

# MaxCut-GP

Shank Tolerance: +0.0000"/-0.0004"  
Diameter Tolerance: +0.0000"/-0.0020"

General Purpose 30 Degree Helix 10% micrograin carbide. All tools honed to improve tool life. Available Uncoated & TiALN Coated.

### GENERAL PURPOSE

|                                                           |     |
|-----------------------------------------------------------|-----|
| Square End 2, 3 & 4 Flute - Fractional .....              | 3-5 |
| Square End 2, 3 & 4 Flute - Metric .....                  | 6   |
| Ball Nose 2, 3 & 4 Flute - Fractional .....               | 7-9 |
| Engraving Tools .....                                     | 9   |
| Spot Drills .....                                         | 9   |
| Ball Nose 2 & 4 Flute - Metric .....                      | 10  |
| 90 Degree Drill/Mills 2 & 4 Flute - Fractional .....      | 10  |
| Double Ended Square End 2 & 4 Flute - Fractional .....    | 11  |
| Double Ended Ball Nose End 2 & 4 Flute - Fractional ..... | 12  |

# MaxCut-HP

Shank Tolerance: +0.0000"/-0.0004"  
Diameter Tolerance: +0.0000"/-0.0015"

High Performance Variable Pitch to reduce chatter. General Purpose 10% micrograin carbide. All tools honed to improve tool life. TiALN Coated for enhanced heat & abrasion resistance providing higher tool life. Special core & heal design to enhance rigidity.

### HP Variable Pitch

|                                                                          |       |
|--------------------------------------------------------------------------|-------|
| Square End & Corner Radius 4 & 5 Flute - Fractional .....                | 14-15 |
| Ball Nose 4 Flute - Fractional .....                                     | 16    |
| Long Reach Neck Relief Square & Corner Radius 4 Flute - Fractional ..... | 16-17 |
| Long Reach Neck Relief Ball Nose 4 Flute - Fractional .....              | 16-17 |

# MaxCut-HP-Ultra

Shank Tolerance: +0.0000"/-0.0004"  
Diameter Tolerance: +0.0000"/-0.0015"

Extreme Production Variable Pitch to reduce chatter. Ultra Premium 10% micrograin carbide. All tools honed to improve tool life. TiALN Coated with a unique post coating polishing process to reduce built up edge. Special core & heal design to enhance rigidity. Experience the highest performance & tool life.

### HP Ultra Variable Pitch - EXTREME PRODUCTION

|                                                              |       |
|--------------------------------------------------------------|-------|
| Square End & Corner Radius 4 & 5 Flute - Fractional .....    | 19-20 |
| Ball Nose 4 Flute - Fractional .....                         | 21    |
| Square & Corner Radius HEM 5, 6 & 7 Flute - Fractional ..... | 22-24 |

# AlumiMax

Shank Tolerance: +0.0000"/-0.0004"  
Diameter Tolerance: +0.0000"/-0.0004"

Specifically designed for high performance Aluminum machining. Medium/Finishing applications & Medium/Roughing applications. Unique variable pitch & variable helix combined with a polished surface, chipbreaking geometry & cylindrical margin. Available Uncoated, ZrN Coated & DLC Coated.

### HP Ultra Variable Pitch for Aluminum - EXTREME PRODUCTION

|                                                                |    |
|----------------------------------------------------------------|----|
| Square End & Corner Radius - Fractional Medium/Roughing .....  | 27 |
| Square End & Corner Radius - Fractional Medium/Finishing ..... | 28 |
| Ball Nose - Fractional .....                                   | 29 |

# MaxCut-GP

## Speeds & Feeds

| Material Classification           | Speed (SFM) |          | Feed Per Tooth By End Mill Diameter (IPT) |       |       |       |       |       |       |       |
|-----------------------------------|-------------|----------|-------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|                                   | Uncoated    | TiALN    | 1/4"                                      | 5/16" | 3/8"  | 7/16" | 1/2"  | 5/8"  | 3/4"  | 1"    |
| Aluminum Alloys & Aluminum        | 600-1200    | 900-1800 | .0020                                     | .0025 | .0030 | .0035 | .0040 | .0050 | .0060 | .0080 |
| Copper Alloys & Copper            | 350-850     | 525-1275 | .0020                                     | .0025 | .0025 | .0030 | .0030 | .0035 | .0040 | .0060 |
| Bronze & Brass                    | 250-400     | 375-600  | .0020                                     | .0025 | .0025 | .0030 | .0030 | .0035 | .0040 | .0050 |
| Graphite                          | 500-800     | 500-1200 | .0030                                     | .0035 | .0025 | .0030 | .0030 | .0040 | .0050 | .0070 |
| Plastics                          | 600-1100    | 600-1650 | .0030                                     | .0035 | .0040 | .0050 | .0060 | .0080 | .0100 | .0150 |
| Softer Cast Iron                  | 250-450     | 375-650  | .0020                                     | .0022 | .0025 | .0027 | .0030 | .0045 | .0060 | .0080 |
| Harder Cast Iron                  | 100-250     | 100-375  | .0008                                     | .0010 | .0015 | .0017 | .0020 | .0025 | .0030 | .0040 |
| Ductile Iron                      | 80-400      | 100-600  | .0010                                     | .0012 | .0015 | .0017 | .0020 | .0030 | .0040 | .0060 |
| Malleable Iron                    | 150-500     | 225-650  | .0010                                     | .0015 | .0020 | .0025 | .0030 | .0040 | .0050 | .0070 |
| Low Carbon Steels (1020 & Under)  | 200-400     | 300-600  | .0010                                     | .0015 | .0020 | .0025 | .0030 | .0040 | .0050 | .0070 |
| Medium Carbon Steels (1030-1060)  | 100-250     | 150-375  | .0015                                     | .0016 | .0017 | .0018 | .0020 | .0030 | .0040 | .0050 |
| Alloy Steels Hardened to 35 Rc    | 130-230     | 130-345  | .0010                                     | .0011 | .0012 | .0013 | .0015 | .0017 | .0020 | .0030 |
| Alloy Steels Hardened to 40-50 Rc | 70-130      | 70-160   | .0007                                     | .0007 | .0008 | .0009 | .0010 | .0015 | .0020 | .0030 |
| Die Steels Hardened to 51-60 Rc   | --          | --       | --                                        | --    | --    | --    | --    | --    | --    | --    |
| Tool Steels                       | 100-250     | 150-375  | .0010                                     | .0012 | .0015 | .0017 | .0020 | .0025 | .0030 | .0040 |
| Mold Steels                       | 200-350     | 300-525  | .0010                                     | .0012 | .0015 | .0017 | .0020 | .0025 | .0030 | .0040 |
| Softer Stainless Steels           | 200-350     | 300-450  | .0010                                     | .0012 | .0015 | .0012 | .0020 | .0030 | .0040 | .0060 |
| Harder Stainless Steels           | 100-200     | 150-300  | .0005                                     | .0006 | .0007 | .0008 | .0010 | .0020 | .0030 | .0050 |
| Monel & High Nickel Steel         | 75-175      | 75-200   | .0010                                     | .0012 | .0015 | .0017 | .0020 | .0025 | .0030 | .0040 |
| Softer Titanium                   | 125-300     | 125-375  | .0010                                     | .0012 | .0015 | .0017 | .0020 | .0030 | .0040 | .0060 |
| Harder Titanium                   | 50-150      | 50-175   | .0005                                     | .0006 | .0007 | .0008 | .0010 | .0015 | .0020 | .0020 |
| Nickel Based High Temp Alloys     | 50-100      | 50-125   | .0008                                     | .0008 | .0009 | .0009 | .0010 | .0012 | .0015 | .0020 |

Note: These are guidelines only & the following points are important to consider:

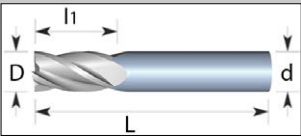
- Higher Feed Per Tooth should be used to start for radial depths of cut less than 25% of the tool diameter. Lower Feed Per Tooth should be used to start for radial depths of cut greater than 25% of the tool diameter.
- The above recommendations are for axial lengths of cut not to exceed 1 times the tool diameter for profiling and .5 times the diameter for full slotting.
- The above parameters are recommended starting points only. If the tool is working well, without vibrations or significant noise, increase the SFM and/or Feed Per Tooth in 5-10% increments.
- Optimum speeds & feeds will depend upon material, setup, machine conditions & tool deflection. Higher or lower parameters may be required to achieve optimum machining conditions.
- For Light Radial Depths of cut, make certain to increase the feed rate to compensate for Radial Chip Thinning Factor (RCTF). Consult a formula or app to calculate.
- For Plunging or Ramping the feed rate should be reduced by about 50%.
- Climb Milling is preferred to Conventional Milling.

