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MONSTER

DYNAMIC. AMERICAN. CARBIDE.

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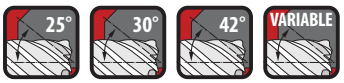
ICON LEGEND

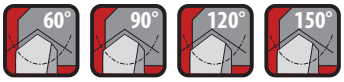
CENTER CUTTING

HELIX ANGLE

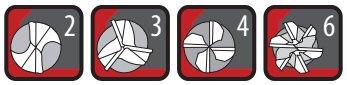


CUT/SPIRAL DIRECTION

DRILL POINT ANGLES



NUMBER OF FLUTES



FLUTE SPACING:

Equal Index

Unequal Index

FINISHES:

Coating		Recommended Materials	Benefits	Structure	Hardness	Oxidation Temp.	Friction Coefficient	Thickness (microns)	Color
TiN	Titanium Nitride	General Purpose	Increases tool longevity & productivity (higher feed rates)	Single-layer	81 Hrc	1100° F	0.5	1-2	Gold
ZrN	Zirconium Nitride	Non-ferrous	Lubricity & tool longevity	Single-layer	88 Hrc	1000° F	0.4	1-4	Canary Yellow
TiCN	Titanium Carbonitride	Carbon Steels, Alloy Steels, Cast Irons, Super Alloys, Copper, Bronze, Brass, High Silicon Aluminum Alloys	Increases edge retention and wear resistance	Single-layer	87 Hrc	750° F	0.45	2-4	Blue / Gray
AlTiN	Aluminum, Titanium Nitride	Alloy Steels, Stainless Steels, Tool Steels, Nickel Alloys & Titaniums	Excellent heat resistance is perfectly suited for dry machining	Multi-layer	90 Hrc	1650° F	0.45	1-4	Gray / Black
AlTiCrN	Aluminum Titanium Chromium Nitride	Cast Irons & Stainless Steels	Low friction	Nano Composite Multi-layer	88 Hrc	1500° F	0.4	1-4	Silver / Gray
nACRo	Chromium Aluminum Titanium Silicon Nitride	Carbon Steel, Stainless Steel, Hardened Steel, Nickel Alloys, Cast Irons, Titaniums & Super Alloys	Extreme heat resistance and edge retention	Nano Composite Multi-layer	89 Hrc	2100° F	0.35	1-7	Gray / Blue

Ground and polished

Unground with Grind Stock

CARBIDE SUBSTRATE:

- C-2 SM 10% — C-2 grade, Sub-Micron grain carbide with 10% cobalt
- PREM SM 12% — Hard metal grade, Sub-Micron grain with 12% cobalt
- C-5 MED 8% — C-5 grade, Medium grain carbide with 8% cobalt

PROFILES:

- FINE PITCH — Fine Pitch
- MED PITCH — Medium Pitch
- COARSE PITCH — Coarse Pitch
- CHIP BREAKER — Chipbreaker

END STYLES:

- SQ — Square Corner
- BN — Ball Nose
- RAD — Corner Radius
- CHAM — Corner Chamfer
- 45° CHAM — End Chamfer

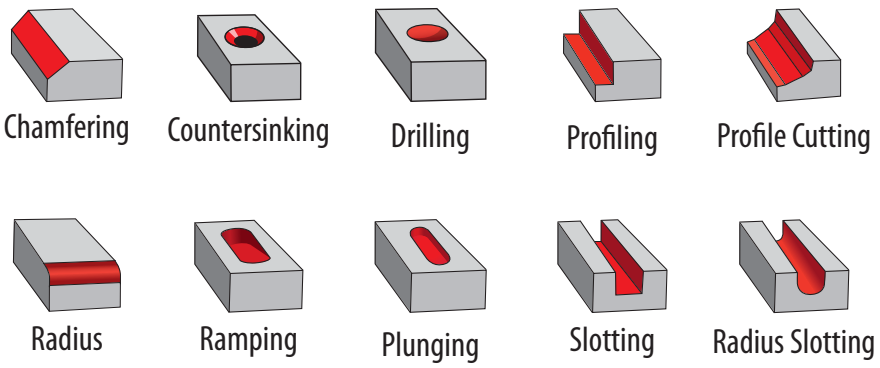
SHANK STYLES:

- STRAIGHT H6 — Straight - H6 Tolerances
- FLAT — Weldon Flat
- NECKED — Necked Shank

SPEEDS AND FEEDS:

- p. XXX — Speed and Feeds Page Location

TOOL APPLICATIONS:



ISO MATERIAL GROUP:

- P — Steels
- M — Stainless Steels
- N — Non-Ferrous
- S — Super Alloys
- K — Cast Iron
- H — Hardened Materials

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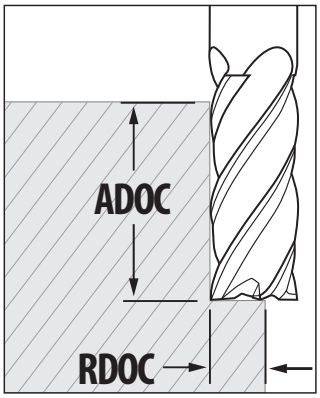
Formulas	
Inch	**Metric**
Inches Per Minute (***IPM***) = IPT x T x RPM	Millimeter per minute (***MMPM***) = RPM x MMPT x T
Inches Per Revolution (***IPR***) = IPM ÷ RPM	Millimeter per revolution (***MMPR***) = MMPM + RPM
Inches Per Tooth (***IPT***) = IPM ÷ (RPM x T)	Millimeter per Tooth (***MMPT***) = MMPM + RPM x T
Metal Removal Rate (***MRR***) = ADOC x RDOC x IPM	Metal Removal Rate (***MRR***) = ADOC x RDOC x MMPM x 1000

NOTE: ALL RECOMMENDATIONS ARE CONSIDERED AS STARTING PARAMETERS ONLY

END MILL CUTTING RECOMMENDATIONS



Axial Depth of Cut (ADOC) *Radial Depth of Cut (RDOC)*	Flute Count (*T*)		
Applications	**2 & 3 Flutes**	**4 & 5 Flutes**	**6 Flutes**
Slotting	ADOC: 100% DIA	ADOC: 50% DIA	
Light Roughing	ADOC: 100% LOC RDOC: 15-25% DIA	ADOC: 100% LOC RDOC: 15-25% DIA	ADOC: 100% LOC RDOC: 10-20% DIA
Heavy Roughing	ADOC: 150% DIA RDOC: 25-50% DIA	ADOC: 150% DIA RDOC: 25-50% DIA	
Finishing	ADOC: 100% LOC RDOC: 3-5% DIA	ADOC: 100% LOC RDOC: 3-5% DIA	ADOC: 100% LOC RDOC: 3-5% DIA

GENERAL GUIDELINES FOR MILLING

- SELECT THE SHORTEST FLUTE LENGTH POSSIBLE FOR BEST RIGIDITY AND MATERIAL REMOVAL
- CHOOSE THE LARGEST DIAMETER POSSIBLE FOR OPTIMUM STRENGTH
- SMALLER FLUTE LENGTH = LARGER SFM
- LARGER FLUTE LENGTH = SMALLER SFM

- COATINGS CAN ALLOW FASTER FEED RATES.

OPTIMAL ENVIRONMENTS SUPPORT THE FOLLOWING INCREASES IN SFM:

TIN: 20% ALTIN: 45%
TICN: 25% ZRN: 35%

CHIP THINNING

RDOC	Increase Feed Rate
30%	1.1 x IPT
25%	1.2 x IPT
20%	1.3 x IPT
15%	1.4 x IPT
10%	1.8 x IPT
7%	2 x IPT
5%	2.3 x IPT
3%	3 x IPT
2%	3.5 x IPT
1%	5 x IPT

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Drill Troubleshooting

	Possible Solutions														
	Speeds & Feeds						Coolant			Setup					
Problem	Reduce Feed or Reduce at Exit	Reduce Feed at Entrance	Consistent Feed rate	Increase Feed	Reduce Speed	Increase Speed	Coolant Mix	Coolant Increase Flow	Coolant Filter	Workpiece Clamp Rigid	Collet Accuracy	Tool Holder fit .0008	Alignment	Peck Drill	Concentricity	Do not Extract Tool During Peck
Flank Wear	◆			◆	◆			◆	◆							
Margin Wear					◆		◆			◆					◆	
Breakage	◆	◆	◆				◆	◆	◆	◆	◆	◆	◆	◆	◆	
Flaking							◆		◆						◆	
Creater Wear					◆											
Chisel Edge Wear	◆			◆				◆		◆						
Corner Chipping	◆			◆			◆		◆						◆	◆
Flute Chipping	◆														◆	
Cutting Edge Chipping	◆						◆	◆	◆	◆	◆	◆	◆			
Cutting Edge Wear				◆	◆											
Point Center Chipping	◆															
Rake Face	◆															
Scoring on Tool Body	◆						◆			◆					◆	
Long Stringy			◆	◆												
Varied Chip Form			◆													
Blue/Brown Chips								◆								
Tool Life	◆				◆		◆	◆	◆	◆						
≤ sized Hole	◆	◆		◆	◆		◆	◆	◆							
≥ sized Hole	◆			◆						◆	◆	◆	◆			
Poor Alignment										◆					◆	
Poor Surface Finish	◆	◆			◆	◆	◆	◆	◆						◆	
Heavy Burr Breakout	◆						◆	◆	◆	◆						
Retract Marks															◆	
Hole Location		◆								◆	◆	◆			◆	
Hole Straightness	◆									◆	◆	◆			◆	
Deflection		◆														
Point Deflection															◆	
Galling					◆											
Vibration			◆								◆	◆			◆	
Abnormal Noise					◆											
Chip Packing	◆	◆	◆		◆		◆	◆	◆							
No Drill Penetration										◆				◆		

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Reamer Troubleshooting

	POSSIBLE SOLUTIONS																			
	SPEEDS & FEEDS							TOOL GEOMETRY							COOLANT AND STOCK REMOVAL				
PROBLEM	Reduce Feed	Increase Feed	Reduce Feed	Increase Speed	Use Larger Reamer	Use Smaller Reamer	Bad Speed and Feed	Worn Tool Margin	Worn Cutting Edge	Uneven Lip Height	Chip Capacity of Reamer	Too Much Clearance	Grind Larger Back Taper	Bent Reamer	Insufficient Stock	Too Much Stock	Use Coolant	Run Dry	Poor Hole Prep
Burnishing		◆									◆				◆				
Reamer Wear	◆		◆				◆									◆	◆		◆
Hole Quality	◆		◆				◆	◆	◆	◆					◆	◆	◆		◆
Hole ≤size	◆		◆		◆			◆	◆	◆					◆	◆	◆		
Hole ≥ size		◆		◆		◆		◆	◆					◆		◆	◆	◆	◆
Accuracy	◆					◆				◆							◆		
Chatter		◆	◆							◆	◆	◆			◆		◆		
Out of Round Hole					◆			◆	◆	◆	◆				◆	◆	◆		
Hole Taper						◆		◆	◆	◆			◆			◆	◆		
Bell Mouth		◆					◆	◆	◆		◆		◆	◆			◆		
Reamer Life		◆	◆				◆			◆		◆					◆		
Scoring in Bore							◆	◆	◆	◆					◆	◆	◆		◆
Deflection																			

NOTE: All recommendations are considered as starting parameters only

Consider the following variables when trying to diagnose tool failure:

1) Machine rigidity
2) Concentricity at spindle
3) Work piece rigidity
4) Coolant type
5) Recommended feeds and speeds
6) Tool Selection

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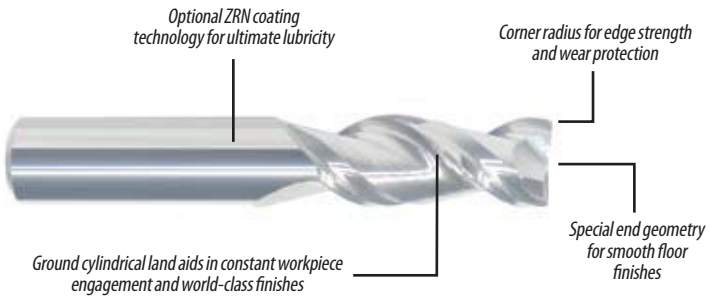
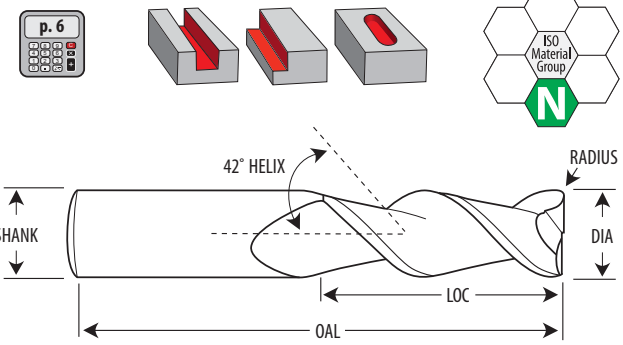
AVALANCHE 2CR





DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ZRN
		1/4	1/8	1-1/2	Stub	0.010	282-125250	282-125250D
						0.010	282-125500	282-125500D
1/8	0.1250	1/2	1/8	1-1/2	Regular	0.015	282-125501	282-125501D
						0.020	282-125502	282-125502D
						0.030	282-125503	282-125503D
		1-1/8	1/8	3	X/Long	0.010	282-126112	282-126112D
5/32	0.1563	5/8	3/16	2	Regular	0.010	282-156625	282-156625D
		5/16	3/16	2	Stub	0.010	282-187312	282-187312D
						0.010	282-187625	282-187625D
3/16	0.1875	5/8	3/16	2	Regular	0.015	282-187626	282-187626D
						0.020	282-187627	282-187627D
						0.030	282-187628	282-187628D
		1-1/8	3/16	3	X/Long	0.010	282-188112	282-188112D
7/32	0.2188	3/4	1/4	2-1/2	Regular	0.010	282-218750	282-218750D
		1/2	1/4	2	Stub	0.015	282-250500	282-250500D
						0.015	282-250750	282-250750D
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.030	282-250751	282-250751D
						0.060	282-250752	282-250752D
						0.090	282-250753	282-250753D
		1-1/4	1/4	3	Long	0.015	282-251500	282-251500D
		2	1/4	4	X/Long	0.015	282-252000	282-252000D
9/32	0.2813	13/16	5/16	2-1/2	Regular	0.015	282-281812	282-281812D
		1/2	5/16	2-1/2	Stub	0.015	282-312500	282-312500D
						0.015	282-312812	282-312812D
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.030	282-312813	282-312813D
						0.060	282-312814	282-312814D
		1-3/8	5/16	3	Long	0.015	282-313375	282-313375D
		2	5/16	4	X/Long	0.015	282-314000	282-314000D
		5/8	3/8	2-1/2	Stub	0.015	282-370625	282-370625D
						0.015	282-371125	282-371125D
						0.030	282-371126	282-371126D
		1-1/8	3/8	2-1/2	Regular	0.060	282-371127	282-371127D
3/8	0.3750					0.090	282-371128	282-371128D
						0.120	282-371129	282-371129D
		1-3/8	3/8	3	Long	0.015	282-371375	282-371375D
		2	3/8	4	X/Long	0.015	282-372000	282-372000D
		3	3/8	6	XX/Long	0.015	282-373000	282-373000D
7/16	0.4375	1-1/4	7/16	2-3/4	Regular	0.015	282-431250	282-431250D
		3/4	1/2	2-1/2	Stub	0.015	282-500750	282-500750D
						0.015	282-501250	282-501250D
						0.020	282-501251	282-501251D
1/2	0.5000	1-1/4	1/2	3	Regular	0.030	282-501252	282-501252D
						0.060	282-501253	282-501253D
						0.090	282-501254	282-501254D
						0.120	282-501255	282-501255D

