



List 9575 - EXOPRO[®] PHX: Deep Feed, Corner Radius

List 9576 - EXOPRO[®] PHX: Long Neck, Deep Feed, Corner Radius

List 9580 - EXOPRO[®] PHX: Pencil Neck, Deep Feed, Corner Radius

Side Milling

| Hardness | | | | <40 HRC | | | | 40-55 HRC | | | | 55-60 HRC | | | | | | | |
|---------------|--------|-------|---------------------|-------------------------------|---------------|-------------------|--------|----------------|---------------|-------------------|--------|--|---------------|-------------------|--------|----------------------|--|--|--|
| Work Material | | | | Mild Steels and Carbon Steels | | | | | | | | Hardened Steels and Prehardened Steels | | | | | | | |
| | | | | High Feed Roughing | | | | Semi-Finishing | | | | Finishing | | | | | | | |
| Cutting Speed | | | | 60-410 SFM | | | | 60-250 SFM | | | | 60-410 SFM | | | | | | | |
| D (mm) | r (mm) | L1 | Rec'd Cutting Angle | Speed (RPM) | Feed (in/min) | Depth of Cut (in) | | Speed (RPM) | Feed (in/min) | Depth of Cut (in) | | Speed (RPM) | Feed (in/min) | Depth of Cut (in) | | Stock to Remove (in) | | | |
| | | | | | | Aa | Ar | | | Aa | Ar | | | Aa | Ar | | | | |
| 1.0 | R0.3 | 10 | 0.3° | 16,000 | 35.4 | 0.0012 | 0.0055 | 16,000 | 35.4 | 0.0012 | 0.0055 | 16,000 | 35.4 | 0.0016 | 0.0055 | 0.0020 | | | |
| | | 15 | 0.3° | 8,000 | 17.7 | 0.0012 | 0.0055 | 8,000 | 17.7 | 0.0012 | 0.0055 | 8,000 | 17.7 | 0.0016 | 0.0055 | 0.0020 | | | |
| | | 20 | 0.3° | 6,000 | 13.8 | 0.0008 | 0.0055 | 6,000 | 13.8 | 0.0008 | 0.0055 | 6,000 | 13.8 | 0.0016 | 0.0055 | 0.0012 | | | |
| | | 25 | 0.3° | 6,000 | 11.8 | 0.0004 | 0.0051 | 6,000 | 11.8 | 0.0004 | 0.0051 | 6,000 | 11.8 | 0.0016 | 0.0055 | 0.0012 | | | |
| | | 30 | 0.3° | 6,000 | 9.8 | 0.0004 | 0.0047 | 6,000 | 9.8 | 0.0004 | 0.0047 | 6,000 | 9.8 | 0.0016 | 0.0055 | 0.0012 | | | |
| 1.5 | R0.3 | 10 | 0.3° | 16,000 | 55.1 | 0.0020 | 0.0118 | 16,000 | 47.2 | 0.0020 | 0.0118 | 16,000 | 55.1 | 0.0016 | 0.0138 | 0.0028 | | | |
| | | 15 | 0.3° | 8,000 | 31.5 | 0.0020 | 0.0118 | 8,000 | 23.6 | 0.0020 | 0.0118 | 8,000 | 31.5 | 0.0016 | 0.0138 | 0.0020 | | | |
| | | 20 | 0.3° | 5,500 | 21.7 | 0.0016 | 0.0118 | 5,500 | 19.7 | 0.0016 | 0.0118 | 5,500 | 21.7 | 0.0016 | 0.0138 | 0.0020 | | | |
| | | 25 | 0.3° | 5,000 | 19.7 | 0.0016 | 0.0118 | 5,000 | 17.7 | 0.0016 | 0.0118 | 5,000 | 19.7 | 0.0016 | 0.0138 | 0.0012 | | | |
| | | 30 | 0.3° | 4,500 | 17.7 | 0.0016 | 0.0118 | 4,500 | 15.7 | 0.0016 | 0.0118 | 4,500 | 17.7 | 0.0016 | 0.0138 | 0.0012 | | | |
