SONIC TOOLS

SOLID CARBIDE CUTTING TOOLS 2022

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(804) 798-0538

Better Tools
Better Results

Discover the spirit of **American** manufacturing!

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100 Series

Ferrous & Titanium Alloys

100 100C 100R 110 120

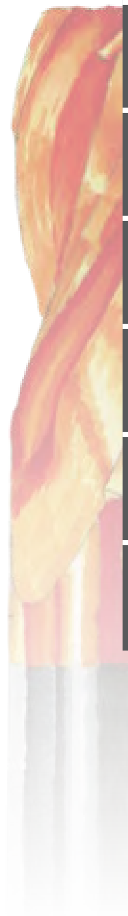
We have compiled our 25 years of experience and comprehensive testing and design to bring forward a line of high-performance cutting tools.

In this section, we took our most successful combinations of rake, helix, core, balance, and accuracy and applied it to several series of broad spectrum use end mills for ferrous and nonferrous materials. All of the items in this section are stocked coated, but uncoated items may be available for rapid delivery upon request.

We also offer full customization of all items.

Section Features:

- Center cutting geometry for ramping and plunging operations
- Balanced design reduces system resonance and tool chatter improving tool life, spindle life, and surface finish
- All shanks finish ground to h6 tolerance for use in precision tool holders
- Shank finish is not polished to aid in slip resistance
- Every item is lot tracked with engraving that has been optimized for readability and to eliminate tool holder interference
- Weldon flats are available upon request. Weldon flats are not recommended or included as a standard option due to a potential increase in TIR
- Diamond coating available upon request



CONSTRUCTION STEEL

TOOL STEEL (≤48HRC)

TOOL STEEL (›48≤56HRC)

DUCTILE CAST IRON

GREY CAST IRON

TITANIUM

STAINLESS STEEL

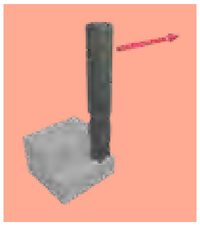
SUPER ALLOY

Speeds & Feeds
Series: 100, 110, 120

Roughing Inch

Chart color coded to match milling style

- SLOT
- SIDE
- CONTOUR



Material	Tool Series	Circumferential Velocity (SFM)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 0.138"	0.138" ≤ D0 < 0.276"	0.276" ≤ D0 < 0.433"	0.433" ≤ D0 < 0.708"	0.708" ≤ D0
Construction Steel	110, 120	360	1.00 X D0	0.20 X D0	0.0003"	0.0006"	0.0013"	0.0019"	0.0031"
	100, 110, 120	425	0.20 X D0	1.00 X D0	0.0005"	0.0009"	0.0019"	0.0028"	0.0047"
	120	460	0.03 X D0	0.03 X D0	0.0006"	0.0013"	0.0025"	0.0038"	0.0063"
Tool Steel (≤48HRC)	110, 120	295	1.00 X D0	0.10 X D0	0.0003"	0.0005"	0.0009"	0.0014"	0.0024"
	100, 110, 120	360	0.10 X D0	1.00 X D0	0.0005"	0.0010"	0.0020"	0.0031"	0.0051"
	120	395	0.03 X D0	0.03 X D0	0.0006"	0.0013"	0.0025"	0.0038"	0.0063"
Tool Steel (>48≤56HRC)	110, 120	130	1.00 X D0	0.05 X D0	0.0002"	0.0003"	0.0006"	0.0009"	0.0016"
	100, 110, 120	200	0.05 X D0	1.00 X D0	0.0004"	0.0008"	0.0016"	0.0024"	0.0039"
	120	230	0.03 X D0	0.03 X D0	0.0006"	0.0011"	0.0022"	0.0033"	0.0055"
Ductile Cast Iron	110, 120	295	1.00 X D0	0.10 X D0	0.0002"	0.0005"	0.0010"	0.0015"	0.0025"
	100, 110, 120	360	0.10 X D0	1.00 X D0	0.0005"	0.0010"	0.0020"	0.0031"	0.0051"
	120	395	0.03 X D0	0.03 X D0	0.0006"	0.0012"	0.0024"	0.0035"	0.0059"
Grey Cast Iron	110, 120	325	1.00 X D0	0.20 X D0	0.0004"	0.0007"	0.0014"	0.0021"	0.0035"
	100, 110, 120	395	0.20 X D0	1.00 X D0	0.0007"	0.0013"	0.0027"	0.0040"	0.0067"
	120	425	0.03 X D0	0.03 X D0	0.0007"	0.0015"	0.0030"	0.0045"	0.0075"
Titanium	110, 120	195	1.00 X D0	0.10 X D0	0.0002"	0.0005"	0.0010"	0.0015"	0.0025"
	100, 110, 120	195	0.10 X D0	1.00 X D0	0.0004"	0.0009"	0.0018"	0.0027"	0.0045"
	120	295	0.03 X D0	0.03 X D0	0.0006"	0.0011"	0.0022"	0.0033"	0.0056"
Stainless Steel	110, 120	165	1.00 X D0	0.10 X D0	0.0002"	0.0005"	0.0010"	0.0015"	0.0025"
	100, 110, 120	230	0.10 X D0	1.00 X D0	0.0005"	0.0009"	0.0019"	0.0028"	0.0046"
	120	260	0.03 X D0	0.03 X D0	0.0006"	0.0012"	0.0024"	0.0035"	0.0059"
Super Alloy	110, 120	65	1.00 X D0	0.08 X D0	0.0002"	0.0005"	0.0010"	0.0015"	0.0024"
	100, 110, 120	100	0.08 X D0	1.00 X D0	0.0005"	0.0009"	0.0019"	0.0028"	0.0047"
	120	130	0.03 X D0	0.03 X D0	0.0006"	0.0012"	0.0024"	0.0035"	0.0059"

Definitions

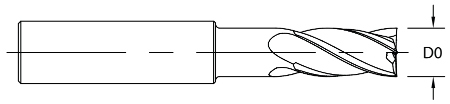
Circumferential Velocity (Vc): This value represents the linear surface speed of the tool. Circumferential Velocity is a constant rate so that it is independent of tool size. Circumferential Velocity is also commonly referred to as Tangential Velocity. To calculate RPM from Vc, see Equation.

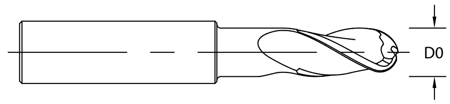
Radial Width of Cut (ae): This value represents the engagement width of the end mill being used per pass. In side milling, the Radial Width of Cut is typically a value less than the diameter of the end mill. Radial Width of Cut is also commonly referred to as step over or cut width.

Inch Equations

$$RPM = \frac{\mathrm{SFM}_{\mathrm{ft/min}} * 3.82}{\mathrm{D0}_{in}}$$

$$Linear\ Feed_{\mathrm{in/min}} = RPM * fz_{in} * \#_z$$





Material	Tool Series	Circumferential Velocity (m/min)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 3.5mm	3.5mm ≤ D0 < 7mm	7mm ≤ D0 < 11mm	11mm ≤ D0 < 18mm	18mm ≤ D0
Construction Steel	110, 120	110	1.00 X D0	0.20 X D0	0.008	0.016	0.032	0.048	0.080
	100, 110, 120	130	0.20 X D0	1.00 X D0	0.012	0.024	0.048	0.072	0.120
	120	140	0.03 X D0	0.03 X D0	0.160	0.032	0.064	0.096	0.160
Tool Steel (≤48HRC)	110, 120	90	1.00 X D0	0.10 X D0	0.007	0.012	0.024	0.036	0.060
	100, 110, 120	110	0.05 X D0	1.00 X D0	0.013	0.026	0.052	0.078	0.130
	120	120	0.03 X D0	0.03 X D0	0.160	0.032	0.064	0.096	0.160
Tool Steel (>48≤56HRC)	110, 120	40	1.00 X D0	0.05 X D0	0.006	0.008	0.016	0.024	0.040
	100, 110, 120	60	0.05 X D0	1.00 X D0	0.010	0.020	0.040	0.060	0.100
	120	70	0.03 X D0	0.03 X D0	0.014	0.028	0.056	0.084	0.140
Ductile Cast Iron	110, 120	90	1.00 X D0	0.10 X D0	0.006	0.013	0.026	0.038	0.064
	100, 110, 120	110	0.10 X D0	1.00 X D0	0.013	0.026	0.052	0.078	0.130
	120	120	0.03 X D0	0.03 X D0	0.015	0.030	0.060	0.090	0.150
Grey Cast Iron	110, 120	100	1.00 X D0	0.20 X D0	0.009	0.018	0.036	0.054	0.090
	100, 110, 120	120	0.20 X D0	1.00 X D0	0.017	0.034	0.068	0.102	0.170
	120	130	0.03 X D0	0.03 X D0	0.019	0.038	0.076	0.114	0.190
Titanium	110, 120	60	1.00 X D0	0.10 X D0	0.006	0.013	0.026	0.038	0.064
	100, 110, 120	80	0.10 X D0	1.00 X D0	0.011	0.023	0.046	0.068	0.114
	120	90	0.03 X D0	0.03 X D0	0.014	0.028	0.057	0.085	0.142
Stainless Steel	110, 120	50	1.00 X D0	0.10 X D0	0.006	0.013	0.026	0.038	0.064
	100, 110, 120	70	0.10 X D0	1.00 X D0	0.012	0.024	0.047	0.071	0.118
	120	80	0.03 X D0	0.03 X D0	0.015	0.030	0.060	0.090	0.150
Super Alloy	110, 120	20	1.00 X D0	0.08 X D0	0.006	0.012	0.025	0.037	0.062
	100, 110, 120	30	0.08 X D0	1.00 X D0	0.012	0.024	0.048	0.072	0.120
	120	40	0.03 X D0	0.03 X D0	0.015	0.030	0.060	0.090	0.150

Definitions

Axial Depth of Cut (ap): Axial Depth of Cut represents the plunge depth of the end mill per pass. Axial Depth of Cut is also commonly known as step down or cut depth.

Feed per Tooth (fz): Feed per tooth represents the rate at which material is fed to a single tooth of an end mill while milling, this value represents the amount of material a tooth expunges per revolution while moving linearly through the material. To calculate the linear feed rate given Feed per Tooth, see Equation.

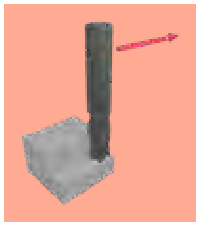
Metric Equations

$$RPM = \frac{\mathrm{SFM}_{\mathrm{m/min}} * 318.5}{\mathrm{D0}_{mm}}$$

$$Linear\ Feed_{\ \mathrm{mm/min}} = RPM * fz_{mm} * \#_z$$

Chart color coded to match milling style

- SLOT
- SIDE
- CONTOUR



Material	Tool Series	Circumferential Velocity (SFM)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 0.138"	0.138" ≤ D0 < 0.276"	0.276" ≤ D0 < 0.433"	0.433" ≤ D0 < 0.708"	0.708" ≤ D0
Construction Steel	110, 120	430	0.025 X D0	0.80 X D0	0.0002"	0.0004"	0.0009"	0.0013"	0.0022"
	100, 110, 120	510	0.025 X D0	0.80 X D0	0.0003"	0.0007"	0.0013"	0.0020"	0.0033"
	120	550	0.025 X D0	0.025 X D0	0.0004"	0.0009"	0.0018"	0.0026"	0.0044"
Tool Steel (≤48HRC)	110, 120	350	0.025 X D0	0.80 X D0	0.0002"	0.0003"	0.0007"	0.0010"	0.0017"
	100, 110, 120	430	0.025 X D0	0.80 X D0	0.0004"	0.0007"	0.0014"	0.0021"	0.0036"
	120	475	0.025 X D0	0.025 X D0	0.0004"	0.0009"	0.0018"	0.0026"	0.0044"
Tool Steel (>48≤56HRC)	110, 120	155	0.025 X D0	0.80 X D0	0.0002"	0.0002"	0.0004"	0.0007"	0.0011"
	100, 110, 120	240	0.025 X D0	0.80 X D0	0.0003"	0.0006"	0.0011"	0.0017"	0.0028"
	120	275	0.025 X D0	0.025 X D0	0.0004"	0.0008"	0.0015"	0.0023"	0.0039"
Ductile Cast Iron	110, 120	350	0.025 X D0	0.80 X D0	0.0002"	0.0004"	0.0007"	0.0010"	0.0018"
	100, 110, 120	430	0.025 X D0	0.80 X D0	0.0004"	0.0007"	0.0014"	0.0021"	0.0036"
	120	475	0.025 X D0	0.025 X D0	0.0004"	0.0008"	0.0017"	0.0025"	0.0041"
Grey Cast Iron	110, 120	390	0.025 X D0	0.80 X D0	0.0002"	0.0005"	0.0010"	0.0015"	0.0025"
	100, 110, 120	470	0.025 X D0	0.80 X D0	0.0005"	0.0009"	0.0019"	0.0028"	0.0047"
	120	510	0.025 X D0	0.025 X D0	0.0005"	0.0010"	0.0021"	0.0031"	0.0052"
Titanium	110, 120	240	0.025 X D0	0.80 X D0	0.0002"	0.0004"	0.0007"	0.0010"	0.0018"
	100, 110, 120	310	0.025 X D0	0.80 X D0	0.0003"	0.0006"	0.0013"	0.0019"	0.0031"
	120	350	0.025 X D0	0.025 X D0	0.0004"	0.0008"	0.0016"	0.0023"	0.0039"
Stainless Steel	110, 120	200	0.025 X D0	0.80 X D0	0.0002"	0.0004"	0.0007"	0.0010"	0.0018"
	100, 110, 120	275	0.025 X D0	0.80 X D0	0.0003"	0.0007"	0.0013"	0.0020"	0.0033"
	120	310	0.025 X D0	0.025 X D0	0.0004"	0.0008"	0.0017"	0.0025"	0.0041"
Super Alloy	110, 120	80	0.025 X D0	0.80 X D0	0.0002"	0.0003"	0.0007"	0.0010"	0.0017"
	100, 110, 120	120	0.025 X D0	0.80 X D0	0.0003"	0.0007"	0.0013"	0.0020"	0.0033"
	120	155	0.025 X D0	0.025 X D0	0.0004"	0.0008"	0.0017"	0.0025"	0.0041"

Definitions

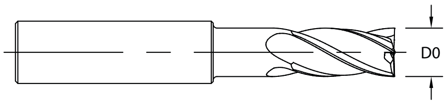
Circumferential Velocity (Vc): This value represents the linear surface speed of the tool. Circumferential Velocity is a constant rate so that it is independent of tool size. Circumferential Velocity is also commonly referred to as Tangential Velocity. To calculate RPM from Vc, see Equation.

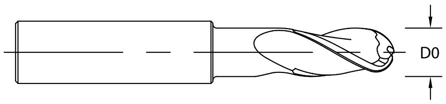
Radial Width of Cut (ae): This value represents the engagement width of the end mill being used per pass. In side milling, the Radial Width of Cut is typically a value less than the diameter of the end mill. Radial Width of Cut is also commonly referred to as step over or cut width.

Inch Equations

$$RPM = \frac{\mathrm{SFM}_{\mathrm{ft/min}} * 3.82}{\mathrm{D0}_{in}}$$

$$Linear\ Feed_{\ \mathrm{in/min}} = RPM * fz_{in} * \#_z$$





Material	Tool Series	Circumferential Velocity (m/min)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 3.5mm	3.5mm ≤ D0 < 7mm	7mm ≤ D0 < 11mm	11mm ≤ D0 < 18mm	18mm ≤ D0
Construction Steel	110, 120	130	0.025 X D0	0.80 X D0	0.006	0.011	0.022	0.034	0.056
	100, 110, 120	155	0.025 X D0	0.80 X D0	0.008	0.017	0.034	0.050	0.084
	120	170	0.025 X D0	0.025 X D0	0.011	0.022	0.045	0.067	0.112
Tool Steel (≤48HRC)	110, 120	110	0.025 X D0	0.80 X D0	0.005	0.008	0.017	0.025	0.042
	100, 110, 120	130	0.025 X D0	0.80 X D0	0.009	0.018	0.036	0.055	0.091
	120	145	0.025 X D0	0.025 X D0	0.011	0.022	0.045	0.067	0.112
Tool Steel (>48≤56HRC)	110, 120	50	0.025 X D0	0.80 X D0	0.004	0.006	0.011	0.017	0.028
	100, 110, 120	70	0.025 X D0	0.80 X D0	0.007	0.014	0.028	0.042	0.070
	120	85	0.025 X D0	0.025 X D0	0.010	0.020	0.039	0.059	0.098
Ductile Cast Iron	110, 120	110	0.025 X D0	0.80 X D0	0.004	0.009	0.018	0.027	0.045
	100, 110, 120	130	0.025 X D0	0.80 X D0	0.009	0.018	0.036	0.055	0.091
	120	145	0.025 X D0	0.025 X D0	0.011	0.021	0.042	0.063	0.105
Grey Cast Iron	110, 120	120	0.025 X D0	0.80 X D0	0.006	0.013	0.025	0.038	0.063
	100, 110, 120	145	0.025 X D0	0.80 X D0	0.012	0.024	0.048	0.071	0.119
	120	155	0.025 X D0	0.025 X D0	0.013	0.027	0.053	0.080	0.133
Titanium	110, 120	70	0.025 X D0	0.80 X D0	0.004	0.009	0.018	0.027	0.045
	100, 110, 120	95	0.025 X D0	0.80 X D0	0.008	0.016	0.032	0.048	0.080
	120	110	0.025 X D0	0.025 X D0	0.010	0.020	0.040	0.060	0.099
Stainless Steel	110, 120	60	0.025 X D0	0.80 X D0	0.004	0.009	0.018	0.027	0.045
	100, 110, 120	85	0.025 X D0	0.80 X D0	0.008	0.017	0.033	0.050	0.083
	120	95	0.025 X D0	0.025 X D0	0.011	0.021	0.042	0.063	0.105
Super Alloy	110, 120	25	0.025 X D0	0.80 X D0	0.004	0.008	0.018	0.026	0.043
	100, 110, 120	35	0.025 X D0	0.80 X D0	0.008	0.017	0.034	0.050	0.084
	120	50	0.025 X D0	0.025 X D0	0.011	0.021	0.042	0.063	0.105

Definitions

Axial Depth of Cut (ap): Axial Depth of Cut represents the plunge depth of the end mill per pass. Axial Depth of Cut is also commonly known as step down or cut depth.

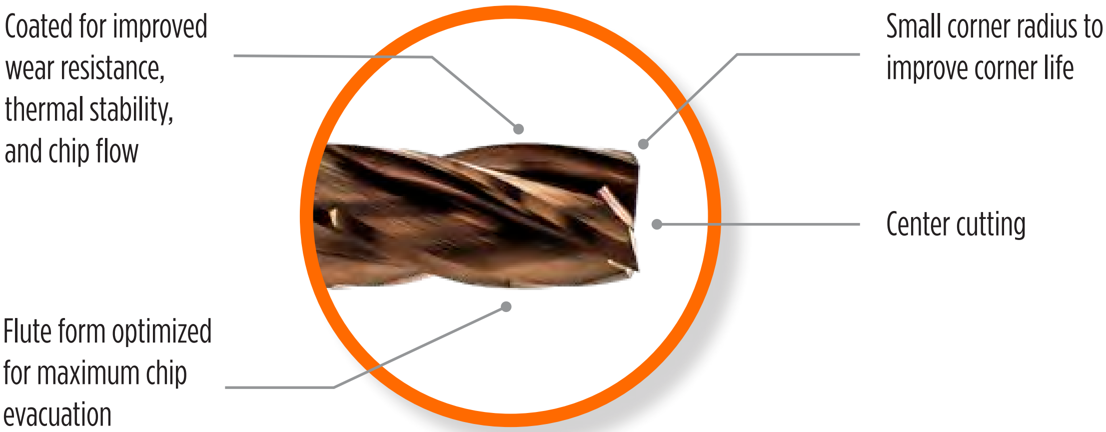
Feed per Tooth (fz): Feed per tooth represents the rate at which material is fed to a single tooth of an end mill while milling, this value represents the amount of material a tooth expunges per revolution while moving linearly through the material. To calculate the linear feed rate given Feed per Tooth, see Equation.