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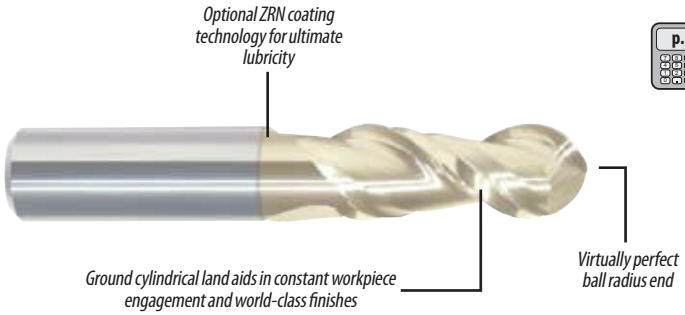
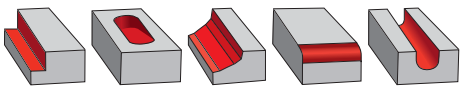
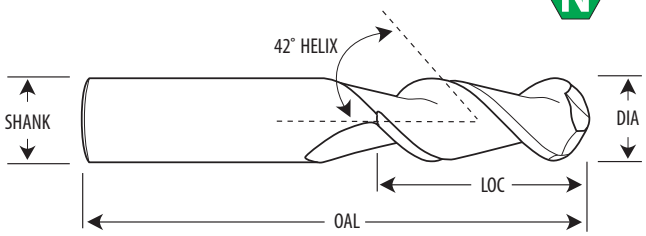
AVALANCHE 2CR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ZRN
1/2	0.5000	2	1/2	4	Long	0.015	282-502000	282-502000D
		3-1/8	1/2	6	X/Long	0.015	282-503125	282-503125D
5/8	0.6250	1-1/4	5/8	3	Stub	0.030	282-621250	282-621250D
		1-5/8	5/8	3-1/2	Regular	0.030	282-621625	282-621625D
						0.060	282-621626	282-621626D
						0.090	282-621627	282-621627D
						0.120	282-621628	282-621628D
		2-1/2	5/8	5	Long	0.030	282-622500	282-622500D
		3-1/8	5/8	6	X/Long	0.030	282-623125	282-623125D
3/4	0.7500	1-1/4	3/4	3	Stub	0.030	282-751000	282-751000D
		1-3/4	3/4	4	Regular	0.030	282-751750	282-751750D
						0.060	282-751751	282-751751D
						0.090	282-751752	282-751752D
						0.120	282-751753	282-751753D
						0.156	282-751754	282-751754D
						0.190	282-751755	282-751755D
		2-1/2	3/4	5	Long	0.030	282-752500	282-752500D
		3-1/4	3/4	6	X/Long	0.030	282-753250	282-753250D
1	1.0000	1-3/4	1	4	Regular	0.030	282-911750	282-911750D
		2-5/8	1	5	Long	0.030	282-912625	282-912625D
		3-1/4	1	6	X/Long	0.030	282-913250	282-913250D
		4-1/8	1	7	XX/Long	0.030	282-914125	282-914125D

AVALANCHE 2BN







DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	BRIGHT	ZRN
1/8	0.1250	1/2	1/8	1-1/2	Regular	282-125510	282-125510D
5/32	0.1563	5/8	3/16	2	Regular	282-156635	282-156635D
3/16	0.1875	5/8	3/16	2	Regular	282-187635	282-187635D
7/32	0.2188	3/4	1/4	2-1/2	Regular	282-218760	282-218760D
1/4	0.2500	3/4	1/4	2-1/2	Regular	282-250760	282-250760D
5/16	0.3125	13/16	5/16	2-1/2	Regular	282-312822	282-312822D
3/8	0.3750	1-1/8	3/8	2-1/2	Regular	282-371135	282-371135D
7/16	0.4375	1-1/4	7/16	2-3/4	Regular	282-431260	282-431260D
1/2	0.5000	1-1/4	1/2	3	Regular	282-501260	282-501260D
5/8	0.6250	1-5/8	5/8	3-1/2	Regular	282-621635	282-621635D
3/4	0.7500	1-3/4	3/4	4	Regular	282-751760	282-751760D
1	1.0000	1-3/4	1	4	Regular	282-911760	282-911760D

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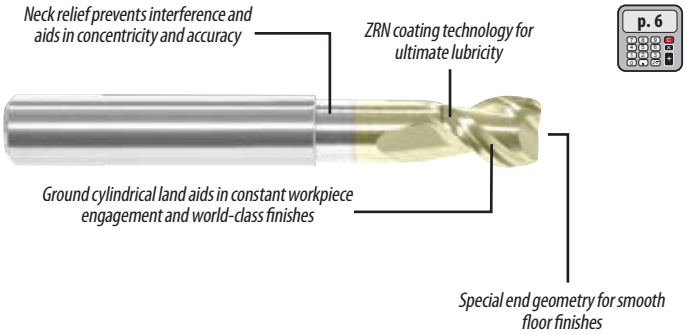
AVALANCHE 2LR



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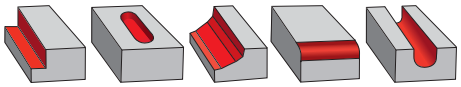

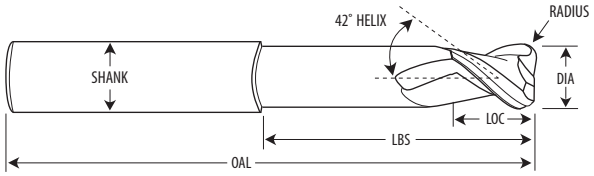

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LBS	RADIUS	ZRN
1/8	0.1250	1/4	1/8	1-1/2	1/2	0.010	274-121001D
						0.015	274-121002D
						0.020	274-121003D
						0.030	274-121004D
1/8	0.1250	1/4	1/8	3	1-3/8	0.010	274-121005D
						0.015	274-121006D
						0.020	274-121007D
						0.030	274-121008D
3/16	0.1875	5/16	3/16	2	1/2	0.010	274-121021D
						0.015	274-121022D
						0.020	274-121023D
						0.030	274-121024D
3/16	0.1875	5/16	3/16	3	1-3/8	0.010	274-121025D
						0.015	274-121026D
						0.020	274-121027D
						0.030	274-121028D
1/4	0.2500	3/8	1/4	2-1/2	1-1/8	0.015	274-121041D
						0.030	274-121042D
						0.060	274-121043D
						0.090	274-121044D
1/4	0.2500	3/8	1/4	4	2-1/8	0.015	274-121045D
						0.030	274-121046D
						0.060	274-121047D
						0.090	274-121048D
1/4	0.2500	3/4	1/4	4	2-1/8	0.015	274-121049D
						0.030	274-121050D
						0.060	274-121051D
						0.090	274-121052D
5/16	0.3125	7/16	5/16	2-1/2	1-1/8	0.015	274-121071D
						0.030	274-121072D
						0.060	274-121073D
5/16	0.3125	13/16	5/16	4	2-1/8	0.015	274-121074D
						0.030	274-121075D
						0.060	274-121076D
3/8	0.3750	1/2	3/8	3	1-1/2	0.015	274-121091D
						0.030	274-121092D
						0.060	274-121093D
						0.090	274-121094D
						0.120	274-121095D
3/8	0.3750	1/2	3/8	4	2-1/8	0.015	274-121096D
						0.030	274-121097D
						0.060	274-121098D
						0.090	274-121099D
						0.120	274-121100D

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AVALANCHE 2LR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LBS	RADIUS	ZRN
3/8	0.3750	1	3/8	4	2-1/8	0.015	274-121101D
						0.030	274-121102D
						0.060	274-121103D
						0.090	274-121104D
						0.120	274-121105D
1/2	0.5000	5/8	1/2	3	1-3/8	0.015	274-121131D
						0.020	274-121132D
						0.030	274-121133D
						0.060	274-121134D
						0.090	274-121135D
						0.120	274-121136D
1/2	0.5000	5/8	1/2	4	2-3/8	0.015	274-121140D
						0.020	274-121141D
						0.030	274-121142D
						0.060	274-121143D
						0.090	274-121144D
						0.120	274-121145D
1/2	0.5000	5/8	1/2	6	3-3/8	0.015	274-121150D
						0.020	274-121151D
						0.030	274-121152D
						0.060	274-121153D
						0.090	274-121154D
						0.120	274-121155D
1/2	0.5000	1-1/4	1/2	6	3-3/8	0.015	274-121160D
						0.020	274-121161D
						0.030	274-121162D
						0.060	274-121163D
						0.090	274-121164D
						0.120	274-121165D
5/8	0.6250	3/4	5/8	3-1/2	1-5/8	0.030	274-121201D
						0.060	274-121202D
						0.090	274-121203D
						0.120	274-121204D
5/8	0.6250	3/4	5/8	5	2-3/8	0.030	274-121211D
						0.060	274-121212D
						0.090	274-121213D
						0.120	274-121214D
5/8	0.6250	3/4	5/8	6	3-3/8	0.030	274-121221D
						0.060	274-121222D
						0.090	274-121223D
						0.120	274-121224D
5/8	0.6250	1-1/2	5/8	6	3-3/8	0.030	274-121231D
						0.060	274-121232D
						0.090	274-121233D
						0.120	274-121234D
3/4	0.7500	1	3/4	4	2	0.030	274-121271D
						0.060	274-121272D
						0.090	274-121273D
						0.120	274-121274D
						0.156	274-121275D
						0.190	274-121276D
3/4	0.7500	1	3/4	5	3	0.030	274-121281D
						0.060	274-121282D
						0.090	274-121283D
						0.120	274-121284D
						0.156	274-121285D
						0.190	274-121286D
3/4	0.7500	1	3/4	6	3-1/2	0.030	274-121291D
						0.060	274-121292D
						0.090	274-121293D
						0.120	274-121294D
						0.156	274-121295D
						0.190	274-121296D

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AVALANCHE 2LR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LBS	RADIUS	ZRN
3/4	0.7500	1	3/4	7	4-1/2	0.030	274-121311D
						0.060	274-121312D
						0.090	274-121313D
						0.120	274-121314D
						0.156	274-121315D
						0.190	274-121316D
3/4	0.7500	1	3/4	8	5-1/2	0.030	274-121331D
						0.060	274-121332D
						0.090	274-121333D
						0.120	274-121334D
						0.156	274-121335D
						0.190	274-121336D
3/4	0.7500	1-5/8	3/4	6	3-1/2	0.030	274-121341D
						0.060	274-121342D
						0.090	274-121343D
						0.120	274-121344D
						0.156	274-121345D
						0.190	274-121346D
1	1.0000	1-1/4	1	5	2-1/2	0.030	274-121401D
						0.060	274-121402D
						0.090	274-121403D
						0.120	274-121404D
						0.156	274-121405D
						0.190	274-121406D
						0.250	274-121407D
1	1.0000	1-1/4	1	6	3-1/2	0.030	274-121421D
						0.060	274-121422D
						0.090	274-121423D
						0.120	274-121424D
						0.156	274-121425D
						0.190	274-121426D
						0.250	274-121427D
1	1.0000	1-1/4	1	7	3-1/2	0.030	274-121431D
						0.060	274-121432D
						0.090	274-121433D
						0.120	274-121434D
						0.156	274-121435D
						0.190	274-121436D
						0.250	274-121437D
1	1.0000	1-1/4	1	8	5-1/2	0.030	274-121441D
						0.060	274-121442D
						0.090	274-121443D
						0.120	274-121444D
						0.156	274-121445D
						0.190	274-121446D
						0.250	274-121447D
1	1.0000	2	1	7	4-1/2	0.030	274-121461D
						0.060	274-121462D
						0.090	274-121463D
						0.120	274-121464D
						0.156	274-121465D
						0.190	274-121466D
						0.250	274-121467D
1	1.0000	2	1	8	5-1/2	0.030	274-121471D
						0.060	274-121472D
						0.090	274-121473D
						0.120	274-121474D
						0.156	274-121475D
						0.190	274-121476D
						0.250	274-121477D

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PROFILING

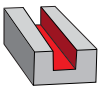
Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group		SFM based on RDOC: Cutting Diameter Engaged 10%	20%	30%	50%	IPT * (BASELINE): Cutting Diameter 1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Non-Ferrous	Aluminum /Aluminum Alloys < 10% Si	2000	1800	1200	900	0.0025	0.0037	0.0050	0.0062	0.0075	0.0100	0.0125	0.0150	0.0200
	Aluminum /Aluminum Alloys > 10% Si	1500	1200	1000	800									
	Brass	900	800	600	500									
	Cu/Cu Alloys / Magnesium	1000	800	600	500									
	Plastics	900	800	600	500									

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	2 x
20%	3.1 x
10%	3.8 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

SLOTTING



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group		SFM: Cutting Diameter Engaged 25%	50%	100%	IPT: Cutting Diameter 1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Non-Ferrous	Aluminum /Aluminum Alloys < 10% Si	2000	1500	1000	0.0012	0.0018	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100
	Aluminum /Aluminum Alloys > 10% Si	1500	1200	800									
	Brass	600	500	400	0.0018	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100	0.0120
	Cu/Cu Alloys / Magnesium	500	400	300									
	Plastics	1200	1000	800									

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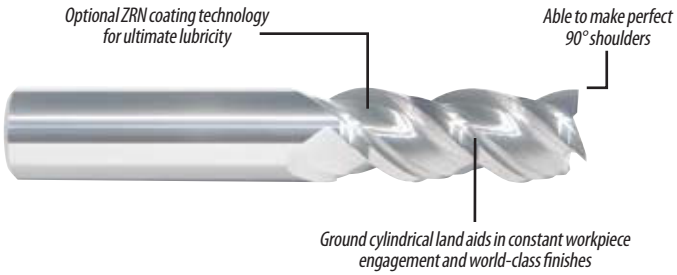
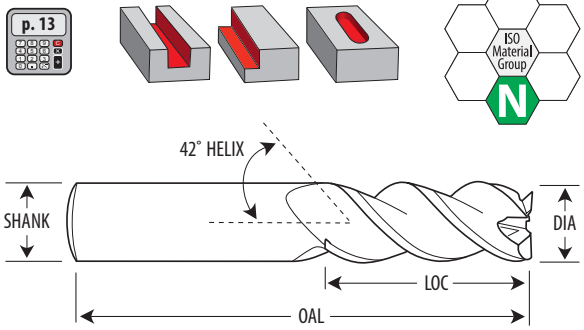
AVALANCHE 3SQ





DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	BRIGHT	ZRN
1/8	0.1250	1/2	1/8	1-1/2	Regular	273-125500	273-125500D
		1-1/8	1/8	3	X/Long	273-126112	273-126112D
3/16	0.1875	5/8	3/16	2	Regular	273-187625	273-187625D
		1-1/8	3/16	3	X/Long	273-188112	273-188112D
1/4	0.2500	3/4	1/4	2-1/2	Regular	273-250750	273-250750D
		1-1/4	1/4	3	Long	273-251500	273-251500D
		2	1/4	4	X/Long	273-252000	273-252000D
5/16	0.3125	13/16	5/16	2-1/2	Regular	273-312812	273-312812D
		1-3/8	5/16	3	Long	273-313375	273-313375D
		2	5/16	4	X/Long	273-314000	273-314000D
3/8	0.3750	1-1/8	3/8	2-1/2	Regular	273-371125	273-371125D
		1-3/8	3/8	3	Long	273-371375	273-371375D
		2	3/8	4	X/Long	273-372000	273-372000D
		3	3/8	6	X/Long	273-373000	273-373000D
7/16	0.4375	1-1/4	7/16	2-3/4	Regular	273-431250	273-431250D
1/2	0.5000	1-1/4	1/2	3	Regular	273-501250	273-501250D
		2	1/2	4	Long	273-502000	273-502000D
		3-1/8	1/2	6	X/Long	273-503125	273-503125D
5/8	0.6250	1-5/8	5/8	3-1/2	Regular	273-621625	273-621625D
		2-1/2	5/8	5	Long	273-622500	273-622500D
		3-1/8	5/8	6	X/Long	273-623125	273-623125D
3/4	0.7500	1-3/4	3/4	4	Regular	273-751750	273-751750D
		2-1/2	3/4	5	Long	273-752500	273-752500D
		3-1/4	3/4	6	X/Long	273-753250	273-753250D
1	1.0000	1-3/4	1	4	Regular	273-911750	273-911750D
		2-5/8	1	5	Long	273-912625	273-912625D
		3-1/4	1	6	X/Long	273-913250	273-913250D

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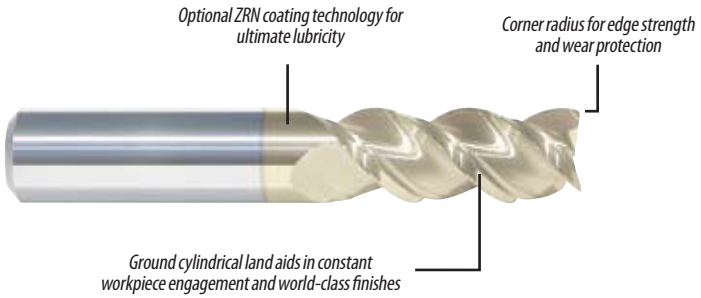
AVALANCHE 3CR