| 2.0 | R0.5 | 10 | 0.3° | 12,000 | 57.1 | 0.0059 | 0.0157 | 12,000 | 43.3 | 0.0059 | 0.0157 | 12,000 | 43.3 | 0.0024 | 0.0157 | 0.0028 | | | |
| | | 15 | 0.3° | 7,800 | 35.4 | 0.0047 | 0.0157 | 7,800 | 27.6 | 0.0039 | 0.0157 | 7,800 | 27.6 | 0.0024 | 0.0157 | 0.0028 | | | |
| | | 20 | 0.3° | 6,200 | 29.5 | 0.0039 | 0.0118 | 6,200 | 23.6 | 0.0028 | 0.0118 | 6,200 | 23.6 | 0.0024 | 0.0157 | 0.0020 | | | |
| | | 25 | 0.3° | 4,700 | 21.7 | 0.0028 | 0.0118 | 4,700 | 19.7 | 0.0024 | 0.0118 | 4,700 | 19.7 | 0.0024 | 0.0157 | 0.0020 | | | |
| | | 30 | 0.3° | 3,500 | 15.7 | 0.0028 | 0.0118 | 3,500 | 15.7 | 0.0020 | 0.0118 | 3,500 | 15.7 | 0.0024 | 0.0157 | 0.0020 | | | |
| | | 35 | 0.3° | 3,500 | 15.7 | 0.0028 | 0.0079 | 3,500 | 15.7 | 0.0016 | 0.0079 | 3,500 | 15.7 | 0.0024 | 0.0157 | 0.0012 | | | |
| | | 40 | 0.3° | 3,500 | 11.8 | 0.0028 | 0.0079 | 3,500 | 11.8 | 0.0016 | 0.0079 | 3,500 | 11.8 | 0.0024 | 0.0157 | 0.0012 | | | |
| | | 45 | 0.3° | 3,500 | 7.9 | 0.0028 | 0.0079 | 3,500 | 7.9 | 0.0012 | 0.0079 | 3,500 | 7.9 | 0.0024 | 0.0157 | 0.0012 | | | |
| | | 50 | 0.3° | 3,500 | 5.9 | 0.0024 | 0.0039 | 3,500 | 5.9 | 0.0012 | 0.0039 | 3,500 | 7.9 | 0.0024 | 0.0157 | 0.0012 | | | |
| 60 | 0.3° | 3,500 | 5.9 | 0.0020 | 0.0039 | 3,500 | 5.9 | 0.0012 | 0.0039 | 3,500 | 7.9 | 0.0024 | 0.0157 | 0.0012 | | | | | |
| 3.0 | R0.8 | 10 | 0.3° | 11,000 | 65.0 | 0.0051 | 0.0236 | 8,000 | 47.2 | 0.0051 | 0.0236 | 11,000 | 82.7 | 0.0039 | 0.0197 | 0.0039 | | | |
| | | 15 | 0.3° | 10,000 | 59.1 | 0.0051 | 0.0236 | 8,000 | 47.2 | 0.0051 | 0.0236 | 10,000 | 74.8 | 0.0039 | 0.0197 | 0.0028 | | | |
| | | 20 | 0.3° | 7,500 | 43.3 | 0.0005 | 0.0197 | 7,200 | 39.4 | 0.0005 | 0.0197 | 7,500 | 55.1 | 0.0039 | 0.0197 | 0.0028 | | | |
| | | 25 | 0.3° | 4,800 | 27.6 | 0.0047 | 0.0157 | 4,600 | 25.6 | 0.0047 | 0.0157 | 4,800 | 35.4 | 0.0039 | 0.0197 | 0.0020 | | | |
| | | 30 | 0.3° | 3,800 | 21.7 | 0.0039 | 0.0157 | 3,400 | 19.7 | 0.0039 | 0.0157 | 3,800 | 29.5 | 0.0039 | 0.0197 | 0.0012 | | | |
| | | 40 | 0.3° | 2,600 | 17.7 | 0.0031 | 0.0118 | 2,600 | 15.7 | 0.0031 | 0.0118 | 2,600 | 21.7 | 0.0039 | 0.0197 | 0.0012 | | | |
| | | 50 | 0.3° | 2,200 | 13.8 | 0.0024 | 0.0118 | 2,200 | 11.8 | 0.0024 | 0.0118 | 2,200 | 17.7 | 0.0039 | 0.0197 | 0.0012 | | | |
| 60 | 0.3° | 2,200 | 13.8 | 0.0016 | 0.0118 | 2,200 | 11.8 | 0.0016 | 0.0118 | 2,200 | 15.7 | 0.0039 | 0.0197 | 0.0012 | | | | | |