Metric Equations

$$RPM = \frac{\mathrm{SFM}_{\mathrm{m/min}} * 318.5}{\mathrm{D0}_{mm}}$$

$$Linear\ Feed_{\mathrm{mm/min}} = RPM * fz_{mm} * \#_z$$

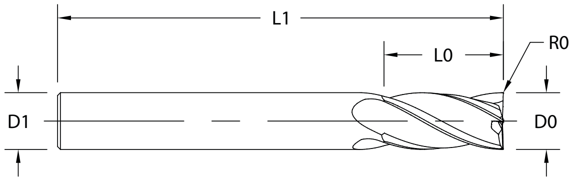
4 Flute Square End Mill, Inch

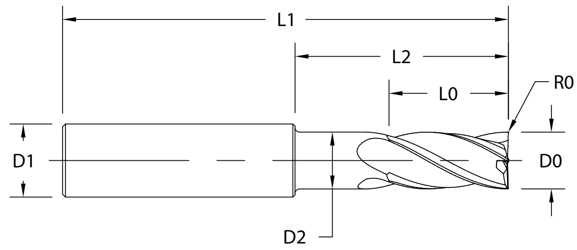


Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	L2 +0.04"	R0 +/-0.001"	Z	Series/Unit/ Size/Shape	USD
0.1250"	0.2500"	0.1250"	2.0"	-	0.004"	4	100i125	17
	0.3750"	0.1250"	2.0"	-	0.004"	4	100i125L	18
	0.2500"	0.2500"	2.0"	0.625"	0.004"	4	100i125F	25
	0.3750"	0.2500"	2.0"	0.875"	0.004"	4	100i125LF	27
0.1563"	0.3125"	0.1563"	2.0"	-	0.004"	4	100i156	25
	0.4690"	0.1563"	2.0"	-	0.004"	4	100i156L	27
	0.3125"	0.2500"	2.0"	0.750"	0.004"	4	100i156F	26
	0.4690"	0.2500"	2.0"	1.000"	0.004"	4	100i156LF	28
0.1875"	0.3750"	0.1875"	2.0"	-	0.004"	4	100i188	20
	0.5625"	0.1875"	2.0"	-	0.004"	4	100i188L	21
	0.3750"	0.2500"	2.0"	0.875"	0.004"	4	100i188F	26
	0.5625"	0.2500"	2.0"	1.250"	0.004"	4	100i188LF	28
0.2500"	0.5000"	0.2500"	2.0"	-	0.006"	4	100i250	27
	0.7500"	0.2500"	2.0"	-	0.006"	4	100i250L	29
0.3125"	0.6250"	0.3125"	2.0"	-	0.006"	4	100i313	36
	0.9375"	0.3125"	2.5"	-	0.006"	4	100i313L	37
0.3750"	0.7500"	0.3750"	2.5"	-	0.006"	4	100i375	43
	1.1250"	0.3750"	3.0"	-	0.006"	4	100i375L	46
0.5000"	1.0000"	0.5000"	3.0"	-	0.008"	4	100i500	65
	1.5000"	0.5000"	3.5"	-	0.008"	4	100i500L	85
0.6250"	1.2500"	0.6250"	4.0"	-	0.008"	4	100i625	119
	1.8750"	0.6250"	5.0"	-	0.008"	4	100i625L	145
0.7500"	1.5000"	0.7500"	4.0"	-	0.008"	4	100i750	185
	2.2500"	0.7500"	5.0"	-	0.008"	4	100i750L	204

100 Series

4 Flute Square End Mill, Metric





*D2 is 0.1mm (0.004”) less than cutting diameter

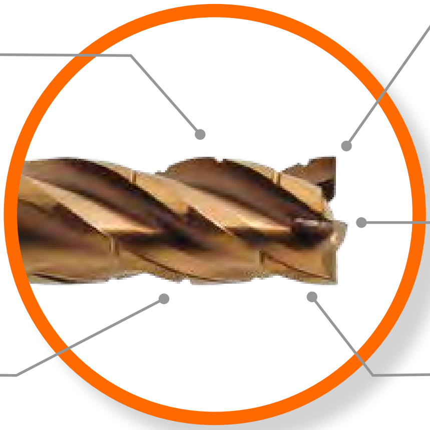
***Dimensions in mm**

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	L2 +1	R0 +/-0.025	Z	Series/Unit/ Size/Shape	USD
3	6	3	50	-	0.1	4	100m030	33
	9	3	50	-	0.1	4	100m030L	35
	6	6	50	15	0.1	4	100m030F	41
	9	6	50	21	0.1	4	100m030LF	42
4	8	4	50	-	0.1	4	100m040	37
	12	4	50	-	0.1	4	100m040L	38
	8	6	50	18	0.1	4	100m040F	44
	12	6	50	26	0.1	4	100m040LF	46
5	10	5	50	-	0.1	4	100m050	37
	15	5	50	-	0.1	4	100m050L	38
	10	6	50	21	0.1	4	100m050F	44
	15	6	50	31	0.1	4	100m050LF	46
6	12	6	50	-	0.15	4	100m060	31
	18	6	50	-	0.15	4	100m060L	32
8	16	8	50	-	0.15	4	100m080	38
	24	8	64	-	0.15	4	100m080L	42
10	20	10	65	-	0.15	4	100m100	51
	30	10	73	-	0.15	4	100m100L	54
12	24	12	75	-	0.2	4	100m120	73
	36	12	89	-	0.2	4	100m120L	81
16	32	16	100	-	0.2	4	100m160	130
	48	16	122	-	0.2	4	100m160L	136
20	40	20	100	-	0.2	4	100m200	211
	60	20	125	-	0.2	4	100m200L	216

- CONSTRUCTION STEEL
- TOOL STEEL (≤48HRC)
- TOOL STEEL (›48≤56HRC)
- DUCTILE CAST IRON
- GREY CAST IRON
- TITANIUM
- STAINLESS STEEL
- SUPER ALLOY

100C Series

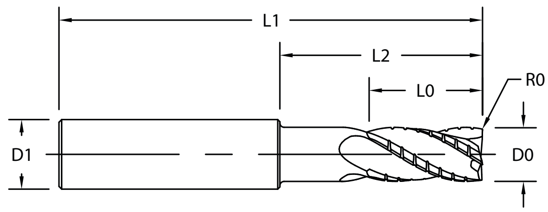
4 Flute Square End Mill with Chipbreakers, Inch

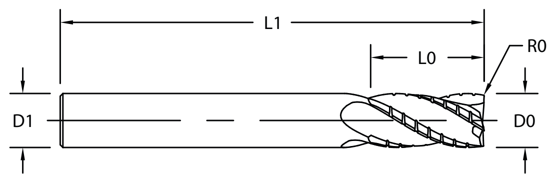


Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	L2 +0.04"	R0 +/-0.001"	Z	Series/Unit Size/Shape	USD
0.1250"	0.2500"	0.1250"	2.0"	-	0.004"	4	100Ci125	20
	0.3750"	0.1250"	2.0"	-	0.004"	4	100Ci125L	21
	0.2500"	0.2500"	2.0"	0.625"	0.004"	4	100Ci125F	29
	0.3750"	0.2500"	2.0"	0.875"	0.004"	4	100Ci125LF	32
0.1563"	0.3125"	0.1563"	2.0"	-	0.004"	4	100Ci156	26
	0.4690"	0.1563"	2.0"	-	0.004"	4	100Ci156L	29
	0.3125"	0.2500"	2.0"	0.750"	0.004"	4	100Ci156F	27
	0.4690"	0.2500"	2.0"	1.000"	0.004"	4	100Ci156LF	30
0.1875"	0.3750"	0.1875"	2.0"	-	0.004"	4	100Ci188	25
	0.5625"	0.1875"	2.0"	-	0.004"	4	100Ci188L	26
	0.3750"	0.2500"	2.0"	0.875"	0.004"	4	100Ci188F	31
	0.5625"	0.2500"	2.0"	1.250"	0.004"	4	100Ci188LF	33
0.2500"	0.5000"	0.2500"	2.0"	-	0.006"	4	100Ci250	32
	0.7500"	0.2500"	2.0"	-	0.006"	4	100Ci250L	35
0.3125"	0.6250"	0.3125"	2.0"	-	0.006"	4	100Ci313	42
	0.9375"	0.3125"	2.5"	-	0.006"	4	100Ci313L	46
0.3750"	0.7500"	0.3750"	2.5"	-	0.006"	4	100Ci375	52
	1.1250"	0.3750"	3.0"	-	0.006"	4	100Ci375L	61
0.5000"	1.0000"	0.5000"	3.0"	-	0.008"	4	100Ci500	79
	1.5000"	0.5000"	3.5"	-	0.008"	4	100Ci500L	102
0.6250"	1.2500"	0.6250"	4.0"	-	0.008"	4	100Ci625	143
	1.8750"	0.6250"	5.0"	-	0.008"	4	100Ci625L	173
0.7500"	1.5000"	0.7500"	4.0"	-	0.008"	4	100Ci750	223
	2.2500"	0.7500"	5.0"	-	0.008"	4	100Ci750L	245

100C Series

4 Flute Square End Mill with Chipbreakers, Metric





*Dimensions in mm

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	L2 +1	R0 +/-0.025	Z	Series/Unit Size/Shape	USD
3	6	3	50	-	0.1	4	100Cm030	40
	9	3	50	-	0.1	4	100Cm030L	41
	6	6	50	15	0.1	4	100Cm030F	49
	9	6	50	21	0.1	4	100Cm030LF	51
4	8	4	50	-	0.1	4	100Cm040	44
	12	4	50	-	0.1	4	100Cm040L	46
	8	6	50	18	0.1	4	100Cm040F	53
	12	6	50	26	0.1	4	100Cm040LF	54
5	10	5	50	-	0.1	4	100Cm050	44
	15	5	50	-	0.1	4	100Cm050L	46
	10	6	50	21	0.1	4	100Cm050F	53
	15	6	50	31	0.1	4	100Cm050LF	54
6	12	6	50	-	0.15	4	100Cm060	38
	18	6	50	-	0.15	4	100Cm060L	39
8	16	8	50	-	0.15	4	100Cm080	46
	24	8	64	-	0.15	4	100Cm080L	51
10	20	10	65	-	0.15	4	100Cm100	61
	30	10	73	-	0.15	4	100Cm100L	65
12	24	12	75	-	0.2	4	100Cm120	87
	36	12	89	-	0.2	4	100Cm120L	97
16	32	16	100	-	0.2	4	100Cm160	157
	48	16	122	-	0.2	4	100Cm160L	163
20	40	20	100	-	0.2	4	100Cm200	252
	60	20	125	-	0.2	4	100Cm200L	259

CONSTRUCTION STEEL

TOOL STEEL (≤48HRC)

TOOL STEEL (>48≤56HRC)

DUCTILE CAST IRON

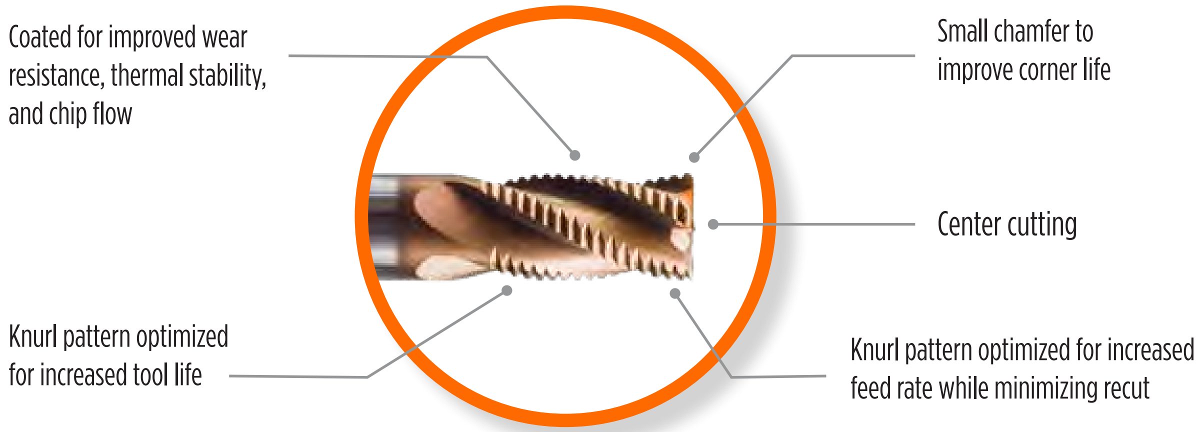
GREY CAST IRON

TITANIUM

STAINLESS STEEL

SUPER ALLOY

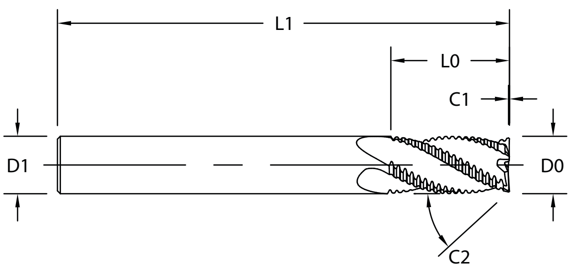
4 Flute Square End Mill, Rougher, Inch

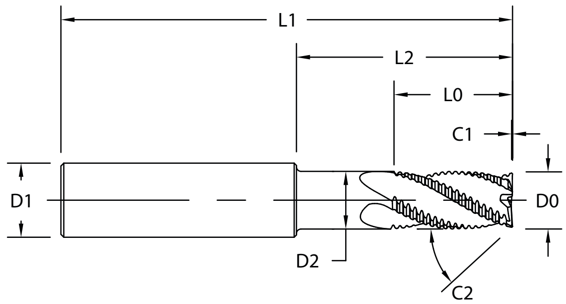


Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Chamfer	Flutes	Part #	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	L2 +0.04"	C1 x 45˚ +/-0.001"	Z	Series/Unit Size/Shape	USD
0.1250"	0.2500"	0.1250"	2.0"	-	0.004"	4	100Ri125	21
	0.3750"	0.1250"	2.0"	-	0.004"	4	100Ri125L	24
	0.2500"	0.2500"	2.0"	0.625"	0.004"	4	100Ri125F	32
	0.3750"	0.2500"	2.0"	0.875"	0.004"	4	100Ri125LF	35
0.1563"	0.3125"	0.1563"	2.0"	-	0.004"	4	100Ri156	28
	0.4690"	0.1563"	2.0"	-	0.004"	4	100Ri156L	32
	0.3125"	0.2500"	2.0"	0.750"	0.004"	4	100Ri156F	29
	0.4690"	0.2500"	2.0"	1.000"	0.004"	4	100Ri156LF	33
0.1875"	0.3750"	0.1875"	2.0"	-	0.004"	4	100Ri188	26
	0.5625"	0.1875"	2.0"	-	0.004"	4	100Ri188L	28
	0.3750"	0.2500"	2.0"	0.875"	0.004"	4	100Ri188F	33
	0.5625"	0.2500"	2.0"	1.250"	0.004"	4	100Ri188LF	37
0.2500"	0.5000"	0.2500"	2.0"	-	0.006"	4	100Ri250	35
	0.7500"	0.2500"	2.0"	-	0.006"	4	100Ri250L	38
0.3125"	0.6250"	0.3125"	2.0"	-	0.006"	4	100Ri313	47
	0.9375"	0.3125"	2.5"	-	0.006"	4	100Ri313L	49
0.3750"	0.7500"	0.3750"	2.5"	-	0.006"	4	100Ri375	57
	1.1250"	0.3750"	3.0"	-	0.006"	4	100Ri375L	66
0.5000"	1.0000"	0.5000"	3.0"	-	0.008"	4	100Ri500	85
	1.5000"	0.5000"	3.5"	-	0.008"	4	100Ri500L	110
0.6250"	1.2500"	0.6250"	4.0"	-	0.008"	4	100Ri625	154
	1.8750"	0.6250"	5.0"	-	0.008"	4	100Ri625L	187
0.7500"	1.5000"	0.7500"	4.0"	-	0.008"	4	100Ri750	240
	2.2500"	0.7500"	5.0"	-	0.008"	4	100Ri750L	264

100R Series

4 Flute Square End Mill, Rougher, Metric





*D2 is 0.1mm (0.004”) less than cutting diameter

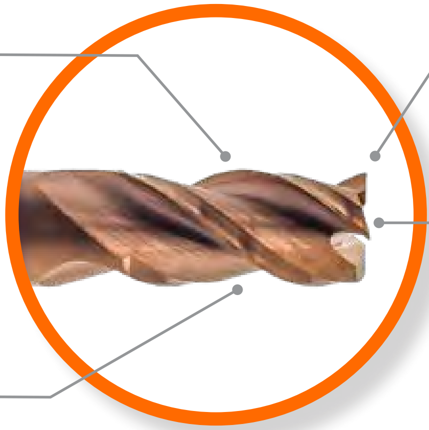
***Dimensions in mm**

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Chamfer	Flutes	Part #	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	L2 +1	C1 x 45˚ +/-0.025	Z	Series/Unit Size/Shape	USD
3	6	3	50	-	0.1	4	100Rm030	43
	9	3	50	-	0.1	4	100Rm030L	44
	6	6	50	15	0.1	4	100Rm030F	53
	9	6	50	21	0.1	4	100Rm030LF	54
4	8	4	50	-	0.1	4	100Rm040	48
	12	4	50	-	0.1	4	100Rm040L	49
	8	6	50	18	0.1	4	100Rm040F	58
	12	6	50	26	0.1	4	100Rm040LF	59
5	10	5	50	-	0.1	4	100Rm050	48
	15	5	50	-	0.1	4	100Rm050L	49
	10	6	50	21	0.1	4	100Rm050F	58
	15	6	50	31	0.1	4	100Rm050LF	59
6	12	6	50	-	0.15	4	100Rm060	40
	18	6	50	-	0.15	4	100Rm060L	42
8	16	8	50	-	0.15	4	100Rm080	49
	24	8	64	-	0.15	4	100Rm080L	54
10	20	10	65	-	0.15	4	100Rm100	66
	30	10	73	-	0.15	4	100Rm100L	71
12	24	12	75	-	0.2	4	100Rm120	95
	36	12	89	-	0.2	4	100Rm120L	105
16	32	16	100	-	0.2	4	100Rm160	169
	48	16	122	-	0.2	4	100Rm160L	176
20	40	20	100	-	0.2	4	100Rm200	273
	60	20	125	-	0.2	4	100Rm200L	281

- CONSTRUCTION STEEL
- TOOL STEEL (≤48HRC)
- TOOL STEEL (›48≤56HRC)
- DUCTILE CAST IRON
- TITANIUM
- GREY CAST IRON
- STAINLESS STEEL
- SUPER ALLOY