# MaxCut-GP



|                                 |   |                   |
|---------------------------------|---|-------------------|
| P                               | ● | Steel             |
| M                               | ● | Stainless Steel   |
| K                               | ● | Cast Iron         |
| N                               | ○ | Non-Ferrous       |
| S                               | ○ | High Temp. Alloys |
| H                               | ○ | Hardened Steel    |
| ● GOOD    ● OK    ○ NOT OPTIMAL |   |                   |

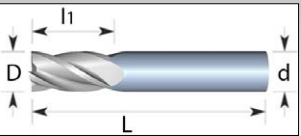
- Square End
- 2, 3, 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Fractional Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



| Square End - Fractional |            |           |              |          |         |         |         |         |         |
|-------------------------|------------|-----------|--------------|----------|---------|---------|---------|---------|---------|
| Cutter<br>D             | Shank<br>d | LOC<br>l1 | Overall<br>L | Uncoated |         |         | TiALN   |         |         |
|                         |            |           |              | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 1/32                    | 1/8        | 1/16      | 1-1/2        | 991000   | 991001  | 991002  | 991096  | 991097  | 991098  |
|                         |            | 3/32      |              | 991147   | 991148  | 991149  | 991543  | 991544  | 991545  |
| 3/64                    | 1/8        | 3/32      | 1-1/2        | 991003   | 991004  | 991005  | 991099  | 991100  | 991101  |
|                         |            | 1/8       |              | 991150   | 991151  | 991152  | 991546  | 991547  | 991548  |
| 1/16                    | 1/8        | 1/8       | 1-1/2        | 991006   | 991007  | 991008  | 991102  | 991103  | 991104  |
|                         |            | 3/16      |              | 991153   | 991154  | 991155  | 991549  | 991550  | 991551  |
| 5/64                    | 1/8        | 1/4       | 1-1/2        | 991156   | 991157  | 991158  | 991552  | 991553  | 991554  |
| 3/32                    | 1/8        | 3/16      | 1-1/2        | 991009   | 991010  | 991011  | 991105  | 991106  | 991107  |
|                         |            | 3/8       |              | 991159   | 991160  | 991161  | 991555  | 991556  | 991557  |
| 7/64                    | 1/8        | 3/8       | 1-1/2        | 991166   | 991167  | 991168  | 991562  | 991563  | 991564  |
| 1/8                     | 1/8        | 1/4       | 1-1/2        | 991015   | 991016  | 991017  | 991111  | 991112  | 991113  |
|                         |            | 1/2       |              | 991169   | 991170  | 991171  | 991565  | 991566  | 991567  |
|                         |            | 3/4       | 2-1/2        | 991746   | --      | 991747  | 991790  | --      | 991791  |
|                         |            | 1         |              | 991815   | --      | 991816  | 991879  | --      | 991880  |
| 9/64                    | 3/16       | 9/16      | 2            | 991173   | 991174  | 991175  | 991569  | 991570  | 991571  |
| 5/32                    | 3/16       | 5/16      | 2            | 991018   | 991019  | 991020  | 991114  | 991115  | 991116  |
|                         |            | 9/16      |              | 991176   | 991177  | 991178  | 991572  | 991573  | 991574  |
| 11/64                   | 3/16       | 9/16      | 2            | 991179   | 991180  | 991181  | 991575  | 991576  | 991577  |
| 3/16                    | 3/16       | 3/8       | 2            | 991021   | 991022  | 991023  | 991117  | 991118  | 991119  |
|                         |            | 5/8       |              | 991182   | 991183  | 991184  | 991578  | 991579  | 991580  |
|                         |            | 3/4       | 2-1/2        | 991748   | --      | 991749  | 991792  | --      | 991793  |
|                         |            | 1-1/8     |              | 991817   | --      | 991818  | 991881  | --      | 991882  |
| 13/64                   | 1/4        | 5/8       | 2-1/2        | 991186   | 991187  | 991188  | 991582  | 991583  | 991584  |
| 7/32                    | 1/4        | 7/16      | 2            | 991024   | 991025  | 991026  | 991120  | 991121  | 991122  |
|                         |            | 5/8       | 2-1/2        | 991189   | 991190  | 991191  | 991585  | 991586  | 991587  |
| 15/64                   | 1/4        | 3/4       | 2-1/2        | 991192   | 991193  | 991194  | 991588  | 991589  | 991590  |
| 1/4                     | 1/4        | 1/2       | 2            | 991027   | 991028  | 991029  | 991123  | 991124  | 991125  |
|                         |            | 3/4       | 2-1/2        | 991195   | 991196  | 991197  | 991591  | 991592  | 991593  |
|                         |            | 1-1/8     | 3            | 991750   | --      | 991751  | 991794  | --      | 991795  |
|                         |            | 1-1/2     | 4            | 991819   | --      | 991820  | 991883  | --      | 991884  |
| 17/64                   | 5/16       | 7/8       | 2-1/2        | 991199   | 991200  | 991201  | 991595  | 991596  | 991597  |
| 9/32                    | 5/16       | 7/8       | 2-1/2        | 991202   | 991203  | 991204  | 991598  | 991599  | 991600  |
| 19/64                   | 5/16       | 7/8       | 2-1/2        | 991205   | 991206  | 991207  | 991601  | 991602  | 991603  |
| 5/16                    | 5/16       | 1/2       | 2            | 991030   | 991031  | 991032  | 991126  | 991127  | 991128  |
|                         |            | 7/8       | 2-1/2        | 991208   | 991209  | 991210  | 991604  | 991605  | 991606  |
|                         |            | 1-1/8     | 3            | 991752   | --      | 991753  | 991796  | --      | 991797  |
|                         |            | 1-5/8     | 4            | 991823   | --      | 991824  | 991887  | --      | 991888  |
| 21/64                   | 3/8        | 7/8       | 2-1/2        | 991212   | 991213  | 991214  | 991608  | 991609  | 991610  |

|                                 |   |                   |
|---------------------------------|---|-------------------|
| P                               | ● | Steel             |
| M                               | ● | Stainless Steel   |
| K                               | ● | Cast Iron         |
| N                               | ○ | Non-Ferrous       |
| S                               | ○ | High Temp. Alloys |
| H                               | ○ | Hardened Steel    |
| ● GOOD    ● OK    ○ NOT OPTIMAL |   |                   |