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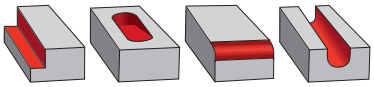

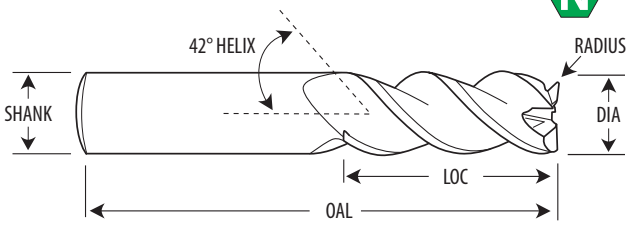

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ZRN
1/8	0.1250	1/4	1/8	1-1/2	Stub	0.010	283-125250	283-125250D
		1/2	1/8	1-1/2	Regular	0.010	283-125500	283-125500D
						0.015	283-125501	283-125501D
						0.020	283-125502	283-125502D
						0.030	283-125503	283-125503D
		1-1/8	1/8	3	X/Long	0.010	283-126112	283-126112D
5/32	0.1563	5/8	3/16	2	Regular	0.010	283-156625	283-156625D
3/16	0.1875	5/16	3/16	2	Stub	0.010	283-187312	283-187312D
		5/8	3/16	2	Regular	0.010	283-187625	283-187625D
						0.015	283-187626	283-187626D
						0.020	283-187627	283-187627D
						0.030	283-187628	283-187628D
		1-1/8	3/16	3	X/Long	0.010	283-188112	283-188112D
7/32	0.2188	3/4	1/4	2-1/2	Regular	0.010	283-218750	283-218750D
1/4	0.2500	1/2	1/4	2	Stub	0.015	283-250500	283-250500D
		3/4	1/4	2-1/2	Regular	0.015	283-250750	283-250750D
						0.030	283-250751	283-250751D
						0.060	283-250752	283-250752D
						0.090	283-250753	283-250753D
		1-1/4	1/4	3	Long	0.015	283-251500	283-251500D
		2	1/4	4	X/Long	0.015	283-252000	283-252000D
9/32	0.2813	13/16	5/16	2-1/2	Regular	0.015	283-281812	283-281812D
5/16	0.3125	1/2	5/16	2-1/2	Stub	0.015	283-312500	283-312500D
		13/16	5/16	2-1/2	Regular	0.015	283-312812	283-312812D
						0.030	283-312813	283-312813D
						0.060	283-312814	283-312814D
		1-3/8	5/16	3	Long	0.015	283-313375	283-313375D
		2	5/16	4	X/Long	0.015	283-314000	283-314000D
3/8	0.3750	5/8	3/8	2-1/2	Stub	0.015	283-370625	283-370625D
		1-1/8	3/8	2-1/2	Regular	0.015	283-371125	283-371125D
						0.030	283-371126	283-371126D
						0.060	283-371127	283-371127D
						0.090	283-371128	283-371128D
						0.120	283-371129	283-371129D
		1-3/8	3/8	3	Long	0.015	283-371375	283-371375D
		2	3/8	4	X/Long	0.015	283-372000	283-372000D
		3	3/8	6	XX/Long	0.015	283-373000	283-373000D
7/16	0.4375	1-1/4	7/16	2-3/4	Regular	0.015	283-431250	283-431250D
1/2	0.5000	3/4	1/2	2-1/2	Stub	0.015	283-500750	283-500750D
		1-1/4	1/2	3	Regular	0.015	283-501250	283-501250D
						0.020	283-501251	283-501251D
						0.030	283-501252	283-501252D
						0.060	283-501253	283-501253D
						0.090	283-501254	283-501254D
						0.120	283-501255	283-501255D

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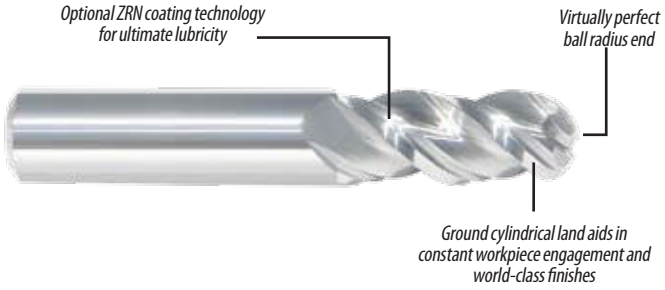
AVALANCHE 3CR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ZRN
1/2	0.5000	2	1/2	4	Long	0.015	283-502000	283-502000D
		3-1/8	1/2	6	X/Long	0.015	283-503125	283-503125D
5/8	0.6250	1-1/4	5/8	3	Stub	0.030	283-621250	283-621250D
		1-5/8	5/8	3-1/2	Regular	0.030	283-621625	283-621625D
						0.060	283-621626	283-621626D
						0.090	283-621627	283-621627D
						0.120	283-621628	283-621628D
		2-1/2	5/8	5	Long	0.030	283-622500	283-622500D
		3-1/8	5/8	6	X/Long	0.030	283-623125	283-623125D
3/4	0.7500	1-1/4	3/4	3	Stub	0.030	283-751000	283-751000D
		1-3/4	3/4	4	Regular	0.030	283-751750	283-751750D
						0.060	283-751751	283-751751D
						0.090	283-751752	283-751752D
						0.120	283-751753	283-751753D
						0.156	283-751754	283-751754D
						0.190	283-751755	283-751755D
		2-1/2	3/4	5	Long	0.030	283-752500	283-752500D
		3-1/4	3/4	6	X/Long	0.030	283-753250	283-753250D
1	1.0000	1-3/4	1	4	Regular	0.030	283-911750	283-911750D
		2-5/8	1	5	Long	0.030	283-912625	283-912625D
		3-1/4	1	6	X/Long	0.030	283-913250	283-913250D
		4-1/8	1	7	XX/Long	0.030	283-914125	283-914125D

AVALANCHE 3BN



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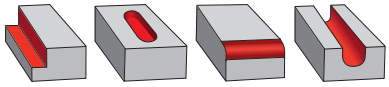

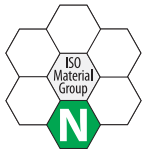

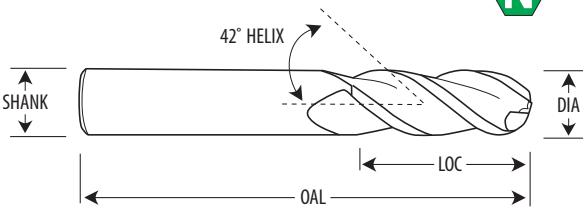

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	BRIGHT	ZRN
1/8	0.1250	1/2	1/8	1-1/2	Regular	283-125510	283-125510D
5/32	0.1563	5/8	3/16	2	Regular	283-156635	283-156635D
3/16	0.1875	5/8	3/16	2	Regular	283-187635	283-187635D
7/32	0.2188	3/4	1/4	2-1/2	Regular	283-218760	283-218760D
1/4	0.2500	3/4	1/4	2-1/2	Regular	283-250760	283-250760D
5/16	0.3125	13/16	5/16	2-1/2	Regular	283-312822	283-312822D
3/8	0.3750	1-1/8	3/8	2-1/2	Regular	283-371135	283-371135D
7/16	0.4375	1-1/4	7/16	2-3/4	Regular	283-431260	283-431260D
1/2	0.5000	1-1/4	1/2	3	Regular	283-501260	283-501260D
5/8	0.6250	1-5/8	5/8	3-1/2	Regular	283-621635	283-621635D
3/4	0.7500	1-3/4	3/4	4	Regular	283-751760	283-751760D
1	1.0000	1-3/4	1	4	Regular	283-911760	283-911760D

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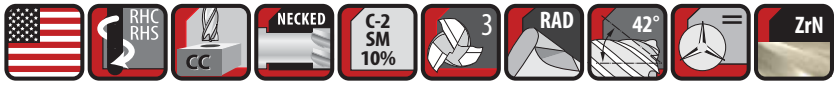
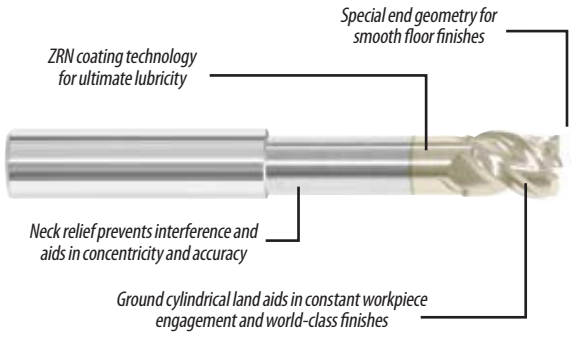
AVALANCHE 3LR





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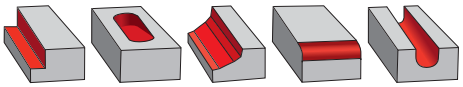

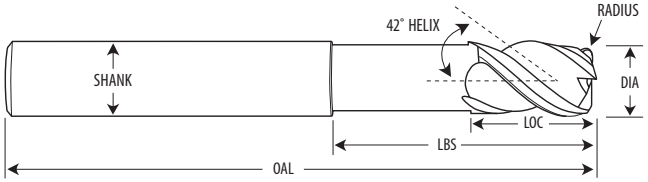

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LBS	RADIUS	ZRN
1/8	0.1250	1/4	1/8	1-1/2	1/2	0.010	274-131001D
						0.015	274-131002D
						0.020	274-131003D
						0.030	274-131004D
1/8	0.1250	1/4	1/8	3	1-3/8	0.010	274-131005D
						0.015	274-131006D
						0.020	274-131007D
						0.030	274-131008D
3/16	0.1875	5/16	3/16	2	1/2	0.010	274-131021D
						0.015	274-131022D
						0.020	274-131023D
						0.030	274-131024D
3/16	0.1875	5/16	3/16	3	1-3/8	0.010	274-131025D
						0.015	274-131026D
						0.020	274-131027D
						0.030	274-131028D
1/4	0.2500	3/8	1/4	2-1/2	1-1/8	0.015	274-131041D
						0.030	274-131042D
						0.060	274-131043D
						0.090	274-131044D
1/4	0.2500	3/8	1/4	4	2-1/8	0.015	274-131045D
						0.030	274-131046D
						0.060	274-131047D
						0.090	274-131048D
1/4	0.2500	3/4	1/4	4	2-1/8	0.015	274-131049D
						0.030	274-131050D
						0.060	274-131051D
						0.090	274-131052D
5/16	0.3125	7/16	5/16	2-1/2	1-1/8	0.015	274-131071D
						0.030	274-131072D
						0.060	274-131073D
5/16	0.3125	13/16	5/16	4	2-1/8	0.015	274-131074D
						0.030	274-131075D
						0.060	274-131076D
3/8	0.3750	1/2	3/8	3	1-1/2	0.015	274-131091D
						0.030	274-131092D
						0.060	274-131093D
						0.090	274-131094D
						0.120	274-131095D
3/8	0.3750	1/2	3/8	4	2-1/8	0.015	274-131096D
						0.030	274-131097D
						0.060	274-131098D
						0.090	274-131099D
						0.120	274-131100D

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AVALANCHE 3LR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LBS	RADIUS	ZRN
3/8	0.3750	1	3/8	4	2-1/8	0.015	274-131101D
						0.030	274-131102D
						0.060	274-131103D
						0.090	274-131104D
						0.120	274-131105D
1/2	0.5000	5/8	1/2	3	1-3/8	0.015	274-131131D
						0.020	274-131132D
						0.030	274-131133D
						0.060	274-131134D
						0.090	274-131135D
						0.120	274-131136D
1/2	0.5000	5/8	1/2	4	2-3/8	0.015	274-131140D
						0.020	274-131141D
						0.030	274-131142D
						0.060	274-131143D
						0.090	274-131144D
						0.120	274-131145D
1/2	0.5000	5/8	1/2	6	3-3/8	0.015	274-131150D
						0.020	274-131151D
						0.030	274-131152D
						0.060	274-131153D
						0.090	274-131154D
						0.120	274-131155D
1/2	0.5000	1-1/4	1/2	6	3-3/8	0.015	274-131160D
						0.020	274-131161D
						0.030	274-131162D
						0.060	274-131163D
						0.090	274-131164D
						0.120	274-131165D
5/8	0.6250	3/4	5/8	3-1/2	1-5/8	0.030	274-131201D
						0.060	274-131202D
						0.090	274-131203D
						0.120	274-131204D
5/8	0.6250	3/4	5/8	5	2-3/8	0.030	274-131211D
						0.060	274-131212D
						0.090	274-131213D
						0.120	274-131214D
5/8	0.6250	3/4	5/8	6	3-3/8	0.030	274-131221D
						0.060	274-131222D
						0.090	274-131223D
						0.120	274-131224D
5/8	0.6250	1-1/2	5/8	6	3-3/8	0.030	274-131231D
						0.060	274-131232D
						0.090	274-131233D
						0.120	274-131234D
3/4	0.7500	1	3/4	4	2	0.030	274-131271D
						0.060	274-131272D
						0.090	274-131273D
						0.120	274-131274D
						0.156	274-131275D
						0.190	274-131276D
3/4	0.7500	1	3/4	5	3	0.030	274-131281D
						0.060	274-131282D
						0.090	274-131283D
						0.120	274-131284D
						0.156	274-131285D
						0.190	274-131286D
3/4	0.7500	1	3/4	6	3-1/2	0.030	274-131291D
						0.060	274-131292D
						0.090	274-131293D
						0.120	274-131294D
						0.156	274-131295D
						0.190	274-131296D

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AVALANCHE 3LR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LBS	RADIUS	ZRN
3/4	0.7500	1	3/4	7	4-1/2	0.030	274-131311D
						0.060	274-131312D
						0.090	274-131313D
						0.120	274-131314D
						0.156	274-131315D
						0.190	274-131316D
3/4	0.7500	1	3/4	8	5-1/2	0.030	274-131331D
						0.060	274-131332D
						0.090	274-131333D
						0.120	274-131334D
						0.156	274-131335D
						0.190	274-131336D
3/4	0.7500	1-5/8	3/4	6	3-1/2	0.030	274-131341D
						0.060	274-131342D
						0.090	274-131343D
						0.120	274-131344D
						0.156	274-131345D
						0.190	274-131346D
1	1.0000	1-1/4	1	5	2-1/2	0.030	274-131401D
						0.060	274-131402D
						0.090	274-131403D
						0.120	274-131404D
						0.156	274-131405D
						0.190	274-131406D
						0.250	274-131407D
1	1.0000	1-1/4	1	6	3-1/2	0.030	274-131421D
						0.060	274-131422D
						0.090	274-131423D
						0.120	274-131424D
						0.156	274-131425D
						0.190	274-131426D
						0.250	274-131427D
1	1.0000	1-1/4	1	7	4-1/2	0.030	274-131431D
						0.060	274-131432D
						0.090	274-131433D
						0.120	274-131434D
						0.156	274-131435D
						0.190	274-131436D
						0.250	274-131437D
1	1.0000	1-1/4	1	8	5-1/2	0.030	274-131441D
						0.060	274-131442D
						0.090	274-131443D
						0.120	274-131444D
						0.156	274-131445D
						0.190	274-131446D
						0.250	274-131447D
1	1.0000	2	1	7	4-1/2	0.030	274-131461D
						0.060	274-131462D
						0.090	274-131463D
						0.120	274-131464D
						0.156	274-131465D
						0.190	274-131466D
						0.250	274-131467D
1	1.0000	2	1	8	5-1/2	0.030	274-131471D
						0.060	274-131472D
						0.090	274-131473D
						0.120	274-131474D
						0.156	274-131475D
						0.190	274-131476D
						0.250	274-131477D

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MILLING RECOMMENDATIONS

AVALANCHE 3CR AVALANCHE 3BN AVALANCHE 3LR AVALANCHE 3SQ

PROFILING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group		SFM based on RDOC: Cutting Diameter Engaged 10%	20%	30%	50%	IPT * (BASELINE): Cutting Diameter 3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Non-Ferrous	Aluminum /Aluminum Alloys < 10% Si	2000	1800	1200	900	0.0018	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100
	Aluminum /Aluminum Alloys > 10% Si	1500	1200	1000	800	0.0018	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100
	Brass	900	800	600	500	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100	0.0120
	Cu/Cu Alloys / Magnesium	1000	800	600	500	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100	0.0120
	Plastics	900	800	600	500	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100	0.0120