110 Series

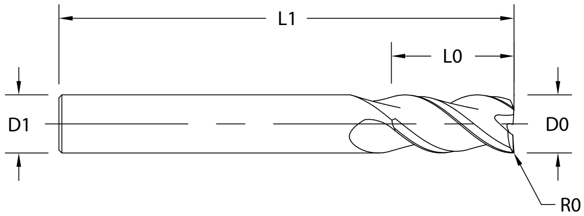
3 Flute Square End Mill, Inch

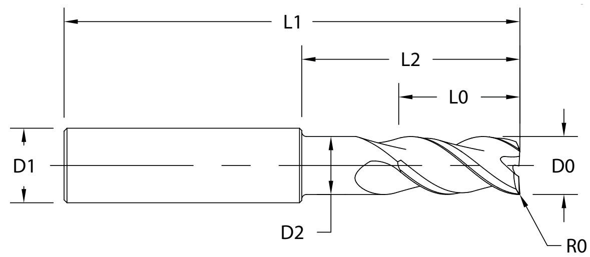


Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	L2 +0.04"	R0 +/-0.001"	Z	Series/Unit Size/Shape	USD
0.1250"	0.2500"	0.1250"	2.0"	-	0.004"	3	110i125	17
	0.3750"	0.1250"	2.0"	-	0.004"	3	110i125L	18
	0.2500"	0.2500"	2.0"	0.625"	0.004"	3	110i125F	25
	0.3750"	0.2500"	2.0"	0.875"	0.004"	3	110i125LF	27
0.1563"	0.3125"	0.1563"	2.0"	-	0.004"	3	110i156	21
	0.4690"	0.1563"	2.0"	-	0.004"	3	110i156L	25
	0.3125"	0.2500"	2.0"	0.750"	0.004"	3	110i156F	22
	0.4690"	0.2500"	2.0"	1.000"	0.004"	3	110i156LF	26
0.1875"	0.3750"	0.1875"	2.0"	-	0.004"	3	110i188	20
	0.5625"	0.1875"	2.0"	-	0.004"	3	110i188L	21
	0.3750"	0.2500"	2.0"	0.875"	0.004"	3	110i188F	26
	0.5625"	0.2500"	2.0"	1.250"	0.004"	3	110i188LF	28
0.2500"	0.5000"	0.2500"	2.0"	-	0.006"	3	110i250	27
	0.7500"	0.2500"	2.0"	-	0.006"	3	110i250L	29
0.3125"	0.6250"	0.3125"	2.0"	-	0.006"	3	110i313	36
	0.9375"	0.3125"	2.5"	-	0.006"	3	110i313L	38
0.3750"	0.7500"	0.3750"	2.5"	-	0.006"	3	110i375	43
	1.1250"	0.3750"	3.0"	-	0.006"	3	110i375L	51
0.5000"	1.0000"	0.5000"	3.0"	-	0.008"	3	110i500	65
	1.5000"	0.5000"	3.5"	-	0.008"	3	110i500L	85
0.6250"	1.2500"	0.6250"	4.0"	-	0.008"	3	110i625	119
	1.8750"	0.6250"	5.0"	-	0.008"	3	110i625L	145
0.7500"	1.5000"	0.7500"	4.0"	-	0.008"	3	110i750	185
	2.2500"	0.7500"	5.0"	-	0.008"	3	110i750L	204

110 Series

3 Flute Square End Mill, Metric





*D2 is 0.1mm (0.004”) less than cutting diameter

*Dimensions in mm

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	L2 +1	R0 +/-0.025	Z	Series/Unit Size/Shape	USD
3	6	3	50	-	0.1	3	110m030	33
	9	3	50	-	0.1	3	110m030L	35
	6	6	50	15	0.1	3	110m030F	41
	9	6	50	21	0.1	3	110m030LF	42
4	8	4	50	-	0.1	3	110m040	37
	12	4	50	-	0.1	3	110m040L	38
	8	6	50	18	0.1	3	110m040F	44
	12	6	50	26	0.1	3	110m040LF	46
5	10	5	50	-	0.1	3	110m050	37
	15	5	50	-	0.1	3	110m050L	38
	10	6	50	21	0.1	3	110m050F	44
	15	6	50	31	0.1	3	110m050LF	46
6	12	6	50	-	0.15	3	110m060	31
	18	6	50	-	0.15	3	110m060L	32
8	16	8	50	-	0.15	3	110m080	38
	24	8	64	-	0.15	3	110m080L	42
10	20	10	65	-	0.15	3	110m100	51
	30	10	73	-	0.15	3	110m100L	54
12	24	12	75	-	0.2	3	110m120	73
	36	12	89	-	0.2	3	110m120L	81
16	32	16	100	-	0.2	3	110m160	130
	48	16	122	-	0.2	3	110m160L	136
20	40	20	100	-	0.2	3	110m200	211
	60	20	125	-	0.2	3	110m200L	216

CONSTRUCTION STEEL

TOOL STEEL (≤48HRC)

TOOL STEEL (>48≤56HRC)

DUCTILE CAST IRON

GREY CAST IRON

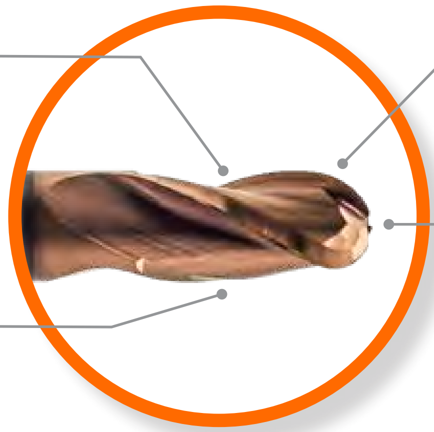
TITANIUM

STAINLESS STEEL

SUPER ALLOY

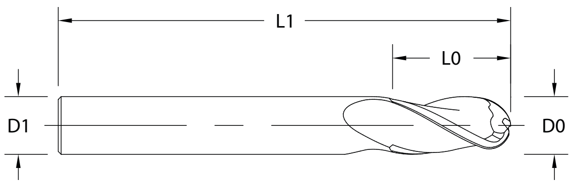
120 Series

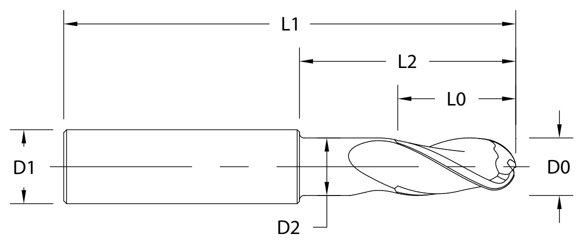
3 Flute Ball Nose End Mill, Inch



Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Flutes	Part #	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	L2 +0.04"	Z	Series/Unit Size/Shape	USD
0.1250"	0.2500"	0.1250"	2.0"	-	3	120i125	19
	0.3750"	0.1250"	2.0"	-	3	120i125L	20
	0.2500"	0.2500"	2.0"	0.625"	3	120i125F	27
	0.3750"	0.2500"	2.0"	0.875"	3	120i125LF	29
0.1563"	0.3125"	0.1563"	2.0"	-	3	120i156	24
	0.4690"	0.1563"	2.0"	-	3	120i156L	27
	0.3125"	0.2500"	2.0"	0.750"	3	120i156F	25
	0.4690"	0.2500"	2.0"	1.000"	3	120i156LF	28
0.1875"	0.3750"	0.1875"	2.0"	-	3	120i188	22
	0.5625"	0.1875"	2.0"	-	3	120i188L	24
	0.3750"	0.2500"	2.0"	0.875"	3	120i188F	28
	0.5625"	0.2500"	2.0"	1.250"	3	120i188LF	31
0.2500"	0.5000"	0.2500"	2.0"	-	3	120i250	29
	0.7500"	0.2500"	2.0"	-	3	120i250L	32
0.3125"	0.6250"	0.3125"	2.0"	-	3	120i313	39
	0.9375"	0.3125"	2.5"	-	3	120i313L	41
0.3750"	0.7500"	0.3750"	2.5"	-	3	120i375	48
	1.1250"	0.3750"	3.0"	-	3	120i375L	57
0.5000"	1.0000"	0.5000"	3.0"	-	3	120i500	72
	1.5000"	0.5000"	3.5"	-	3	120i500L	94
0.6250"	1.2500"	0.6250"	4.0"	-	3	120i625	130
	1.8750"	0.6250"	5.0"	-	3	120i625L	159
0.7500"	1.5000"	0.7500"	4.0"	-	3	120i750	204
	2.2500"	0.7500"	5.0"	-	3	120i750L	225

3 Flute Ball Nose End Mill, Metric





*D2 is 0.1mm (0.004”) less than cutting diameter

***Dimensions in mm**

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Flutes	Part #	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	L2 +1	Z	Series/Unit Size/Shape	USD
3	6	3	50	-	3	120m030	37
	9	3	50	-	3	120m030L	38
	6	6	50	15	3	120m030F	46
	9	6	50	21	3	120m030LF	47
4	8	4	50	-	3	120m040	40
	12	4	50	-	3	120m040L	41
	8	6	50	18	3	120m040F	49
	12	6	50	26	3	120m040LF	50
5	10	5	50	-	3	120m050	40
	15	5	50	-	3	120m050L	41
	10	6	50	21	3	120m050F	49
	15	6	50	31	3	120m050LF	50
6	12	6	50	-	3	120m060	35
	18	6	50	-	3	120m060L	36
8	16	8	50	-	3	120m080	41
	24	8	64	-	3	120m080L	47
10	20	10	65	-	3	120m100	57
	30	10	73	-	3	120m100L	60
12	24	12	75	-	3	120m120	81
	36	12	89	-	3	120m120L	88
16	32	16	100	-	3	120m160	143
	48	16	122	-	3	120m160L	149
20	40	20	100	-	3	120m200	231
	60	20	125	-	3	120m200L	238

CONSTRUCTION STEEL

TOOL STEEL (≤48HRC)

TOOL STEEL (›48≤56HRC)

DUCTILE CAST IRON

GREY CAST IRON

TITANIUM

STAINLESS STEEL

SUPER ALLOY

200 Series

Aluminum, Copper, Plastics

200 200C 220 240

ALUMINUM

COPPER

PLASTICS

We have compiled our 25 years of experience and comprehensive testing and design to bring forward a line of high-performance cutting tools.

In this section, we took our most successful combinations of rake, helix, core, balance, and accuracy and applied it to several series of broad spectrum use end mills for ferrous and nonferrous materials. All of the items in this section are stocked coated, but uncoated items may be available for rapid delivery upon request.

We also offer full customization of all items.

Section Features:

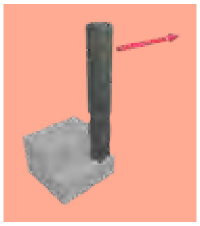
- Center cutting geometry for ramping and plunging operations
- Balanced design reduces system resonance and tool chatter improving tool life, spindle life, and surface finish
- All shanks finish ground to h6 tolerance for use in precision tool holders
- Shank finish is not polished to aid in slip resistance
- Every item is lot tracked with engraving that has been optimized for readability and to eliminate tool holder interference
- Weldon flats are available upon request. Weldon flats are not recommended or included as a standard option due to a potential increase in TIR
- Diamond coating available upon request

Chart color coded to match milling style

SLOT

SIDE

CONTOUR



Material	Tool Series	Circumferential Velocity (SFM)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 0.138″	0.138″ ≤ D0 < 0.276″	0.276″ ≤ D0 < 0.433″	0.433″ ≤ D0 < 0.708″	0.708″ ≤ D0
Aluminum	200, 220	Max	1.00 X D0	0.40 X D0	0.0004″	0.0008″	0.0016″	0.0024″	0.0039″
	200, 220	Max	0.40 X D0	1.00 X D0	0.0007″	0.0014″	0.0028″	0.0043″	0.0071″
	220	Max	0.03 X D0	0.03 X D0	0.0008″	0.0017″	0.0033″	0.0050″	0.0083″
Copper	200, 220	660	1.00 X D0	0.30 X D0	0.0004″	0.0007″	0.0014″	0.0021″	0.0035″
	200, 220	985	0.30 X D0	1.00 X D0	0.0006″	0.0013″	0.0025″	0.0038″	0.0063″
	220	1150	0.03 X D0	0.03 X D0	0.0008″	0.0016″	0.0031″	0.0047″	0.0079″
Thermoplastic	200, 220	660	1.00 X D0	0.30 X D0	0.0003″	0.0006″	0.0013″	0.0019″	0.0032″
	200, 220	985	0.30 X D0	1.00 X D0	0.0006″	0.0013″	0.0025″	0.0038″	0.0063″
	220	1150	0.03 X D0	0.03 X D0	0.0008″	0.0016″	0.0031″	0.0047″	0.0079″
Hard Thermoplastic	200, 220	330	1.00 X D0	0.20 X D0	0.0003″	0.0006″	0.0012″	0.0019″	0.0031″
	200, 220	490	0.20 X D0	1.00 X D0	0.0006″	0.0013″	0.0025″	0.0038″	0.0063″
	220	560	0.03 X D0	0.03 X D0	0.0007″	0.0014″	0.0028″	0.0043″	0.0071″

Definitions

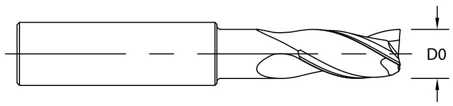
Circumferential Velocity (Vc): This value represents the linear surface speed of the tool. Circumferential Velocity is a constant rate so that it is independent of tool size. Circumferential Velocity is also commonly referred to as Tangential Velocity. To calculate RPM from Vc, see Equation.

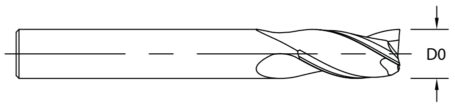
Radial Width of Cut (ae): This value represents the engagement width of the end mill being used per pass. In side milling, the Radial Width of Cut is typically a value less than the diameter of the end mill. Radial Width of Cut is also commonly referred to as step over or cut width.

Inch Equations

$$RPM = \frac{\mathrm{SFM}_{\mathrm{ft/min}} * 3.82}{\mathrm{D0}_{in}}$$

$$Linear\ Feed_{\ \mathrm{in/min}} = RPM * fz_{in} * \#_z$$





Material	Tool Series	Circumferential Velocity (m/min)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 3.5mm	3.5mm ≤ D0 < 7mm	7mm ≤ D0 < 11mm	11mm ≤ D0 < 18mm	18mm ≤ D0
Aluminum	200, 220	Max	1.00 X D0	0.40 X D0	0.010	0.020	0.040	0.060	0.100
	200, 220	Max	0.40 X D0	1.00 X D0	0.018	0.036	0.072	0.108	0.180
	220	Max	0.03 X D0	0.03 X D0	0.021	0.042	0.084	0.126	0.210
Copper	200, 220	200	1.00 X D0	0.30 X D0	0.009	0.018	0.036	0.054	0.090
	200, 220	300	0.30 X D0	1.00 X D0	0.016	0.032	0.064	0.096	0.160
	220	350	0.03 X D0	0.03 X D0	0.020	0.040	0.080	0.120	0.200
Thermoplastic	200, 220	200	1.00 X D0	0.30 X D0	0.008	0.016	0.033	0.049	0.082
	200, 220	300	0.30 X D0	1.00 X D0	0.016	0.032	0.064	0.096	0.160
	220	350	0.03 X D0	0.03 X D0	0.020	0.040	0.080	0.120	0.200
Hard Thermoplastic	200, 220	100	1.00 X D0	0.20 X D0	0.008	0.016	0.031	0.047	0.078
	200, 220	150	0.20 X D0	1.00 X D0	0.016	0.032	0.064	0.096	0.160
	220	170	0.03 X D0	0.03 X D0	0.018	0.036	0.072	0.108	0.180

Definitions

Axial Depth of Cut (ap): Axial Depth of Cut represents the plunge depth of the end mill per pass. Axial Depth of Cut is also commonly known as step down or cut depth.

Feed per Tooth (fz): Feed per tooth represents the rate at which material is fed to a single tooth of an end mill while milling, this value represents the amount of material a tooth expunges per revolution while moving linearly through the material. To calculate the linear feed rate given Feed per Tooth, see Equation.

Metric Equations

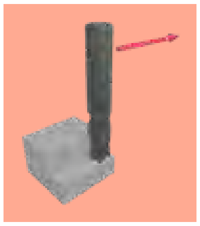
$$RPM = \frac{\mathrm{SFM}_{\mathrm{m/min}} * 318.5}{\mathrm{D0}_{mm}}$$

$$Linear\ Feed_{\ \mathrm{mm/min}} = RPM * fz_{mm} * \#_z$$

Finishing Inch

Chart color coded to match milling style

- SLOT
- SIDE
- CONTOUR


Material	Tool Series	Circumferential Velocity (SFM)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 0.138”	0.138” ≤ D0 < 0.276”	0.276” ≤ D0 < 0.433”	0.433” ≤ D0 < 0.708”	0.708” ≤ D0
Aluminum	200, 220	Max	0.025 X D0	0.80 X D0	0.0003"	0.0006"	0.0011"	0.0017"	0.0028"
	200, 220	Max	0.025 X D0	0.80 X D0	0.0005"	0.0010"	0.0020"	0.0030"	0.0050"
	220	Max	0.025 X D0	0.025 X D0	0.0006"	0.0012"	0.0023"	0.0035"	0.0058"
Copper	200, 220	790	0.025 X D0	0.80 X D0	0.0002"	0.0005"	0.0010"	0.0015"	0.0025"
	200, 220	1180	0.025 X D0	0.80 X D0	0.0004"	0.0009"	0.0018"	0.0026"	0.0044"
	220	1380	0.025 X D0	0.025 X D0	0.0006"	0.0011"	0.0022"	0.0033"	0.0055"
Thermoplastic	200, 220	790	0.025 X D0	0.80 X D0	0.0002"	0.0004"	0.0009"	0.0014"	0.0023"
	200, 220	1180	0.025 X D0	0.80 X D0	0.0004"	0.0009"	0.0018"	0.0026"	0.0044"
	220	1380	0.025 X D0	0.025 X D0	0.0006"	0.0011"	0.0022"	0.0033"	0.0055"
Hard Thermoplastic	200, 220	395	0.025 X D0	0.80 X D0	0.0002"	0.0004"	0.0009"	0.0013"	0.0021"
	200, 220	585	0.025 X D0	0.80 X D0	0.0004"	0.0009"	0.0018"	0.0026"	0.0044"
	220	670	0.025 X D0	0.025 X D0	0.0005"	0.0010"	0.0020"	0.0030"	0.0050"

Definitions

Circumferential Velocity (Vc): This value represents the linear surface speed of the tool. Circumferential Velocity is a constant rate so that it is independent of tool size. Circumferential Velocity is also commonly referred to as Tangential Velocity. To calculate RPM from Vc, see Equation.

Radial Width of Cut (ae): This value represents the engagement width of the end mill being used per pass. In side milling, the Radial Width of Cut is typically a value less than the diameter of the end mill. Radial Width of Cut is also commonly referred to as step over or cut width.

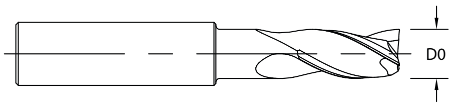
Inch Equations

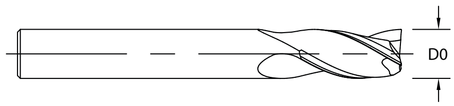
$$RPM = \frac{SFM_{ft/min} * 3.82}{D0_{in}}$$

$$Linear\ Feed_{in/min} = RPM * fz_{in} * \#_z$$

Finishing Metric

Speeds & Feeds
Series: 200, 200C, 220





Material	Tool Series	Circumferential Velocity (m/min)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 3.5mm	3.5mm ≤ D0 < 7mm	7mm ≤ D0 < 11mm	11mm ≤ D0 < 18mm	18mm ≤ D0
Aluminum	200, 220	Max	0.025 X D0	0.80 X D0	0.007	0.014	0.028	0.042	0.070
	200, 220	Max	0.025 X D0	0.80 X D0	0.013	0.025	0.050	0.076	0.126
	220	Max	0.025 X D0	0.025 X D0	0.015	0.029	0.059	0.088	0.147
Copper	200, 220	240	0.025 X D0	0.80 X D0	0.006	0.013	0.025	0.038	0.063
	200, 220	360	0.025 X D0	0.80 X D0	0.011	0.022	0.045	0.067	0.112
	220	420	0.025 X D0	0.025 X D0	0.014	0.028	0.056	0.084	0.140
Thermoplastic	200, 220	240	0.025 X D0	0.80 X D0	0.006	0.011	0.023	0.034	0.057
	200, 220	360	0.025 X D0	0.80 X D0	0.011	0.022	0.045	0.067	0.112
	220	420	0.025 X D0	0.025 X D0	0.014	0.028	0.056	0.084	0.140
Hard Thermoplastic	200, 220	120	0.025 X D0	0.80 X D0	0.006	0.011	0.022	0.033	0.055
	200, 220	180	0.025 X D0	0.80 X D0	0.011	0.022	0.045	0.067	0.112
	220	205	0.025 X D0	0.025 X D0	0.013	0.025	0.050	0.076	0.126

Definitions

Axial Depth of Cut (ap): Axial Depth of Cut represents the plunge depth of the end mill per pass. Axial Depth of Cut is also commonly known as step down or cut depth.