| 4.0 | R1 | 10 | 0.5° | 9,500 | 82.7 | 0.0079 | 0.0354 | 6,000 | 49.2 | 0.0079 | 0.0354 | 9,500 | 88.6 | 0.0047 | 0.0315 | 0.0039 | | | |
| | | 15 | 0.5° | 9,000 | 78.7 | 0.0079 | 0.0315 | 6,000 | 49.2 | 0.0079 | 0.0315 | 9,000 | 84.6 | 0.0047 | 0.0315 | 0.0039 | | | |
| | | 20 | 0.5° | 8,200 | 66.9 | 0.0079 | 0.0276 | 6,000 | 49.2 | 0.0055 | 0.0276 | 8,200 | 78.7 | 0.0047 | 0.0276 | 0.0039 | | | |
| | | 25 | 0.5° | 5,500 | 55.1 | 0.0059 | 0.0276 | 5,500 | 45.3 | 0.0043 | 0.0276 | 5,500 | 53.1 | 0.0047 | 0.0276 | 0.0028 | | | |
| | | 30 | 0.5° | 4,500 | 45.3 | 0.0059 | 0.0276 | 4,500 | 35.4 | 0.0035 | 0.0276 | 4,500 | 43.3 | 0.0047 | 0.0276 | 0.0028 | | | |
| | | 35 | 0.5° | 3,600 | 43.3 | 0.0047 | 0.0236 | 3,600 | 29.5 | 0.0035 | 0.0236 | 3,600 | 35.4 | 0.0047 | 0.0276 | 0.0020 | | | |
| | | 40 | 0.5° | 3,000 | 35.4 | 0.0047 | 0.0236 | 3,000 | 25.6 | 0.0035 | 0.0236 | 3,000 | 31.5 | 0.0047 | 0.0276 | 0.0020 | | | |
| | | 45 | 0.5° | 2,700 | 33.5 | 0.0039 | 0.0197 | 2,700 | 23.6 | 0.0031 | 0.0197 | 2,700 | 29.5 | 0.0047 | 0.0276 | 0.0012 | | | |
| | | 50 | 0.5° | 2,500 | 31.5 | 0.0039 | 0.0197 | 2,500 | 21.7 | 0.0031 | 0.0197 | 2,500 | 23.6 | 0.0047 | 0.0276 | 0.0012 | | | |
| 60 | 0.5° | 2,100 | 27.6 | 0.0031 | 0.0197 | 2,100 | 17.7 | 0.0024 | 0.0197 | 2,100 | 19.7 | 0.0047 | 0.0276 | 0.0012 | | | | | |
| 5.0 | R1 | 10 | 0.5° | 7,700 | 98.4 | 0.0079 | 0.0472 | 4,800 | 141.7 | 0.0079 | 0.0472 | 7,700 | 70.9 | 0.0047 | 0.0472 | 0.0039 | | | |
| | | 15 | 0.5° | 7,700 | 94.5 | 0.0079 | 0.0472 | 4,800 | 133.9 | 0.0063 | 0.0472 | 6,100 | 57.1 | 0.0047 | 0.0472 | 0.0039 | | | |
| | | 20 | 0.5° | 7,700 | 94.5 | 0.0079 | 0.0472 | 4,800 | 133.9 | 0.0063 | 0.0472 | 6,100 | 57.1 | 0.0047 | 0.0472 | 0.0039 | | | |
| | | 25 | 0.5° | 5,100 | 86.6 | 0.0067 | 0.0394 | 4,800 | 118.1 | 0.0051 | 0.0394 | 5,100 | 47.2 | 0.0047 | 0.0472 | 0.0028 | | | |
| | | 30 | 0.5° | 5,100 | 86.6 | 0.0067 | 0.0394 | 4,800 | 118.1 | 0.0051 | 0.0394 | 5,100 | 47.2 | 0.0047 | 0.0472 | 0.0028 | | | |
| | | 35 | 0.5° | 4,400 | 66.9 | 0.0059 | 0.0394 | 4,400 | 94.5 | 0.0035 | 0.0394 | 4,400 | 39.4 | 0.0047 | 0.0472 | 0.0020 | | | |
| 40 | 0.5° | 3,100 | 43.3 | 0.0059 | 0.0394 | 3,100 | 59.1 | 0.0031 | 0.0394 | 3,100 | 29.5 | 0.0047 | 0.0472 | 0.0020 | | | | | |
| 6.0 | R1.5 | 24 | 0.5° | 6,500 | 255.9 | 0.0138 | 0.0512 | 4,000 | 66.9 | 0.0094 | 0.0512 | 6,500 | 74.8 | 0.0059 | 0.0472 | 0.0039 | | | |
