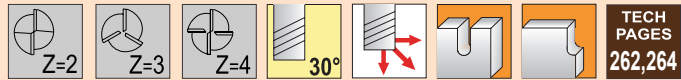


TOLERANCES

| | |
|-------------|----------------------------------|
| d_1 | +0.000" - .002" (+.000 - .050mm) |
| d_2 | h6 |
| ball radius | +0.000" - .001" (+.000 - .025mm) |

Series 320MA, 323MA, 330MA, 920MA, 923MA, 930MA



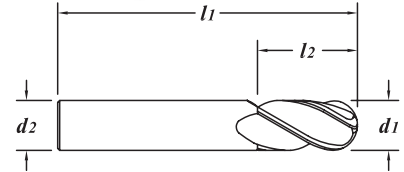
.0312" - .3150"
(0.792mm - 8.000mm)

END MILLS

Standard Length - Ball End

TiAlN Coating

- Solid submicron grain carbide end mill - center cutting
- Dry or semi-dry machining
- Extremely versatile
- Uncoated - page 205
- TiN Coating - page 207
- TiCN Coating - page 208
- Stub Length - page 189
- Extended length - page 234



| (320MA/920MA) 2 Flute EDP# | (323MA/923MA) 3 Flute EDP# | (330MA/930MA) 4 Flute EDP# | d_1 † Diameter | | d_2 Shank Diameter | l_1 Overall Length | l_2 Flute Length | 1-11 | 12-24 | 25-49 | 50-100 | |
|----------------------------------|----------------------------------|----------------------------------|---------------------|--------|----------------------------|----------------------------|--------------------------|-------|-------|-------|--------|-------|
| | | | Decimal | Metric | | | | | | | | |
| 16017 | 17017 | 18017 | .0312 | 1/32" | 0.792 | 1/8" | 1-1/2" | 3/32" | 15.46 | 14.78 | 14.11 | 13.44 |
| 47017 | 38017 | 48017 | .0394 | | 1.000 | 3.0 | 38 | 4 | 16.11 | 15.41 | 14.71 | 14.01 |
| 16027 | 17027 | 18027 | .0469 | 3/64" | 1.191 | 1/8" | 1-1/2" | 1/8" | 15.46 | 14.78 | 14.11 | 13.44 |
| 47027 | 38027 | 48027 | .0591 | | 1.500 | 3.0 | 38 | 6 | 16.11 | 15.41 | 14.71 | 14.01 |
| 16037 | 17037 | 18037 | .0625 | 1/16" | 1.588 | 1/8" | 1-1/2" | 1/4" | 14.73 | 14.09 | 13.45 | 12.81 |
| 16047 | 17047 | 18047 | .0781 | 5/64" | 1.984 | 1/8" | 1-1/2" | 1/4" | 14.73 | 14.09 | 13.45 | 12.81 |
| 47037 | 38037 | 48037 | .0787 | | 2.000 | 3.0 | 38 | 8 | 15.34 | 14.67 | 14.01 | 13.34 |
| 16057 | 17057 | 18057 | .0938 | 3/32" | 2.383 | 1/8" | 1-1/2" | 3/8" | 14.19 | 13.57 | 12.96 | 12.34 |
| 47047 | 38047 | 48047 | .0984 | | 2.500 | 3.0 | 38 | 12 | 14.79 | 14.15 | 13.50 | 12.86 |
| 16067 | 17067 | 18067 | .1094 | 7/64" | 2.779 | 1/8" | 1-1/2" | 3/8" | 14.19 | 13.57 | 12.96 | 12.34 |
