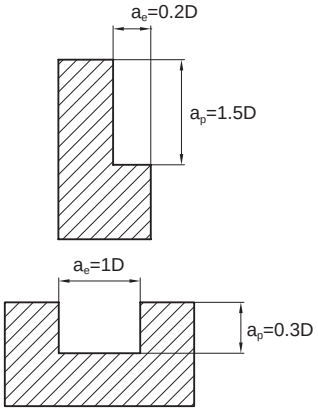
## Cutting parameters for ALG series end mills

### ALG-3E

| Workpiece material | Aluminum alloy | | Silicon aluminum alloy Si≤10% | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **1** | 40000 | 800 | 40000 | 600 |
| **2** | 40000 | 1200 | 32000 | 900 |
| **3** | 26500 | 1800 | 21000 | 1300 |
| **4** | 20000 | 2000 | 16000 | 1500 |
| **5** | 16000 | 1750 | 13000 | 1300 |
| **6** | 13000 | 1500 | 10600 | 1200 |
| **8** | 10000 | 1650 | 8000 | 1300 |
| **10** | 8000 | 1900 | 6500 | 1500 |
| **12** | 6600 | 1950 | 5300 | 1550 |
| **14** | 5700 | 2000 | 4600 | 1600 |
| **16** | 5000 | 2000 | 4000 | 1600 |
| **18** | 4400 | 2000 | 3500 | 1600 |
| **20** | 4000 | 2000 | 3200 | 1600 |
| Maximum cutting depth |   | | | |

1.The above table shows the standard value of side milling.When milling slot,70% of feed speed stated above are recommend as standard.
2.Please select high-rigidity and high-precision machine and tool holder.When the machine rigidity and workpiece fixture stability is low,vibration and abnormal noise may be generated.Please reduce the rotating speed and feed speed above correspondingly.
3.When cutting depth is smaller,rotating speed and feed speed can be increased correspondingly.
4.Please select water-soluble cutting liquid.
5.Down milling is recommended in the case of side milling.
6.Make overhang of tool as short as possible in condition of non-interference.

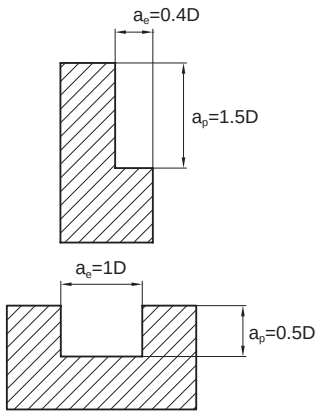
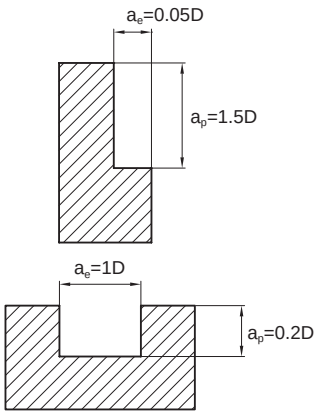
## SM-3E

| Workpiece material | Carbon steel、Alloy steel | | Stainless steel | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **3** | 8500 | 660 | 4400 | 100 |
| **4** | 6400 | 690 | 3700 | 160 |
| **5** | 5800 | 710 | 3000 | 190 |
| **6** | 5300 | 750 | 2700 | 200 |
| **8** | 3900 | 700 | 2000 | 210 |
| **10** | 3100 | 640 | 1600 | 210 |
| **12** | 2600 | 600 | 1300 | 170 |
| **16** | 1900 | 520 | 1000 | 130 |
| **20** | 1500 | 445 | 800 | 140 |
| Maximum cutting depth |   | | | |

1.The above table shows the standard value of side milling. When milling slot, rotating speed is around 80%~100% of the stated value, and feed speed around 60%~80%.
2.Non water-soluble cutting liquid is recommended in machining of stainless steel and heat-resistant alloy.
3.Please select high rigid and precise machine and tool holder.
4.Adjust rotating speed and feed speed according to cutting depth and machine rigidity.
5.Down milling is recommended in the case of side milling.
6.Make overhang of tool as short as possible in conditions of non-interference.