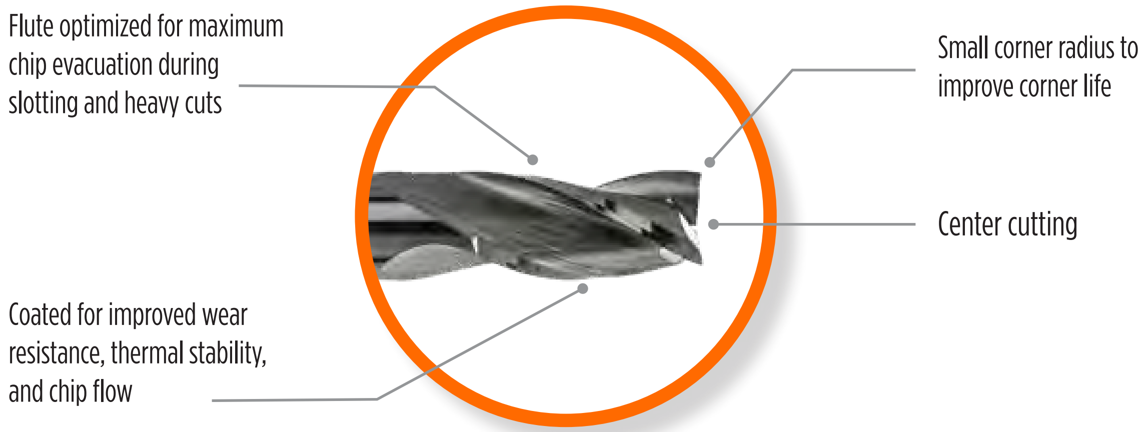
Feed per Tooth (fz): Feed per tooth represents the rate at which material is fed to a single tooth of an end mill while milling, this value represents the amount of material a tooth expunges per revolution while moving linearly through the material. To calculate the linear feed rate given Feed per Tooth, see Equation.

Metric Equations

$$RPM = \frac{\mathrm{SFM}_{\mathrm{m/min}} * 318.5}{\mathrm{D0}_{mm}}$$

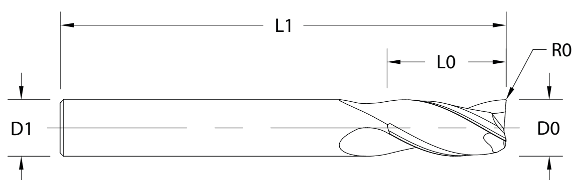
$$Linear\ Feed_{\ \mathrm{mm/min}} = RPM * fz_{mm} * \#_z$$

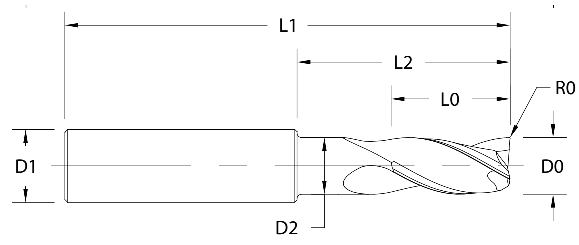
3 Flute Square End Mill, Inch



Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	L2 +0.04"	R0 +/-0.001"	Z	Series/Unit Size/Shape	USD
0.1250"	0.2500"	0.1250"	2.0"	-	0.004"	3	200i125	16
	0.3750"	0.1250"	2.0"	-	0.004"	3	200i125L	18
	0.2500"	0.2500"	2.0"	0.625"	0.004"	3	200i125F	19
	0.3750"	0.2500"	2.0"	0.875"	0.004"	3	200i125LF	21
0.1563"	0.3125"	0.1563"	2.0"	-	0.004"	3	200i156	27
	0.4690"	0.1563"	2.0"	-	0.004"	3	200i156L	31
	0.3125"	0.2500"	2.0"	0.750"	0.004"	3	200i156F	30
	0.4690"	0.2500"	2.0"	1.000"	0.004"	3	200i156LF	35
0.1875"	0.3750"	0.1875"	2.0"	-	0.004"	3	200i188	24
	0.5625"	0.1875"	2.0"	-	0.004"	3	200i188L	29
	0.3750"	0.2500"	2.0"	0.875"	0.004"	3	200i188F	27
	0.5625"	0.2500"	2.0"	1.250"	0.004"	3	200i188LF	32
0.2500"	0.5000"	0.2500"	2.0"	-	0.006"	3	200i250	28
	0.7500"	0.2500"	2.0"	-	0.006"	3	200i250L	36
0.3125"	0.6250"	0.3125"	2.0"	-	0.006"	3	200i313	36
	0.9375"	0.3125"	2.5"	-	0.006"	3	200i313L	48
0.3750"	0.7500"	0.3750"	2.5"	-	0.006"	3	200i375	42
	1.1250"	0.3750"	3.0"	-	0.006"	3	200i375L	53
0.5000"	1.0000"	0.5000"	3.0"	-	0.008"	3	200i500	59
	1.5000"	0.5000"	3.5"	-	0.008"	3	200i500L	77
0.6250"	1.2500"	0.6250"	4.0"	-	0.008"	3	200i625	108
	1.8750"	0.6250"	5.0"	-	0.008"	3	200i625L	138
0.7500"	1.5000"	0.7500"	4.0"	-	0.008"	3	200i750	143
	2.2500"	0.7500"	5.0"	-	0.008"	3	200i750L	219

3 Flute Square End Mill, Metric





*D2 is 0.1mm (0.004") less than cutting diameter

***Dimensions in mm**

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	L2 +1	R0 +/-0.025	Z	Series/Unit Size/Shape	USD
3	6	3	50	-	0.1	3	200m030	36
	9	3	50	-	0.1	3	200m030L	35
	6	6	50	15	0.1	3	200m030F	39
	9	6	50	21	0.1	3	200m030LF	40
4	8	4	50	-	0.1	3	200m040	40
	12	4	50	-	0.1	3	200m040L	43
	8	6	50	18	0.1	3	200m040F	44
	12	6	50	26	0.1	3	200m040LF	48
5	10	5	50	-	0.1	3	200m050	41
	15	5	50	-	0.1	3	200m050L	49
	10	6	50	21	0.1	3	200m050F	46
	15	6	50	31	0.1	3	200m050LF	53
6	12	6	50	-	0.15	3	200m060	31
	18	6	50	-	0.15	3	200m060L	37
8	16	8	50	-	0.15	3	200m080	41
	24	8	64	-	0.15	3	200m080L	43
10	20	10	65	-	0.15	3	200m100	50
	30	10	73	-	0.15	3	200m100L	57
12	24	12	75	-	0.2	3	200m120	55
	36	12	89	-	0.2	3	200m120L	80
16	32	16	100	-	0.2	3	200m160	115
	48	16	122	-	0.2	3	200m160L	139
20	40	20	100	-	0.2	3	200m200	186
	60	20	125	-	0.2	3	200m200L	204

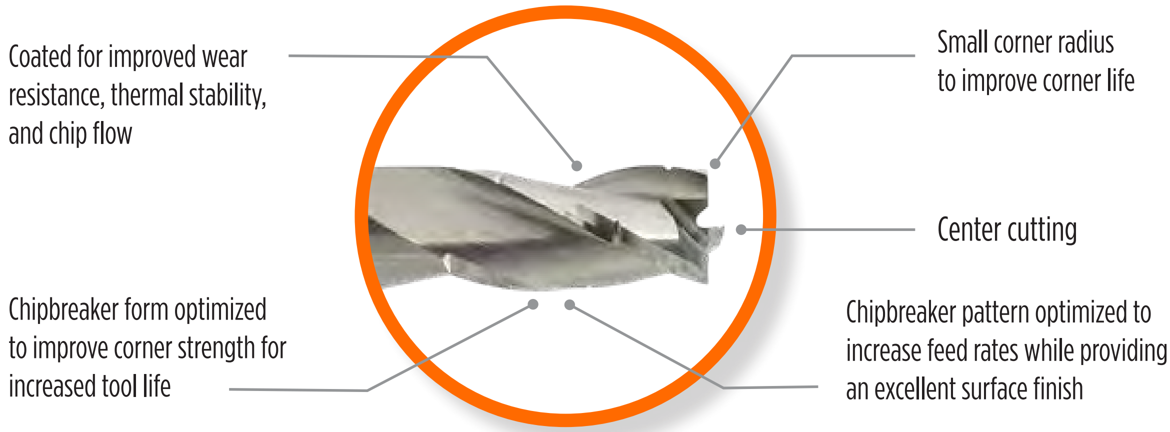
ALUMINUM

COPPER

PLASTICS

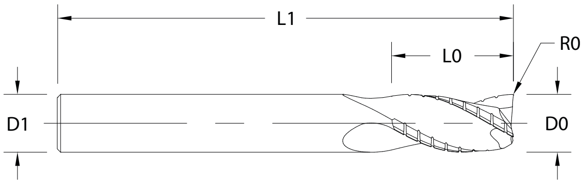
200C Series

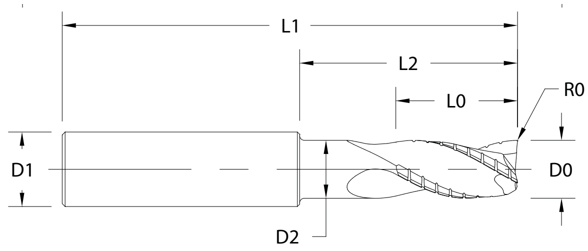
3 Flute Square End Mill with Chipbreakers, Inch



Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	L2 +0.04"	R0 +/-0.001"	Z	Series/Unit Size/Shape	USD
0.1250"	0.2500"	0.1250"	2.0"	-	0.004"	3	200Ci125	24
	0.3750"	0.1250"	2.0"	-	0.004"	3	200Ci125L	25
	0.2500"	0.2500"	2.0"	0.625"	0.004"	3	200Ci125F	32
	0.3750"	0.2500"	2.0"	0.875"	0.004"	3	200Ci125LF	35
0.1563"	0.3125"	0.1563"	2.0"	-	0.004"	3	200Ci156	31
	0.4690"	0.1563"	2.0"	-	0.004"	3	200Ci156L	33
	0.3125"	0.2500"	2.0"	0.750"	0.004"	3	200Ci156F	35
	0.4690"	0.2500"	2.0"	1.000"	0.004"	3	200Ci156LF	37
0.1875"	0.3750"	0.1875"	2.0"	-	0.004"	3	200Ci188	29
	0.5625"	0.1875"	2.0"	-	0.004"	3	200Ci188L	32
	0.3750"	0.2500"	2.0"	0.875"	0.004"	3	200Ci188F	36
	0.5625"	0.2500"	2.0"	1.250"	0.004"	3	200Ci188LF	38
0.2500"	0.5000"	0.2500"	2.0"	-	0.006"	3	200Ci250	39
	0.7500"	0.2500"	2.0"	-	0.006"	3	200Ci250L	42
0.3125"	0.6250"	0.3125"	2.0"	-	0.006"	3	200Ci313	36
	0.9375"	0.3125"	2.5"	-	0.006"	3	200Ci313L	44
0.3750"	0.7500"	0.3750"	2.5"	-	0.006"	3	200Ci375	50
	1.1250"	0.3750"	3.0"	-	0.006"	3	200Ci375L	63
0.5000"	1.0000"	0.5000"	3.0"	-	0.008"	3	200Ci500	70
	1.5000"	0.5000"	3.5"	-	0.008"	3	200Ci500L	83
0.6250"	1.2500"	0.6250"	4.0"	-	0.008"	3	200Ci625	123
	1.8750"	0.6250"	5.0"	-	0.008"	3	200Ci625L	125
0.7500"	1.5000"	0.7500"	4.0"	-	0.008"	3	200Ci750	182
	2.2500"	0.7500"	5.0"	-	0.008"	3	200Ci750L	229

3 Flute Square End Mill with Chipbreakers, Metric



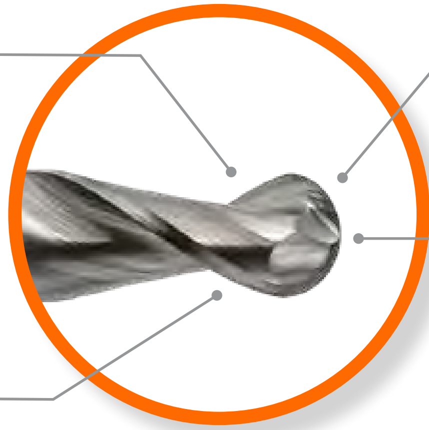


*D2 is 0.1mm (0.004”) less than cutting diameter

***Dimensions in mm**

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Radius	Flutes	Part #	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	L2 +1	R0 +/-0.025	Z	Series/Unit Size/Shape	USD
3	6	3	50	-	0.1	3	200Cm030	42
	9	3	50	-	0.1	3	200Cm030L	41
	6	6	50	15	0.1	3	200Cm030F	47
	9	6	50	21	0.1	3	200Cm030LF	48
4	8	4	50	-	0.1	3	200Cm040	48
	12	4	50	-	0.1	3	200Cm040L	52
	8	6	50	18	0.1	3	200Cm040F	53
	12	6	50	26	0.1	3	200Cm040LF	58
5	10	5	50	-	0.1	3	200Cm050	49
	15	5	50	-	0.1	3	200Cm050L	59
	10	6	50	21	0.1	3	200Cm050F	54
	15	6	50	31	0.1	3	200Cm050LF	64
6	12	6	50	-	0.15	3	200Cm060	38
	18	6	50	-	0.15	3	200Cm060L	44
8	16	8	50	-	0.15	3	200Cm080	49
	24	8	64	-	0.15	3	200Cm080L	52
10	20	10	65	-	0.15	3	200Cm100	60
	30	10	73	-	0.15	3	200Cm100L	68
12	24	12	75	-	0.2	3	200Cm120	66
	36	12	89	-	0.2	3	200Cm120L	95
16	32	16	100	-	0.2	3	200Cm160	138
	48	16	122	-	0.2	3	200Cm160L	167
20	40	20	100	-	0.2	3	200Cm200	224
	60	20	125	-	0.2	3	200Cm200L	245

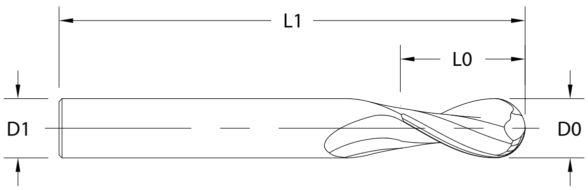
2 Flute Ball Nose End Mill, Inch

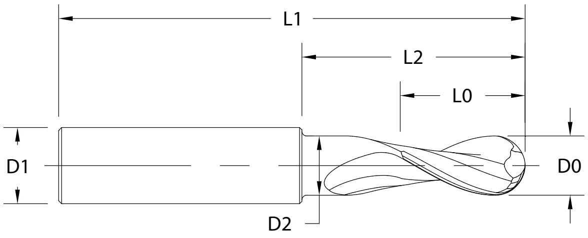


Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Flutes	Part#	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	L2 +0.04"	Z	Series/Unit Size/Shape	USD
0.1250"	0.2500"	0.1250"	2.0"	-	2	220i125	17
	0.3750"	0.1250"	2.0"	-	2	220i125L	20
	0.2500"	0.2500"	2.0"	0.625"	2	220i125F	28
	0.3750"	0.2500"	2.0"	0.875"	2	220i125LF	37
0.1563"	0.3125"	0.1563"	2.0"	-	2	220i156	29
	0.4690"	0.1563"	2.0"	-	2	220i156L	35
	0.3125"	0.2500"	2.0"	0.750"	2	220i156F	33
	0.4690"	0.2500"	2.0"	1.000"	2	220i156LF	38
0.1875"	0.3750"	0.1875"	2.0"	-	2	220i188	26
	0.5625"	0.1875"	2.0"	-	2	220i188L	32
	0.3750"	0.2500"	2.0"	0.875"	2	220i188F	35
	0.5625"	0.2500"	2.0"	1.250"	2	220i188LF	39
0.2500"	0.5000"	0.2500"	2.0"	-	2	220i250	31
	0.7500"	0.2500"	2.0"	-	2	220i250L	39
0.3125"	0.6250"	0.3125"	2.0"	-	2	220i313	39
	0.9375"	0.3125"	2.5"	-	2	220i313L	52
0.3750"	0.7500"	0.3750"	2.5"	-	2	220i375	46
	1.1250"	0.3750"	3.0"	-	2	220i375L	55
0.5000"	1.0000"	0.5000"	3.0"	-	2	220i500	63
	1.5000"	0.5000"	3.5"	-	2	220i500L	79
0.6250"	1.2500"	0.6250"	4.0"	-	2	220i625	118
	1.8750"	0.6250"	5.0"	-	2	220i625L	147
0.7500"	1.5000"	0.7500"	4.0"	-	2	220i750	154
	2.2500"	0.7500"	5.0"	-	2	220i750L	235

220 Series

2 Flute Ball Nose End Mill, Metric





*D2 is 0.1mm (0.004") less than cutting diameter

***Dimensions in mm**

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Length	Flutes	Part#	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	L2 +1	Z	Series/Unit Size/Shape	USD
3	6	3	50	-	2	220m030	39
	9	3	50	-	2	220m030L	38
	6	6	50	15	2	220m030F	42
	9	6	50	21	2	220m030LF	44
4	8	4	50	-	2	220m040	44
	12	4	50	-	2	220m040L	48
	8	6	50	18	2	220m040F	49
	12	6	50	26	2	220m040LF	52
5	10	5	50	-	2	220m050	46
	15	5	50	-	2	220m050L	53
	10	6	50	21	2	220m050F	50
	15	6	50	31	2	220m050LF	59
6	12	6	50	-	2	220m060	35
	18	6	50	-	2	220m060L	40
8	16	8	50	-	2	220m080	46
	24	8	64	-	2	220m080L	48
10	20	10	65	-	2	220m100	55
	30	10	73	-	2	220m100L	62
12	24	12	75	-	2	220m120	61
	36	12	89	-	2	220m120L	87
16	32	16	100	-	2	220m160	126
	48	16	122	-	2	220m160L	153
20	40	20	100	-	2	220m200	205
	60	20	125	-	2	220m200L	225

ALUMINUM

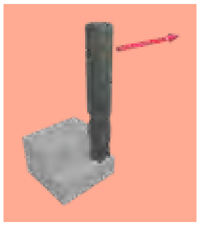
COPPER

PLASTICS

Chart color coded to match milling style

SLOT

SIDE



ROUGHING

Material	Tool Series	Circumferential Velocity (SFM)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 0.138″	0.138″ ≤ D0 < 0.276″	0.276″ ≤ D0 < 0.433″	0.433″ ≤ D0 < 0.708″	0.708″ ≤ D0
Aluminum	240	Max	1.00 X D0	0.18 X D0	0.0009″	0.0018″	0.0035″	0.0050″	0.0074″
	240	Max	0.25 X D0	1.25 X D0	0.0011″	0.0022″	0.0044″	0.0063″	0.0093″
Copper	240	1440	1.00 X D0	0.10 X D0	0.0006″	0.0011″	0.0022″	0.0033″	0.0056″
	240	1440	0.15 X D0	1.05 X D0	0.0007″	0.0015″	0.0030″	0.0044″	0.0074″

FINISHING

Material	Tool Series	Circumferential Velocity (SFM)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 0.138″	0.138″ ≤ D0 < 0.276″	0.276″ ≤ D0 < 0.433″	0.433″ ≤ D0 < 0.708″	0.708″ ≤ D0
Aluminum	240	Max	1.00 X D0	0.05 X D0	0.0009″	0.0019″	0.0038″	0.0054″	0.0079″
	240	Max	0.05 X D0	0.82 X D0	0.0012″	0.0024″	0.0047″	0.0067″	0.0098″
Copper	240	2160	1.00 X D0	0.03 X D0	0.0006″	0.0012″	0.0024″	0.0035″	0.0059″
	240	2160	0.04 X D0	0.75 X D0	0.0008″	0.0016″	0.0031″	0.0047″	0.0079″

Definitions

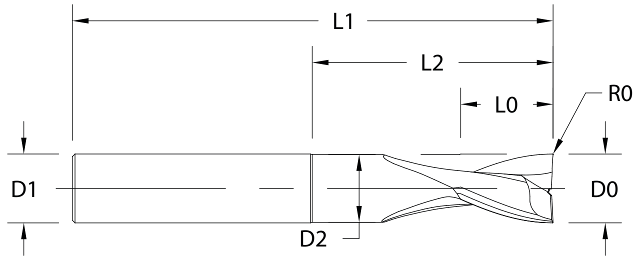
Circumferential Velocity (Vc): This value represents the linear surface speed of the tool. Circumferential Velocity is a constant rate so that it is independent of tool size. Circumferential Velocity is also commonly referred to as Tangential Velocity. To calculate RPM from Vc, see Equation.