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	2 x
20%	3.1 x
10%	3.8 x

† 1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

SLOTTING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group		SFM: Cutting Diameter Engaged 25%	50%	100%	IPT * (BASELINE): Cutting Diameter 3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Non-Ferrous	Aluminum /Aluminum Alloys < 10% Si	2000	1500	1000	0.0040 - 0.0060	0.0040 - 0.0080	0.0060 - 0.0090	0.0070 - 0.0120	0.0100 - 0.0450	0.0150 - 0.0450	0.0150 - 0.0450	0.0150 - 0.040
	Aluminum /Aluminum Alloys > 10% Si	1500	1200	800	0.0040 - 0.0060	0.0040 - 0.0080	0.0060 - 0.0090	0.0070 - 0.0120	0.0100 - 0.0450	0.0150 - 0.0450	0.0150 - 0.0450	0.0150 - 0.040
	Brass	600	500	400	0.0040 - 0.0060	0.0040 - 0.0080	0.0060 - 0.0090	0.0070 - 0.0120	0.0100 - 0.0450	0.0150 - 0.0450	0.0150 - 0.0450	0.0150 - 0.040
	Cu/Cu Alloys / Magnesium	500	400	300	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100	0.0120
	Plastics	1200	1000	800	0.0040 - 0.0060	0.0040 - 0.0080	0.0060 - 0.0090	0.0070 - 0.0120	0.0100 - 0.0450	0.0150 - 0.0450	0.0150 - 0.0450	0.0150 - 0.040

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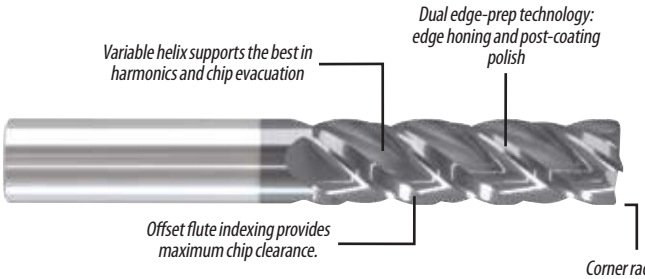
FUSION CR



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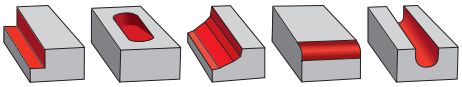

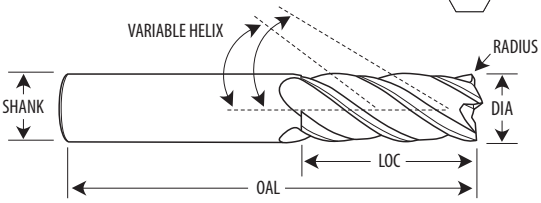

FUSING ADVANCED HP TECHNOLOGY WITH CLASSIC GP AFFORDABILITY

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTICRN
1/8	0.1250	1/4	1/8	1-1/2	Stub	0.010	284-000375	284-000376
						0.015	284-000377	284-000378
						0.020	284-000379	284-000380
						0.030	284-000381	284-000382
1/8	0.1250	1/2	1/8	1-1/2	Regular	0.010	284-000383	284-000384
						0.015	284-000385	284-000386
						0.020	284-000387	284-000388
						0.030	284-000389	284-000390
1/8	0.1250	3/4	1/8	2-1/4	Long	0.015	284-000391	284-000392
						0.020	284-000393	284-000394
						0.030	284-000395	284-000396
1/8	0.1250	1	1/8	3	X/Long	0.015	284-000397	284-000398
						0.020	284-000399	284-000400
						0.030	284-000401	284-000402
3/16	0.1875	3/8	3/16	2	Stub	0.010	284-000403	284-000404
						0.015	284-000405	284-000406
						0.020	284-000407	284-000408
						0.030	284-000409	284-000410
						0.045	284-000411	284-000412
3/16	0.1875	5/8	3/16	2	Regular	0.010	284-000413	284-000414
						0.015	284-000415	284-000416
						0.020	284-000417	284-000418
						0.030	284-000419	284-000420
						0.045	284-000421	284-000422
3/16	0.1875	3/4	3/16	2-1/2	Long	0.015	284-000423	284-000424
						0.020	284-000425	284-000426
						0.030	284-000427	284-000428
3/16	0.1875	1	3/16	4	Ext XX/Long	0.015	284-000435	284-000436
						0.020	284-000437	284-000438
						0.030	284-000439	284-000440
3/16	0.1875	1-1/8	3/16	3	X/Long	0.015	284-000429	284-000430
						0.020	284-000431	284-000432
						0.030	284-000433	284-000434
1/4	0.2500	1/2	1/4	2-1/2	Stub	0.015	284-000441	284-000442
						0.020	284-000443	284-000444
						0.030	284-000445	284-000446
						0.045	284-000447	284-000448
						0.060	284-000449	284-000450

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FUSION CR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTICRN
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.015	284-000451	284-000452
						0.020	284-000453	284-000454
						0.030	284-000455	284-000456
						0.045	284-000457	284-000458
						0.060	284-000459	284-000460
1/4	0.2500	1	1/4	4	X/Long	0.015	284-000471	284-000472
						0.020	284-000473	284-000474
						0.030	284-000475	284-000476
						0.045	284-000477	284-000478
						0.060	284-000479	284-000480
1/4	0.2500	1-1/8	1/4	3	Long	0.015	284-000461	284-000462
						0.020	284-000463	284-000464
						0.030	284-000465	284-000466
						0.045	284-000467	284-000468
						0.060	284-000469	284-000470
1/4	0.2500	1-1/2	1/4	4	X/Long	0.015	284-000481	284-000482
						0.020	284-000483	284-000484
						0.030	284-000485	284-000486
						0.045	284-000487	284-000488
						0.060	284-000489	284-000490
1/4	0.2500	1-1/2	1/4	6	Ext XX/Long	0.015	284-000491	284-000492
						0.020	284-000493	284-000494
						0.030	284-000495	284-000496
						0.045	284-000497	284-000498
						0.060	284-000499	284-000500
5/16	0.3125	1/2	5/16	2-1/2	Stub	0.015	284-000501	284-000502
						0.020	284-000503	284-000504
						0.030	284-000505	284-000506
						0.045	284-000507	284-000508
						0.060	284-000509	284-000510
						0.090	284-000511	284-000512
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.015	284-000513	284-000514
						0.020	284-000515	284-000516
						0.030	284-000517	284-000518
						0.045	284-000519	284-000520
						0.060	284-000521	284-000522
						0.090	284-000523	284-000524
5/16	0.3125	1-1/8	5/16	3	Long	0.015	284-000525	284-000526
						0.020	284-000527	284-000528
						0.030	284-000529	284-000530
						0.045	284-000531	284-000532
						0.060	284-000533	284-000534
5/16	0.3125	1-1/2	5/16	6	Ext XX/Long	0.015	284-000545	284-000546
						0.020	284-000547	284-000548
						0.030	284-000549	284-000550
						0.045	284-000551	284-000552
						0.060	284-000553	284-000554

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FUSION CRN CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTICRN
5/16	0.3125	1-5/8	5/16	4	X/Long	0.015	284-000535	284-000536
						0.020	284-000537	284-000538
						0.030	284-000539	284-000540
						0.045	284-000541	284-000542
						0.060	284-000543	284-000544
3/8	0.3750	5/8	3/8	2-1/2	Stub	0.015	284-000555	284-000556
						0.020	284-000557	284-000558
						0.030	284-000559	284-000560
						0.045	284-000561	284-000562
						0.060	284-000563	284-000564
						0.090	284-000565	284-000566
3/8	0.3750	1	3/8	2-1/2	Regular	0.015	284-000567	284-000568
						0.020	284-000569	284-000570
						0.030	284-000571	284-000572
						0.045	284-000573	284-000574
						0.060	284-000575	284-000576
						0.090	284-000577	284-000578
3/8	0.3750	1	3/8	4	Ext X/Long	0.015	284-000589	284-000590
						0.020	284-000591	284-000592
						0.030	284-000593	284-000594
						0.045	284-000595	284-000596
						0.060	284-000597	284-000598
3/8	0.3750	1-1/8	3/8	3	Long	0.015	284-000579	284-000580
						0.020	284-000581	284-000582
						0.030	284-000583	284-000584
						0.045	284-000585	284-000586
						0.060	284-000587	284-000588
3/8	0.3750	1-1/2	3/8	6	Ext XX/Long	0.015	284-000609	284-000610
						0.020	284-000611	284-000612
						0.030	284-000613	284-000614
						0.045	284-000615	284-000616
						0.060	284-000617	284-000618
3/8	0.3750	1-3/4	3/8	4	X/Long	0.015	284-000599	284-000600
						0.020	284-000601	284-000602
						0.030	284-000603	284-000604
						0.045	284-000605	284-000606
						0.060	284-000607	284-000608
7/16	0.4375	1	7/16	2-3/4	Regular	0.030	284-000619	284-000620
						0.045	284-000621	284-000622
						0.060	284-000623	284-000624
						0.090	284-000625	284-000626
						0.125	284-000627	284-000628

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FUSION (CR) CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTICRN
1/2	0.5000	5/8	1/2	3	Stub	0.015	284-000629	284-000630
						0.020	284-000631	284-000632
						0.030	284-000633	284-000634
						0.045	284-000635	284-000636
						0.060	284-000637	284-000638
						0.090	284-000639	284-000640
						0.125	284-000641	284-000642
1/2	0.5000	1	1/2	4	Sm/Med	0.015	284-000657	284-000658
						0.020	284-000659	284-000660
						0.030	284-000661	284-000662
						0.045	284-000663	284-000664
						0.060	284-000665	284-000666
						0.090	284-000667	284-000668
						0.125	284-000669	284-000670
1/2	0.5000	1-1/4	1/2	3	Regular	0.015	284-000643	284-000644
						0.020	284-000645	284-000646
						0.030	284-000647	284-000648
						0.045	284-000649	284-000650
						0.060	284-000651	284-000652
						0.090	284-000653	284-000654
						0.125	284-000655	284-000656
1/2	0.5000	1-1/2	1/2	4	Medium	0.015	284-000671	284-000672
						0.020	284-000673	284-000674
						0.030	284-000675	284-000676
						0.045	284-000677	284-000678
						0.060	284-000679	284-000680
						0.090	284-000681	284-000682
						0.125	284-000683	284-000684
1/2	0.5000	1-1/2	1/2	6	Ext X/Long	0.015	284-000699	284-000700
						0.020	284-000701	284-000702
						0.030	284-000703	284-000704
						0.045	284-000705	284-000706
						0.060	284-000707	284-000708
						0.090	284-000709	284-000710
						0.125	284-000711	284-000712
1/2	0.5000	2	1/2	4	Long	0.015	284-000685	284-000686
						0.020	284-000687	284-000688
						0.030	284-000689	284-000690
						0.045	284-000691	284-000692
						0.060	284-000693	284-000694
						0.090	284-000695	284-000696
						0.125	284-000697	284-000698
1/2	0.5000	3	1/2	6	X/Long	0.015	284-000713	284-000714
						0.020	284-000715	284-000716
						0.030	284-000717	284-000718
						0.045	284-000719	284-000720
						0.060	284-000721	284-000722
						0.090	284-000723	284-000724
						0.125	284-000725	284-000726

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FUSION CRN CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTICRN
5/8	0.6250	3/4	5/8	3-1/2	Stub	0.015	284-000727	284-000728
						0.020	284-000729	284-000730
						0.030	284-000731	284-000732
						0.045	284-000733	284-000734
						0.060	284-000735	284-000736
						0.090	284-000737	284-000738
						0.125	284-000739	284-000740
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	0.015	284-000741	284-000742
						0.020	284-000743	284-000744
						0.030	284-000745	284-000746
						0.045	284-000747	284-000748
						0.060	284-000749	284-000750
						0.090	284-000751	284-000752
						0.125	284-000753	284-000754
5/8	0.6250	1-1/2	5/8	6	Ext X/Long	0.030	284-000765	284-000766
						0.045	284-000767	284-000768
						0.060	284-000769	284-000770
						0.090	284-000771	284-000772
						0.125	284-000773	284-000774
5/8	0.6250	2-1/4	5/8	5	Long	0.030	284-000755	284-000756
						0.045	284-000757	284-000758
						0.060	284-000759	284-000760
						0.090	284-000761	284-000762
						0.125	284-000763	284-000764
5/8	0.6250	3	5/8	6	X/Long	0.030	284-000775	284-000776
						0.045	284-000777	284-000778
						0.060	284-000779	284-000780
						0.090	284-000781	284-000782
						0.125	284-000783	284-000784
3/4	0.7500	1	3/4	4	Stub	0.030	284-000785	284-000786
						0.045	284-000787	284-000788
						0.060	284-000789	284-000790
						0.090	284-000791	284-000792
						0.125	284-000793	284-000794
						0.190	284-000795	284-000796
						0.250	284-000797	284-000798
3/4	0.7500	1-1/2	3/4	4	Regular	0.030	284-000799	284-000800
						0.045	284-000801	284-000802
						0.060	284-000803	284-000804
						0.090	284-000805	284-000806
						0.125	284-000807	284-000808
						0.190	284-000809	284-000810
						0.250	284-000811	284-000812
3/4	0.7500	1-1/2	3/4	6	Ext X/Long	0.030	284-000825	284-000826
						0.045	284-000827	284-000828
						0.060	284-000829	284-000830
						0.090	284-000831	284-000832
						0.125	284-000833	284-000834
						0.250	284-000835	284-000836

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FUSION CR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTICRN
3/4	0.7500	2-1/4	3/4	5	Long	0.030	284-000813	284-000814
						0.045	284-000815	284-000816
						0.060	284-000817	284-000818
						0.090	284-000819	284-000820
						0.125	284-000821	284-000822
						0.250	284-000823	284-000824
3/4	0.7500	3	3/4	6	X/Long	0.030	284-000837	284-000838
						0.045	284-000839	284-000840
						0.060	284-000841	284-000842
						0.090	284-000843	284-000844
						0.125	284-000845	284-000846
						0.250	284-000847	284-000848
3/4	0.7500	4	3/4	7	XX/Long	0.030	284-000849	284-000850
						0.045	284-000851	284-000852
						0.060	284-000853	284-000854
						0.090	284-000855	284-000856
						0.125	284-000857	284-000858
						0.250	284-000859	284-000860
1	1.0000	1-1/2	1	4	Regular	0.030	284-000861	284-000862
						0.045	284-000863	284-000864
						0.060	284-000865	284-000866
						0.090	284-000867	284-000868
						0.125	284-000869	284-000870
						0.190	284-000871	284-000872
						0.250	284-000873	284-000874
1	1.0000	1-1/2	1	6	Ext X/Long	0.030	284-000887	284-000888
						0.045	284-000889	284-000890
						0.060	284-000891	284-000892
						0.090	284-000893	284-000894
						0.125	284-000895	284-000896
						0.250	284-000897	284-000898
1	1.0000	2-1/4	1	5	Long	0.030	284-000875	284-000876
						0.045	284-000877	284-000878
						0.060	284-000879	284-000880
						0.090	284-000881	284-000882
						0.125	284-000883	284-000884
						0.250	284-000885	284-000886
1	1.0000	3	1	6	X/Long	0.030	284-000899	284-000900
						0.045	284-000901	284-000902
						0.060	284-000903	284-000904
						0.090	284-000905	284-000906
						0.125	284-000907	284-000908
						0.250	284-000909	284-000910
1	1.0000	4	1	7	XX/Long	0.030	284-000911	284-000912
						0.045	284-000913	284-000914
						0.060	284-000915	284-000916
						0.090	284-000917	284-000918
						0.125	284-000919	284-000920
						0.250	284-000921	284-000922

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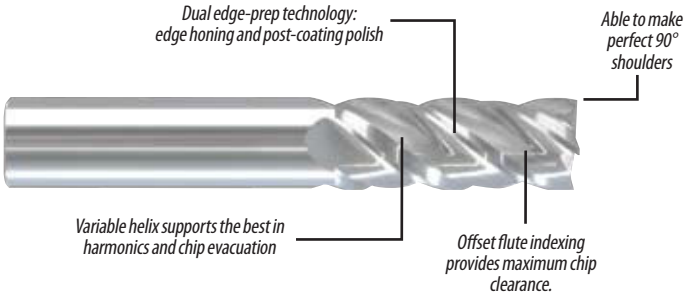
FUSION SQ



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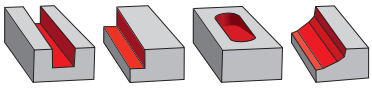