| | | 30 | 0.5° | 5,100 | 200.8 | 0.0094 | 0.0472 | 4,000 | 66.9 | 0.0091 | 0.0472 | 5,100 | 59.1 | 0.0059 | 0.0472 | 0.0039 | | | |
| | | 36 | 0.5° | 4,200 | 165.4 | 0.0079 | 0.0394 | 4,000 | 66.9 | 0.0075 | 0.0394 | 4,200 | 49.2 | 0.0059 | 0.0472 | 0.0028 | | | |
| | | 42 | 0.5° | 3,700 | 145.7 | 0.0059 | 0.0394 | 3,700 | 55.1 | 0.0055 | 0.0394 | 3,700 | 43.3 | 0.0059 | 0.0472 | 0.0028 | | | |
| | | 48 | 0.5° | 2,600 | 102.4 | 0.0051 | 0.0354 | 2,600 | 35.4 | 0.0055 | 0.0354 | 2,600 | 31.5 | 0.0059 | 0.0472 | 0.0020 | | | |
| | | 54 | 0.5° | 2,100 | 82.7 | 0.0039 | 0.0354 | 2,100 | 31.5 | 0.0039 | 0.0354 | 2,100 | 25.6 | 0.0059 | 0.0472 | 0.0020 | | | |
| | | 66 | 0.5° | 1,900 | 74.8 | 0.0031 | 0.0354 | 1,900 | 27.6 | 0.0031 | 0.0354 | 1,900 | 21.7 | 0.0059 | 0.0472 | 0.0012 | | | |
| 80 | 0.5° | 1,700 | 66.9 | 0.0020 | 0.0354 | 1,700 | 23.6 | 0.0020 | 0.0354 | 1,700 | 17.7 | 0.0059 | 0.0472 | 0.0012 | | | | | |





Side Milling

| Hardness | | | | <40 HRC | | | | 40-55 HRC | | | | 55-60 HRC | | | | |
|---------------|--------|-----|---------------------|-------------------------------|---------------|-------------------|--------|--|---------------|-------------------|--------|-------------|---------------|-------------------|--------|----------------------|
| Work Material | | | | Mild Steels and Carbon Steels | | | | Hardened Steels and Prehardened Steels | | | | | | | | |
| | | | | High Feed Roughing | | | | Semi-Finishing | | | | Finishing | | | | |
| Cutting Speed | | | | 60-410 SFM | | | | 60-250 SFM | | | | 60-410 SFM | | | | |
| D (mm) | r (mm) | L1 | Rec'd Cutting Angle | Speed (RPM) | Feed (in/min) | aa | | Speed (RPM) | Feed (in/min) | aa | | Speed (RPM) | Feed (in/min) | aa | | Stock to Remove (in) |
| | | | | | | Depth of Cut (in) | | | | Depth of Cut (in) | | | | Depth of Cut (in) | | |
| | | | | | | Aa | Ar | | | Aa | Ar | | | Aa | Ar | |
| 8.0 | R2 | 30 | 0.5° | 4,800 | 78.7 | 0.0197 | 0.0669 | 3,000 | 49.2 | 0.0118 | 0.0630 | 4,800 | 70.9 | 0.0071 | 0.0630 | 0.0039 |
| | | 40 | 0.5° | 3,800 | 74.8 | 0.0157 | 0.0630 | 3,000 | 49.2 | 0.0118 | 0.0630 | 3,800 | 55.1 | 0.0071 | 0.0630 | 0.0039 |
| | | 48 | 0.5° | 3,200 | 66.9 | 0.0106 | 0.0551 | 3,000 | 49.2 | 0.0102 | 0.0551 | 2,300 | 45.3 | 0.0071 | 0.0630 | 0.0028 |
| | | 56 | 0.5° | 2,700 | 51.2 | 0.0079 | 0.0551 | 2,700 | 43.3 | 0.0079 | 0.0551 | 2,700 | 39.4 | 0.0071 | 0.0630 | 0.0028 |