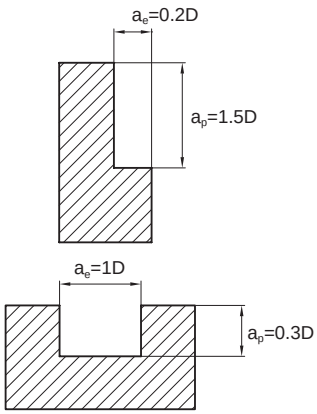
## Cutting parameters for SM series end mills

### VSM-4E★VSM-4EFP

| Workpiece material | Carbon steel、Alloy steel | | Stainless steel | | Heat resistant alloy、Titanium alloy | |
|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **4** | 6400 | 690 | 3700 | 160 | 3055 | 90 |
| **5** | 5800 | 710 | 3000 | 190 | 2470 | 90 |
| **6** | 5300 | 750 | 2700 | 200 | 2470 | 120 |
| **8** | 3900 | 700 | 2000 | 210 | 1820 | 130 |
| **10** | 3100 | 640 | 1600 | 210 | 1430 | 130 |
| **12** | 2600 | 600 | 1300 | 170 | 1235 | 110 |
| **16** | 1900 | 520 | 1000 | 150 | 935 | 90 |
| **20** | 1500 | 445 | 800 | 140 | 740 | 90 |
| Maximum cutting depth |   | | | |   | |

1.The above table shows the standard value of side milling. When milling slot, rotating speed is around 80%~100% of the stated value, and feed speed around 60%~80%.
2.Non water-soluble cutting liquid is recommended in machining of stainless steel and heat-resistant alloy.
3.Please select high rigid and precise machine and tool holder.
4.Adjust rotating speed and feed speed according to cutting depth and machine rigidity.
5.Down milling is recommended
6.Make overhang of tool as short as possible in condition of non-interference.
7.The above table is recommended data based on L/D≤4.When L/D>4,please reduce 70% of rotating speed and feed speed correspondingly.

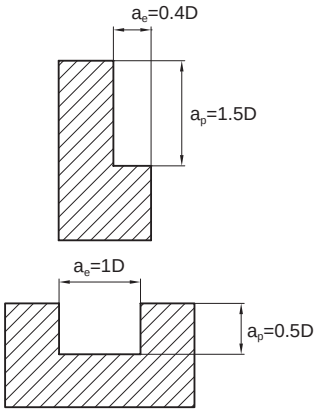
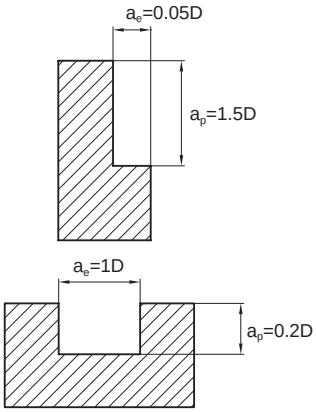
## SM-4R

| Workpiece material | Carbon steel、Alloy steel | | Stainless steel | |
|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 5300 | 900 | 2700 | 240 |
| **8** | 3900 | 840 | 2000 | 255 |
| **10** | 3100 | 770 | 1600 | 255 |
| **12** | 2600 | 720 | 1300 | 205 |
| Maximum cutting depth |   | | | |

1.The above table shows the standard value of side milling. When milling slot, rotating speed is around 80%~100% of the stated value, and feed speed around 60%~80%.
2.Non water-soluble cutting liquid is recommended in machining of stainless steel and heat-resistant alloy.
3.Please select high rigid and precise machine and tool holder.
4.Adjust rotating speed and feed speed according to cutting depth and machine rigidity.
5.Down milling is recommended in the case of side milling.
6.Make overhang of tool as short as possible in conditions of non-interference.

## Cutting parameters for SM series end mills

### VSM-4R★VSM-4RFP

| Workpiece material | Carbon steel、Alloy steel | | Stainless steel | | Heat resistant alloy、Titanium alloy | |
|---|---|---|---|---|---|---|
| Diameter (mm) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) | Rotating speed ($min^{-1}$) | Feed speed (mm/min) |
| **6** | 5300 | 900 | 2700 | 240 | 2470 | 145 |
| **8** | 3900 | 840 | 2000 | 255 | 1820 | 155 |
| **10** | 3100 | 770 | 1600 | 255 | 1430 | 155 |
| **12** | 2600 | 720 | 1300 | 205 | 1235 | 135 |
| **16** | 1900 | 625 | 1000 | 180 | 935 | 110 |
| Maximum cutting depth |   | | | |   | |

1.The above table shows the standard value of side milling. When milling slot, rotating speed is around 80%~100% of the stated value, and feed speed around 60%~80%.

2.Non water-soluble cutting liquid is recommended in machining of stainless steel and heat-resistant alloy.

3.Please select high rigid and precise machine and tool holder.