Radial Width of Cut (ae): This value represents the engagement width of the end mill being used per pass. In side milling, the Radial Width of Cut is typically a value less than the diameter of the end mill. Radial Width of Cut is also commonly referred to as step over or cut width.

Inch Equations

$$RPM = \frac{\mathrm{SFM}_{\mathrm{ft/min}} * 3.82}{\mathrm{D0}_{in}}$$

$$Linear\ Feed_{\mathrm{in/min}} = RPM * fz_{in} * \#_z$$



ROUGHING

Material	Tool Series	Circumferential Velocity (m/min)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 3.5mm	3.5mm ≤ D0 < 7mm	7mm ≤ D0 < 11mm	11mm ≤ D0 < 18mm	18mm ≤ D0
Aluminum	240	Max	1.00 X D0	0.18 X D0	0.023	0.045	0.090	0.128	0.189
	240	Max	0.25 X D0	1.25 X D0	0.028	0.057	0.113	0.160	0.236
Copper	240	440	1.00 X D0	0.10 X D0	0.015	0.028	0.056	0.085	0.141
	240	440	0.15 X D0	1.05 X D0	0.019	0.038	0.076	0.113	0.189

FINISHING

Material	Tool Series	Circumferential Velocity (m/min)	Radial Width of Cut (ae)	Axial Depth of Cut (ap)	Feed per Tooth (Fz)				
					D0 < 3.5mm	3.5mm ≤ D0 < 7mm	7mm ≤ D0 < 11mm	11mm ≤ D0 < 18mm	18mm ≤ D0
Aluminum	240	Max	1.00 X D0	0.05 X D0	0.024	0.048	0.096	0.136	0.200
	240	Max	0.05 X D0	0.82 X D0	0.030	0.060	0.120	0.170	0.250
Copper	240	660	1.00 X D0	0.03 X D0	0.015	0.030	0.060	0.090	0.150
	240	660	0.04 X D0	0.75 X D0	0.020	0.040	0.080	0.120	0.200

Definitions

Axial Depth of Cut (ap): Axial Depth of Cut represents the plunge depth of the end mill per pass. Axial Depth of Cut is also commonly known as step down or cut depth.

Feed per Tooth (fz): Feed per tooth represents the rate at which material is fed to a single tooth of an end mill while milling, this value represents the amount of material a tooth expunges per revolution while moving linearly through the material. To calculate the linear feed rate given Feed per Tooth, see Equation.

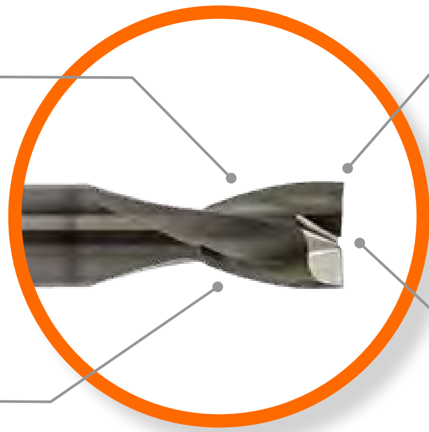
Metric Equations

$$RPM = \frac{\mathrm{SFM}_{\mathrm{m/min}} * 318.5}{\mathrm{D0}_{mm}}$$

$$Linear\ Feed_{\mathrm{mm/min}} = RPM * fz_{mm} * \#_z$$

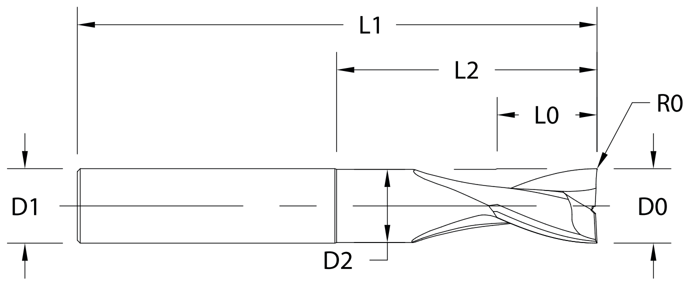
240 Series

2 Flute Square End Mill, Inch



Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Radius	Flutes	Part #	Price
D0 -0.0004"/-0.0012"	L0 +0.04"	D1 h6	L1 +/-0.08"	D2 -0.004"	L2 +0.04"	R0 +/-0.001"	Z	Series/Unit Size/Shape	USD
0.1250"	0.1560"	0.1250"	2.0"	0.1240"	0.3125"	0.004"	2	240i125	46
0.1563"	0.1880"	0.1563"	2.0"	0.1483"	0.5000"	0.004"	2	240i156	52
0.1875"	0.2500"	0.1875"	2.0"	0.1795"	0.5625"	0.004"	2	240i188	58
0.2500"	0.3750"	0.2500"	2.0"	0.2380"	0.7500"	0.004"	2	240i250	68
0.3125"	0.4375"	0.3125"	2.0"	0.3005"	0.8750"	0.004"	2	240i313	86
0.3750"	0.5000"	0.3750"	2.5"	0.3630"	1.1250"	0.004"	2	240i375	107
0.5000"	0.6250"	0.5000"	3.0"	0.4800"	1.3750"	0.004"	2	240i500	149
0.6250"	0.7500"	0.6250"	4.0"	0.6050"	1.5000"	0.004"	2	240i625	233
0.7500"	1.0000"	0.7500"	4.0"	0.7300"	2.0000"	0.004"	2	240i750	326

2 Flute Square End Mill, Metric

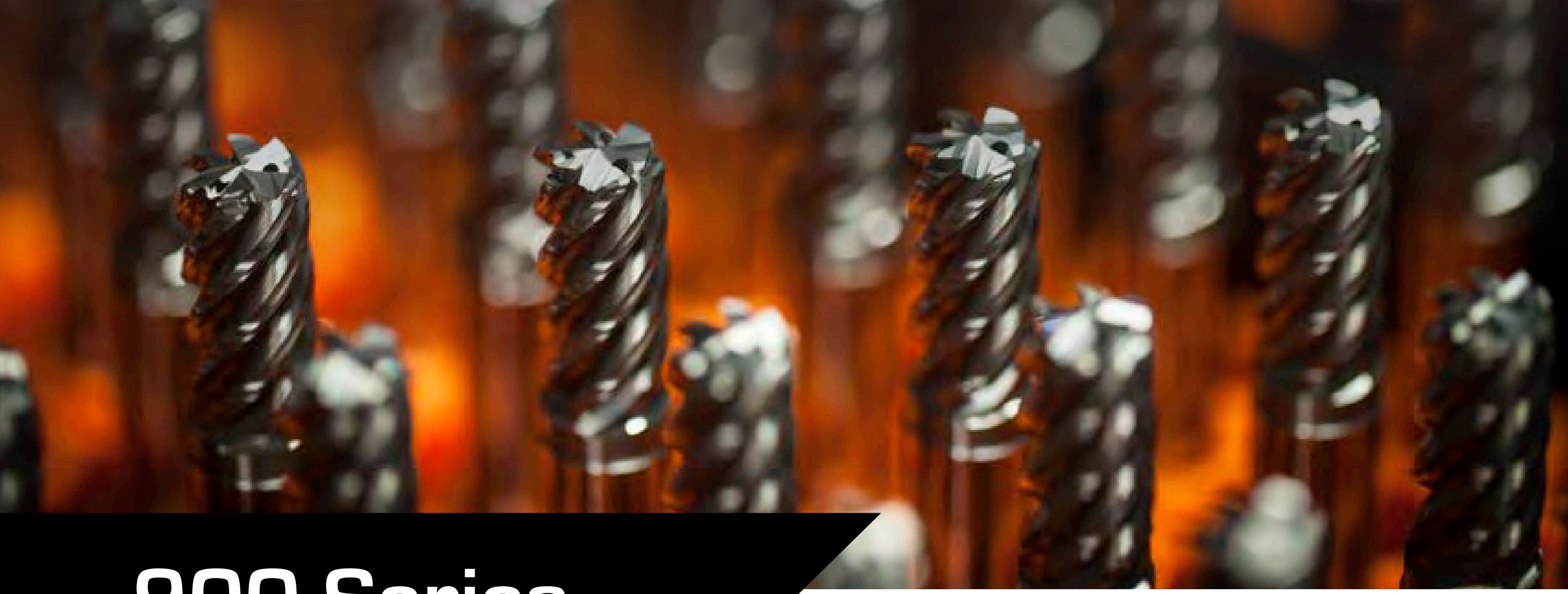


*D2 is 0.1mm (0.004") less than cutting diameter

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Radius	Flutes	Part #	Price
D0 -0.01/-0.03	L0 +1	D1 h6	L1 +/-2	D2 -0.1	L2 +1	R0 +/-0.025	Z	Series/Unit Size/Shape	USD
3	4	3	50	2.9	8	0.1	2	240m030	50
4	5	4	50	3.8	12	0.1	2	240m040	58
5	8	5	50	4.8	14	0.1	2	240m050	63
6	8	6	50	5.7	18	0.1	2	240m060	74
8	10	8	60	7.7	22	0.1	2	240m080	94
10	14	10	65	9.7	28	0.1	2	240m100	116
12	16	12	75	11.5	35	0.1	2	240m120	160
16	20	16	100	15.5	40	0.1	2	240m160	275
20	25	20	100	19.5	50	0.1	2	240m200	352

ALUMINUM

COPPER



900 Series

910 920 930 940 950 960 961 970

SHAPE & PROFILE MILLING

We have been producing high quality profiling cutters for more than 20 years. The tooling in this section has been used in every industry from Aerospace to Woodworking and on materials from austenitic stainless steel to foam. The engravers (940 series), one of our longest standing catalog products, has been in development and production since the foundation of the company.

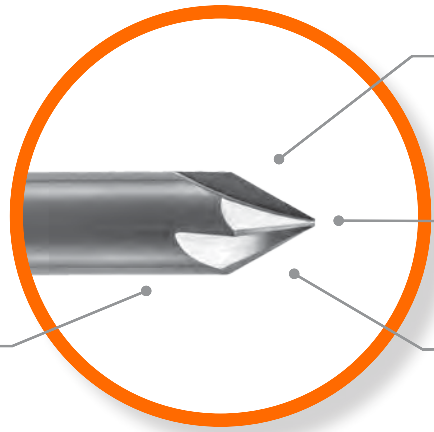
Like all our tooling, we offer a wide variety of coatings and customization options to fit any need or requirement. Through our custom design program, each item in the catalog can be purchased at significantly tighter tolerances. Please make sure to request specific tolerances if required!

Section Features:

- Balanced design reduces system resonance and tool chatter improving tool life, spindle life, and surface finish
- All shanks finish ground to h6 tolerance for use in precision tool holders
- Shank finish is not polished to aid in slip resistance
- Every item is lot tracked with engraving that has been optimized for readability and to eliminate tool holder interference
- Weldon flats are available upon request. Weldon flats are not recommended or included as a standard option due to a potential increase in TIR
- Profile tolerances of less than 0.005mm are avaliable through custom order
- Diamond Coating available upon request

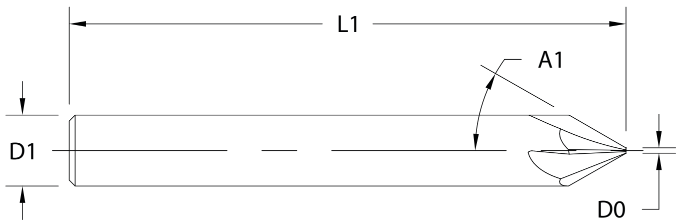
910 Series

Chamfer Cutters 15°/20°/22.5°



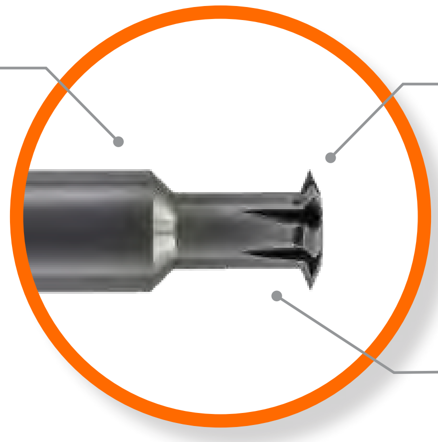
Angle per Side	Shank Diameter	Tip Diameter	Overall Length	Flutes	Uncoated		AlTiN		TiB2	
A1 +/-0.25°	D1 h6	D0 -0.0015"	L1 +/-0.08"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
15°	0.1250"	0.010"	2.0"	2	910i0806	19	910i0806B	24	910i0806C	25
	0.1875"	0.015"	2.0"	2	910i1206	27	910i1206B	30	910i1206C	32
	0.2500"	0.020"	2.0"	2	910i1606	38	910i1606B	42	910i1606C	43
	0.3125"	0.025"	2.0"	3	910i2006	44	910i2006B	50	910i2006C	54
	0.3750"	0.030"	2.5"	3	910i2406	46	910i2406B	55	910i2406C	64
	0.5000"	0.060"	3.0"	4	910i3206	68	910i3206B	80	910i3206C	90
20°	0.1250"	0.010"	2.0"	2	910i0808	19	910i0808B	24	910i0808C	25
	0.1875"	0.015"	2.0"	2	910i1208	27	910i1208B	30	910i1208C	32
	0.2500"	0.020"	2.0"	2	910i1608	38	910i1608B	42	910i1608C	43
	0.3125"	0.025"	2.0"	3	910i2008	44	910i2008B	50	910i2008C	54
	0.3750"	0.030"	2.5"	3	910i2408	46	910i2408B	55	910i2408C	64
	0.5000"	0.060"	3.0"	4	910i3208	68	910i3208B	80	910i3208C	90
22.5°	0.1250"	0.010"	2.0"	2	910i0809	19	910i0809B	24	910i0809C	25
	0.1875"	0.015"	2.0"	2	910i1209	27	910i1209B	30	910i1209C	32
	0.2500"	0.020"	2.0"	2	910i1609	38	910i1609B	42	910i1609C	43
	0.3125"	0.025"	2.0"	3	910i2009	44	910i2009B	50	910i2009C	54
	0.3750"	0.030"	2.5"	3	910i2409	46	910i2409B	55	910i2409C	64
	0.5000"	0.060"	3.0"	4	910i3209	68	910i3209B	80	910i3209C	90

Chamfer Cutters 30°/45°



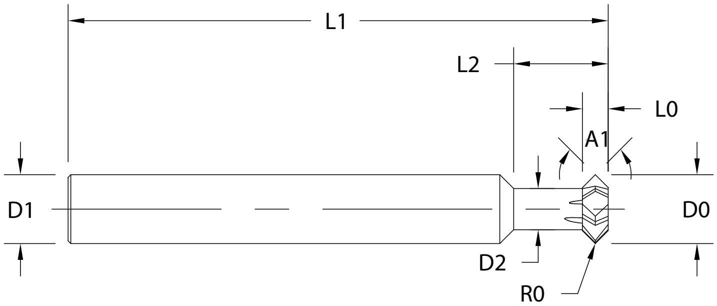
Angle per Side	Shank Diameter	Tip Diameter	Overall Length	Flutes	Uncoated		AlTiN		TiB2	
A1 +/-0.25°	D1 h6	D0 -0.0015"	L1 +/-0.08"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
30°	0.1250"	0.010"	2.0"	2	910i0812	19	910i0812B	24	910i0812C	25
	0.1875"	0.015"	2.0"	2	910i1212	27	910i1212B	30	910i1212C	32
	0.2500"	0.020"	2.0"	2	910i1612	38	910i1612B	42	910i1612C	43
	0.3125"	0.025"	2.0"	3	910i2012	44	910i2012B	50	910i2012C	54
	0.3750"	0.030"	2.5"	3	910i2412	46	910i2412B	55	910i2412C	64
	0.5000"	0.060"	3.0"	4	910i3212	68	910i3212B	80	910i3212C	90
45°	0.1250"	0.010"	2.0"	2	910i0818	19	910i0818B	24	910i0818C	25
	0.1875"	0.015"	2.0"	2	910i1218	27	910i1218B	30	910i1218C	32
	0.2500"	0.020"	2.0"	2	910i1618	38	910i1618B	42	910i1618C	43
	0.3125"	0.025"	2.0"	3	910i2018	44	910i2018B	50	910i2018C	54
	0.3750"	0.030"	2.5"	3	910i2418	46	910i2418B	55	910i2418C	64
	0.5000"	0.060"	3.0"	4	910i3218	68	910i3218B	80	910i3218C	90

Double Angle Cutters 30°/45°/60°



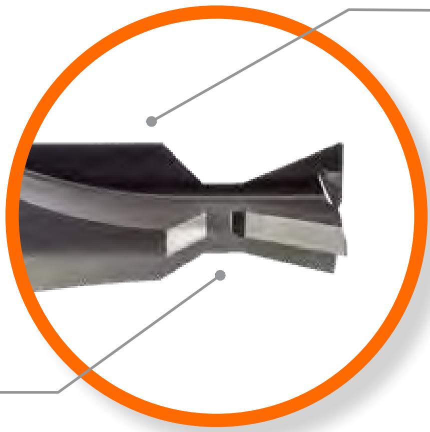
Angle per Side	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Flutes	Uncoated		AlTiN		TiB2	
A1 +/-0.5°	D0 -0.002"	L0	D1 h6	L1 +/-0.08"	D2 -0.002"/-0.006"	L2 +0.04"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
30°	0.1250"	0.0170"	0.1250"	2.0"	0.0625"	0.188"	4	920i0812	49	920i0812B	53	920i0812C	58
	0.1875"	0.0250"	0.1875"	2.0"	0.0938"	0.313"	4	920i1212	50	920i1212B	55	920i1212C	61
	0.2500"	0.0330"	0.2500"	2.0"	0.1250"	0.313"	4	920i1612	62	920i1612B	68	920i1612C	74
	0.3750"	0.0350"	0.3750"	2.5"	0.2500"	0.500"	6	920i2412	81	920i2412B	92	920i2412C	101
	0.5000"	0.0500"	0.5000"	3.0"	0.3125"	0.500"	6	920i3212	108	920i3212B	116	920i3212C	127
45°	0.1250"	0.0260"	0.1250"	2.0"	0.0625"	0.188"	4	920i0818	49	920i0818B	53	920i0818C	59
	0.1875"	0.0390"	0.1875"	2.0"	0.0938"	0.313"	4	920i1218	50	920i1218B	54	920i1218C	60
	0.2500"	0.0520"	0.2500"	2.0"	0.1250"	0.313"	4	920i1618	62	920i1618B	68	920i1618C	74
	0.3750"	0.0520"	0.3750"	2.5"	0.2500"	0.500"	6	920i2418	81	920i2418B	92	920i2418C	101
	0.5000"	0.0780"	0.5000"	3.0"	0.3125"	0.500"	6	920i3218	108	920i3218B	116	920i3218C	127
60°	0.1250"	0.0360"	0.1250"	2.0"	0.0625"	0.188"	4	920i0824	44	920i0824B	49	920i0824C	53
	0.1875"	0.0550"	0.1875"	2.0"	0.0938"	0.250"	4	920i1224	46	920i1224B	50	920i1224C	55
	0.2500"	0.0720"	0.2500"	2.0"	0.1250"	0.313"	4	920i1624	62	920i1624B	68	920i1624C	74
	0.3125"	0.0720"	0.3125"	2.0"	0.1875"	0.375"	6	920i2024	77	920i2024B	83	920i2024C	91
	0.3750"	0.0720"	0.3750"	2.5"	0.2500"	0.500"	6	920i2424	81	920i2424B	91	920i2424C	99
	0.5000"	0.1090"	0.5000"	3.0"	0.3130"	0.500"	6	920i3224	108	920i3224B	116	920i3224C	127