| 47057 | 38057 | 48057 | .1181 | | 3.000 | 3.0 | 38 | 12 | 13.65 | 13.06 | 12.46 | 11.87 |
| 16077 | 17077 | 18077 | .1250 | 1/8" | 3.175 | 1/8" | 1-1/2" | 1/2" | 13.11 | 12.54 | 11.97 | 11.40 |
| 47067 | 38067 | 48067 | .1378 | | 3.500 | 4.0 | 50 | 12 | 18.88 | 18.06 | 17.24 | 16.42 |
| 16087 | 17087 | 18087 | .1406 | 9/64" | 3.571 | 3/16" | 2" | 9/16" | 18.10 | 17.31 | 16.53 | 15.74 |
| 16097 | 17097 | 18097 | .1562 | 5/32" | 3.967 | 3/16" | 2" | 9/16" | 18.10 | 17.31 | 16.53 | 15.74 |
| 47077 | 38077 | 48077 | .1575 | | 4.000 | 4.0 | 50 | 14 | 17.19 | 16.45 | 15.70 | 14.95 |
| 16107 | 17107 | 18107 | .1719 | 11/64" | 4.366 | 3/16" | 2" | 9/16" | 18.10 | 17.31 | 16.53 | 15.74 |
| 47087 | 38087 | 48087 | .1772 | | 4.500 | 5.0 | 50 | 14 | 22.39 | 21.42 | 20.44 | 19.47 |
| 16117 | 17117 | 18117 | .1875 | 3/16" | 4.763 | 3/16" | 2" | 5/8" | 16.49 | 15.77 | 15.06 | 14.34 |
| 47097 | 38097 | 48097 | .1969 | | 5.000 | 5.0 | 65 | 16 | 22.94 | 21.95 | 20.95 | 19.95 |
| 16127 | 17127 | 18127 | .2031 | 13/64" | 5.159 | 1/4" | 2-1/2" | 5/8" | 23.26 | 22.25 | 21.24 | 20.23 |
| 16137 | 17137 | 18137 | .2188 | 7/32" | 5.558 | 1/4" | 2-1/2" | 5/8" | 23.26 | 22.25 | 21.24 | 20.23 |
| 16147 | 17147 | 18147 | .2344 | 15/64" | 5.954 | 1/4" | 2-1/2" | 3/4" | 23.26 | 22.25 | 21.24 | 20.23 |
| 47107 | 38107 | 48107 | .2362 | | 6.000 | 6.0 | 65 | 19 | 23.39 | 22.37 | 21.36 | 20.34 |
| 16157 | 17157 | 18157 | .2500 | 1/4" | 6.350 | 1/4" | 2-1/2" | 3/4" | 22.49 | 21.52 | 20.54 | 19.56 |
| 16167 | 17167 | 18167 | .2656 | 17/64" | 6.746 | 5/16" | 2-1/2" | 7/8" | 34.89 | 33.37 | 31.86 | 30.34 |
| 47117 | 38117 | 48117 | .2756 | | 7.000 | 7.0 | 65 | 22 | 31.10 | 29.74 | 28.39 | 27.04 |
| 16177 | 17177 | 18177 | .2812 | 9/32" | 7.142 | 5/16" | 2-1/2" | 7/8" | 34.89 | 33.37 | 31.86 | 30.34 |
| 16187 | 17187 | 18187 | .2969 | 19/64" | 7.541 | 5/16" | 2-1/2" | 7/8" | 34.89 | 33.37 | 31.86 | 30.34 |
| 16197 | 17197 | 18197 | .3125 | 5/16" | 7.938 | 5/16" | 2-1/2" | 7/8" | 30.49 | 29.16 | 27.84 | 26.51 |
| 47127 | 38127 | 48127 | .3150 | | 8.000 | 8.0 | 65 | 22 | 31.63 | 30.25 | 28.88 | 27.50 |