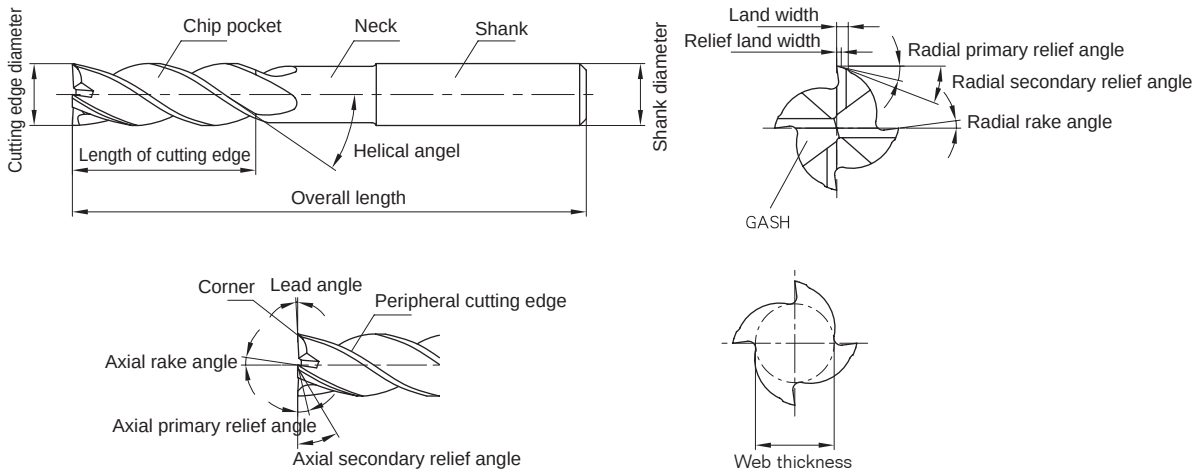
4.Adjust rotating speed and feed speed according to cutting depth and machine rigidity.

5.Down milling is recommended

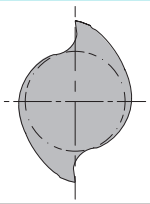
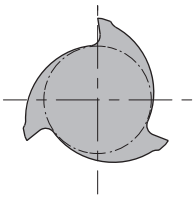
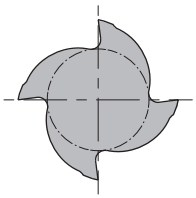
6.Make overhang of tool as short as possible in condition of non-interference.

7.The above table is recommended data based on L/D≤4.When L/D>4,please reduce 70% of rotating speed and feed speed correspondingly.

## Parts terminology of end mill

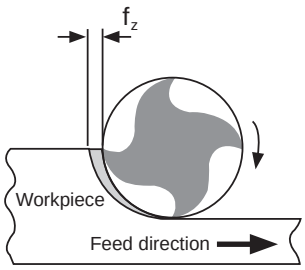



## Number of teeth, chip pocket and tool rigidity

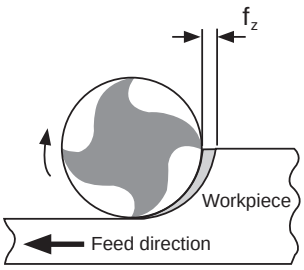
| Number of teeth | | 2 Flutes | 3 Flutes | 4 Flutes |
|---|---|---|---|---|
| Profile of cross section | |  |  |  |
| Proportion of cross section | | 54% | 56% | 60% |
| Features | Advantages | ● Large chip pocket<br>● Easy chip removal | ● Easy chip removal<br>● Perfect surface finish | ● Good rigidity<br>● Perfect surface finish |
| | Disadvantages | Low rigidity | Difficult to measure external diameter | Chip removal is not smooth |
| Functions | | 1. Slot machining<br>2. Side face machining<br>3. Hole machining | 1. Slot machining<br>2. Side face machining<br>3. Heavy cutting<br>4. For finishing | 1. Shallow slot machining<br>2. Side face machining<br>3. For finishing |