Double Angle Cutters 90°/120°



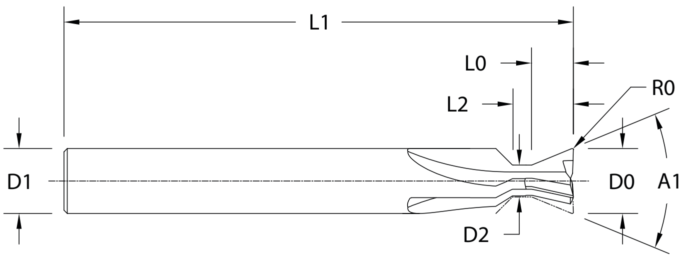
Angle per Side	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Flutes	Uncoated		AlTiN		TiB2	
A1 +/-0.5°	D0 -0.002"	L0	D1 h6	L1 +/-0.08"	D2 -0.002"/-0.006"	L2 +0.04"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
90°	0.1250"	0.0625"	0.1250"	2.0"	0.0625"	0.188"	4	920i0836	42	920i0836B	47	920i0836C	51
	0.1875"	0.0938"	0.1875"	2.0"	0.0938"	0.250"	4	920i1236	43	920i1236B	48	920i1236C	52
	0.2500"	0.1250"	0.2500"	2.0"	0.1250"	0.313"	4	920i1636	55	920i1636B	61	920i1636C	66
	0.3125"	0.1250"	0.3125"	2.0"	0.1875"	0.375"	6	920i2036	76	920i2036B	82	920i2036C	90
	0.3750"	0.1250"	0.3750"	2.5"	0.2500"	0.375"	6	920i2436	79	920i2436B	85	920i2436C	93
	0.5000"	0.1875"	0.5000"	3.0"	0.2500"	0.500"	6	920i3236	104	920i3236B	116	920i3236C	127
120°	0.1250"	0.1090"	0.1250"	2.0"	0.0625"	0.188"	4	920i0848	44	920i0848B	49	920i0848C	53
	0.1875"	0.1630"	0.1875"	2.0"	0.0938"	0.313"	4	920i1248	48	920i1248B	53	920i1248C	59
	0.2500"	0.2160"	0.2500"	2.0"	0.1250"	0.313"	4	920i1648	62	920i1648B	68	920i1648C	74
	0.3750"	0.2160"	0.3750"	2.5"	0.2500"	0.375"	6	920i2448	81	920i2448B	92	920i2448C	101
	0.5000"	0.3250"	0.5000"	3.0"	0.3125"	0.500"	6	920i3248	108	920i3248B	116	920i3248C	127

Dovetail Cutters 30°/45°



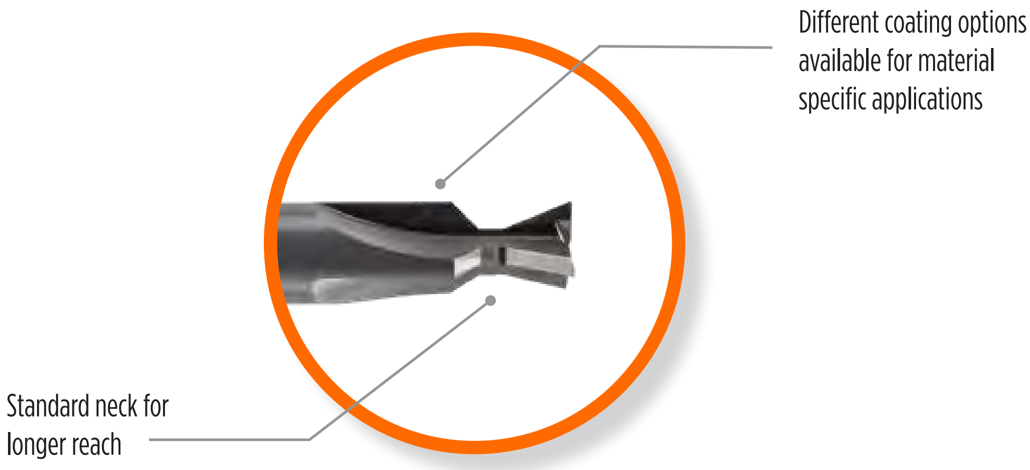
Included Angle	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Radius	Flutes	Uncoated		AlTiN		TiB2	
A1 +/-0.5º	D0 -0.002"	L0 +0.02"	D1 h6	L1 +/-0.08"	D2 -0.002"/-0.006"	L2 +0.04"	R0 +/-0.001"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
30º	0.1250"	0.0863"	0.1250"	2.0"	0.0787"	0.125"	Sharp	2	930i0812	70	930i0812B	75	930i0812C	86
	0.1250"	0.0920"	0.1250"	2.0"	0.0787"	0.125"	0.005"	2	931i0812	72	931i0812B	77	931i0812C	88
	0.1875"	0.1295"	0.1875"	2.0"	0.1181"	0.125"	Sharp	2	930i1212	71	930i1212B	76	930i1212C	88
	0.1875"	0.1351"	0.1875"	2.0"	0.1181"	0.125"	0.005"	2	931i1212	73	931i1212B	79	931i1212C	90
	0.2500"	0.0173"	0.2500"	2.0"	0.1575"	0.125"	Sharp	2	930i1612	91	930i1612B	98	930i1612C	113
	0.2500"	0.0184"	0.2500"	2.0"	0.1576"	0.125"	0.01"	2	931i1612	93	931i1612B	101	931i1612C	114
	0.3125"	0.2271"	0.3125"	2.0"	0.1969"	0.125"	Sharp	3	930i2012	98	930i2012B	106	930i2012C	124
	0.3125"	0.2271"	0.3125"	2.0"	0.1969"	0.125"	0.01"	3	931i2012	102	931i2012B	108	931i2012C	126
	0.3750"	0.2590"	0.3750"	2.5"	0.2362"	0.125"	Sharp	3	930i2412	104	930i2412B	114	930i2412C	130
	0.3750"	0.2703"	0.3750"	2.5"	0.2362"	0.125"	0.01"	3	931i2412	116	931i2412B	126	931i2412C	132
	0.5000"	0.3453"	0.5000"	3.0"	0.3150"	0.125"	Sharp	3	930i3212	145	930i3212B	157	930i3212C	182
	0.5000"	0.3566"	0.5000"	3.0"	0.3150"	0.125"	0.01"	3	931i3212	151	931i3212B	163	931i3212C	184
45º	0.1250"	0.0796"	0.1250"	2.0"	0.0591"	0.125"	Sharp	2	930i0818	70	930i0818B	75	930i0818C	95
	0.1250"	0.0856"	0.1250"	2.0"	0.0591"	0.125"	0.005"	2	931i0818	72	931i0818B	77	931i0818C	95
	0.1875"	0.1075"	0.1875"	2.0"	0.0984"	0.125"	Sharp	2	930i1218	71	930i1218B	76	930i1218C	98
	0.1875"	0.1135"	0.1875"	2.0"	0.0984"	0.125"	0.005"	2	931i1218	73	931i1218B	79	931i1218C	98
	0.2500"	0.0135"	0.2500"	2.0"	0.1378"	0.125"	Sharp	2	930i1618	91	930i1618B	98	930i1618C	121
	0.2500"	0.0147"	0.2500"	2.0"	0.1378"	0.125"	0.01"	2	931i1618	93	931i1618B	101	931i1618C	124
	0.3125"	0.1870"	0.3125"	2.0"	0.1772"	0.125"	Sharp	3	930i2018	98	930i2018B	106	930i2018C	124
	0.3125"	0.1754"	0.3125"	2.0"	0.1772"	0.125"	0.01"	3	931i2018	102	931i2018B	108	931i2018C	124
	0.3750"	0.0215"	0.3750"	2.5"	0.1969"	0.125"	Sharp	3	930i2418	104	930i2418B	114	930i2418C	142
	0.3750"	0.2270"	0.3750"	2.5"	0.1969"	0.125"	0.01"	3	931i2418	116	931i2418B	126	931i2418C	143
	0.5000"	0.3180"	0.5000"	3.0"	0.2362"	0.125"	Sharp	3	930i3218	145	930i3218B	157	930i3218C	196
	0.5000"	0.3304"	0.5000"	2.0"	0.2362"	0.125"	0.01"	3	931i3218	151	931i3218B	163	931i3218C	198

Dovetail Cutters 60°/90°

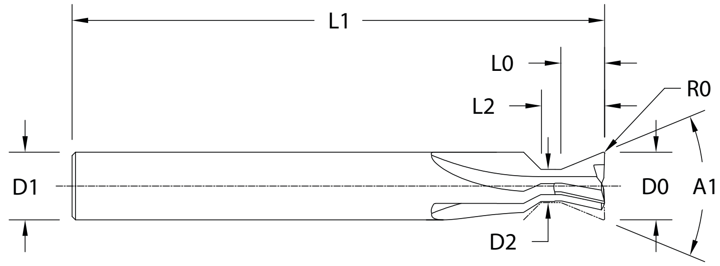


Included Angle A1 +/-0.5°	Cutting Diameter D0 -0.002"	Cutting Length L0 +0.02"	Shank Diameter D1 h6	Overall Length L1 +/-0.08"	Neck Diameter D2 -0.002"/-0.006"	Neck Length L2 +0.04"	Radius R0 +/-0.001"	Flutes Z	Uncoated Part #	Uncoated PRICE USD	AlTiN Part #	AlTiN PRICE USD	TiB2 Part #	TiB2 PRICE USD
60°	0.1250"	0.0571"	0.1250"	2.0"	0.0591"	0.125"	Sharp	2	930i0824	70	930i0824B	75	930i0824C	83
	0.1250"	0.0634"	0.1250"	2.0"	0.0591"	0.125"	0.005"	2	931i0824	72	931i0824B	77	931i0824C	83
	0.1875"	0.0771"	0.1875"	2.0"	0.0984"	0.125"	Sharp	2	930i1224	71	930i1224B	76	930i1224C	86
	0.1875"	0.0835"	0.1875"	2.0"	0.0984"	0.125"	0.005"	2	931i1224	73	931i1224B	79	931i1224C	90
	0.2500"	0.1142"	0.2500"	2.0"	0.1181"	0.125"	Sharp	2	930i1624	91	930i1624B	98	930i1624C	109
	0.2500"	0.1269"	0.2500"	2.0"	0.1181"	0.125"	0.01"	2	931i1624	93	931i1624B	101	931i1624C	109
	0.3125"	0.1270"	0.3125"	2.0"	0.1575"	0.125"	Sharp	3	930i2024	98	930i2024B	106	930i2024C	120
	0.3125"	0.1469"	0.3125"	2.0"	0.1575"	0.125"	0.01"	3	931i2024	102	931i2024B	108	931i2024C	123
	0.3750"	0.1543"	0.3750"	2.5"	0.1969"	0.125"	Sharp	3	930i2424	104	930i2424B	114	930i2424C	127
	0.3750"	0.1670"	0.3750"	2.5"	0.1969"	0.125"	0.01"	3	931i2424	116	931i2424B	126	931i2424C	126
	0.5000"	0.2284"	0.5000"	3.0"	0.2362"	0.125"	Sharp	3	930i3224	145	930i3224B	157	930i3224C	176
	0.5000"	0.2411"	0.5000"	3.0"	0.2362"	0.125"	0.01"	3	931i3224	151	931i3224B	163	931i3224C	171
90°	0.1250"	0.0330"	0.1250"	2.0"	0.0590"	0.125"	Sharp	2	930i0836	70	930i0836B	75	930i0836C	98
	0.1250"	0.0400"	0.1250"	2.0"	0.0590"	0.125"	0.005"	2	931i0836	72	931i0836B	77	931i0836C	98
	0.1875"	0.0540"	0.1875"	2.0"	0.0787"	0.125"	Sharp	2	930i1236	71	930i1236B	76	930i1236C	105
	0.1875"	0.0615"	0.1875"	2.0"	0.0787"	0.125"	0.005"	2	931i1236	73	931i1236B	79	931i1236C	105
	0.2500"	0.0659"	0.2500"	2.0"	0.1181"	0.125"	Sharp	2	930i1636	91	930i1636B	98	930i1636C	126
	0.2500"	0.0801"	0.2500"	2.0"	0.1140"	0.125"	0.01"	2	931i1636	93	931i1636B	101	931i1636C	127
	0.3125"	0.0850"	0.3125"	2.0"	0.1575"	0.125"	Sharp	3	930i2036	98	930i2036B	106	930i2036C	127
	0.3125"	0.0917"	0.3125"	2.0"	0.1575"	0.125"	0.01"	3	931i2036	102	931i2036B	108	931i2036C	143
	0.3750"	0.1088"	0.3750"	2.5"	0.1575"	0.125"	Sharp	3	930i2436	104	930i2436B	114	930i2436C	143
	0.3750"	0.1229"	0.3750"	2.5"	0.1575"	0.125"	0.01"	3	931i2436	116	931i2436B	126	931i2436C	143
	0.5000"	0.1516"	0.5000"	3.0"	0.1969"	0.125"	Sharp	3	930i3236	145	930i3236B	157	930i3236C	196
	0.5000"	0.1657"	0.5000"	2.0"	0.1969"	0.125"	0.01"	3	931i3236	151	931i3236B	163	931i3236C	196

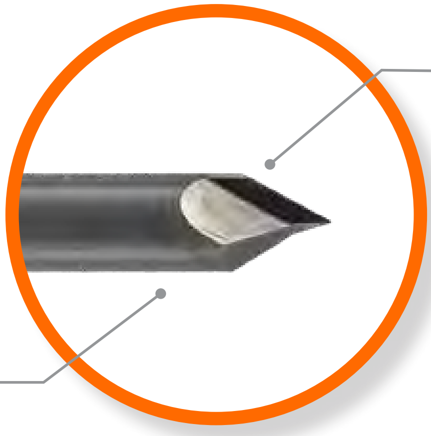
Dovetail Cutters 120°



Included Angle	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Radius	Flutes	Uncoated		AlTiN		TiB2	
A1 +/-0.5°	D0 -0.002"	L0 +0.02"	D1 h6	L1 +/-0.08"	D2 -0.002"/-0.006"	L2 +0.04"	R0 +/-0.001"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
120°	0.1250"	0.0247"	0.1250"	2.0"	0.0394"	0.125"	Sharp	2	930i0848	70	930i0848B	75	930i0848C	83
	0.1250"	0.0326"	0.1250"	2.0"	0.0394"	0.125"	0.005"	2	931i0848	72	931i0848B	77	931i0848C	83
	0.1875"	0.0314"	0.1875"	2.0"	0.0787"	0.125"	Sharp	2	930i1248	71	930i1248B	76	930i1248C	86
	0.1875"	0.0393"	0.1875"	2.0"	0.0787"	0.125"	0.005"	2	931i1248	73	931i1248B	79	931i1248C	90
	0.2500"	0.0438"	0.2500"	2.0"	0.0984"	0.125"	Sharp	2	930i1648	91	930i1648B	98	930i1648C	109
	0.2500"	0.0595"	0.2500"	2.0"	0.0984"	0.125"	0.01"	2	931i1648	93	931i1648B	101	931i1648C	109
	0.3125"	0.0618"	0.3125"	2.0"	0.0984"	0.125"	Sharp	3	930i2048	98	930i2048B	106	930i2048C	120
	0.3125"	0.0776"	0.3125"	2.0"	0.0984"	0.125"	0.01"	3	931i2048	102	931i2048B	108	931i2048C	123
	0.3750"	0.0742"	0.3750"	2.5"	0.1181"	0.125"	Sharp	3	930i2448	104	930i2448B	114	930i2448C	127
	0.3750"	0.0899"	0.3750"	2.5"	0.1181"	0.125"	0.01"	3	931i2448	116	931i2448B	126	931i2448C	126
	0.5000"	0.0975"	0.5000"	3.0"	0.1969"	0.125"	Sharp	3	930i3248	145	930i3248B	157	930i3248C	176
	0.5000"	0.1033"	0.5000"	3.0"	0.1969"	0.125"	0.01"	3	931i3248	151	931i3248B	163	931i3248C	171

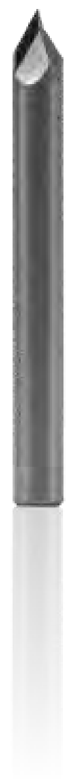


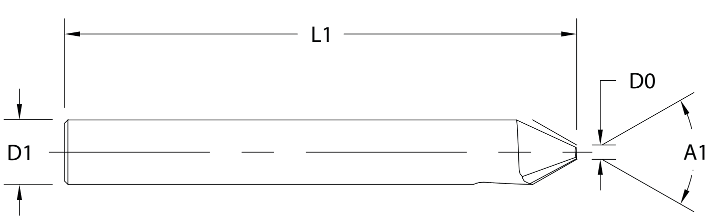
60° Engravers



Included Angle	Shank Diameter	Tip Diameter	Cutting Length	Overall Length	Flutes	Uncoated		AlTiN		TiB2	
A1 +/-0.5°	D1 h6	D0 -0.0004"/-0.0012"	L0	L1 +/-0.08"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
60°	0.1250"	0.004"	0.105"	2.0"	1	941i0804	18	941i0804B	22	941i0804C	25
		0.008"	0.103"	2.0"	1	941i0808	18	941i0808B	22	941i0808C	25
		0.012"	0.100"	2.0"	1	941i0812	18	941i0812B	22	941i0812C	25
		0.016"	0.095"	2.0"	1	941i0816	18	941i0816B	22	941i0816C	25
	0.1875"	0.004"	0.160"	2.0"	1	941i1204	22	941i1204B	27	941i1204C	28
		0.008"	0.158"	2.0"	1	941i1208	22	941i1208B	27	941i1208C	28
		0.012"	0.154"	2.0"	1	941i1212	22	941i1212B	27	941i1212C	28
		0.016"	0.149"	2.0"	1	941i1216	22	941i1216B	27	941i1216C	28
	0.2500"	0.004"	0.208"	2.0"	1	941i1604	27	941i1604B	30	941i1604C	33
		0.008"	0.204"	2.0"	1	941i1608	27	941i1608B	30	941i1608C	33
		0.012"	0.200"	2.0"	1	941i1612	27	941i1612B	30	941i1612C	33
		0.016"	0.196"	2.0"	1	941i1616	27	941i1616B	30	941i1616C	33