70

35

MATERIAL HARDNESS (Rc)

0

continued →

Series 320MA, 323MA, 330MA, 920MA, 923MA, 930MA (continued)

.3281" - 1.000"
(8.334mm - 25.400mm)

END MILLS

MATERIAL HARDNESS (Rc)
70
35
0

| (320MA/920MA) 2 Flute EDP# | (323MA/923MA) 3 Flute EDP# | (330MA/930MA) 4 Flute EDP# | $d1$ † | | $d2$ Shank Diameter | $l1$ Overall Length | $l2$ Flute Length | 1-11 | 12-24 | 25-49 | 50-100 | |
|----------------------------------|----------------------------------|----------------------------------|---------|--------------------|---------------------------|---------------------------|-------------------------|--------|--------|--------|--------|--------|
| | | | Decimal | Diameter Metric | | | | | | | | |
| 16207 | 17207 | 18207 | .3281 | 21/64" | 8.334 | 3/8" | 2-1/2" | 7/8" | 40.27 | 38.52 | 36.77 | 35.02 |
| 16217 | 17217 | 18217 | .3438 | 11/32" | 8.733 | 3/8" | 2-1/2" | 7/8" | 40.27 | 38.52 | 36.77 | 35.02 |
| 47137 | 38137 | 48137 | .3543 | | 9.000 | 9.0 | 65 | 22 | 36.97 | 35.37 | 33.76 | 32.15 |
| 16227 | 17227 | 18227 | .3594 | 23/64" | 9.129 | 3/8" | 2-1/2" | 7/8" | 40.27 | 38.52 | 36.77 | 35.02 |
| 16237 | 17237 | 18237 | .3750 | 3/8" | 9.525 | 3/8" | 2-1/2" | 7/8" | 35.60 | 34.06 | 32.51 | 30.96 |
| 16247 | 17247 | 18247 | .3906 | 25/64" | 9.921 | 7/16" | 2-3/4" | 7/8" | 48.82 | 46.70 | 44.57 | 42.45 |
| 47147 | 38147 | 48147 | .3937 | | 10.000 | 10.0 | 70 | 25 | 42.99 | 41.12 | 39.25 | 37.38 |
| 16257 | 17257 | 18257 | .4062 | 13/32" | 10.317 | 7/16" | 2-3/4" | 7/8" | 48.82 | 46.70 | 44.57 | 42.45 |
| 16267 | - | 18267 | .4219 | 27/64" | 10.716 | 7/16" | 2-3/4" | 7/8" | 48.82 | 46.70 | 44.57 | 42.45 |
| 47157 | 38157 | 48157 | .4331 | | 11.000 | 11.0 | 75 | 25 | 44.78 | 42.83 | 40.89 | 38.94 |
| 16277 | 17277 | 18277 | .4375 | 7/16" | 11.113 | 7/16" | 2-3/4" | 1" | 43.06 | 41.18 | 39.31 | 37.44 |
| 16287 | 17287 | 18287 | .4531 | 29/64" | 11.509 | 1/2" | 3" | 1" | 66.22 | 63.34 | 60.46 | 57.58 |
| 16297 | 17297 | 18297 | .4688 | 15/32" | 11.908 | 1/2" | 3" | 1" | 66.22 | 63.34 | 60.46 | 57.58 |
| 47167 | 38167 | 48167 | .4724 | | 12.000 | 12.0 | 75 | 25 | 63.31 | 60.56 | 57.80 | 55.05 |
| 16307 | 17307 | 18307 | .4844 | 31/64" | 12.304 | 1/2" | 3" | 1" | 66.22 | 63.34 | 60.46 | 57.58 |
| 16317 | 17317 | 18317 | .5000 | 1/2" | 12.700 | 1/2" | 3" | 1" | 60.73 | 58.09 | 55.45 | 52.81 |
| 47177 | 38177 | 48177 | .5512 | | 14.000 | 14.0 | 88 | 32 | 92.10 | 88.10 | 84.09 | 80.09 |
| 16327 | 17327 | 18327 | .5625 | 9/16" | 14.288 | 9/16" | 3-1/2" | 1-1/4" | 88.31 | 84.47 | 80.63 | 76.79 |
| 16337 | 17337 | 18337 | .6250 | 5/8" | 15.875 | 5/8" | 3-1/2" | 1-1/4" | 96.69 | 92.49 | 88.28 | 84.08 |
| 47187 | 38187 | 48187 | .6299 | | 16.000 | 16.0 | 88 | 38 | 100.89 | 96.50 | 92.12 | 87.73 |
| 16347 | 17347 | 18347 | .6875 | 11/16" | 17.463 | 3/4" | 4" | 1-1/2" | 154.89 | 148.16 | 141.42 | 134.69 |
| 47197 | 38197 | 48197 | .7087 | | 18.000 | 18.0 | 100 | 38 | 144.84 | 138.55 | 132.25 | 125.95 |
| 16357 | 17357 | 18357 | .7500 | 3/4" | 19.050 | 3/4" | 4" | 1-1/2" | 138.66 | 132.63 | 126.60 | 120.57 |
| 47207 | 38207 | 48207 | .7874 | | 20.000 | 20.0 | 100 | 38 | 196.24 | 187.70 | 179.17 | 170.64 |
| 47217 | 38217 | 48217 | .8661 | | 22.000 | 22.0 | 100 | 38 | 215.57 | 206.20 | 196.82 | 187.45 |
| - | 17367 | 18367 | .8750 | 7/8" | 22.225 | 7/8" | 4" | 1-1/2" | 220.29 | 210.72 | 201.14 | 191.56 |
| 47227 | 38227 | 48227 | .9843 | | 25.000 | 25.0 | 100 | 38 | 224.91 | 215.13 | 205.35 | 195.57 |
| 16377 | 17377 | 18377 | 1.000 | 1" | 25.400 | 1" | 4" | 1-1/2" | 236.72 | 226.42 | 216.13 | 205.84 |