| | | 64 | 0.5° | 1,900 | 34.6 | 0.0079 | 0.0512 | 1,900 | 31.5 | 0.0079 | 0.0512 | 1,900 | 27.6 | 0.0071 | 0.0630 | 0.0020 |
| | | 80 | 0.5° | 1,500 | 27.6 | 0.0059 | 0.0512 | 1,500 | 27.6 | 0.0059 | 0.0512 | 1,500 | 21.7 | 0.0071 | 0.0630 | 0.0012 |
| | | 100 | 0.5° | 1,200 | 25.6 | 0.0059 | 0.0512 | 1,200 | 25.6 | 0.0059 | 0.0512 | 1,200 | 19.7 | 0.0071 | 0.0630 | 0.0012 |
| | | 120 | 0.5° | 1,000 | 21.7 | 0.0039 | 0.0512 | 1,000 | 21.7 | 0.0039 | 0.0512 | 1,000 | 17.7 | 0.0071 | 0.0630 | 0.0012 |
| 10.0 | R2 | 35 | 0.5° | 3,800 | 82.7 | 0.0197 | 0.0984 | 2,400 | 94.5 | 0.0118 | 0.0630 | 3,800 | 149.6 | 0.0079 | 0.0945 | 0.0039 |
| | | 50 | 0.5° | 3,100 | 76.8 | 0.0157 | 0.0945 | 2,400 | 94.5 | 0.0118 | 0.0630 | 3,100 | 122.0 | 0.0079 | 0.0945 | 0.0039 |
| | | 60 | 0.5° | 2,500 | 68.9 | 0.0106 | 0.0787 | 2,400 | 94.5 | 0.0106 | 0.0630 | 2,500 | 98.4 | 0.0079 | 0.0945 | 0.0039 |
| | | 70 | 0.5° | 2,200 | 53.1 | 0.0079 | 0.0787 | 2,200 | 86.6 | 0.0079 | 0.0630 | 2,200 | 86.6 | 0.0079 | 0.0945 | 0.0028 |
| | | 80 | 0.5° | 1,500 | 35.4 | 0.0075 | 0.0787 | 1,500 | 59.1 | 0.0075 | 0.0630 | 1,500 | 59.1 | 0.0079 | 0.0945 | 0.0028 |
| | | 100 | 0.5° | 1,200 | 28.3 | 0.0063 | 0.0787 | 1,200 | 47.2 | 0.0063 | 0.0630 | 1,200 | 47.2 | 0.0079 | 0.0945 | 0.0020 |
| | | 120 | 0.5° | 1,050 | 25.6 | 0.0051 | 0.0787 | 1,000 | 39.4 | 0.0051 | 0.0630 | 1,050 | 41.3 | 0.0079 | 0.0945 | 0.0020 |
| | | 140 | 0.5° | 850 | 21.7 | 0.0039 | 0.0591 | 800 | 31.5 | 0.0039 | 0.0551 | 850 | 33.5 | 0.0079 | 0.0945 | 0.0012 |
| 12.0 | R2 | 45 | 0.5° | 3,200 | 86.6 | 0.0236 | 0.1339 | 2,000 | 78.7 | 0.0118 | 0.0630 | 3,200 | 126.0 | 0.0094 | 0.1260 | 0.0059 |
| | | 60 | 0.5° | 2,500 | 82.7 | 0.0197 | 0.1260 | 2,000 | 78.7 | 0.0118 | 0.0630 | 2,500 | 98.4 | 0.0094 | 0.1260 | 0.0059 |
| | | 70 | 0.5° | 2,100 | 74.8 | 0.0157 | 0.1102 | 2,000 | 78.7 | 0.0110 | 0.0630 | 2,100 | 82.7 | 0.0094 | 0.1260 | 0.0039 |
| | | 85 | 0.5° | 1,800 | 59.1 | 0.0118 | 0.1063 | 1,500 | 59.1 | 0.0087 | 0.0630 | 1,800 | 70.9 | 0.0094 | 0.1260 | 0.0039 |
| | | 100 | 0.5° | 1,300 | 39.4 | 0.0079 | 0.1024 | 1,200 | 47.2 | 0.0079 | 0.0630 | 1,300 | 51.2 | 0.0094 | 0.1260 | 0.0039 |
| | | 120 | 0.5° | 1,000 | 27.6 | 0.0059 | 0.0984 | 1,000 | 39.4 | 0.0059 | 0.0630 | 1,000 | 39.4 | 0.0094 | 0.1260 | 0.0020 |
| | | 140 | 0.5° | 900 | 23.6 | 0.0059 | 0.0787 | 900 | 35.4 | 0.0039 | 0.0630 | 900 | 35.4 | 0.0094 | 0.1260 | 0.0020 |
| | | 160 | 0.5° | 700 | 19.7 | 0.0039 | 0.0787 | 700 | 27.6 | 0.0039 | 0.0630 | 700 | 27.6 | 0.0094 | 0.1260 | 0.0020 |