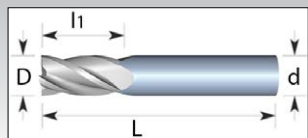
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- 2, 3, 4 Flute
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- General Purpose
- Micrograin Carbide
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- Plunging, Pocketing
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- Profiling



| Square End - Fractional |            |           |              |          |         |         |         |         |         |
|-------------------------|------------|-----------|--------------|----------|---------|---------|---------|---------|---------|
| Cutter<br>D             | Shank<br>d | LOC<br>l1 | Overall<br>L | Uncoated |         |         | TiALN   |         |         |
|                         |            |           |              | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 11/32                   | 3/8        | 7/8       | 2-1/2        | 991215   | 991216  | 991217  | 991611  | 991612  | 991613  |
| 23/64                   | 3/8        | 7/8       | 2-1/2        | 991218   | 991219  | 991220  | 991614  | 991615  | 991616  |
| 3/8                     | 3/8        | 5/8       | 2            | 991033   | 991034  | 991035  | 991129  | 991130  | 991131  |
|                         |            | 1         | 2-1/2        | 991221   | 991222  | 991223  | 991617  | 991618  | 991619  |
|                         |            | 1-1/8     | 3            | 991754   | --      | 991755  | 991798  | --      | 991799  |
| 25/64                   | 7/16       | 1-3/4     | 4            | 991829   | --      | 991830  | 991893  | --      | 991894  |
|                         |            | 1         | 2-1/2        | 991225   | 991226  | 991227  | 991621  | 991622  | 991623  |
|                         |            | 1         | 2-1/2        | 991228   | 991229  | 991230  | 991624  | 991625  | 991626  |
| 13/32                   | 7/16       | 1         | 2-1/2        | 991231   | 991232  | 991233  | 991627  | 991628  | 991629  |
| 27/64                   | 7/16       | 1         | 2-1/2        | 991231   | 991232  | 991233  | 991627  | 991628  | 991629  |
| 7/16                    | 7/16       | 5/8       | 2-1/2        | 991036   | 991037  | 991038  | 991132  | 991133  | 991134  |
|                         |            | 1         | 2            | 991234   | 991235  | 991236  | 991630  | 991631  | 991632  |
|                         |            | 2         | 4            | 991756   | --      | 991757  | 991800  | --      | 991801  |
| 29/64                   | 1/2        | 1         | 3            | 991238   | 991239  | 991240  | 991634  | 991635  | 991636  |
| 15/32                   | 1/2        | 1         | 3            | 991241   | 991242  | 991243  | 991637  | 991638  | 991639  |
| 31/64                   | 1/2        | 1         | 3            | 991244   | 991245  | 991246  | 991640  | 991641  | 991642  |
| 1/2                     | 1/2        | 5/8       | 2-1/2        | 991039   | 991040  | 991041  | 991135  | 991136  | 991137  |
|                         |            | 1         | 3            | 991247   | 991248  | 991249  | 991643  | 991644  | 991645  |
|                         |            | 1-1/4     | 3            | --       | --      | 994001  | --      | --      | 994000  |
| 33/64                   | 9/16       | 2         | 4            | 991758   | --      | 991759  | 991802  | --      | 991803  |
|                         |            | 3         | 6            | 991833   | --      | 991834  | 991897  | --      | 991898  |
|                         |            | 1-1/4     | 3-1/2        | 991251   | 991252  | 991253  | 991647  | 991648  | 991649  |
| 17/32                   | 9/16       | 1-1/4     | 3-1/2        | 991254   | 991255  | 991256  | 991650  | 991651  | 991652  |
| 35/64                   | 9/16       | 1-1/4     | 3-1/2        | 991257   | 991258  | 991260  | 991653  | 991654  | 991655  |
| 9/16                    | 9/16       | 1-1/4     | 3-1/2        | 991261   | 991262  | 991263  | 991656  | 991657  | 991658  |
| 37/64                   | 5/8        | 1-1/4     | 3-1/2        | 991265   | 991266  | 991267  | 991660  | 991661  | 991662  |
| 19/32                   | 5/8        | 1-1/4     | 3-1/2        | 991268   | 991269  | 991270  | 991663  | 991664  | 991665  |
| 39/64                   | 5/8        | 1-1/4     | 3-1/2        | 991271   | 991272  | 991273  | 991666  | 991667  | 991668  |
| 5/8                     | 5/8        | 3/4       | 3            | 991042   | 991043  | 991044  | 991138  | 991139  | 991140  |
|                         |            | 1-1/4     | 3-1/2        | 991274   | 991275  | 991276  | 991669  | 991670  | 991671  |
|                         |            | 2-1/4     | 5            | 991762   | --      | 991763  | 991806  | --      | 991807  |
|                         |            | 3         | 6            | 991837   | --      | 991838  | 991901  | --      | 991902  |
| 41/64                   | 3/4        | 1-1/2     | 4            | 991278   | 991279  | 991280  | 991673  | 991674  | 991675  |
| 21/32                   | 3/4        | 1-1/2     | 4            | 991281   | 991282  | 991283  | 991676  | 991677  | 991678  |
| 43/64                   | 3/4        | 1-1/2     | 4            | 991284   | 991285  | 991286  | 991679  | 991680  | 991681  |
| 11/16                   | 3/4        | 1-1/2     | 4            | 991287   | 991288  | 991289  | 991682  | 991683  | 991684  |
| 45/64                   | 3/4        | 1-1/2     | 4            | 991290   | 991291  | 991292  | 991685  | 991686  | 991687  |
| 23/32                   | 3/4        | 1-1/2     | 4            | 991293   | 991294  | 991295  | 991688  | 991689  | 991690  |
| 47/64                   | 3/4        | 1-1/2     | 4            | 991296   | 991297  | 991298  | 991691  | 991692  | 991693  |

|                           |   |                   |
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| P                         | ● | Steel             |
| M                         | ○ | Stainless Steel   |
| K                         | ● | Cast Iron         |
| N                         | ○ | Non-Ferrous       |
| S                         | ○ | High Temp. Alloys |
| H                         | ○ | Hardened Steel    |
| ● GOOD ○ OK ○ NOT OPTIMAL |   |                   |

- Square End
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- Center Cutting
- Fractional & Metric
- General Purpose
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- Uncoated & TiALN Coated
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- Profiling



| Square End - Fractional |       |       |         |          |         |         |         |         |         |
|-------------------------|-------|-------|---------|----------|---------|---------|---------|---------|---------|
| Cutter                  | Shank | LOC   | Overall | Uncoated |         |         | TiALN   |         |         |
| D                       | d     | l1    | L       | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 3/4                     | 3/4   | 1     | 3       | 991045   | 991046  | 991047  | 991141  | 991142  | 991143  |
|                         |       | 1-1/2 | 4       | 991299   | 991300  | 991301  | 991694  | 991695  | 991696  |
|                         |       | 2-1/4 | 5       | 991764   | --      | 991765  | 991808  | --      | 991809  |
|                         |       | 3     | 6       | 991839   | --      | 991840  | 991903  | --      | 991904  |
| 49/64                   | 7/8   | 1-1/2 | 4       | 991303   | 991304  | 991305  | 991698  | 991699  | 991700  |
| 25/32                   | 7/8   | 1-1/2 | 4       | 991306   | 991307  | 991308  | 991701  | 991702  | 991703  |
| 51/64                   | 7/8   | 1-1/2 | 4       | 991309   | 991310  | 991311  | 991704  | 991705  | 991706  |
| 13/16                   | 7/8   | 1-1/2 | 4       | 991312   | 991313  | 991314  | 991707  | 991708  | 991709  |
| 53/64                   | 7/8   | 1-1/2 | 4       | 991315   | 991316  | 991317  | 991710  | 991711  | 991712  |
| 27/32                   | 7/8   | 1-1/2 | 4       | 991318   | 991319  | 991320  | 991713  | 991714  | 991715  |
| 55/64                   | 7/8   | 1-1/2 | 4       | 991321   | 991322  | 991323  | 991716  | 991717  | 991718  |
| 7/8                     | 7/8   | 1-1/2 | 4       | 991324   | 991325  | 991326  | 991719  | 991720  | 991721  |
| 57/64                   | 1     | 1-1/2 | 4       | 991328   | 991329  | 991330  | 991723  | 991724  | 991725  |
| 29/32                   | 1     | 1-1/2 | 4       | 991331   | 991332  | 991333  | 991726  | 991727  | 991728  |
| 59/64                   | 1     | 1-1/2 | 4       | 991334   | 991335  | 991336  | 991729  | 991730  | 991731  |
| 15/16                   | 1     | 1-1/2 | 4       | 991337   | 991338  | 991339  | 991732  | 991733  | 991734  |
| 61/64                   | 1     | 1-1/2 | 4       | 991340   | 991341  | 991342  | 991735  | 991736  | 991737  |
| 31/32                   | 1     | 1-1/2 | 4       | 991343   | 991344  | 991345  | 991738  | 991739  | 991740  |
| 63/64                   | 1     | 1-1/2 | 4       | 991346   | 991347  | 991348  | 991741  | 991742  | 991743  |
| 1                       | 1     | 1     | 3       | 991012   | 991013  | 991014  | 991108  | 991109  | 991110  |
|                         |       | 1-1/2 | 4       | 991162   | 991163  | 991164  | 991558  | 991559  | 991560  |
|                         |       | 2-1/4 | 5       | 991744   | --      | 991745  | 991788  | --      | 991789  |
|                         |       | 3     | 6       | 991810   | --      | 991812  | 991875  | --      | 991876  |