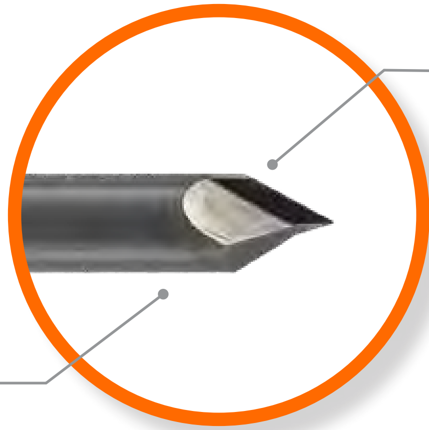
SHAPE & PROFILE MILLING



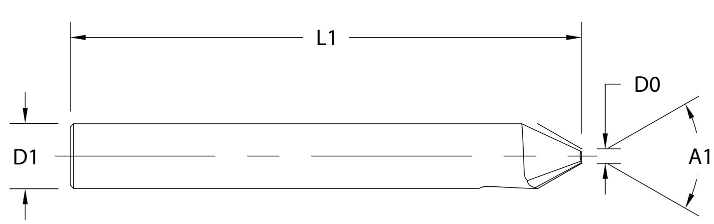


940 Series

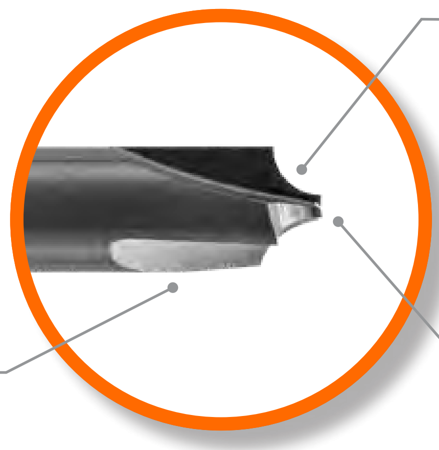
Engravers 90°



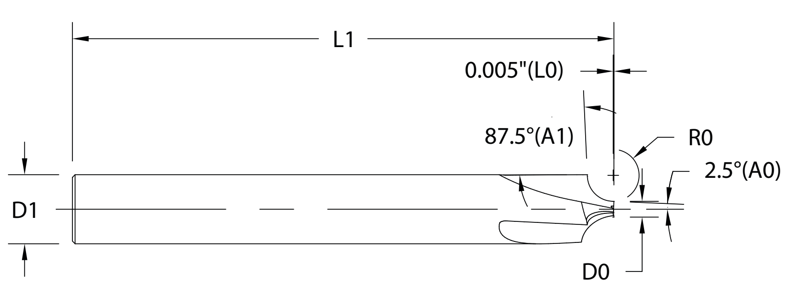
Included Angle	Shank Diameter	Tip Diameter	Cutting Length	Overall Length	Flutes	Uncoated		AlTiN		TiB2	
A1 +/-0.5°	D1 h6	D0 -0.0004"/-0.0012"	L0	L1 +/-0.08"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
90°	0.1250"	0.004"	0.061"	2.0"	1	942i0804	18	942i0804B	22	942i0804C	25
		0.008"	0.059"	2.0"	1	942i0808	18	942i0808B	22	942i0808C	25
		0.012"	0.057"	2.0"	1	942i0812	18	942i0812B	22	942i0812C	25
		0.016"	0.055"	2.0"	1	942i0816	18	942i0816B	22	942i0816C	25
		0.020"	0.053"	2.0"	1	942i0820	18	942i0820B	22	942i0820C	25
		0.024"	0.051"	2.0"	1	942i0824	18	942i0824B	22	942i0824C	25
	0.1875"	0.004"	0.092"	2.0"	1	942i1204	22	942i1204B	27	942i1204C	28
		0.008"	0.090"	2.0"	1	942i1208	22	942i1208B	27	942i1208C	28
		0.012"	0.088"	2.0"	1	942i1212	22	942i1212B	27	942i1212C	28
		0.016"	0.086"	2.0"	1	942i1216	22	942i1216B	27	942i1216C	28
		0.030"	0.084"	2.0"	1	942i1220	22	942i1220B	27	942i1220C	28
		0.024"	0.082"	2.0"	1	942i1224	22	942i1224B	27	942i1224C	28
	0.2500"	0.004"	0.123"	2.0"	1	942i1604	27	942i1604B	30	942i1604C	33
		0.008"	0.121"	2.0"	1	942i1608	27	942i1608B	30	942i1608C	33
		0.012"	0.119"	2.0"	1	942i1612	27	942i1612B	30	942i1612C	33
		0.016"	0.117"	2.0"	1	942i1616	27	942i1616B	30	942i1616C	33
		0.020"	0.115"	2.0"	1	942i1620	27	942i1620B	30	942i1620C	33
		0.024"	0.113"	2.0"	1	942i1624	27	942i1624B	30	942i1624C	33



Corner Rounding Cutters

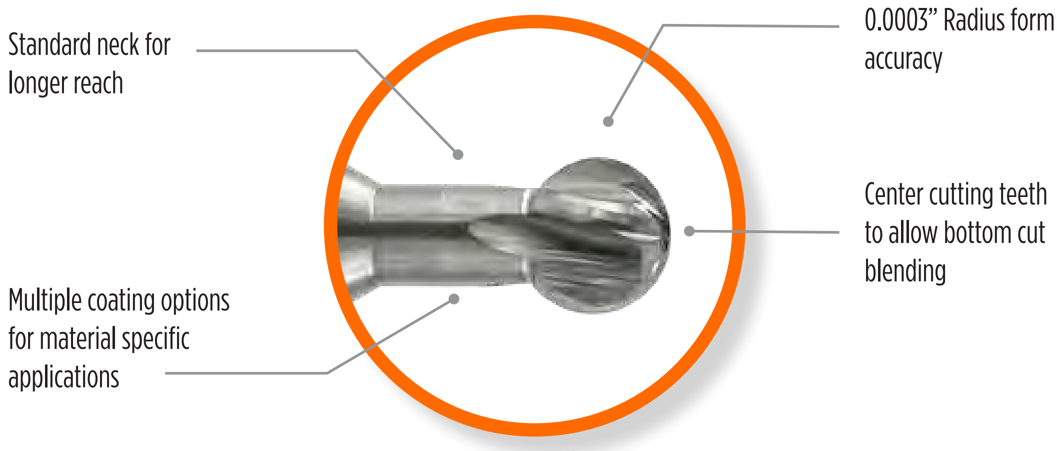


Radius	Pilot Diameter	Shank Diameter	Overall Length	Flutes	Uncoated		AlTiN		TiB2	
R0 +/-0.0005"	D0 -0.0015"	D1 h6	L1 +/-0.08"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
0.0156"	0.0843"	0.1250"	2.0"	3	950i0801	31	950i0801B	36	950i0801C	39
0.0313"	0.0548"	0.1250"	2.0"	3	950i0802	31	950i0802B	36	950i0802C	39
0.0469"	0.0832"	0.1875"	2.0"	3	950i1203	40	950i1203B	46	950i1203C	50
0.0625"	0.1144"	0.2500"	2.0"	3	950i1604	59	950i1604B	66	950i1604C	73
0.0781"	0.0832"	0.2500"	2.0"	3	950i1605	59	950i1605B	66	950i1605C	73
0.0938"	0.1769"	0.3750"	2.5"	3	950i2406	77	950i2406B	87	950i2406C	96
0.1094"	0.1456"	0.3750"	2.5"	3	950i2407	77	950i2407B	87	950i2407C	96
0.1250"	0.1143"	0.3750"	2.5"	3	950i2408	77	950i2408B	87	950i2408C	96
0.1875"	0.1142"	0.5000"	3.0"	3	950i3212	110	950i3212B	123	950i3212C	135
0.2500"	0.1141"	0.6250"	4.0"	3	950i4016	128	950i4016B	142	950i4016C	157



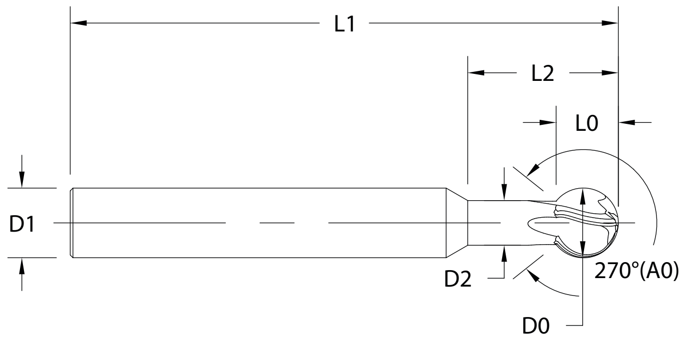
960 Series

270° Spherical Cutters



Ball Angle	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Flutes	Uncoated		AlTiN		TiB2	
A0 +5°	D0 -0.001"	L0 +0.010"	D1 h6	L1 +/-0.08"	D2 -0.002"/-0.006"	L2 +0.04"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
270°	0.1250"	0.107"	0.125"	2.0"	0.076"	0.062"	4	960i0801	32	960i0801B	37	960i0801C	40
		0.107"	0.125"	2.0"	0.076"	0.125"	4	960i0802	32	960i0802B	37	960i0802C	40
		0.107"	0.125"	2.0"	0.076"	0.250"	4	960i0804	35	960i0804B	39	960i0804C	42
		0.107"	0.125"	2.0"	0.076"	0.375"	4	960i0806	36	960i0806B	40	960i0806C	43
		0.107"	0.125"	2.0"	0.076"	0.500"	4	960i0808	38	960i0808B	42	960i0808C	47
		0.107"	0.125"	2.0"	0.076"	0.625"	4	960i0810	40	960i0810B	44	960i0810C	49
		0.107"	0.125"	2.0"	0.076"	0.750"	4	960i0812	40	960i0812B	44	960i0812C	49
	0.1875"	0.160"	0.188"	2.0"	0.117"	0.125"	4	960i1202	38	960i1202B	43	960i1202C	48
		0.160"	0.188"	2.0"	0.117"	0.188"	4	960i1203	41	960i1203B	47	960i1203C	51
		0.160"	0.188"	2.0"	0.117"	0.250"	4	960i1204	41	960i1204B	47	960i1204C	51
		0.160"	0.188"	2.0"	0.117"	0.375"	4	960i1206	44	960i1206B	50	960i1206C	54
		0.160"	0.188"	2.0"	0.117"	0.500"	4	960i1208	46	960i1208B	50	960i1208C	54
		0.160"	0.188"	2.0"	0.117"	0.625"	4	960i1210	49	960i1210B	53	960i1210C	58
		0.160"	0.188"	2.0"	0.117"	0.750"	4	960i1212	50	960i1212B	55	960i1212C	61

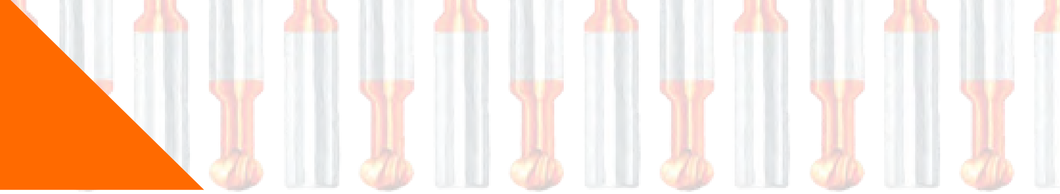
270° Spherical Cutters



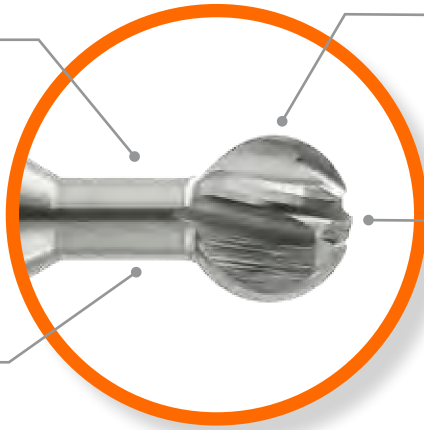
Ball Angle A0 +5°	Cutting Diameter D0 -0.001"	Cutting Length L0 +0.010"	Shank Diameter D1 h6	Overall Length L1 +/-0.08"	Neck Diameter D2 -0.002"/-0.006"	Neck Length L2 +0.04"	Flutes Z	Uncoated Part #	Uncoated PRICE USD	AlTiN Part #	AlTiN PRICE USD	TiB2 Part #	TiB2 PRICE USD
270°	0.2500"	0.213"	0.250"	2.0"	0.158"	0.125"	4	960i1602	51	960i1602B	59	960i1602C	64
		0.213"	0.250"	2.0"	0.158"	0.250"	4	960i1604	54	960i1604B	61	960i1604C	66
		0.213"	0.250"	2.0"	0.158"	0.375"	4	960i1606	54	960i1606B	61	960i1606C	66
		0.213"	0.250"	2.0"	0.158"	0.500"	4	960i1608	57	960i1608B	62	960i1608C	69
		0.213"	0.250"	2.0"	0.158"	0.625"	4	960i1610	57	960i1610B	63	960i1610C	70
		0.213"	0.250"	2.0"	0.158"	0.750"	4	960i1612	60	960i1612B	65	960i1612C	72
		0.213"	0.250"	2.0"	0.158"	0.875"	4	960i1614	60	960i1614B	65	960i1614C	72
	0.3750"	0.320"	0.375"	2.5"	0.241"	0.188"	4	960i2403	74	960i2403B	82	960i2403C	90
		0.320"	0.375"	2.5"	0.241"	0.375"	4	960i2406	76	960i2406B	85	960i2406C	94
		0.320"	0.375"	2.5"	0.241"	0.500"	4	960i2408	76	960i2408B	84	960i2408C	93
		0.320"	0.375"	2.5"	0.241"	0.750"	4	960i2412	77	960i2412B	87	960i2412C	96
		0.320"	0.375"	3.5"	0.241"	1.125"	4	960i2418	92	960i2418B	105	960i2418C	115
		0.320"	0.375"	3.5"	0.241"	1.500"	4	960i2424	95	960i2424B	107	960i2424C	117
		0.320"	0.375"	3.5"	0.241"	2.000"	4	960i2432	98	960i2432B	112	960i2432C	123
	0.5000"	0.427"	0.500"	3.0"	0.323"	0.500"	4	960i3208	107	960i3208B	121	960i3208C	134
		0.427"	0.500"	3.0"	0.323"	0.750"	4	960i3212	109	960i3212B	123	960i3212C	135
		0.427"	0.500"	3.0"	0.323"	1.000"	4	960i3216	110	960i3216B	125	960i3216C	137
		0.427"	0.500"	5.0"	0.323"	1.500"	4	960i3224	181	960i3224B	195	960i3224C	214
		0.427"	0.500"	5.0"	0.323"	2.000"	4	960i3232	185	960i3232B	200	960i3232C	219
		0.427"	0.500"	5.0"	0.323"	3.000"	4	960i3248	197	960i3248B	212	960i3248C	233

SHAPE & PROFILE MILLING

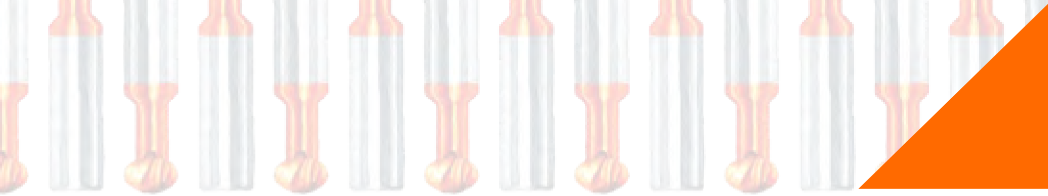
961 Series



300° Spherical Cutters

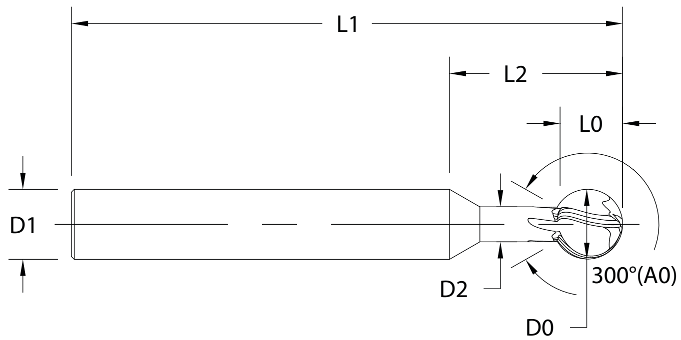


Ball Angle	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Flutes	Uncoated		AlTiN		TiB2	
A0 +5°	D0 -0.001"	L0 +0.010"	D1 h6	L1 +/-0.08"	D2 -0.002"/-0.006"	L2 +0.04"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
300°	0.1250"	0.107"	0.125"	2.0"	0.076"	0.062"	4	961i0801	37	961i0801B	42	961i0801C	46
		0.107"	0.125"	2.0"	0.076"	0.125"	4	961i0802	40	961i0802B	44	961i0802C	49
		0.107"	0.125"	2.0"	0.076"	0.250"	4	961i0804	49	961i0804B	53	961i0804C	59
		0.107"	0.125"	2.0"	0.076"	0.375"	4	961i0806	53	961i0806B	59	961i0806C	64
		0.107"	0.125"	2.0"	0.076"	0.500"	4	961i0808	58	961i0808B	62	961i0808C	68
		0.107"	0.125"	2.0"	0.076"	0.625"	4	961i0810	77	961i0810B	82	961i0810C	90
		0.107"	0.125"	2.0"	0.076"	0.750"	4	961i0812	80	961i0812B	84	961i0812C	92
	0.1875"	0.160"	0.188"	2.0"	0.117"	0.125"	4	961i1202	47	961i1202B	52	961i1202C	57
		0.160"	0.188"	2.0"	0.117"	0.188"	4	961i1203	50	961i1203B	55	961i1203C	61
		0.160"	0.188"	2.0"	0.117"	0.250"	4	961i1204	53	961i1204B	59	961i1204C	65
		0.160"	0.188"	2.0"	0.117"	0.375"	4	961i1206	59	961i1206B	64	961i1206C	70
		0.160"	0.188"	2.0"	0.117"	0.500"	4	961i1208	61	961i1208B	66	961i1208C	73
		0.160"	0.188"	2.0"	0.117"	0.625"	4	961i1210	64	961i1210B	69	961i1210C	75
		0.160"	0.188"	2.0"	0.117"	0.750"	4	961i1212	66	961i1212B	72	961i1212C	79



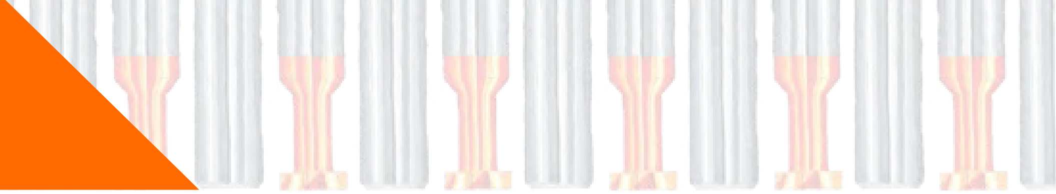
961 Series

300° Spherical Cutters

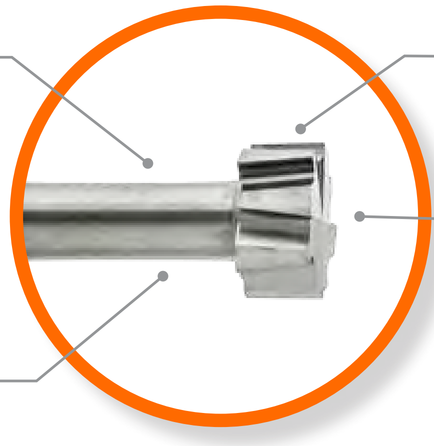


Ball Angle	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Flutes	Uncoated		AlTiN		TiB2	
A0 +5°	D0 -0.001"	L0 +0.010"	D1 h6	L1 +/-0.08"	D2 -0.002"/-0.006"	L2 +0.04"	Z	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
300°	0.2500"	0.213"	0.250"	2.0"	0.158"	0.125"	4	961i1602	63	961i1602B	70	961i1602C	76
		0.213"	0.250"	2.0"	0.158"	0.250"	4	961i1604	66	961i1604B	73	961i1604C	81
		0.213"	0.250"	2.0"	0.158"	0.375"	4	961i1606	69	961i1606B	76	961i1606C	84
		0.213"	0.250"	2.0"	0.158"	0.500"	4	961i1608	76	961i1608B	83	961i1608C	91
		0.213"	0.250"	2.0"	0.158"	0.625"	4	961i1610	84	961i1610B	91	961i1610C	99
		0.213"	0.250"	2.0"	0.158"	0.750"	4	961i1612	90	961i1612B	96	961i1612C	105
		0.213"	0.250"	2.0"	0.158"	0.875"	4	961i1614	95	961i1614B	103	961i1614C	113
	0.3750"	0.320"	0.375"	2.5"	0.241"	0.250"	4	961i2404	92	961i2404B	101	961i2404C	110
		0.320"	0.375"	2.5"	0.241"	0.375"	4	961i2406	99	961i2406B	108	961i2406C	118
		0.320"	0.375"	2.5"	0.241"	0.500"	4	961i2408	107	961i2408B	117	961i2408C	128
		0.320"	0.375"	2.5"	0.241"	0.750"	4	961i2412	119	961i2412B	128	961i2412C	140
		0.320"	0.375"	3.5"	0.241"	1.250"	4	961i2418	132	961i2418B	139	961i2418C	153
		0.320"	0.375"	3.5"	0.241"	1.500"	4	961i2424	151	961i2424B	163	961i2424C	179
	0.5000"	0.427"	0.500"	3.0"	0.323"	0.500"	4	961i3208	139	961i3208B	152	961i3208C	167
		0.427"	0.500"	3.0"	0.323"	0.750"	4	961i3212	161	961i3212B	171	961i3212C	187
		0.427"	0.500"	3.0"	0.323"	1.000"	4	961i3216	171	961i3216B	184	961i3216C	202
		0.427"	0.500"	5.0"	0.323"	1.500"	4	961i3224	189	961i3224B	202	961i3224C	222
		0.427"	0.500"	5.0"	0.323"	2.000"	4	961i3232	211	961i3232B	225	961i3232C	247
		0.427"	0.500"	5.0"	0.323"	3.000"	4	961i3248	224	961i3248B	228	961i3248C	251