## Down milling and up milling

● Side milling

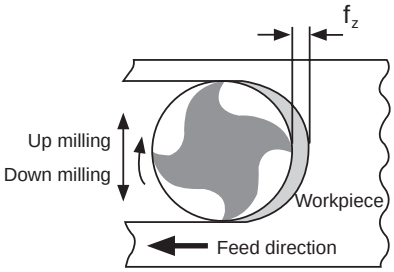



(a) up milling




(b) Down milling

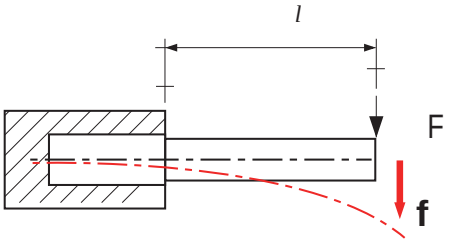
● Slot milling



## Length of cutting edge (overhang) and cutting edge diameter

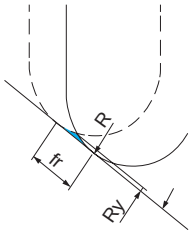
The shorter of overhang is, the higher the rigidity is. Thus it is not easy to bend or vibrate in the cutting process, and machining precision is improved. When length of cutting edge (overhang) doubles, the Deflection degree (f) will be 8 times of the original.

***When the overhang is reduced by 20%, the Deflection degree (f) will decrease by 50%.***
***When the diameter increases by 20%, the Deflection degree (f) will decrease by 50%.***




$$f = \frac{F \cdot l^3}{3 \cdot E \cdot I} = \frac{F \cdot l^3 \cdot 64}{3 \cdot E \cdot d^4 \cdot \pi}$$

## Feed rate selection table in profile machining by ball nose and R end mills




**Ry=R×{1-cos[arc sin(fr/2R)]}**

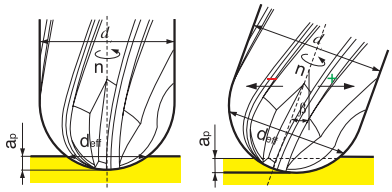
Ry：Theoretical value of surface roughness
fr：Feed rate
R：Ball nose radius or corner radius

Table of theoretical roughness formed by ball nose of end mill ( corner radius of R end mill) and feed rate(mm)

| R \ Ry | Feed rate fr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| **0.5** | 0.003 | 0.010 | 0.023 | 0.042 | 0.067 | 0.100 | | | | |
| **1.0** | 0.001 | 0.005 | 0.011 | 0.020 | 0.032 | 0.046 | 0.063 | 0.083 | 0.107 | |
| **1.5** | 0.001 | 0.003 | 0.008 | 0.013 | 0.021 | 0.030 | 0.041 | 0.054 | 0.069 | 0.086 |
| **2.0** | 0.001 | 0.003 | 0.006 | 0.010 | 0.015 | 0.023 | 0.031 | 0.040 | 0.051 | 0.064 |
| **2.5** | 0.001 | 0.002 | 0.005 | 0.008 | 0.013 | 0.018 | 0.025 | 0.032 | 0.041 | 0.051 |
| **3.0** | | 0.001 | 0.004 | 0.007 | 0.010 | 0.015 | 0.020 | 0.027 | 0.034 | 0.042 |
| **4.0** | | 0.001 | 0.003 | 0.005 | 0.008 | 0.011 | 0.015 | 0.020 | 0.025 | 0.031 |
| **5.0** | | 0.001 | 0.002 | 0.004 | 0.006 | 0.009 | 0.012 | 0.016 | 0.020 | 0.025 |
| **6.0** | | | 0.002 | 0.003 | 0.005 | 0.008 | 0.010 | 0.013 | 0.017 | 0.021 |
| **8.0** | | | 0.001 | 0.003 | 0.004 | 0.006 | 0.008 | 0.010 | 0.013 | 0.016 |
| **10.0** | | | 0.001 | 0.002 | 0.003 | 0.005 | 0.006 | 0.008 | 0.010 | 0.013 |
| **12.5** | | | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.008 | 0.010 |

| R \ Ry | Feed rate fr | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
| **0.5** | | | | | | | | | | |
| **1.0** | | | | | | | | | | |
| **1.5** | 0.104 | | | | | | | | | |
| **2.0** | 0.077 | 0.092 | 0.109 | | | | | | | |
| **2.5** | 0.061 | 0.073 | 0.086 | 0.100 | | | | | | |
| **3.0** | 0.051 | 0.061 | 0.071 | 0.083 | 0.095 | 0.109 | | | | |
| **4.0** | 0.038 | 0.045 | 0.053 | 0.062 | 0.071 | 0.081 | 0.091 | 0.103 | | |
| **5.0** | 0.030 | 0.036 | 0.042 | 0.049 | 0.057 | 0.064 | 0.073 | 0.082 | 0.091 | 0.101 |
| **6.0** | 0.025 | 0.030 | 0.035 | 0.041 | 0.047 | 0.054 | 0.061 | 0.068 | 0.076 | 0.084 |
| **8.0** | 0.019 | 0.023 | 0.026 | 0.031 | 0.035 | 0.040 | 0.045 | 0.051 | 0.057 | 0.063 |
| **10.0** | 0.015 | 0.018 | 0.021 | 0.025 | 0.028 | 0.032 | 0.036 | 0.041 | 0.045 | 0.050 |
| **12.5** | 0.012 | 0.014 | 0.017 | 0.020 | 0.023 | 0.026 | 0.029 | 0.032 | 0.036 | 0.040 |