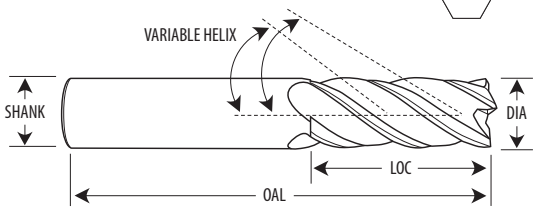

FUSING ADVANCED HP TECHNOLOGY WITH CLASSIC GP AFFORDABILITY

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	BRIGHT	ALTICRN
1/8	0.1250	1/4	1/8	1-1/2	Stub	284-000058	284-000059
		1/2	1/8	1-1/2	Regular	284-000060	284-000061
		3/4	1/8	2-1/4	Long	284-000062	284-000063
		1	1/8	3	X/Long	284-000064	284-000065
3/16	0.1875	3/8	3/16	2	Stub	284-000088	284-000089
		5/8	3/16	2	Regular	284-000090	284-000091
		3/4	3/16	2-1/2	Long	284-000092	284-000093
		1-1/8	3/16	3	X/Long	284-000094	284-000095
1/4	0.2500	1/2	1/4	2-1/2	Stub	284-000118	284-000119
		3/4	1/4	2-1/2	Regular	284-000120	284-000121
		1-1/8	1/4	3	Long	284-000122	284-000123
		1-1/2	1/4	4	X/Long	284-000124	284-000125
5/16	0.3125	1/2	5/16	2-1/2	Stub	284-000148	284-000149
		13/16	5/16	2-1/2	Regular	284-000150	284-000151
		1-1/8	5/16	3	Long	284-000152	284-000153
		1-5/8	5/16	4	X/Long	284-000154	284-000155
3/8	0.3750	5/8	3/8	2-1/2	Stub	284-000178	284-000179
		1	3/8	2-1/2	Regular	284-000180	284-000181
		1-1/8	3/8	3	Long	284-000182	284-000183
		1-3/4	3/8	4	X/Long	284-000184	284-000185
7/16	0.4375	1	7/16	2-3/4	Regular	284-000210	284-000211
		2	7/16	4	Long	284-000212	284-000213
		3	7/16	6	X/Long	284-000214	284-000215
1/2	0.5000	5/8	1/2	3	Stub	284-000238	284-000239
		1	1/2	3	Regular	284-000240	284-000241
		1-1/4	1/2	3	Regular	284-000242	284-000243
		1-1/2	1/2	4	Medium	284-000244	284-000245
		2	1/2	4	Long	284-000246	284-000247
		3	1/2	6	X/Long	284-000248	284-000249
5/8	0.6250	3/4	5/8	3-1/2	Stub	284-000268	284-000269
		1-1/4	5/8	3-1/2	Regular	284-000270	284-000271
		2-1/4	5/8	5	Long	284-000272	284-000273
		3	5/8	6	X/Long	284-000274	284-000275
3/4	0.7500	1	3/4	4	Stub	284-000298	284-000299
		1-1/2	3/4	4	Regular	284-000300	284-000301
		2-1/4	3/4	5	Long	284-000302	284-000303
		3	3/4	6	X/Long	284-000304	284-000305
		4	3/4	7	XX/Long	284-000306	284-000307
1	1.0000	1-1/2	1	4	Regular	284-000330	284-000331
		2-1/4	1	5	Long	284-000332	284-000333
		3	1	6	X/Long	284-000334	284-000335
		4	1	7	XX/Long	284-000336	284-000337

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PROFILING

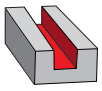
Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM based on RDOC: Cutting Diameter Engaged 5%	10%	20%	30%	50%	IPT * (BASELINE): Cutting Diameter 1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	1050	700	385	375	350	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	630	420	320	250	210	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	525	350	300	275	250	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	650	600	550	500	450	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	525	400	350	300	250	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		> 28 Rc	525	400	350	300	250	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	265	200	175	150	100	0.00048	0.00065	0.00096	0.0017	0.0019	0.0028	0.0032	0.0038	0.0054
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	230	200	175	150	125	0.00048	0.00065	0.00096	0.0017	0.0019	0.0028	0.0032	0.0038	0.0054
Hardened Materials		H	45-55 Rc	250	240	230	210	200	0.00360	0.00432	0.00504	0.0022	0.0025	0.0036	0.0043	0.0050	0.0072
Cast-Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	425	400	375	350	300	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	320	300	250	225	200	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		1000	960	920	880	840	0.00048	0.00065	0.00096	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

SLOTTING



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM: Cutting Diameter Engaged 25%	50%	100%	IPT * (BASELINE): Cutting Diameter 1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	462	444	420	0.00060	0.00084	0.00120	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	294	276	2652	0.00048	0.00084	0.00108	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	252	234	210	0.00048	0.00072	0.00096	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	462	444	420	0.00060	0.00084	0.00120	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	294	252	210	0.00048	0.00084	0.00108	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		> 28 Rc	252	234	210	0.00036	0.00048	0.00060	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	150	126	108	0.00036	0.00048	0.00060	0.0010	0.0012	0.0016	0.0019	0.0020	0.0031
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	120	108	96	0.00036	0.00048	0.00060	0.0010	0.0012	0.0016	0.0019	0.0020	0.0031
Hardened Materials		H	34-45 Rc	294	276	252	0.00024	0.00036	0.00048	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Cast-Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	540	480	420	0.00060	0.00084	0.00120	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	360	300	270	0.00048	0.00084	0.00108	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		900	720	540	0.00132	0.00204	0.00264	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060

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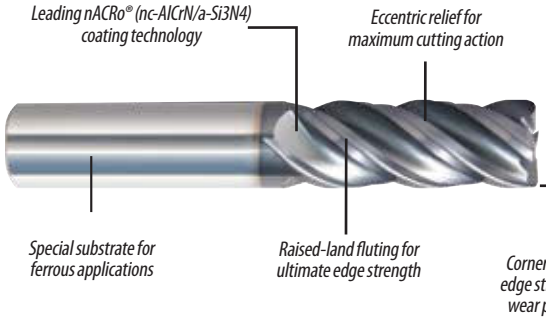
ALPHA 4

RHC RHS | CC | STRAIGHT H6 | PREM SM 12% | 4 | RAD | VARIABLE | ≠ | nACRo



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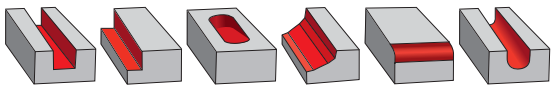
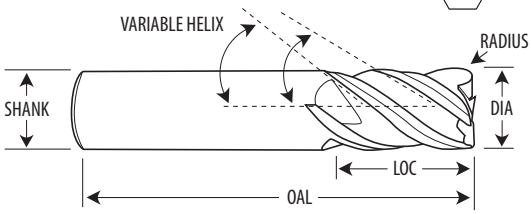


ISO Material Group: P, M, S, K



DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	LOC	Shank	OAL	Length	Radius	nACRo®
1/8	0.1250	1/4	1/8	1-1/2	Stub	0.015	294-001011
						0.020	294-001012
						0.030	294-001013
1/8	0.1250	1/2	1/8	1-1/2	Regular	0.015	294-002011
						0.020	294-002012
						0.030	294-002013
3/16	0.1875	3/8	3/16	2	Stub	0.015	294-001021
						0.020	294-001022
						0.030	294-001023
3/16	0.1875	5/8	3/16	2	Regular	0.015	294-002021
						0.020	294-002022
						0.030	294-002023
1/4	0.2500	1/2	1/4	2	Stub	0.015	294-001029
						0.020	294-001031
						0.030	294-001032
						0.060	294-001033
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.015	294-002029
						0.020	294-002031
						0.030	294-002032
						0.060	294-002033
1/4	0.2500	1-1/8	1/4	4	Long	0.020	294-003031
5/16	0.3125	5/8	5/16	2	Stub	0.015	294-001039
						0.030	294-001041
						0.060	294-001042
5/16	0.3125	3/4	5/16	2-1/2	Regular	0.015	294-002039
						0.030	294-002041
						0.060	294-002042
3/8	0.3750	5/8	3/8	2	Stub	0.015	294-001049
						0.030	294-001051
						0.060	294-001052
3/8	0.3750	1	3/8	2-1/2	Regular	0.015	294-002049
						0.030	294-002051
						0.060	294-002052
3/8	0.3750	1-1/2	3/8	4	Long	0.030	294-003051
7/16	0.4375	1	7/16	2-3/4	Regular	0.030	294-002056
1/2	0.5000	5/8	1/2	2-1/2	Stub	0.015	294-001059
						0.030	294-001061
						0.060	294-001062
						0.090	294-001063
						0.120	294-001064
1/2	0.5000	1-1/4	1/2	3	Regular	0.015	294-002059
						0.030	294-002061
						0.045	294-002062
						0.060	294-002063
						0.090	294-002064
						0.120	294-002065

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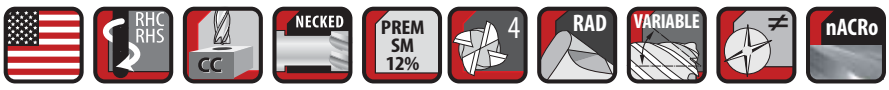
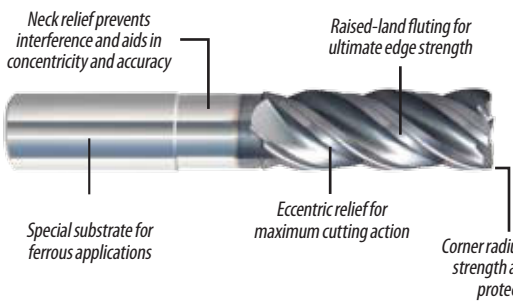
ALPHA 4 CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	nACRo®
1/2	0.5000	2	1/2	4	Long	0.030	294-003061
5/8	0.6250	3/4	5/8	3	Stub	0.030	294-001069
						0.045	294-001071
						0.060	294-001072
						0.090	294-001073
						0.120	294-001074
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	0.030	294-002069
						0.045	294-002071
						0.060	294-002072
						0.090	294-002073
						0.120	294-002074
5/8	0.6250	2-1/4	5/8	5	Long	0.045	294-003071
3/4	0.7500	1	3/4	3	Stub	0.030	294-001079
						0.045	294-001081
						0.060	294-001082
						0.090	294-001083
						0.120	294-001084
3/4	0.7500	1-1/2	3/4	4	Regular	0.030	294-002079
						0.045	294-002081
						0.060	294-002082
						0.090	294-002083
						0.120	294-002084
3/4	0.7500	2-1/4	3/4	5	Long	0.045	294-003081
3/4	0.7500	3-1/4	3/4	6	X/Long	0.050	294-003083
1	1.0000	1-1/2	1	4	Regular	0.030	294-002089
						0.060	294-002091
						0.090	294-002092
						0.120	294-002093
1	1.0000	2-1/4	1	5	Long	0.060	294-003091
1	1.0000	3	1	6	X/Long	0.060	294-003093
1	1.0000	4	1	7	XX/Long	0.060	294-003095

ALPHA 4LR





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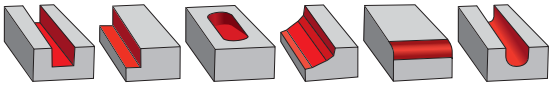

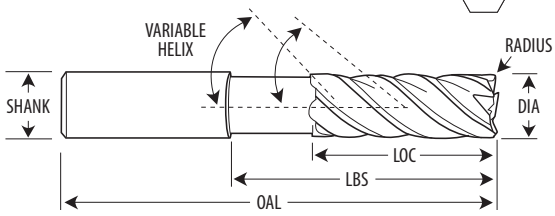

DIA TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LBS	LENGTH	RADIUS	nACRo®
1/8	0.1250	1/4	1/8	3	1-3/8	Long	0.010	294-004001
							0.015	294-004002
							0.030	294-004003
3/16	0.1875	5/16	3/16	3	1-3/8	Long	0.015	294-004011
							0.030	294-004012

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ALPHA 4LR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LBS	LENGTH	RADIUS	NACRO®
1/4	0.2500	3/8	1/4	4	2-1/8	Long	0.015	294-004021
							0.030	294-004022
							0.060	294-004023
3/8	0.3750	1/2	3/8	3	1-1/2	Medium	0.015	294-004033
							0.030	294-004034
							0.060	294-004035
							0.090	294-004036
							0.120	294-004037
3/8	0.3750	1/2	3/8	4	2-1/8	Long	0.015	294-004038
							0.030	294-004039
							0.060	294-004040
							0.090	294-004041
							0.120	294-004042
1/2	0.5000	5/8	1/2	4	2-3/8	Medium	0.030	294-004051
							0.060	294-004052
							0.090	294-004053
							0.120	294-004054
1/2	0.5000	5/8	1/2	6	3-3/8	Long	0.030	294-004055
							0.060	294-004056
							0.090	294-004057
							0.120	294-004058
5/8	0.6250	3/4	5/8	5	2-3/8	Long	0.030	294-004071
							0.060	294-004072
							0.090	294-004073
							0.120	294-004074
5/8	0.6250	3/4	5/8	6	3-3/8	X/Long	0.030	294-004075
							0.060	294-004076
							0.090	294-004077
							0.120	294-004078
3/4	0.7500	1	3/4	6	3-1/2	X/Long	0.030	294-004091
							0.060	294-004092
							0.090	294-004093
							0.120	294-004094
3/4	0.7500	1	3/4	7	4-1/2	XX/Long	0.030	294-004095
							0.060	294-004096
							0.090	294-004097
							0.120	294-004098
1	1.0000	1-1/4	1	6	3-1/2	Long	0.030	294-004111
							0.060	294-004112
							0.090	294-004113
							0.120	294-004114
1	1.0000	1-1/4	1	7	4-1/2	X/Long	0.030	294-004115
							0.060	294-004116
							0.090	294-004117
							0.120	294-004118

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MILLING RECOMMENDATIONS

ALPHA4 ALPHA4LR

PROFILING

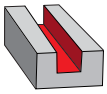
Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group		Hardness	SFM based on RDOC: Cutting Diameter Engaged 5%	10%	25%	50%	IPT* (BASELINE): Cutting Diameter 1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	1/4	1
Steels	Free Machining & Low Carbon, 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	≤ 28 Rc	1475	1150	980	500	0.0012	0.0020	0.0024	0.0031	0.0039	0.0047	0.0060	0.0078	0.0100
Steels	Medium Carbon Steels, 1140, 1145	28 - 38 Rc	1130	900	840	250									
Steels	Alloy, 41XX	28 - 44 Rc	1035	840	765										
Tool & Die Steels	A2, D2, H13, L6, P20, S7	28 - 44 Rc	900	725	615	200									
Stainless Steels	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	≤ 28 Rc	675	545	425	360	0.0012	0.0020	0.0024	0.0031	0.0039	0.0047	0.0060	0.0078	0.0100
Stainless Steels	Austenitic, 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	≤ 28 Rc	525	430	400	210									
Stainless Steels	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	≤ 28 Rc	410	330	295										
Stainless Steels	Difficult to Machine, 17-4 PH, PH13-8Mo, Nitronics	> 28 Rc	525	430	395	110	0.0006	0.0010	0.0012	0.0016	0.0020	0.0024	0.0030	0.0040	0.0050
Stainless Steels	Cobalt Chrome Alloys, ASTM F75, ASTMf562, ASTM, F90:	> 28 Rc	410	325	295	130									
Stainless Steels	22% Duplex	> 28 Rc	245	195	180										
Stainless Steels	25% Super Duplex	> 28 Rc	245	195	180	110									
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	≤ 42 Rc	180	150	130	85	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
Super Alloys	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	≤ 42 Rc	525	425	330	175									
Hardened Materials		45-50 Rc	610	495	325	250	0.0006	0.0010	0.0012	0.0016	0.0020	0.0024	0.0030	0.0040	0.0050
Hardened Materials		50-55 Rc	510	410	280	200	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
Cast-Iron	Gray, SAE J431, ASTM A48	≤ 240 HB	1625	1295	870	350	0.0012	0.0020	0.0024	0.0031	0.0039	0.0047	0.0060	0.0078	0.0100
Cast-Iron	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	> 240 HB	675	540	510	260									