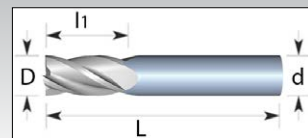


Precision Grinding with  
high quality surface  
finishes for maximum  
tool life!

| Square End - Metric |       |     |         |          |         |         |         |         |         |
|---------------------|-------|-----|---------|----------|---------|---------|---------|---------|---------|
| Cutter              | Shank | LOC | Overall | Uncoated |         |         | TiALN   |         |         |
| D                   | d     | l1  | L       | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 1                   | 1     | 3   | 38      | 993244   | 993245  | 993246  | 993310  | 993311  | 993312  |
| 1.5                 | 2     | 5   | 38      | 993247   | 993248  | 993249  | 993313  | 993314  | 993315  |
| 2                   | 2     | 6   | 38      | 993250   | 993251  | 993252  | 993316  | 993317  | 993318  |

|                           |   |                   |
|---------------------------|---|-------------------|
| P                         | ● | Steel             |
| M                         | ○ | Stainless Steel   |
| K                         | ● | Cast Iron         |
| N                         | ○ | Non-Ferrous       |
| S                         | ○ | High Temp. Alloys |
| H                         | ○ | Hardened Steel    |
| ● GOOD ○ OK ○ NOT OPTIMAL |   |                   |

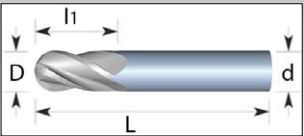
- Square End
- 2, 3, 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Metric Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



| Square End - Metric |       |     |         |          |         |         |         |         |         |
|---------------------|-------|-----|---------|----------|---------|---------|---------|---------|---------|
| Cutter              | Shank | LOC | Overall | Uncoated |         |         | TiALN   |         |         |
| D                   | d     | l1  | L       | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 3                   | 3     | 12  | 38      | 993256   | 993257  | 993258  | 993322  | 993323  | 993324  |
|                     |       | 25  | 75      | 993464   | --      | 993465  | 993488  | --      | 993489  |
|                     |       | 25  | 100     | 993512   | --      | 993513  | 993528  | --      | 993529  |
| 3.5                 | 4     | 12  | 50      | 993259   | 993260  | 993261  | 993325  | 993326  | 993327  |
| 4                   | 4     | 14  | 50      | 993262   | 993263  | 993264  | 993328  | 993329  | 993330  |
|                     |       | 25  | 75      | 993466   | --      | 993467  | 993490  | --      | 993491  |
|                     |       | 50  | 100     | 993514   | --      | 993515  | 993530  | --      | 993531  |
| 4.5                 | 5     | 14  | 50      | 993265   | 993266  | 993267  | 993331  | 993332  | 993333  |
| 5                   | 5     | 16  | 50      | 993268   | 993269  | 993270  | 993334  | 993335  | 993336  |
|                     |       | 25  | 75      | 993468   | --      | 993469  | 993492  | --      | 993493  |
|                     |       | 30  | 100     | 993516   | --      | 993517  | 993532  | --      | 993533  |
| 6                   | 6     | 19  | 63      | 993271   | 993272  | 993273  | 993337  | 993338  | 993339  |
|                     |       | 25  | 75      | 993470   | --      | 993471  | 993494  | --      | 993495  |
|                     |       | 50  | 100     | 993518   | --      | 993519  | 993534  | --      | 993535  |
| 7                   | 7     | 19  | 63      | 993274   | 993275  | 993276  | 993340  | 993341  | 993342  |
| 8                   | 8     | 19  | 63      | 993277   | 993278  | 993279  | 993343  | 993344  | 993345  |
|                     |       | 30  | 100     | 993472   | --      | 993473  | 993496  | --      | 993497  |
|                     |       | 50  | 150     | 993520   | --      | 993521  | 993536  | --      | 993537  |
| 9                   | 10    | 22  | 70      | 993280   | 993281  | 993282  | 993346  | 993347  | 993348  |
| 10                  | 10    | 22  | 70      | 993283   | 993284  | 993285  | 993349  | 993350  | 993351  |
|                     |       | 38  | 100     | 993474   | --      | 993475  | 993498  | --      | 993499  |
|                     |       | 75  | 150     | 993522   | --      | 993523  | 993538  | --      | 993539  |
| 11                  | 12    | 25  | 70      | 993286   | 993287  | 993288  | 993352  | 993353  | 993354  |
| 12                  | 12    | 25  | 75      | 993289   | 993290  | 993291  | 993355  | 993356  | 993357  |
|                     |       | 50  | 100     | 993476   | --      | 993477  | 993500  | --      | 993501  |
|                     |       | 75  | 150     | 993524   | --      | 993525  | 993540  | --      | 993541  |
| 14                  | 14    | 30  | 88      | 993292   | 993293  | 993294  | 993358  | 993359  | 993360  |
|                     |       | 50  | 125     | 993478   | --      | 993479  | 993502  | --      | 993503  |
|                     |       | 75  | 150     | 993526   | --      | 993527  | 993542  | --      | 993543  |
| 16                  | 16    | 32  | 88      | 993295   | 993296  | 993297  | 993361  | 993362  | 993363  |
|                     |       | 75  | 150     | 993480   | --      | 993481  | 993504  | --      | 993505  |
| 18                  | 18    | 36  | 100     | 993298   | 993299  | 993300  | 993364  | 993365  | 993366  |
|                     |       | 75  | 150     | 993482   | --      | 993483  | 993506  | --      | 993507  |
| 20                  | 20    | 38  | 100     | 993301   | 993302  | 993303  | 993367  | 993368  | 993369  |
|                     |       | 75  | 150     | 993484   | --      | 993485  | 993508  | --      | 993509  |
| 22                  | 25    | 38  | 100     | 993304   | 993305  | 993306  | 993370  | 993371  | 993372  |
|                     |       | 38  | 100     | 993307   | 993308  | 993309  | 993373  | 993374  | 993375  |
| 25                  | 25    | 38  | 100     | 993486   | --      | 993487  | 993510  | --      | 993511  |

|                                 |   |                   |
|---------------------------------|---|-------------------|
| P                               | ● | Steel             |
| M                               | ● | Stainless Steel   |
| K                               | ● | Cast Iron         |
| N                               | ○ | Non-Ferrous       |
| S                               | ○ | High Temp. Alloys |
| H                               | ○ | Hardened Steel    |
| ● GOOD    ● OK    ○ NOT OPTIMAL |   |                   |