## Cutting parameters calculation

| Symbol | Description | Formula |
|---|---|---|
| $n$ | Rotating speed per minute n[min$^{-1}$]r/min | $n=\frac{v_c \cdot 1000}{d \cdot \pi}$ |
| $v_c$ | Cutting speed $V_c$[m/min] | $v_c=\frac{d \cdot \pi \cdot n}{1000}$ |
| $f_z$ | Amount of feed per tooth $f_z$[mm/tooth] | $f_z=\frac{V_f}{z \cdot n}$ |
| $f$ | Amount of feed per rotation $f_z$[mm/rev.] | $f=f_z \cdot z$ |
| $V_f$ | Feed rate $V_f$[mm/min] | $V_f=f_z \cdot z \cdot n=f \cdot n$ |
| $Q$ | Removal rate Q[cm$^3$/min] | $Q=\frac{a_e \cdot a_p \cdot v_f}{1000}$ |
| $d_{eff}$ | Effective diameter of ball nose end mill $d_{eff}$[mm]   | $\beta=0$<br>$d_{eff}=2 \cdot \sqrt{d \cdot a_p - a_p^2}$<br>$\beta \neq 0$<br>$d_{eff}=d \cdot sin[\beta \pm arccos(\frac{d-2a_p}{d})]$ |
| $V_{eff}$ | Effective cutting speed of end mill $V_{eff}$[m/min] | $V_{eff}=\frac{d_{eff} \cdot \pi \cdot n}{1000}$ |
| $a_e$ | Radial cutting width $a_e$[mm] | |
| $a_p$ | Axial cutting depth $a_p$[mm] | |
| $d$ | Milling diameter[mm] | |
| $z$ | Number of teeth | |
| $\beta$ | Inclined angle | |

## Common problems and solutions for end mill

| Common problems \ Solutions | | Tool material | Cutting condition | | | | | | | Tool shape | | | Machine clamping | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Select coated end mill | Cutting speed | Feed rate | Cutting depth | Cutting direction ( down / up milling ) | Cutting liquid: Increase the amount of cutting liquid | Cutting liquid: Water-insoluble cutting liquid | Cutting liquid: Dry or wet machining | Helical angle | Number of tooth | Milling diameter | Reduce the overhang length | Improve tool clamping precision | Change collet | Increase clamping force | Improve workpiece clamping rigidity |
| **Tool fracture** | Fracture of end mill | | | ↓ | ↓ | | | | | | ↓ | ↑ | ✓ | | ✓ | ✓ | |
| **Damage of cutting edge** | Rapid wear of cutting edge | ✓ | ↓ | ↑ | | down | | ✓ | | | | ↑ | | | | | |
| | Breakage | | ↓ | ↓ | ↓ | down | | | dry | | | | ✓ | | ✓ | | ✓ |
| | Severe chips bond | ✓ | | | | | ✓ | | wet | ↑ | | | | | | | |
| **Machining precision** | Poor surface quality | | ↑ | ↓ | ↓ | | | ✓ | wet | | | | | ✓ | | | |
| | Uneven | | | ↓ | ↓ | | | | | ↓ | ↑ | ↑ | | ✓ | ✓ | | |
| | Uneven side face of workpiece | | | ↓ | ↓ | up | | ✓ | | ↑ | ↑ | ↑ | ✓ | | | | |
| | Burrs, breakage and slice frittering | | | ↓ | ↓ | | | | | ↓ | | | | | | | |
| | Large vibration | | ↓ | ↑ | | | | | | ↑ | ↓ | ↑ | ✓ | | ✓ | ✓ | ✓ |
| **Chip control** | obstructed chip removal | | | ↓ | ↓ | | ✓ | | | | ↓ | | | | | | |
| **Others** | | 1.Large abrasion of cutting edge is easy to cause fracture of end mill or poor surface quality, so it is recommended to regrind the end mills.<br>2.Make overhang of tool as short as possible. | | | | | | | | | | | | | | | |