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

SLOTTING



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group		Hardness	SFM based on RDOC: Cutting Diameter Engaged 25%	50%	100%	IPT: Cutting Diameter 1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon, 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	≤ 28 Rc	550	500	475	0.0004	0.0010	0.0012	0.0016	0.0020	0.0025	0.0031	0.0040	0.0050
Steels	Medium Carbon Steels, 1140, 1145	28 - 38 Rc	275	250	225									
Steels	Alloy, 41XX	28 - 44 Rc												
Tool & Die Steels	A2, D2, H13, L6, P20, S7	28 - 44 Rc	225	200	175									
Stainless Steels	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	≤ 28 Rc	385	360	350	0.0004	0.0010	0.0012	0.0016	0.0020	0.0024	0.0031	0.0040	0.0050
Stainless Steels	Austenitic, 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	≤ 28 Rc	225	210	200									
Stainless Steels	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	≤ 28 Rc												
Stainless Steels	Difficult to Machine, 17-4 PH, PH13-8Mo, Nitronics	> 28 Rc	125	110	100	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
Stainless Steels	Cobalt Chrome Alloys, ASTM F75, ASTMf562, ASTM, F90:	> 28 Rc	150	130	120									
Stainless Steels	22% Duplex	> 28 Rc												
Stainless Steels	25% Super Duplex	> 28 Rc	120	110	100									
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	≤ 42 Rc	100	85	75	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
Super Alloys	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	≤ 42 Rc	180	175	160									
Hardened Materials		45-50 Rc	275	250	225	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
Hardened Materials		50-55 Rc	225	200	175	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0010	0.0015
Cast-Iron	Gray, SAE J431, ASTM A48	≤ 240 HB	375	350	325	0.0004	0.0010	0.0012	0.0016	0.0020	0.0024	0.0031	0.0040	0.0050
Cast-Iron	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	> 240 HB	275	260	250									

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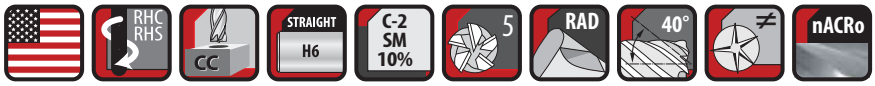
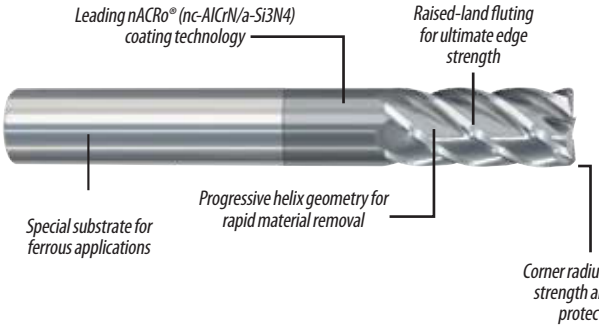
ALPHA 5





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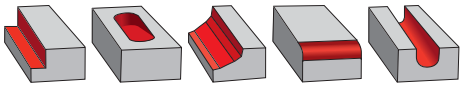

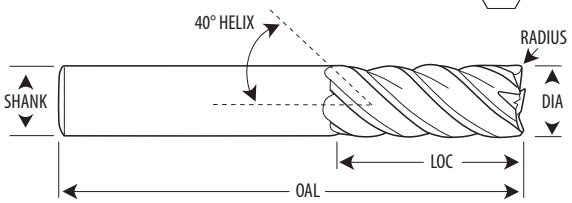

DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	LOC	Shank	OAL	Length	Radius	nACRo®
						0.010	295-010125B
1/8	0.1250	1/4	1/8	2-1/2	Stub	0.020	295-010126B
						0.030	295-010127B
						0.010	295-020125B
1/8	0.1250	1/2	1/8	2-1/2	Regular	0.020	295-020126B
						0.030	295-020127B
						0.010	295-010187B
3/16	0.1875	3/8	3/16	2-1/2	Stub	0.020	295-010188B
						0.030	295-010189B
						0.010	295-020187B
3/16	0.1875	5/8	3/16	2-1/2	Regular	0.020	295-020188B
						0.030	295-020189B
						0.015	295-010249B
1/4	0.2500	3/8	1/4	2-1/2	Stub	0.020	295-010250B
						0.030	295-010251B
						0.060	295-010252B
						0.015	295-020249B
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.020	295-020250B
						0.030	295-020251B
						0.060	295-020252B
						0.015	295-030249B
1/4	0.2500	1-1/4	1/4	4	Long	0.020	295-030250B
						0.030	295-030251B
						0.060	295-030252B
5/16	0.3125	1/2	5/16	2-1/2	Stub	0.020	295-010312B
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.020	295-020312B
5/16	0.3125	1-1/4	5/16	4	Long	0.020	295-030312B
						0.015	295-010374B
3/8	0.3750	1/2	3/8	2-1/2	Stub	0.020	295-010375B
						0.030	295-010376B
						0.060	295-010377B

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ALPHA 5 CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	NACRO®
3/8	0.3750	1	3/8	2-1/2	Regular	0.015	295-020374B
						0.020	295-020375B
						0.030	295-020376B
						0.060	295-020377B
3/8	0.3750	1-1/2	3/8	4	Long	0.015	295-030374B
						0.020	295-030375B
						0.030	295-030376B
						0.060	295-030377B
1/2	0.5000	5/8	1/2	3	Stub	0.020	295-010500B
						0.030	295-010501B
						0.060	295-010502B
						0.090	295-010503B
						0.120	295-010504B
1/2	0.5000	1-1/4	1/2	3	Regular	0.020	295-020500B
						0.030	295-020501B
						0.060	295-020502B
						0.090	295-020503B
						0.120	295-020504B
1/2	0.5000	1-5/8	1/2	4	Long	0.020	295-030490B
						0.030	295-030491B
						0.060	295-030492B
						0.090	295-030493B
						0.120	295-030494B
1/2	0.5000	2	1/2	4	Long	0.020	295-030500B
						0.030	295-030501B
						0.060	295-030502B
						0.090	295-030503B
						0.120	295-030504B
5/8	0.6250	3/4	5/8	3-1/2	Stub	0.020	295-010625B
						0.030	295-010626B
						0.060	295-010627B
						0.090	295-010628B
						0.120	295-010629B
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	0.020	295-020625B
						0.030	295-020626B
						0.060	295-020627B
						0.090	295-020628B
						0.120	295-020629B
5/8	0.6250	2-1/8	5/8	4	Medium	0.020	295-030620B

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ALPHA 5 CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	NACRO®
5/8	0.6250	2-1/2	5/8	5	Long	0.020	29S-030625B
						0.030	29S-030626B
						0.060	29S-030627B
						0.090	29S-030628B
						0.120	29S-030629B
3/4	0.7500	1	3/4	4	Stub	0.020	29S-010750B
						0.030	29S-010751B
						0.060	29S-010752B
						0.090	29S-010753B
						0.120	29S-010754B
						0.156	29S-010755B
						0.190	29S-010756B
3/4	0.7500	1-5/8	3/4	4	Regular	0.020	29S-020750B
						0.030	29S-020751B
						0.060	29S-020752B
						0.090	29S-020753B
						0.120	29S-020754B
						0.156	29S-020755B
						0.190	29S-020756B
3/4	0.7500	2-1/2	3/4	5	Long	0.020	29S-030750B
						0.030	29S-030751B
						0.060	29S-030752B
						0.090	29S-030753B
						0.120	29S-030754B
						0.156	29S-030755B
						0.190	29S-030756B
1	1.0000	1-3/4	1	4	Regular	0.020	29S-021000B
						0.030	29S-021001B
						0.060	29S-021002B
						0.090	29S-021003B
						0.120	29S-021004B
						0.156	29S-021005B
						0.190	29S-021006B
						0.250	29S-021007B
1	1.0000	2-5/8	1	6	Long	0.020	29S-031000B
						0.030	29S-031001B
						0.060	29S-031002B
						0.090	29S-031003B
						0.120	29S-031004B
						0.156	29S-031005B
						0.190	29S-031006B
						0.250	29S-031007B

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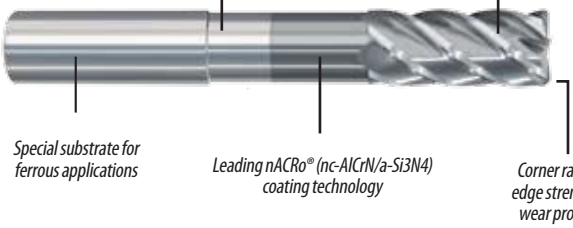
ALPHA 5LR

RHC RHS | CC | NECKED | PREM SM 12% | 5 | RAD | 40° | ≠ | nACRo



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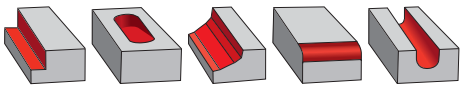
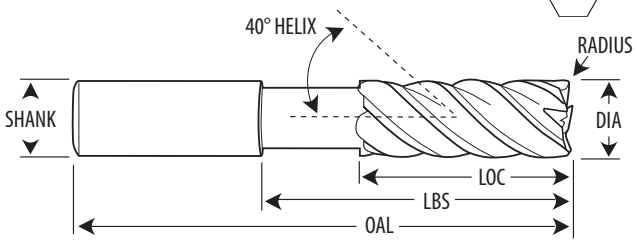


P M K S — ISO Material Group



DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	LOC	Shank	OAL	LBS	Length	Radius	nACRo®
							0.010	295-054001
1/8	0.1250	1/4	1/8	3	1-3/8	Long	0.015	295-054002
							0.030	295-054003
							0.015	295-054011
3/16	0.1875	5/16	3/16	3	1-3/8	Long	0.030	295-054012
							0.015	295-054021
1/4	0.2500	3/8	1/4	4	2-1/8	Long	0.030	295-054022
							0.060	295-054023
							0.015	295-054033
							0.030	295-054034
3/8	0.3750	1/2	3/8	3	1-1/2	Medium	0.060	295-054035
							0.090	295-054036
							0.120	295-054037
							0.015	295-054038
							0.030	295-054039
3/8	0.3750	1/2	3/8	4	2-1/8	Long	0.060	295-054040
							0.090	295-054041
							0.120	295-054042
							0.030	295-054051
							0.060	295-054052
1/2	0.5000	5/8	1/2	4	2-3/8	Long	0.090	295-054053
							0.120	295-054054

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ALPHA 5LR CONTINUED

DIA	DEC IN	LOC	SHANK	OAL	LBS	LENGTH	RADIUS	NACRO®
1/2	0.5000	5/8	1/2	6	3-3/8	X/Long	0.030	295-054055
							0.060	295-054056
							0.090	295-054057
							0.120	295-054058
5/8	0.6250	3/4	5/8	5	2-3/8	Long	0.030	295-054071
							0.060	295-054072
							0.090	295-054073
							0.120	295-054074
5/8	0.6250	3/4	5/8	6	3-3/8	X/Long	0.030	295-054075
							0.060	295-054076
							0.090	295-054077
							0.120	295-054078
3/4	0.7500	1	3/4	6	3-1/2	X/Long	0.030	295-054091
							0.060	295-054092
							0.090	295-054093
							0.120	295-054094
3/4	0.7500	1	3/4	7	4-1/2	XX/Long	0.030	295-054095
							0.060	295-054096
							0.090	295-054097
							0.120	295-054098
							0.156	295-054099
							0.190	295-054100
1	1.0000	1-1/4	1	6	3-1/2	Long	0.030	295-054111
							0.060	295-054112
							0.090	295-054113
							0.120	295-054114
1	1.0000	1-1/4	1	7	4-1/2	X/Long	0.030	295-054115
							0.060	295-054116
							0.090	295-054117
							0.120	295-054118
							0.156	295-054119
							0.190	295-054120
							0.250	295-054121

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PROFILING

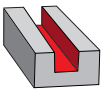
Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM based on RDOC				IPT * (BASELINE)								
				Cutting Diameter Engaged				Cutting Diameter								
				5%	10%	25%	50%	1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	1/4	1
Steels	Free Machining & Low Carbon, 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	1475	1150	980	500	0.0012	0.0020	0.0024	0.0031	0.0039	0.0047	0.0060	0.0078	0.0100
	Medium Carbon Steels, 1140, 1145	P	28 - 38 Rc	1130	900	830	250									
	Alloy, 41XX	P	28 - 44 Rc	1035	840	755	250									
Tool & Die Steels	A2, D2, H13, L6, P20, S7	P	28 - 44 Rc	900	725	615	200									
Stainless Steels	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	675	545	425	360	0.0012	0.0020	0.0024	0.0031	0.0039	0.0047	0.0060	0.0078	0.0100
	Austenitic, 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	≤ 28 Rc	525	430	400	210									
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	≤ 28 Rc	410	330	295	210									
	Difficult to Machine, 17-4 PH, PH13-8Mo, Nitronics	M	> 28 Rc	525	430	395	110	0.0006	0.0010	0.0012	0.0016	0.0020	0.0024	0.0030	0.0040	0.0050
	Cobalt Chrome Alloys, ASTM F75, ASTMf562, ASTM, F90:	M	> 28 Rc	410	325	295	130									
	22% Duplex	M	> 28 Rc	245	195	180	130									
	25% Super Duplex	M	> 28 Rc	245	195	180	110									
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	180	150	130	85	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S	≤ 42 Rc	525	425	330	175									
Hardened Materials		H	45-50 Rc	610	495	325	250	0.0006	0.0010	0.0012	0.0016	0.0020	0.0024	0.0030	0.0040	0.0050
		H	50-55 Rc	510	410	280	200	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
Cast-Iron	Gray, SAE J431, ASTM A48	K	≤ 240 HB	1625	1295	870	350	0.0012	0.0020	0.0024	0.0031	0.0039	0.0047	0.0060	0.0078	0.0100
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K	> 240 HB	675	540	510	260									

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

SLOTTING



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM			IPT								
				Cutting Diameter Engaged			Cutting Diameter								
				25%	50%	100%	1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon, 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	550	500	475	0.0004	0.0010	0.0012	0.0016	0.0020	0.0025	0.0031	0.0040	0.0050
	Medium Carbon Steels, 1140, 1145	P	28 - 38 Rc	275	250	225									
	Alloy, 41XX	P	28 - 44 Rc												
Tool & Die Steels	A2, D2, H13, L6, P20, S7	P	28 - 44 Rc	225	200	175									
Stainless Steels	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	275	250	225	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
	Austenitic, 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	≤ 28 Rc	225	200	175	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0010	0.0015
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	≤ 28 Rc	385	360	350	0.0002	0.0004	0.0008	0.0012	0.0014	0.0018	0.0022	0.0026	0.0038
	Difficult to Machine, 17-4 PH, PH13-8Mo, Nitronics	M	> 28 Rc	225	210	200									
	Cobalt Chrome Alloys, ASTM F75, ASTMf562, ASTM, F90:	M	> 28 Rc	225	210	200									
	22% Duplex	M	> 28 Rc	125	110	100	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
	25% Super Duplex	M	> 28 Rc	150	130	120									
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	135	120	110	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S	≤ 42 Rc	100	85	75									
Hardened Materials		H	45-50 Rc	95	85	75	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0016	0.0020	0.0024
		H	50-55 Rc	180	175	160									
Cast-Iron	Gray, SAE J431, ASTM A48	K	≤ 240 HB	375	350	325	0.0004	0.0010	0.0012	0.0016	0.0020	0.0024	0.0031	0.0040	0.0050
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K	> 240 HB	275	260	250									

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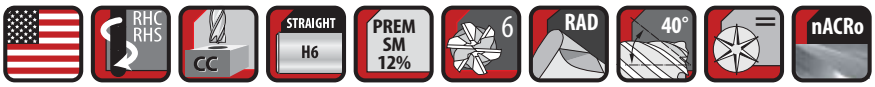
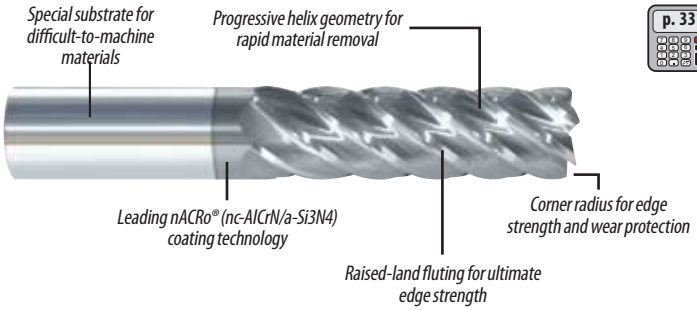
ALPHA 6





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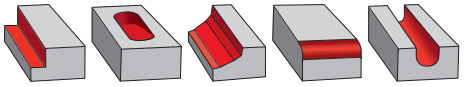