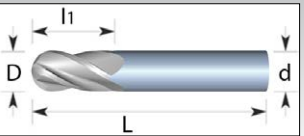
- Ball Nose End
  - 2, 3, 4 Flute
  - Single End
  - Round Shanks
  - Center Cutting
  - Fractional Sizes
- General Purpose
  - Micrograin Carbide
  - Uncoated & TiALN Coated
  - Plunging, Pocketing
  - Slotting, Ramping
  - Profiling



| Ball Nose - Fractional |            |           |              |          |         |         |         |         |         |
|------------------------|------------|-----------|--------------|----------|---------|---------|---------|---------|---------|
| Cutter<br>D            | Shank<br>d | LOC<br>l1 | Overall<br>L | Uncoated |         |         | TiALN   |         |         |
|                        |            |           |              | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 1/32                   | 1/8        | 1/16      | 1-1/2        | 991907   | 991908  | 991909  | 992003  | 992004  | 993580  |
|                        |            | 3/32      |              | 992053   | 992054  | 992055  | 992436  | 992437  | 992438  |
| 3/64                   | 1/8        | 3/32      | 1-1/2        | 991910   | 991911  | 991912  | 992005  | 992006  | 992007  |
|                        |            | 1/8       |              | 992056   | 992057  | 992058  | 992439  | 992440  | 992441  |
| 1/16                   | 1/8        | 1/8       | 1-1/2        | 991913   | 991914  | 991915  | 992008  | 992009  | 992010  |
|                        |            | 3/16      |              | 992059   | 992060  | 992061  | 992442  | 992443  | 992444  |
| 5/64                   | 1/8        | 1/4       | 1-1/2        | 992062   | 992063  | 992064  | 992445  | 992446  | 992447  |
| 3/32                   | 1/8        | 3/16      | 1-1/2        | 991916   | 991917  | 991918  | 992011  | 992012  | 992013  |
|                        |            | 3/8       |              | 992065   | 992066  | 992067  | 992448  | 992449  | 992450  |
| 7/64                   | 1/8        | 3/8       | 1-1/2        | 992071   | 992072  | 992073  | 992454  | 992455  | 992456  |
| 1/8                    | 1/8        | 1/4       | 1-1/2        | 991922   | 991923  | 991924  | 992017  | 992018  | 992019  |
|                        |            | 1/2       |              | 992074   | 992075  | 992076  | 992457  | 992458  | 992459  |
|                        |            | 3/4       | 2-1/2        | 992628   | --      | 992629  | 992672  | --      | 992673  |
|                        |            | 1         |              | 992696   | --      | 992697  | 992760  | --      | 992761  |
| 9/64                   | 3/16       | 9/16      | 2            | 992077   | 992078  | 992079  | 992460  | 992461  | 992462  |
| 5/32                   | 3/16       | 5/16      | 2            | 991925   | 991926  | 991927  | 992020  | 992021  | 992022  |
|                        |            | 9/16      |              | 992080   | 992081  | 992082  | 992463  | 992464  | 992465  |
| 11/64                  | 3/16       | 9/16      | 2            | 992083   | 992084  | 992085  | 992466  | 992467  | 992468  |
|                        |            | 3/8       |              | 991928   | 991929  | 991930  | 992023  | 992024  | 992025  |
|                        |            | 5/8       | 2            | 992086   | 992087  | 992088  | 992470  | 992471  | 992472  |
|                        |            | 3/4       |              | 992630   | --      | 992631  | 992674  | --      | 992675  |
| 3/16                   | 3/16       | 1-1/8     | 3            | 992698   | --      | 992699  | 992762  | --      | 992763  |
|                        |            | 2-1/2     |              |          |         |         |         |         |         |
| 13/64                  | 1/4        | 5/8       | 2-1/2        | 992089   | 992090  | 992091  | 992473  | 992474  | 992475  |
| 7/32                   | 1/4        | 7/16      | 2            | 991931   | 991932  | 991933  | 992026  | 992027  | 992028  |
|                        |            | 5/8       |              | 992092   | 992093  | 992094  | 992476  | 992477  | 992478  |
| 15/64                  | 1/4        | 3/4       | 2-1/2        | 992095   | 992096  | 992097  | 992479  | 992480  | 992481  |
| 1/4                    | 1/4        | 1/2       | 2            | 991934   | 991935  | 991936  | 992029  | 992030  | 992031  |
|                        |            | 3/4       |              | 992098   | 992099  | 992100  | 992482  | 992483  | 992484  |
|                        |            | 1-1/8     | 3            | 992632   | --      | 992633  | 992676  | --      | 992677  |
|                        |            | 1-1/2     |              | 992700   | --      | 992701  | 992764  | --      | 992765  |
| 17/64                  | 5/16       | 7/8       | 2-1/2        | 992101   | 992102  | 992103  | 992485  | 992486  | 992487  |
| 9/32                   | 5/16       | 7/8       | 2-1/2        | 992104   | 992105  | 992106  | 992488  | 992489  | 992490  |
| 19/64                  | 5/16       | 7/8       | 2-1/2        | 992107   | 992108  | 992109  | 992491  | 992492  | 992493  |
| 5/16                   | 5/16       | 1/2       | 2            | 991937   | 991938  | 991939  | 992032  | 992033  | 992034  |
|                        |            | 7/8       |              | 992110   | 992111  | 992112  | 992494  | 992495  | 992496  |
|                        |            | 1-1/8     | 3            | 992634   | --      | 992635  | 992678  | --      | 992679  |
|                        |            | 1-5/8     |              | 992704   | --      | 992705  | 992768  | --      | 992769  |

|                                 |   |                   |
|---------------------------------|---|-------------------|
| P                               | ● | Steel             |
| M                               | ● | Stainless Steel   |
| K                               | ● | Cast Iron         |
| N                               | ○ | Non-Ferrous       |
| S                               | ○ | High Temp. Alloys |
| H                               | ○ | Hardened Steel    |
| ● GOOD    ● OK    ○ NOT OPTIMAL |   |                   |

- Ball Nose End
  - 2, 3, 4 Flute
  - Single End
  - Round Shanks
  - Center Cutting
  - Fractional Sizes
- General Purpose
  - Micrograin Carbide
  - Uncoated & TiALN Coated
  - Plunging, Pocketing
  - Slotting, Ramping
  - Profiling