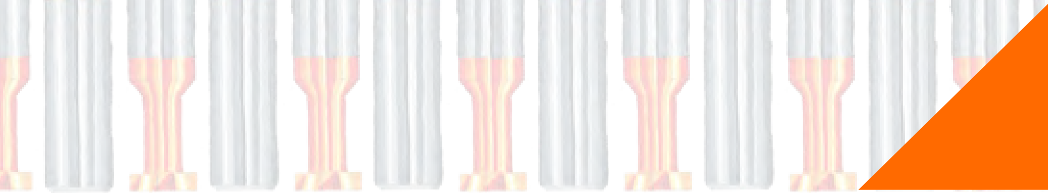
970 Series



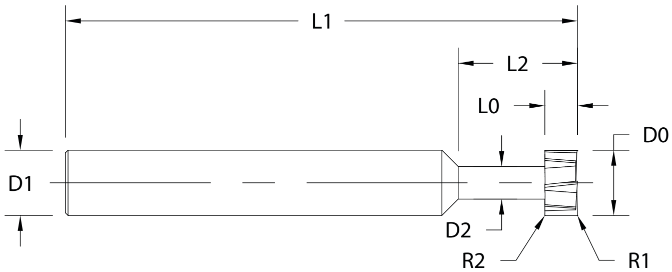
Keyseat Cutters



Cutting Diameter	Cut Width	Neck Diameter	Neck Length	Flutes	Shank Diameter	Overall Length	Uncoated		AlTiN		TiB2	
D0 -0.0004"/-0.0012"	L0 +/- 0.0004"	D2 -0.005"	L2 +0.04"	Z	D1 h6	L1 +/-0.08"	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
0.1250"	0.0156"	0.0625"	0.1875"	6	0.125"	2.0"	970i0801	59	970i0801B	63	970i0801C	66
	0.0313"	0.0625"	0.1875"	6	0.125"	2.0"	970i0802	59	970i0802B	63	970i0802C	66
	0.0469"	0.0625"	0.1875"	6	0.125"	2.0"	970i0803	59	970i0803B	63	970i0803C	66
	0.0625"	0.0625"	0.1875"	6	0.125"	2.0"	970i0804	59	970i0804B	63	970i0804C	66
0.1875"	0.0625"	0.0938"	0.2813"	6	0.250"	2.0"	970I1204	70	970I1204B	74	970I1204C	77
	0.0938"	0.0938"	0.2813"	6	0.250"	2.0"	970I1206	70	970I1206B	74	970I1206C	77
	0.1250"	0.0938"	0.2813"	6	0.250"	2.0"	970I1208	70	970I1208B	74	970I1208C	77
0.2500"	0.0313"	0.1250"	0.3750"	6	0.250"	2.0"	970i1602	81	970i1602B	88	970i1602C	93
	0.0469"	0.1250"	0.3750"	6	0.250"	2.0"	970i1603	81	970i1603B	88	970i1603C	93
	0.0625"	0.1250"	0.3750"	6	0.250"	2.0"	970i1604	81	970i1604B	88	970i1604C	93
	0.0938"	0.1250"	0.3750"	6	0.250"	2.0"	970i1606	81	970i1606B	88	970i1606C	93
	0.1250"	0.1250"	0.3750"	6	0.250"	2.0"	970i1608	81	970i1608B	88	970i1608C	93



Keyseat Cutters



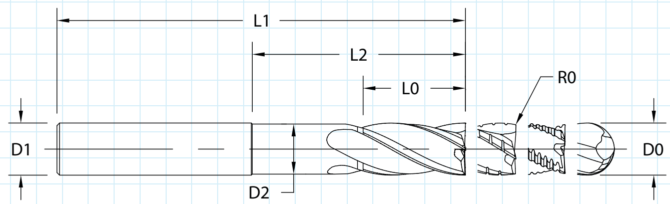
Cut Diameter	Cut Width	Neck Diameter	Neck Length	Flutes	Shank Diameter	Overall Length	Uncoated		AlTiN		TiB2	
D0 -0.0004"/-0.0012"	L0 +/- 0.0004"	D2 -0.005"	L2 +0.04"	Z	D1 h6	L1 +/-0.08"	Part #	PRICE USD	Part #	PRICE USD	Part #	PRICE USD
0.3750"	0.0625"	0.1875"	0.5625"	8	0.375"	2.5"	970i2404	99	970i2404B	108	970i2404C	114
	0.0938"	0.1875"	0.5625"	8	0.375"	2.5"	970i2406	99	970i2406B	108	970i2406C	114
	0.1250"	0.1875"	0.5625"	8	0.375"	2.5"	970i2408	99	970i2408B	108	970i2408C	114
	0.1875"	0.1875"	0.5625"	8	0.375"	2.5"	970i2412	99	970i2412B	108	970i2412C	114
	0.2500"	0.1875"	0.5625"	8	0.375"	2.5"	970i2416	99	970i2416B	108	970i2416C	114
0.5000"	0.0625"	0.2500"	0.7500"	8	0.500"	3.0"	970i3204	129	970i3204B	143	970i3204C	151
	0.0938"	0.2500"	0.7500"	8	0.500"	3.0"	970i3206	129	970i3206B	143	970i3206C	151
	0.1250"	0.2500"	0.7500"	8	0.500"	3.0"	970i3208	129	970i3208B	143	970i3208C	151
	0.1875"	0.2500"	0.7500"	8	0.500"	3.0"	970i3212	129	970i3212B	143	970i3212C	151
	0.2500"	0.2500"	0.7500"	8	0.500"	3.0"	970i3216	129	970i3216B	143	970i3216C	151
0.6250"	0.1250"	0.3125"	1.0000"	8	0.625"	4.0"	970i4008	183	970i4008B	196	970i4008C	206
	0.1875"	0.3125"	1.0000"	8	0.625"	4.0"	970i4012	183	970i4012B	196	970i4012C	206
	0.2500"	0.3125"	1.0000"	8	0.625"	4.0"	970i4016	183	970i4016B	196	970i4016C	206

Custom End Mill

Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Radius	Flutes	Customer Part Number
D0	L0	D1	L1	D2	L2	R0	Z	

Helix Angle	Center Cutting	Coating	Coolant Fed	Direction of Cut	Direction of Helix	Chipbreakers	Roughing Knurls	Material to Cut
	Y/N	Y/N	Y/N	R/L	R/L	Y/N	Y/N	

CUSTOMIZE IT:



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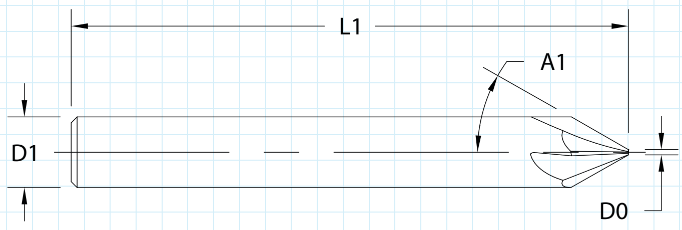
Customize It

Custom Chamfer Cutter

Angle per Side	Tip Diameter	Shank Diameter	Overall Length	Flutes	Customer Part Number
A1	D0	D1	L1	Z	

Helix Angle	Center Cutting	Coating	Coolant Fed	Direction of Cut	Direction of Helix	Chipbreakers	Material to Cut
	Y/N	Y/N	Y/N	R/L	R/L	Y/N	

CUSTOMIZE IT:



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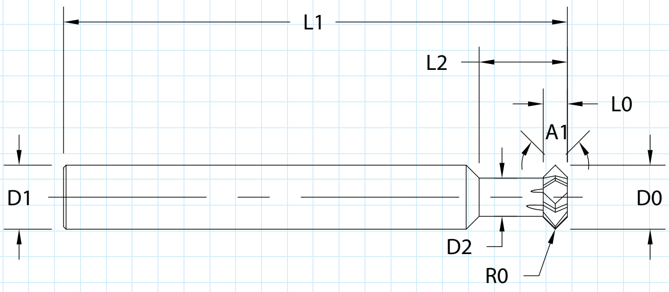
Custom Double Angle Cutter

Included Angle	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Radius	Flutes	Customer Part Number
A1	D0	L0	D1	L1	D2	L2	R0	Z	

Helix Angle	Coating	Coolant Fed	Direction of Cut	Direction of Helix	Chipbreakers	Material to Cut
	Y/N	Y/N	R/L	R/L	Y/N	

CUSTOMIZE IT:



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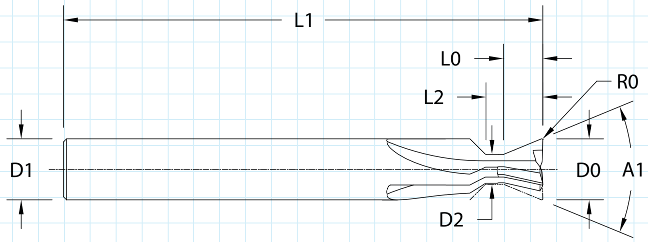
Customize It

Custom Dovetail Cutter

Included Angle	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Radius	Flutes	Customer Part Number
A1	D0	L0	D1	L1	D2	L2	R0	Z	

Helix Angle	Center Cutting	Coating	Coolant Fed	Direction of Cut	Direction of Helix	Chipbreakers	Material to Cut
	Y/N	Y/N	Y/N	R/L	R/L	Y/N	

CUSTOMIZE IT:



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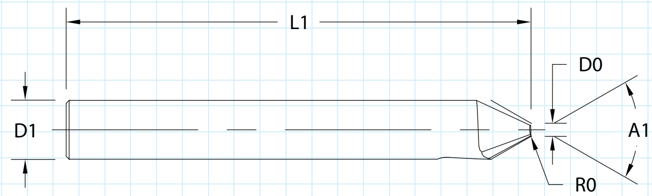
Customize It

Custom Engraver

Included Angel	Tip Diameter	Shank Diameter	Overall Length	Radius	Flutes	Customer Part Number
A1	D0	D1	L1	R0	Z	

Helix Angle	Center Cutting	Coating	Coolant Fed	Direction of Cut	Direction of Helix	Chipbreakers	Material to Cut
	Y/N	Y/N	Y/N	R/L	R/L	Y/N	

CUSTOMIZE IT:



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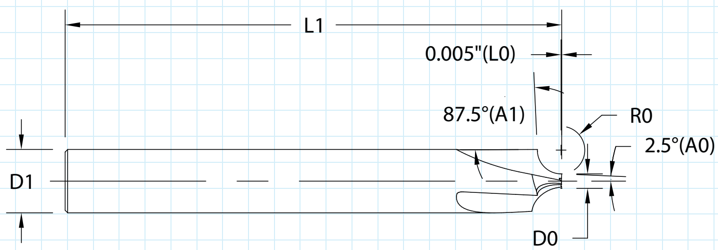
Customize It

Custom Corner Rounding Cutter

Radius	Tip Diameter	Blending Length	Shank Diameter	Overall Length	Start Angle	Exit Angle	Flutes	Customer Part Number
R0	D0	L0	D1	L1	A0	A1	Z	

Helix Angle	Center Cutting	Coating	Coolant Fed	Direction of Cut	Direction of Helix	Chipbreakers	Material to Cut
	Y/N	Y/N	Y/N	R/L	R/L	Y/N	

CUSTOMIZE IT:



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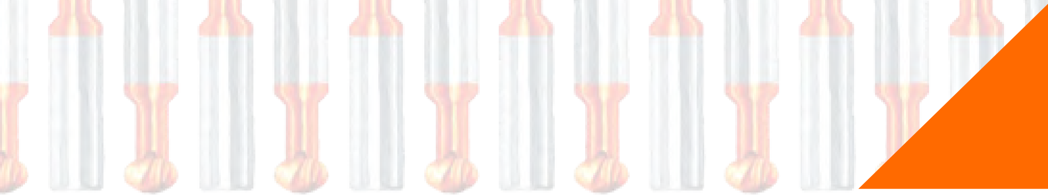


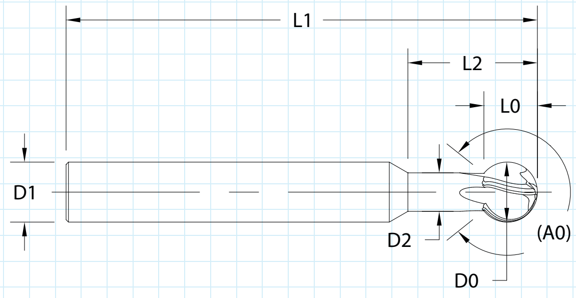
Customize It

Custom Spherical Cutter

Ball Angle	Cutting Diameter	Cutting Length	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Flutes	Customer Part Number
A0	D0	L0	D1	L1	D2	L2	Z	

Helix Angle	Coating	Coolant Fed	Direction of Cut	Direction of Helix	Chipbreakers	Material to Cut
	Y/N	Y/N	R/L	R/L	Y/N	

CUSTOMIZE IT:



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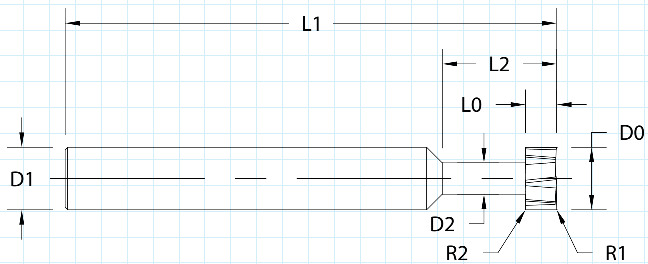
Custom Keyseat Cutter

Cutting Diameter	Cutting Width	Shank Diameter	Overall Length	Neck Diameter	Neck Length	Radius	Flutes	Customer Part Number
D0	L0	D1	L1	D2	L2	R1/R2	Z	

Helix Angle	Staggered Cut	Coating	Coolant Fed	Direction of Cut	Direction of Helix	Chipbreakers	Roughing Knurls	Material to Cut
	Y/N	Y/N	Y/N	R/L	R/L	Y/N	Y/N	

CUSTOMIZE IT:



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At Sonic Tools, our primary focus has always been custom projects. We believe our design and engineering services coupled with high performance tooling and fast turnaround are the key to making your project a profitable success.

We specialize in:

- R & D projects that require fast turnaround
- Tool design for custom applications
- Engineering to decrease cycle time, maximize tool life, and optimize your manufacturing process

IF YOU CAN SKETCH IT, WE CAN MAKE IT:

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Reconditioning

Better Tools, Better Results.

This has been the inspiration for our entire catalog product line. We believe creating better tooling at a competitive price allows our customers to reduce cost, improve cycle time, and provide a better product.

In addition, our catalog product line has been designed to allow reconditioning. Our goal is to save you money by keeping tools in circulation for as long as possible.

What you can expect:

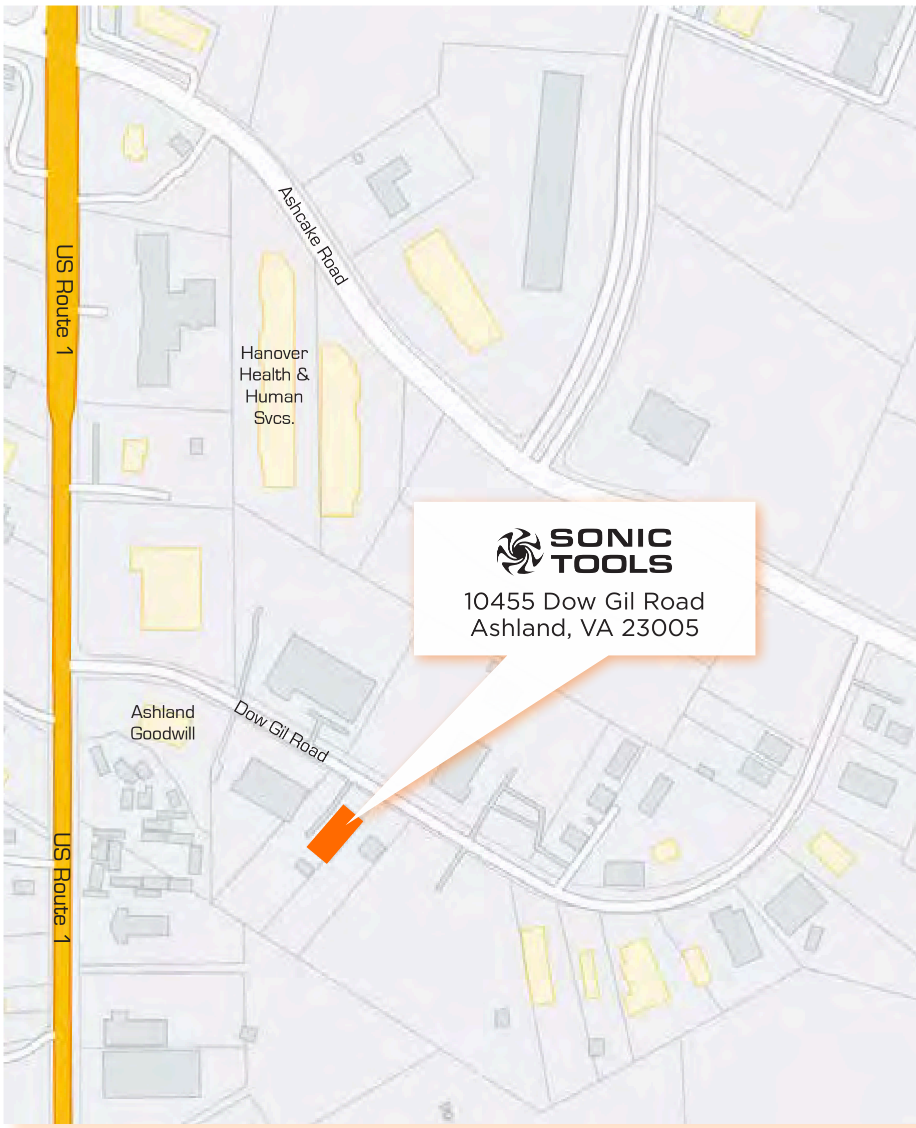
- All tools, new or reconditioned, are:
  - Ground on the same 5-axis machines guaranteeing equivalent accuracy and precision
  - Laser etched for lot and history tracking
  - Passed through the same rigorous inspection protocols
- Reconditioned tools are re-coated and re-packaged
- Price: approximately 33% of list price
- Lead:
  - 1 week, uncoated
  - 12 working days, drop shipped from coating, UPS or FedEx shipping account required.
  - 3 weeks if shipping Prepaid & Add.

Please include a packing slip or purchase order when returning tools for reconditioning.

We recommend shipping tools in original tubes to protect from damage during shipping. Upon receipt, tools are evaluated and a sales confirmation will be returned with the final quantity and expected delivery date.

For large quantities, please contact go@soniclp.com to enroll in our monthly or quarterly regrind program.

How to Order



Contact Us

go@soniclp.com

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SONIC TOOLS has been designing, engineering, and manufacturing precision cutting tools for almost 20 years. We make the hard stuff, tools others have said are impossible and can't be made. The manufacturing industry has served us well and now it is time for us to serve you. We've taken our unique design and engineering approach and applied those principles to a product line of standard tooling.

Our goal is to bring high performance tooling to the everyday machine shop. We give YOU a better tool to deliver a better product to your customer at a competitive market price. Better Tools, Better Results. It's how we support American manufacturing.

We are the backbone of the original American dream. We serve and support US engineering and design, allowing our customers to introduce the highest quality products into the marketplace. We share a common vision with our customers...ingenuity, creativity and a passion for doing things right.

We are American manufacturing.
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