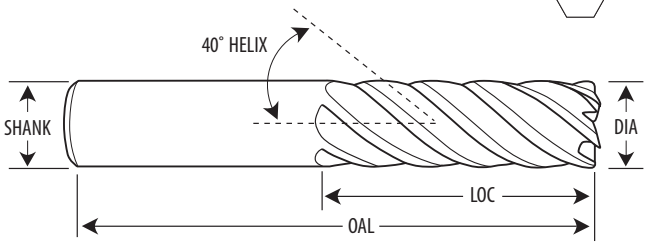

DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	LOC	Shank	OAL	Length	Radius	nACRo®
1/4	0.2500	1/2	1/4	2	Stub	0.020	292-201133
		3/4	1/4	2-1/2	Regular	0.020	292-301133
		1-1/8	1/4	3	Long	0.020	292-401133
		1-1/2	1/4	4	X/Long	0.020	292-501133
		1-1/2	1/4	6	EXT X/Long	0.020	292-601133
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.020	292-301153
		1-1/8	5/16	3	Long	0.020	292-401153
		1-1/2	5/16	6	EXT X/Long	0.020	292-601153
		1-5/8	5/16	4	X/Long	0.020	292-501153
3/8	0.3750	5/8	3/8	2	Stub	0.020	292-201173
		1	3/8	2-1/2	Regular	0.020	292-301173
		1-1/8	3/8	3	Long	0.020	292-401173
		1-1/2	3/8	6	EXT X/Long	0.020	292-601173
		1-3/4	3/8	4	X/Long	0.020	292-501173
		3	3/8	6	XX/Long	0.020	292-601193
1/2	0.5000	5/8	1/2	2-1/2	Stub	0.020	292-201203
		1	1/2	3	Regular	0.020	292-301203
		1-1/2	1/2	4	Medium	0.020	292-401193
		1-1/2	1/2	6	EXT X/Long	0.020	292-601203
		2	1/2	4	Long	0.020	292-401203
		3	1/2	6	X/Long	0.020	292-501203
5/8	0.6250	1	5/8	3	Stub	0.020	292-201223
		1-1/4	5/8	3-1/2	Regular	0.020	292-301223
		1-1/2	5/8	6	EXT X/Long	0.020	292-601223
		2-1/4	5/8	5	Long	0.020	292-401223
		3-1/4	5/8	6	X/Long	0.020	292-501223
3/4	0.7500	1	3/4	3	Stub	0.020	292-201243
		1-1/2	3/4	4	Regular	0.020	292-301243
		1-1/2	3/4	6	EXT X/Long	0.020	292-601233
		2-1/4	3/4	5	Long	0.020	292-401243
		3-1/4	3/4	6	X/Long	0.020	292-501243
		4	3/4	7	XX/Long	0.020	292-601243
1	1.0000	1-1/2	1	6	EXT X/Long	0.020	292-601253
		1-3/4	1	4	Regular	0.020	292-301263
		2-1/4	1	5	Long	0.020	292-401263
		3-1/4	1	6	X/Long	0.020	292-501263
		4	1	7	XX/Long	0.020	292-601263

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PROFILING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)

Inches Per Tooth (IPT)

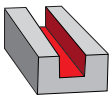
Workpiece Material Group		Hardness	SFM based on RDOC: Cutting Diameter Engaged 5%	10%	20%	30%	50%	IPT* (BASELINE): Cutting Diameter 1/8†	1/4†	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon, 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P ≤ 28 Rc	600	550	500	450	400	0.0011	0.0022	0.0035	0.0042	0.0059	0.0680	0.0900
	Medium Carbon & High Carbon, 1030, 4140, 5115	P 28 - 38 Rc	600	550	500	450								
Tool & Die Steels	A2, D2, H13, L6, P20, S7	P 28 - 44 Rc	550	500	450	400	375	0.0011	0.0020	0.0033	0.0040	0.0055	0.0650	0.0850
Stainless Steels	Ferritic	M ≤ 28 Rc	360	340	300	280	260	0.0007	0.0014	0.0024	0.0030	0.0040	0.5200	0.0680
	Martensitic	M ≤ 28 Rc						0.0004	0.0008	0.0016	0.0018	0.0024	0.0300	0.0400
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M > 28 Rc	320	300	280	260	240	0.0003	0.0006	0.0010	0.0015	0.0018	0.0240	0.0300
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S ≤ 42 Rc	550	525	500	450	425	0.0010	0.0020	0.0033	0.0040	0.0055	0.0700	0.0100
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S ≤ 42 Rc	550	525	500	450								
Hardened Materials		H 40-50 Rc	550	525	500	450	425	0.0010	0.0020	0.0033	0.0040	0.0055	0.0700	0.0100
		H 50-55 Rc	165	165	130	115	100	0.0004	0.0008	0.0016	0.0018	0.0024	0.0300	0.0400
		H > 55 Rc	400	375	350	300	250							
Cast-Iron	Gray, SAE J431, ASTM A48	K ≤ 240 HB	1625	1295	900	700	350	0.0012	0.0024	0.0039	0.0047	0.0060	0.0078	0.0100
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K > 240 HB	675	540	550	400	260							

***CHIP THINNING Adjustments**

RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

SLOTTING



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)

Inches Per Tooth (IPT)
‡ *Trochoidal Milling*

Workpiece Material Group		Hardness	SFM: Cutting Diameter Engaged 25%	50%	100%‡	IPT (BASELINE): Cutting Diameter 1/8†	1/4†	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon, 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P ≤ 28 Rc	480	480	400	0.0005	0.0011	0.0017	0.0021	0.0029	0.0380	0.0480
	Medium Carbon & High Carbon, 1030, 4140, 5115	P 28 - 38 Rc										
Tool & Die Steels	A2, D2, H13, L6, P20, S7	P 28 - 44 Rc	420	420	380	0.0005	0.0010	0.0016	0.0020	0.0027	0.0360	0.0460
Stainless Steels	Ferritic	M ≤ 28 Rc	420	420	400	0.0005	0.0010	0.0016	0.0020	0.0027	0.0035	0.0045
	Martensitic	M ≤ 28 Rc										
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M > 28 Rc	400	400	380							
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S ≤ 42 Rc	120	120	95	0.0002	0.0004	0.0008	0.0009	0.0012	0.0016	0.0020
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S ≤ 42 Rc	200	200	175							
Hardened Materials		H 40-50 Rc	350	350	300	0.0003	0.0006	0.0012	0.0015	0.0020	0.0024	0.0030
		H 50-55 Rc	180	180	150	0.0002	0.0004	0.0008	0.0009	0.0012	0.0016	0.0020
		H > 55 Rc	150	150	100		0.0003	0.0005	0.0007	0.0009	0.0011	0.0014
Cast-Iron	Gray, SAE J431, ASTM A48	K ≤ 240 HB	375	350	325	0.0004	0.0012	0.0020	0.0024	0.0031	0.0040	0.0050
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K > 240 HB	275	260	250							

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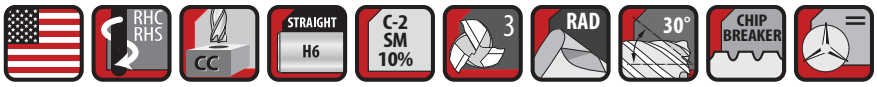
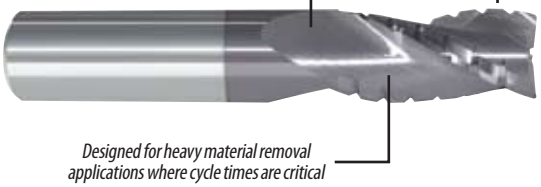
ATTACKER 3





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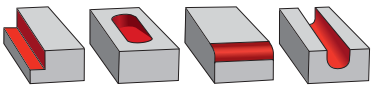
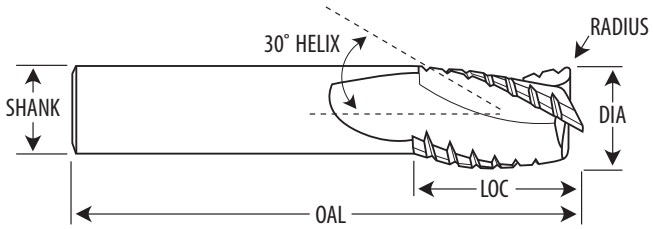
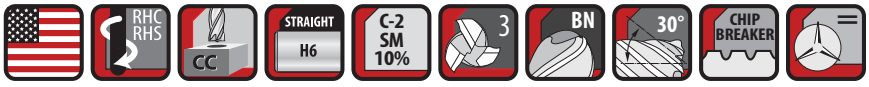


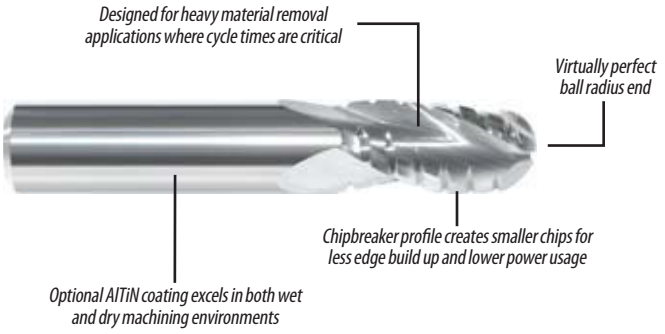


DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	LOC	Shank	OAL	Length	Radius	Bright	AlTiN
1/8	0.1250	1/2	1/8	1-1/2	Regular	0.010	267-125500	267-125503
3/16	0.1875	5/8	3/16	2	Regular	0.010	267-187625	267-187628
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.010	267-250750	267-250753
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.010	267-312812	267-312815
3/8	0.3750	1	3/8	2-1/2	Regular	0.015	267-375875	267-375878
7/16	0.4375	1	7/16	2-3/4	Regular	0.015	267-437100	267-437103
1/2	0.5000	1	1/2	3	Regular	0.015	267-500100	267-500103
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	0.020	267-625114	267-625117
3/4	0.7500	1-1/2	3/4	4	Regular	0.020	267-750112	267-750115
1	1.0000	1-1/2	1	4	Regular	0.020	267-100112	267-100115

ATTACKER 3BN





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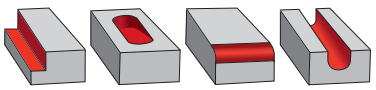

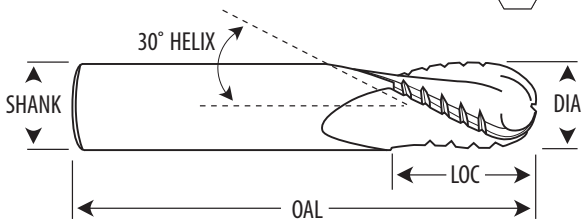

DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	AlTiN
1/8	0.1250	1/2	1/8	1-1/2	Regular	268-125500	268-125503
3/16	0.1875	5/8	3/16	2	Regular	268-187625	268-187628
1/4	0.2500	3/4	1/4	2-1/2	Regular	268-250750	268-250753
5/16	0.3125	13/16	5/16	2-1/2	Regular	268-312812	268-312815
3/8	0.3750	1	3/8	2-1/2	Regular	268-375875	268-375878
7/16	0.4375	1	7/16	2-3/4	Regular	268-437100	268-437103
1/2	0.5000	1	1/2	3	Regular	268-500100	268-500103
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	268-625114	268-625117
3/4	0.7500	1-1/2	3/4	4	Regular	268-750112	268-750115
1	1.0000	1-1/2	1	4	Regular	268-100112	268-100115

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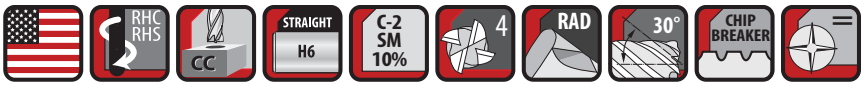
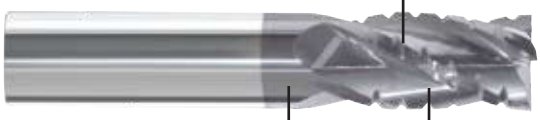
ATTACKER 4





Chipbreaker profile creates smaller chips for less edge build up and lower power usage

Optional AlTiN coating excels in both wet and dry machining environments

Designed for heavy material removal applications where cycle times are critical

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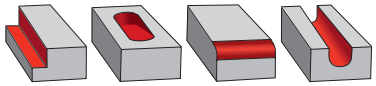
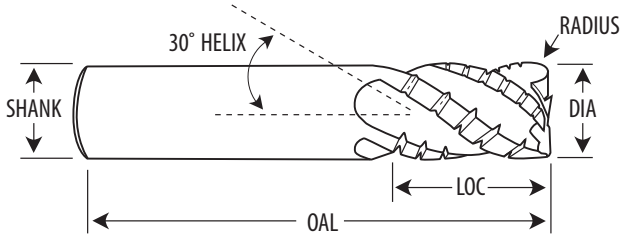
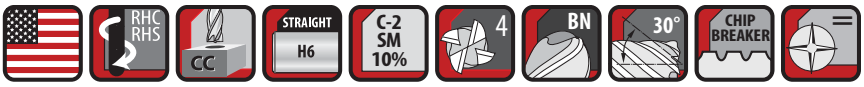




DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	LOC	Shank	OAL	Length	Radius	Bright	AlTiN
1/8	0.1250	1/2	1/8	1-1/2	Regular	0.010	257-125500	257-125503
3/16	0.1875	5/8	3/16	2	Regular	0.010	257-187625	257-187628
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.010	257-250750	257-250753
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.010	257-312812	257-312815
3/8	0.3750	1	3/8	2-1/2	Regular	0.015	257-375875	257-375878
7/16	0.4375	1	7/16	2-3/4	Regular	0.015	257-437100	257-437103
1/2	0.5000	1	1/2	3	Regular	0.015	257-500100	257-500103
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	0.020	257-625114	257-625117
3/4	0.7500	1-1/2	3/4	4	Regular	0.020	257-750112	257-750115
1	1.0000	1-1/2	1	4	Regular	0.020	257-100112	257-100115

ATTACKER 4BN

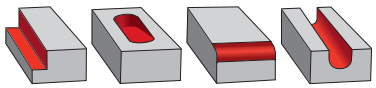


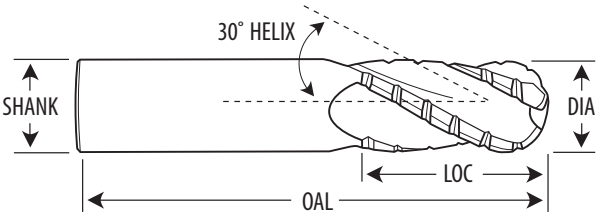
Designed for heavy material removal applications where cycle times are critical

Virtually perfect ball radius end

Chipbreaker profile creates smaller chips for less edge build up and lower power usage

p. 36





DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	AlTiN
1/8	0.1250	1/2	1/8	1-1/2	Regular	258-125500	258-125503
3/16	0.1875	5/8	3/16	2	Regular	258-187625	258-187628
1/4	0.2500	3/4	1/4	2-1/2	Regular	258-250750	258-250753
5/16	0.3125	13/16	5/16	2-1/2	Regular	258-312812	258-312815
3/8	0.3750	1	3/8	2-1/2	Regular	258-375875	258-375878
7/16	0.4375	1	7/16	2-3/4	Regular	258-437100	258-437103
1/2	0.5000	1	1/2	3	Regular	258-500100	258-500103
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	258-625114	258-625117
3/4	0.7500	1-1/2	3/4	4	Regular	258-750112	258-750115
1	1.0000	1-1/2	1	4	Regular	258-100112	258-100115

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MILLING RECOMMENDATIONS

ATTACKER³ ATTACKER^3BN ATTACKER⁴ ATTACKER^4BN

PROFILING

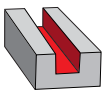
Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM based on RDOC: Cutting Diameter Engaged 5%	10%	20%	30%	50%	IPT* (BASELINE): Cutting Diameter 5/16	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	1050	700	385	375	350	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	630	420	320	250	210						
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	525	350	300	275	250	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	650	600	550	500	450	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	525	400	350	300	250						
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		> 28 Rc	525	400	350	300	250						
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	265	200	175	150	100	0.0014	0.0016	0.0023	0.0027	0.0032	0.0045
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	230	200	175	150	125						
Hardened Materials		H	45-55 Rc	250	240	230	210	200	0.0018	0.0021	0.0030	0.0036	0.0042	0.0060
			55-65 Rc	200	180	160	150	100	0.0013	0.0014	0.0021	0.0024	0.0029	0.0041
Cast-Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	425	400	375	350	300	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	320	300	250	225	200						
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		1000	960	920	880	840	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