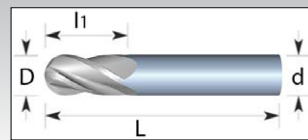


| Ball Nose - Fractional |            |           |              |          |         |         |         |         |         |
|------------------------|------------|-----------|--------------|----------|---------|---------|---------|---------|---------|
| Cutter<br>D            | Shank<br>d | LOC<br>l1 | Overall<br>L | Uncoated |         |         | TiALN   |         |         |
|                        |            |           |              | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 21/64                  | 3/8        | 7/8       | 2-1/2        | 992113   | 992114  | 992115  | 992497  | 992498  | 992499  |
| 11/32                  | 3/8        | 7/8       | 2-1/2        | 992116   | 992117  | 992118  | 992500  | 992501  | 992502  |
| 23/64                  | 3/8        | 7/8       | 2-1/2        | 992119   | 992120  | 992121  | 992503  | 992504  | 992505  |
| 3/8                    | 3/8        | 5/8       | 2            | 991940   | 991941  | 991942  | 992035  | 992036  | 992037  |
|                        |            | 1         | 2-1/2        | 992122   | 992123  | 992124  | 992506  | 992507  | 992508  |
|                        |            | 1-1/8     | 3            | 992636   | --      | 992637  | 992680  | --      | 992681  |
|                        |            | 1-3/4     | 4            | 992710   | --      | 992711  | 992774  | --      | 992775  |
| 25/64                  | 7/16       | 1         | 2-1/2        | 992125   | 992126  | 992127  | 992509  | 992510  | 992511  |
| 13/32                  | 7/16       | 1         | 2-1/2        | 992128   | 992129  | 992130  | 992512  | 992513  | 992514  |
| 27/64                  | 7/16       | 1         | 2-1/2        | 992131   | 992132  | 992133  | 992515  | 992516  | 992517  |
| 7/16                   | 7/16       | 5/8       | 2-1/2        | 991943   | 991944  | 991945  | 992038  | 992039  | 992040  |
|                        |            | 1         |              | 992134   | 992135  | 992136  | 992518  | 992519  | 992520  |
|                        |            | 2         |              | 992638   | --      | 992639  | 992682  | --      | 992683  |
| 29/64                  | 1/2        | 1         | 3            | 992137   | 992138  | 992139  | 992521  | 992522  | 992523  |
| 15/32                  | 1/2        | 1         | 3            | 992140   | 992141  | 992142  | 992524  | 992525  | 992526  |
| 31/64                  | 1/2        | 1         | 3            | 992143   | 992144  | 992145  | 992527  | 992528  | 992529  |
| 1/2                    | 1/2        | 5/8       | 2-1/2        | 991946   | 991947  | 991948  | 992041  | 992042  | 992043  |
|                        |            | 1         | 3            | 992146   | 992147  | 992148  | 992530  | 992531  | 992532  |
|                        |            | 2         | 4            | 992640   | --      | 992641  | 992684  | --      | 992685  |
|                        |            | 3         | 6            | 992714   | --      | 992715  | 992778  | --      | 992779  |
| 33/64                  | 9/16       | 1-1/4     | 3-1/2        | 992149   | 992150  | 992151  | 992533  | 992534  | 992535  |
| 17/32                  | 9/16       | 1-1/4     | 3-1/2        | 992152   | 992153  | 992154  | 992536  | 992537  | 992538  |
| 35/64                  | 9/16       | 1-1/4     | 3-1/2        | 992155   | 992156  | 992157  | 992539  | 992540  | 992541  |
| 9/16                   | 9/16       | 1-1/4     | 3-1/2        | 992158   | 992159  | 992160  | 992542  | 992543  | 992544  |
| 37/64                  | 5/8        | 1-1/4     | 3-1/2        | 992161   | 992162  | 992163  | 992545  | 992546  | 992547  |
| 19/32                  | 5/8        | 1-1/4     | 3-1/2        | 992164   | 992165  | 992166  | 992548  | 992549  | 992550  |
| 39/64                  | 5/8        | 1-1/4     | 3-1/2        | 992167   | 992168  | 992169  | 992551  | 992552  | 992553  |
| 5/8                    | 5/8        | 3/4       | 3            | 991949   | 991950  | 991951  | 992044  | 992045  | 992046  |
|                        |            | 1-1/4     | 3-1/2        | 992170   | 992171  | 992172  | 992554  | 992555  | 992556  |
|                        |            | 2-1/4     | 5            | 992644   | --      | 992645  | 992688  | --      | 992689  |
|                        |            | 3         | 6            | 992718   | --      | 992719  | 992782  | --      | 992783  |
| 41/64                  | 3/4        | 1-1/2     | 4            | 992173   | 992174  | 992175  | 992557  | 992558  | 992559  |
| 21/32                  | 3/4        | 1-1/2     | 4            | 992176   | 992177  | 992178  | 992560  | 992561  | 992562  |
| 43/64                  | 3/4        | 1-1/2     | 4            | 992179   | 992180  | 992181  | 992563  | 992564  | 992565  |
| 11/16                  | 3/4        | 1-1/2     | 4            | 992182   | 992183  | 992184  | 992566  | 992567  | 992568  |
| 45/64                  | 3/4        | 1-1/2     | 4            | 992185   | 992186  | 993999  | 992569  | 992570  | 992571  |
| 23/32                  | 3/4        | 1-1/2     | 4            | 992187   | 992188  | 992189  | 992572  | 992573  | 992574  |
| 47/64                  | 3/4        | 1-1/2     | 4            | 992190   | 992191  | 992192  | 992575  | 992576  | 992577  |

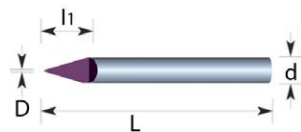
|   |                   |
|---|-------------------|
| P | Steel             |
| M | Stainless Steel   |
| K | Cast Iron         |
| N | Non-Ferrous       |
| S | High Temp. Alloys |
| H | Hardened Steel    |

● GOOD ● OK ○ NOT OPTIMAL

- Ball Nose End
- 2, 3, 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Fractional Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
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- Slotting, Ramping
- Profiling

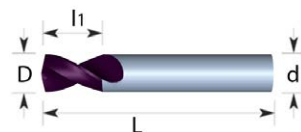


| Ball Nose - Fractional |       |       |         |          |         |         |         |         |         |
|------------------------|-------|-------|---------|----------|---------|---------|---------|---------|---------|
| Cutter                 | Shank | LOC   | Overall | Uncoated |         |         | TiALN   |         |         |
| D                      | d     | l1    | L       | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 3/4                    | 3/4   | 1     | 3       | 991952   | 991953  | 991954  | 992047  | 992048  | 992049  |
|                        |       | 1-1/2 | 4       | 992193   | 992194  | 992195  | 992578  | 992579  | 992580  |
|                        |       | 2-1/4 | 5       | 992646   | --      | 992647  | 992690  | --      | 992691  |
|                        |       | 3     | 6       | 992720   | --      | 992721  | 992784  | --      | 992785  |
| 49/64                  | 7/8   | 1-1/2 | 4       | 992196   | 992197  | 992198  | 992581  | 992582  | 992583  |
| 25/32                  | 7/8   | 1-1/2 | 4       | 992199   | 992200  | 992201  | 992584  | 992585  | 992586  |
| 51/64                  | 7/8   | 1-1/2 | 4       | 992202   | 992203  | 992204  | 992587  | 992588  | 992589  |
| 13/16                  | 7/8   | 1-1/2 | 4       | 992205   | 992206  | 992207  | 992590  | 992591  | 992592  |
| 53/64                  | 7/8   | 1-1/2 | 4       | 992208   | 992209  | 992210  | 992593  | 992594  | 992595  |
| 27/32                  | 7/8   | 1-1/2 | 4       | 992211   | 992212  | 992213  | 992596  | 992597  | 992598  |
| 55/64                  | 7/8   | 1-1/2 | 4       | 992214   | 992215  | 992216  | 992599  | 992600  | 992601  |
| 7/8                    | 7/8   | 1-1/2 | 4       | 992217   | 992218  | 992219  | 992602  | 992603  | 992604  |
| 57/64                  | 1     | 1-1/2 | 4       | 992220   | 992221  | 992222  | 992605  | 992606  | 992607  |
| 29/32                  | 1     | 1-1/2 | 4       | 992223   | 992224  | 992225  | 992608  | 992609  | 992610  |
| 59/64                  | 1     | 1-1/2 | 4       | 992226   | 992227  | 992228  | 992611  | 992612  | 992613  |
| 15/16                  | 1     | 1-1/2 | 4       | 992229   | 992230  | 992231  | 992614  | 992615  | 992616  |
| 61/64                  | 1     | 1-1/2 | 4       | 992232   | 992233  | 992234  | 992617  | 992618  | 992619  |
| 31/32                  | 1     | 1-1/2 | 4       | 992235   | 992236  | 992237  | 992620  | 992621  | 992622  |
| 63/64                  | 1     | 1-1/2 | 4       | 992238   | 992239  | 992240  | 992623  | 992624  | 992625  |
| 1                      | 1     | 1     | 3       | 991919   | 991920  | 991921  | 992014  | 992015  | 992016  |
|                        |       | 1-1/2 | 4       | 992068   | 992069  | 992070  | 992451  | 992452  | 992453  |
|                        |       | 2-1/4 | 5       | 992626   | --      | 992627  | 992670  | --      | 992671  |
|                        |       | 3     | 6       | 992692   | --      | 992693  | 992756  | --      | 992757  |