| 16.0 | R3 | 55 | 0.5° | 2,400 | 78.7 | 0.0197 | 0.1654 | 1,500 | 59.1 | 0.0118 | 0.0630 | 2,400 | 94.5 | 0.0118 | 0.1575 | 0.0079 |
| | | 80 | 0.5° | 1,900 | 74.8 | 0.0185 | 0.1575 | 1,500 | 59.1 | 0.0118 | 0.0630 | 1,900 | 74.8 | 0.0118 | 0.1575 | 0.0059 |
| | | 90 | 0.5° | 1,600 | 66.9 | 0.0157 | 0.1339 | 1,500 | 59.1 | 0.0118 | 0.0630 | 1,600 | 63.0 | 0.0118 | 0.1575 | 0.0039 |
| | | 105 | 0.5° | 1,400 | 51.2 | 0.0114 | 0.1299 | 1,400 | 55.1 | 0.0110 | 0.0630 | 1,400 | 55.1 | 0.0118 | 0.1575 | 0.0028 |
| | | 120 | 0.5° | 1,000 | 33.5 | 0.0079 | 0.1260 | 1,000 | 39.4 | 0.0079 | 0.0630 | 1,000 | 39.4 | 0.0118 | 0.1575 | 0.0020 |
| 20.0 | R3 | 70 | 0.5° | 1,900 | 78.7 | 0.0197 | 0.2165 | 1,200 | 47.2 | 0.0118 | 0.0630 | 1,900 | 74.8 | 0.0165 | 0.2165 | 0.0079 |
| | | 90 | 0.5° | 1,500 | 74.8 | 0.0185 | 0.2087 | 1,200 | 47.2 | 0.0118 | 0.0630 | 1,500 | 59.1 | 0.0165 | 0.2165 | 0.0059 |
| | | 110 | 0.5° | 1,300 | 66.9 | 0.0165 | 0.1654 | 1,200 | 47.2 | 0.0118 | 0.0630 | 1,300 | 51.2 | 0.0165 | 0.2165 | 0.0039 |
| | | 130 | 0.5° | 1,100 | 51.2 | 0.0122 | 0.1496 | 1,100 | 43.3 | 0.0118 | 0.0630 | 1,100 | 43.3 | 0.0165 | 0.2165 | 0.0028 |
| | | 150 | 0.5° | 760 | 29.9 | 0.0098 | 0.1339 | 760 | 29.9 | 0.0091 | 0.0630 | 760 | 29.9 | 0.0165 | 0.2165 | 0.0020 |

1. The above mentioned conditions according to projection lengths are intended as general guidelines for reference only. Adjustments should be made based on actual milling conditions.
2. Highly rigid machines and tool holders should be used.
3. Tool vibrations should be kept at a minimum level for maximum accuracy.
4. In the case of linear machining, do not use the Ar value, instead refer to the Aa value.
5. Under general machining conditiona, air-blow cutting method is recommended.
6. More stable high-feed machining in the corners can be attained by setting an R insertion or deceleration on the CAM or machine side.
7. When cutting load fluctuates (in the corners, etc.) or when high-precision is required, be sure to control the rotational speed.
8. When cutting at greater than the recommended cutting angle, reduce the feed.
9. When the depth of cut is less than the specified amount as listed above, the feed rate can be increased up to 150%.
10. When the depth of cut is greater than the specified amount as listed above, the feed rate can be reduced by no more than 60% to ensure stable milling.