- Engraving Tools with 30 Degree angle
- 3 tip sizes to choose from

| Engraving Tools |       |     |         |         |
|-----------------|-------|-----|---------|---------|
| Tip             | Shank | LOC | Overall | TiALN   |
| D               | d     | l1  | L       | 1 Flute |
| .005            | 1/4   | 1/2 | 2-1/2   | 993998  |
| .010            | 1/4   | 1/2 | 2-1/2   | 993581  |
| .020            | 1/4   | 1/2 | 2-1/2   | 993582  |



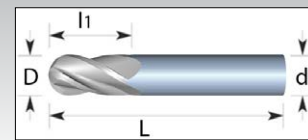
- Allows High Performance drills to center properly without damaging their outside edge
- 145 Degree Point Carbide with honed edges

| Spot Drills |       |       |         |         |
|-------------|-------|-------|---------|---------|
| Drill       | Shank | LOC   | Overall | TiALN   |
| D           | d     | l1    | L       | 2 Flute |
| 1/4         | 1/4   | 1/2   | 3       | 993583  |
| 3/8         | 3/8   | 3/4   | 3       | 993584  |
| 1/2         | 1/2   | 1     | 4       | 993585  |
| 5/8         | 5/8   | 1     | 4       | 993586  |
| 3/4         | 3/4   | 1-1/8 | 4       | 993587  |

|   |                   |
|---|-------------------|
| P | Steel             |
| M | Stainless Steel   |
| K | Cast Iron         |
| N | Non-Ferrous       |
| S | High Temp. Alloys |
| H | Hardened Steel    |

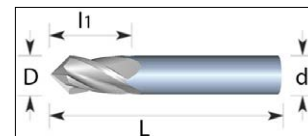
● GOOD ● OK ○ NOT OPTIMAL

- Ball Nose End
- 2 & 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Metric Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



| Ball Nose - Metric |       |     |         |          |         |         |         |         |         |
|--------------------|-------|-----|---------|----------|---------|---------|---------|---------|---------|
| Cutter             | Shank | LOC | Overall | Uncoated |         |         | TiALN   |         |         |
| D                  | d     | l1  | L       | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 1                  | 1     | 3   | 38      | 993376   | --      | 993377  | 993420  | --      | 993421  |
| 1.5                | 2     | 5   | 38      | 993378   | --      | 993379  | 993422  | --      | 993423  |
| 2                  | 2     | 6   | 38      | 993380   | --      | 993381  | 993424  | --      | 993425  |
| 3                  | 3     | 12  | 38      | 993384   | --      | 993385  | 993428  | --      | 993429  |
| 3.5                | 4     | 12  | 50      | 993386   | --      | 993387  | 993430  | --      | 993431  |
| 4                  | 4     | 14  | 50      | 993388   | --      | 993389  | 993432  | --      | 993433  |
| 4.5                | 5     | 14  | 50      | 993390   | --      | 993391  | 993434  | --      | 993435  |
| 5                  | 5     | 16  | 50      | 993392   | --      | 993393  | 993436  | --      | 993437  |
| 6                  | 6     | 19  | 63      | 993394   | --      | 993395  | 993438  | --      | 993439  |
| 7                  | 7     | 19  | 63      | 993396   | --      | 993397  | 993440  | --      | 993441  |
| 8                  | 8     | 19  | 63      | 993398   | --      | 993399  | 993442  | --      | 993443  |
| 9                  | 9     | 22  | 70      | 993400   | --      | 993401  | 993444  | --      | 993445  |
| 10                 | 10    | 22  | 70      | 993402   | --      | 993403  | 993446  | --      | 993447  |
| 11                 | 11    | 25  | 70      | 993404   | --      | 993405  | 993448  | --      | 993449  |
| 12                 | 12    | 25  | 75      | 993406   | --      | 993407  | 993450  | --      | 993451  |
| 14                 | 14    | 30  | 88      | 993408   | --      | 993409  | 993452  | --      | 993453  |
| 16                 | 16    | 32  | 88      | 993410   | --      | 993411  | 993454  | --      | 993455  |
| 18                 | 18    | 36  | 100     | 993412   | --      | 993413  | 993456  | --      | 993457  |
| 20                 | 20    | 38  | 100     | 993414   | --      | 993415  | 993458  | --      | 993459  |
| 22                 | 25    | 38  | 100     | 993416   | --      | 993417  | 993460  | --      | 993461  |
| 25                 | 25    | 38  | 100     | 993418   | --      | 993419  | 993462  | --      | 993463  |

- 90 Degree End
- 2 & 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Fractional Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Milling, Drilling
- Countersinking
- Chamfering, De-burring



| Drill/Mill 90 Degree - Fractional |       |       |         |          |         |         |         |         |         |
|-----------------------------------|-------|-------|---------|----------|---------|---------|---------|---------|---------|
| Cutter                            | Shank | LOC   | Overall | Uncoated |         |         | TiALN   |         |         |
| D                                 | d     | l1    | L       | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 1/8                               | 1/8   | 1/2   | 1-1/2   | 993544   | --      | 993545  | 993562  | --      | 993563  |
| 3/16                              | 3/16  | 5/8   | 2       | 993546   | --      | 993547  | 993564  | --      | 993565  |
| 1/4                               | 1/4   | 3/4   | 2-1/2   | 993548   | --      | 993549  | 993566  | --      | 993567  |
| 5/16                              | 5/16  | 7/8   | 2-1/2   | 993550   | --      | 993551  | 993568  | --      | 993569  |
| 3/8                               | 3/8   | 1     | 2-1/2   | 993552   | --      | 993553  | 993570  | --      | 993571  |
| 7/16                              | 7/16  | 1     | 2-3/4   | 993554   | --      | 993555  | 993572  | --      | 993573  |
| 1/2                               | 1/2   | 1     | 3       | 993556   | --      | 993557  | 993574  | --      | 993575  |
| 5/8                               | 5/8   | 1-1/4 | 3-1/2   | 993558   | --      | 993559  | 993576  | --      | 993577  |
| 3/4                               | 3/4   | 1-1/2 | 4       | 993560   | --      | 993561  | 993578  | --      | 993579  |

|                           |   |                   |
|---------------------------|---|-------------------|
| P                         | ● | Steel             |
| M                         | ○ | Stainless Steel   |
| K                         | ● | Cast Iron         |
| N                         | ○ | Non-Ferrous       |
| S                         |   | High Temp. Alloys |
| H                         |   | Hardened Steel    |
| ● GOOD ○ OK ○ NOT OPTIMAL |   |                   |

- Square End

▪ 2 & 4 Flute

▪ Double End

▪ 1/32-3/16 Round Shanks

▪ 7/32-3/4 Weldon Shanks

▪ Fractional Sizes
- General Purpose

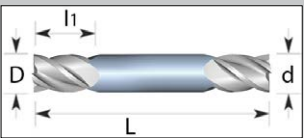
▪ Micrograin Carbide

▪ Uncoated & TiALN Coated

▪ Plunging, Pocketing

▪ Slotting, Ramping

▪ Profiling



|                           |   |                   |
|---------------------------|---|-------------------|
| P                         | ● | Steel             |
| M                         | ○ | Stainless Steel   |
| K                         | ● | Cast Iron         |
| N                         | ○ | Non-Ferrous       |
| S                         |   | High Temp. Alloys |
| H                         |   | Hardened Steel    |
| ● GOOD ○ OK ○ NOT OPTIMAL |   |                   |

- Ball Nose End

▪ 2 & 4 Flute

▪ Double End

▪ 1/32-3/16 Round Shanks

▪ 7/32-3/4 Weldon Shanks

▪ Fractional Sizes
- General Purpose

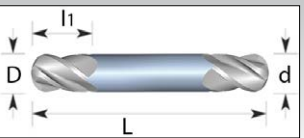
▪ Micrograin Carbide

▪ Uncoated & TiALN Coated

▪ Plunging, Pocketing

▪ Slotting, Ramping

▪ Profiling



| Square Double End - Fractional |            |           |              |          |         |         |         |         |         |
|--------------------------------|------------|-----------|--------------|----------|---------|---------|---------|---------|---------|
| Cutter<br>D                    | Shank<br>d | LOC<br>l1 | Overall<br>L | Uncoated |         |         | TiALN   |         |         |
|                                |            |           |              | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 1/32                           | 1/8        | 1/16      | 1-1/2        | 992788   | --      | 992789  | 992860  | --      | 992861  |
| 3/64                           | 1/8        | 3/32      | 1-1/2        | 992790   | --      | 992791  | 992862  | --      | 992863  |
| 1/16                           | 1/8        | 1/8       | 1-1/2        | 992792   | --      | 992793  | 992864  | --      | 992865  |
| 3/32                           | 1/8        | 3/16      | 1-1/2        | 992794   | --      | 992795  | 992866  | --      | 992867  |
| 7/64                           | 1/8        | 7/32      | 1-1/2        | 992796   | --      | 992797  | 992868  | --      | 992869  |
| 1/8                            | 1/8        | 1/4       | 1-1/2        | 992798   | --      | 992799  | 992870  | --      | 992871  |
| 5/32                           | 3/16       | 5/16      | 2            | 992800   | --      | 992801  | 992872  | --      | 992873  |
|                                |            | 7/16      | 3            | 993008   | --      | 993009  | 993036  | --      | 993037  |
| 3/16                           | 3/16       | 5/16      | 2            | 992802   | --      | 992803  | 992874  | --      | 992875  |
|                                |            | 1/2       | 3            | 993010   | --      | 993011  | 993038  | --      | 993039  |
| 7/32                           | 1/4        | 3/8       | 2-1/2        | 992804   | --      | 992805  | 992876  | --      | 992877  |
|                                |            | 9/16      | 4            | 993012   | --      | 993013  | 993040  | --      | 993041  |
| 1/4                            | 1/4        | 1/2       | 2-1/2        | 992806   | --      | 992807  | 992878  | --      | 992879  |
|                                |            | 5/8       | 4            | 993014   | --      | 993015  | 993042  | --      | 993043  |
| 9/32                           | 5/16       | 1/2       | 2-1/2        | 992808   | --      | 992809  | 992880  | --      | 992881  |
| 5/16                           | 5/16       | 1/2       | 2-1/2        | 992810   | --      | 992811  | 992882  | --      | 992883  |
|                                |            | 3/4       | 4            | 993016   | --      | 993017  | 993044  | --      | 993045  |
| 3/8                            | 3/8        | 9/16      | 2-1/2        | 992812   | --      | 992813  | 992884  | --      | 992885  |
|                                |            | 3/4       | 4            | 993020   | --      | 993021  | 993048  | --      | 993049  |
| 7/16                           | 1/2        | 9/16      | 2-3/4        | 992814   | --      | 992815  | 992886  | --      | 992887  |
|                                |            | 7/8       | 4            | 993022   | --      | 993023  | 993050  | --      | 993051  |
| 1/2                            | 1/2        | 5/8       | 3            | 992816   | --      | 992817  | 992888  | --      | 992889  |
|                                |            | 1         | 4            | 993024   | --      | 993025  | 993052  | --      | 993053  |
| 9/16                           | 5/8        | 11/16     | 3-1/2        | 992818   | --      | 992819  | 992890  | --      | 992891  |
| 5/8                            | 5/8        | 11/16     | 3-1/2        | 992820   | --      | 992821  | 992892  | --      | 992893  |
|                                |            | 1-1/2     | 6            | 993028   | --      | 993029  | 993056  | --      | 993057  |
| 3/4                            | 3/4        | 7/8       | 4            | 992822   | --      | 992823  | 992894  | --      | 992895  |
|                                |            | 1-1/2     | 6            | 993030   | --      | 993031  | 993058  | --      | 993059  |

| Ball Nose Double End - Fractional |            |           |              |          |         |         |         |         |         |
|-----------------------------------|------------|-----------|--------------|----------|---------|---------|---------|---------|---------|
| Cutter<br>D                       | Shank<br>d | LOC<br>l1 | Overall<br>L | Uncoated |         |         | TiALN   |         |         |
|                                   |            |           |              | 2 Flute  | 3 Flute | 4 Flute | 2 Flute | 3 Flute | 4 Flute |
| 1/32                              | 1/8        | 1/16      | 1-1/2        | 992896   | --      | 992897  | 992968  | --      | 992969  |
| 3/64                              | 1/8        | 3/32      | 1-1/2        | 992898   | --      | 992899  | 992970  | --      | 992971  |
| 1/16                              | 1/8        | 1/8       | 1-1/2        | 992900   | --      | 992901  | 992972  | --      | 992973  |
| 3/32                              | 1/8        | 3/16      | 1-1/2        | 992902   | --      | 992903  | 992974  | --      | 992975  |
| 7/64                              | 1/8        | 7/32      | 1-1/2        | 992904   | --      | 992905  | 992976  | --      | 992977  |
| 1/8                               | 1/8        | 1/4       | 1-1/2        | 992906   | --      | 992907  | 992978  | --      | 992979  |
| 5/32                              | 3/16       | 5/16      | 2            | 992908   | --      | 992909  | 992980  | --      | 992981  |
|                                   |            | 7/16      | 3            | 993064   | --      | 993065  | 993092  | --      | 993093  |
| 3/16                              | 3/16       | 5/16      | 2            | 992910   | --      | 992911  | 992982  | --      | 992983  |
|                                   |            | 1/2       | 3            | 993066   | --      | 993067  | 993094  | --      | 993095  |
| 7/32                              | 1/4        | 3/8       | 2-1/2        | 992912   | --      | 992913  | 992984  | --      | 992985  |
|                                   |            | 9/16      | 4            | 993068   | --      | 993069  | 993096  | --      | 993097  |
| 1/4                               | 1/4        | 1/2       | 2-1/2        | 992914   | --      | 992915  | 992986  | --      | 992987  |
|                                   |            | 5/8       | 4            | 993070   | --      | 993071  | 993098  | --      | 993099  |
| 9/32                              | 5/16       | 1/2       | 2-1/2        | 992916   | --      | 992917  | 992988  | --      | 992989  |
| 5/16                              | 5/16       | 1/2       | 2-1/2        | 992918   | --      | 992919  | 992990  | --      | 992991  |
|                                   |            | 3/4       | 4            | 993072   | --      | 993073  | 993100  | --      | 993101  |
| 3/8                               | 3/8        | 9/16      | 2-1/2        | 992920   | --      | 992921  | 992992  | --      | 992993  |
|                                   |            | 3/4       | 4            | 993076   | --      | 993077  | 993104  | --      | 993105  |
| 7/16                              | 1/2        | 9/16      | 2-3/4        | 992922   | --      | 992923  | 992994  | --      | 992995  |
|                                   |            | 7/8       | 4            | 993078   | --      | 993079  | 993106  | --      | 993107  |
| 1/2                               | 1/2        | 5/8       | 3            | 992924   | --      | 992925  | 992996  | --      | 992997  |
|                                   |            | 1         | 4            | 993080   | --      | 993081  | 993108  | --      | 993109  |
| 9/16                              | 5/8        | 11/16     | 3-1/2        | 992926   | --      | 992927  | 992998  | --      | 992999  |
| 5/8                               | 5/8        | 11/16     | 3-1/2        | 992928   | --      | 992929  | 993000  | --      | 993001  |
|                                   |            | 1-1/2     | 6            | 993084   | --      | 993085  | 993112  | --      | 993113  |
| 3/4                               | 3/4        | 7/8       | 4            | 992930   | --      | 992931  | 993002  | --      | 993003  |
|                                   |            | 1-1/2     | 6            | 993086   | --      | 993087  | 993114  | --      | 993115  |