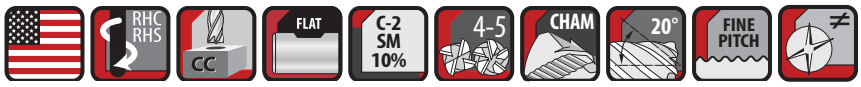
SLOTTING



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM: Cutting Diameter Engaged 25%	50%	100%	IPT* (BASELINE): Cutting Diameter 5/16	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	385	370	350	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	245	230	2210						
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	210	195	175	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	385	370	350	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	245	210	175						
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		> 28 Rc	210	195	175						
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	125	105	90	0.0008	0.0010	0.0013	0.0016	0.0017	0.0026
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	100	90	80						
Hardened Materials		H	34-45 Rc	245	230	210	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
			45-55 Rc	175	160	140	0.0008	0.0010	0.0013	0.0016	0.0020	0.0025
			55-65 Rc	150	125	100	0.0004	0.0005	0.0008	0.0008	0.0010	0.0012
Cast-Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	450	400	350	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	300	250	225						
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		750	600	450	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050

AGGRESSOR^{F}

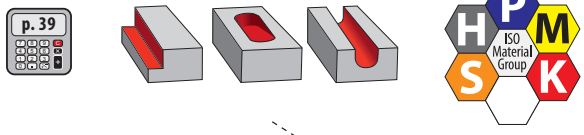


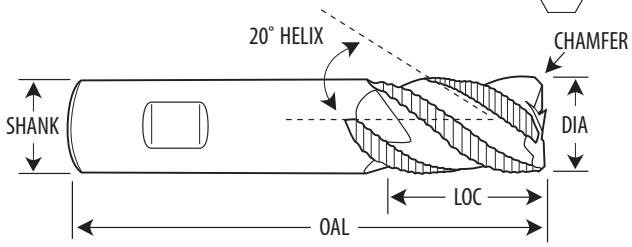
Designed for heavy material removal applications where cycle times are critical

Relaxed 20° helix enhances stability in hard materials

Fine tooth serrations promote smooth chip clearance by creating small chips in hardest materials

Corner chamfer for edge strength and wear protection

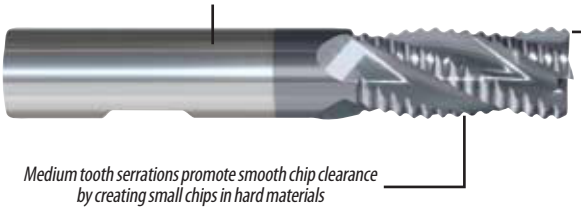


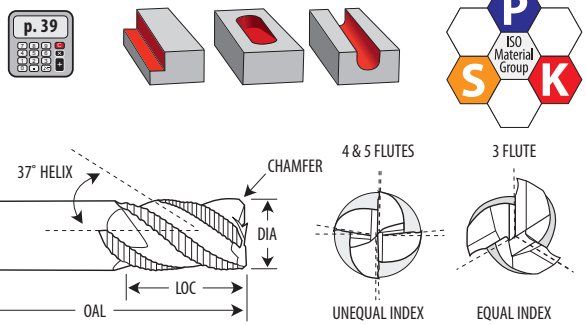


DIA TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	FLUTES	LOC	SHANK	OAL	LENGTH	CHAMFER	BRIGHT	ALTICRN
1/4	0.2500	4	1/2	1/4	2	Stub	.020	255-100240	255-100240B
			3/4	1/4	2-1/2	Regular	.020	255-100250	255-100250B
5/16	0.3125	4	1/2	5/16	2	Stub	.020	255-100302	255-100302B
			13/16	5/16	2-1/2	Regular	.020	255-100312	255-100312B
3/8	0.3750	4	5/8	3/8	2	Stub	.020	255-100365	255-100365B
			1	3/8	2-1/2	Regular	.020	255-100375	255-100375B
7/16	0.4375	4	1	7/16	2-3/4	Regular	.020	255-100437	255-100437B
1/2	0.5000	4	5/8	1/2	2-1/2	Stub	.025	255-100490	255-100490B
			1-1/4	1/2	3	Regular	.025	255-100500	255-100500B
			2	1/2	4	Long	.025	255-200500	255-200500B
5/8	0.6250	4	3/4	5/8	3	Stub	.025	255-100615	255-100615B
			1-5/8	5/8	4	Regular	.025	255-100625	255-100625B
3/4	0.7500	4	1	3/4	3-1/2	Stub	.025	255-100740	255-100740B
			1-3/4	3/4	4	Regular	.025	255-100750	255-100750B
			2-1/4	3/4	5	Long	.025	255-200750	255-200750B
			3	3/4	6	X/Long	.025	255-300750	255-300750B
1	1.0000	5	2	1	5	Regular	.025	255-101000	255-101000B
			2-5/8	1	5	Long	.025	255-201000	255-201000B
			3-1/4	1	6	X/Long	.025	255-301000	255-301000B
			4-1/8	1	7	XX/Long	.025	255-301100	255-301100B

AGGRESSOR™

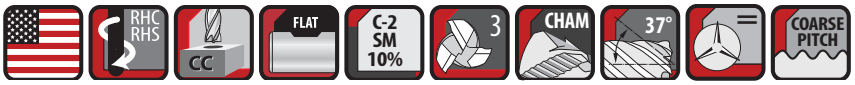


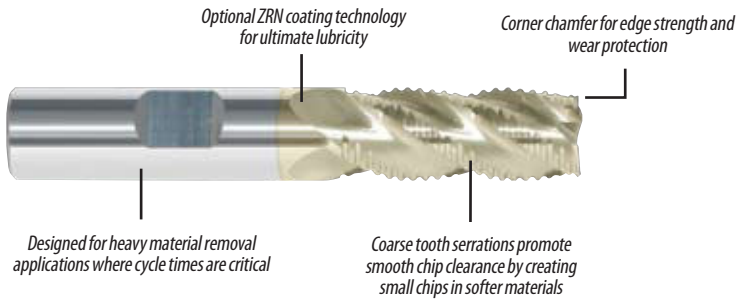


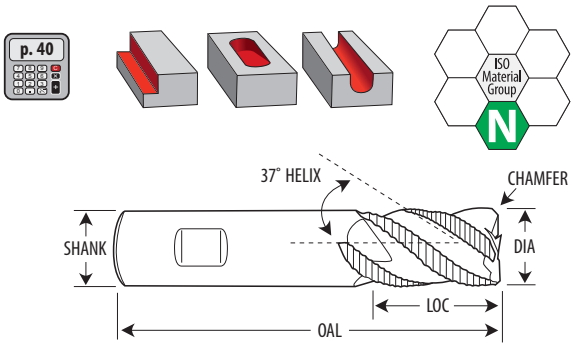
DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	Flutes	LOC	Shank	OAL	Length	Chamfer	Bright	AlTiCrN
3/16	0.1875	3	5/8	3/16	2	Regular	.020	256-187625	256-187628
1/4	0.2500	4	3/4	1/4	2-1/2	Regular	.020	256-250750	256-250753
5/16	0.3125	4	3/4	5/16	2-1/2	Regular	.020	256-312812	256-312815
3/8	0.3750	4	7/8	3/8	2-1/2	Regular	.020	256-375875	256-375878
7/16	0.4375	4	1	7/16	2-3/4	Regular	.025	256-437100	256-437103
1/2	0.5000	4	1-1/4	1/2	3	Regular	.025	256-500100	256-500103
5/8	0.6250	4	1-1/4	5/8	3-1/2	Regular	.025	256-625114	256-625117
3/4	0.7500	4	1-5/8	3/4	4	Regular	.025	256-750112	256-750115
1	1.0000	5	1-3/4	1	4	Regular	.025	256-100112	256-100115

AGGRESSOR™







DIA Tolerance: +0.000 / -0.002" Shank Tolerance: +0.0000 / -0.0004"

DIA	Dec In	Flutes	LOC	Shank	OAL	Length	Chamfer	Bright	ZrN
3/16	0.1875	3	3/4	3/16	2	Regular	0.020	255-050187	255-050187D
1/4	0.2500	3	3/4	1/4	2-1/2	Regular	0.020	255-050250	255-050250D
5/16	0.3125	3	7/8	5/16	2-1/2	Regular	0.020	255-050312	255-050312D
3/8	0.3750	3	1	3/8	2-1/2	Regular	0.020	255-050375	255-050375D
1/2	0.5000	3	1-1/4	1/2	3	Regular	0.025	255-050500	255-050500D
5/8	0.6250	3	1-1/4	5/8	3-1/2	Regular	0.025	255-050625	255-050625D
3/4	0.7500	3	1-5/8	3/4	4	Regular	0.025	255-050750	255-050750D
1	1.0000	3	1-3/4	1	4	Regular	0.025	255-051000	255-051000D

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PROFILING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)

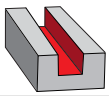
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM based on RDOC: Cutting Diameter Engaged 5%	10%	20%	30%	50%	IPT* (BASELINE): Cutting Diameter 5/16	3/8	1/2	5/8	3/4
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	1485	1485	1155	1000	825	0.0033	0.0047	0.0066	0.0078	0.0090
	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	890	890	825	750	660	0.0033	0.0047	0.0066	0.0078	0.0090
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	750	750	660	560	430	0.0033	0.0047	0.0066	0.0078	0.0090
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	500	500	430	400	350	0.0033	0.0047	0.0066	0.0078	0.0090
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	430	430	400	370	330	0.0025	0.0033	0.0049	0.0059	0.0066
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		> 28 Rc	430	430	400	360	330	0.0025	0.0033	0.0049	0.0059	0.0066
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	165	165	130	115	100	0.0008	0.0011	0.0017	0.0019	0.0023
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	400	400	370	300	250	0.0008	0.0011	0.0017	0.0019	0.0023
Hardened Materials		H	35 - 45 Rc	450	450	410	300	165	0.0029	0.0039	0.0059	0.0070	0.0078
			45 - 55 Rc	380	380	350	250	150	0.0020	0.0029	0.0039	0.0051	0.0061
Cast-Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	1180	1180	1120	800	630	0.0033	0.0047	0.0066	0.0078	0.0090
	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	530	530	500	460	430	0.0033	0.0047	0.0066	0.0078	0.0090

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

SLOTTING



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)

Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM: Cutting Diameter Engaged 25%	50%	100%	IPT* (BASELINE): Cutting Diameter 5/16	3/8	1/2	5/8	3/4
Steels	*Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36*	P	*≤ 28 Rc*	800	700	500	0.0010	0.0020	0.0025	0.0030	0.0035
	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		*28 - 38 Rc*	650	550	450	0.0010	0.0020	0.0025	0.0030	0.0035
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	500	450	400	0.0010	0.0020	0.0025	0.0030	0.0035
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	400	350	325	0.0010	0.0020	0.0025	0.0030	0.0035
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	320	275	250	0.0010	0.0020	0.0025	0.0030	0.0035
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		*> 28 Rc*	330	275	250	0.0010	0.0020	0.0025	0.0030	0.0035
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	110	100	95	0.0005	0.0010	0.0010	0.0015	0.0020
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	230	210	195	0.0008	0.0009	0.0011	0.0017	0.0019
Hardened Materials		H	35 - 45 Rc	200	180	150	0.0010	0.0020	0.0025	0.0030	0.0035
			45 - 55 Rc	180	150	125	0.0005	0.0010	0.0010	0.0015	0.0020
Cast-Iron	*Gray: SAE J431, ASTM A48*	K	≤ 240 HB	600	550	500	0.0010	0.0020	0.0025	0.0030	0.0035
	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	320	275	250	0.0010	0.0020	0.0025	0.0030	0.0035

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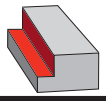
PROFILING



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group		SFM based on RDOC				IPT* (BASELINE)						
		Cutting Diameter Engaged				Cutting Diameter						
		10%	20%	30%	50%	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4
Non-Ferrous (N)	Aluminum /Aluminum Alloys < 10% Si	2000	1800	1200	900	0.0037	0.005	0.0062	0.0075	0.01	0.0125	0.015
	Aluminum /Aluminum Alloys > 10% Si	1500	1200	1000	800	0.0037	0.005	0.0062	0.0075	0.01	0.0125	0.015
	Brass	900	800	600	500	0.0037	0.005	0.0062	0.0075	0.01	0.0125	0.015
	Cu/Cu Alloys / Magnesium	1000	800	600	500	0.0037	0.005	0.0062	0.0075	0.01	0.0125	0.015
	Plastics	900	800	600	500	0.0037	0.005	0.0062	0.0075	0.01	0.0125	0.015

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	2 x
20%	3.1 x
10%	3.8 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

SLOTTING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group		SFM			IPT							
		Cutting Diameter Engaged			Cutting Diameter							
		25%	50%	100%	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Non-Ferrous (N)	Aluminum /Aluminum Alloys < 10% Si	2000	1500	1000	0.0018	0.0025	0.0031	0.0037	0.0050	0.0065	0.0075	0.0100
	Aluminum /Aluminum Alloys > 10% Si	1500	1200	800	0.0018	0.0025	0.0031	0.0037	0.0050	0.0065	0.0075	0.0100
	Brass	600	500	400	0.0025	0.0032	0.0040	0.0050	0.0065	0.0075	0.0100	0.0120
	Cu/Cu Alloys / Magnesium	500	400	300	0.0025	0.0032	0.0040	0.0050	0.0065	0.0075	0.0100	0.0120
	Plastics	1200	1000	800	0.0025	0.0032	0.0040	0.0050	0.0065	0.0075	0.0100	0.0120

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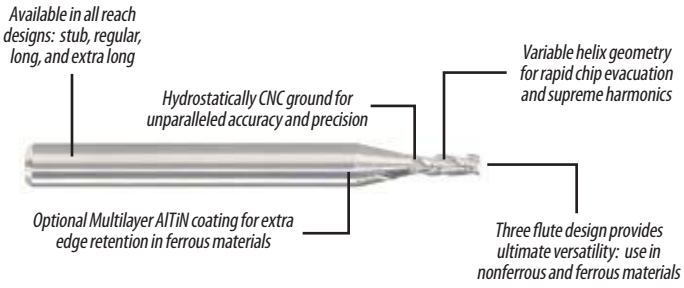
ATOMIC 3



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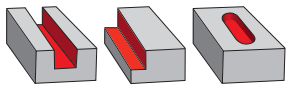
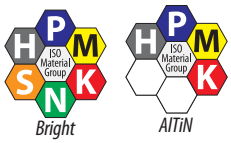
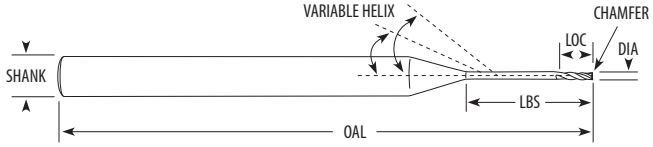


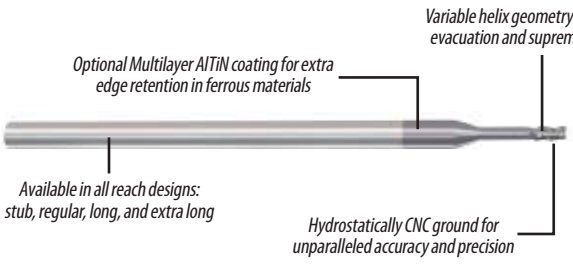




DIA Tolerance: ±0.0005" LOC Tolerance: +0.0000 / +0.0120" Shank Tolerance: +0.0000/-0.0003"

DIA		LOC	Shank	OAL	LBS	Length	Chamfer	Bright	AlTiN
0.0312	1/32	0.047	0.125	1.500	—	Stub	0.003	251-003005	251-003005B
		0.093	0.125	1.500	—	Regular	0.003	251-003010	251-003010B
0.0469	3/64	0.071	0.125	1.500	—	Stub	0.003	251-003025	251-003025B
		0.141	0.125	1.500	—	Regular	0.003	251-003030	251-003030B
0.0625	1/16	0.093	0.125	1.500	—	Stub	0.003	251-003045	251-003045B
		0.186	0.125	1.500	—	Regular	0.003	251-003050	251-003050B
0.0781	5/64	0.117	0.125	1.500	—	Stub	0.003	251-003065	251-003065B
		0.234	0.125	1.500	—	Regular	0.003	251-003070	251-003070B
0.0938	3/32	0.140	0.125	1.500	—	Stub	0.003	251-003085	251-003085B
		0.279	0.125	1.500	—	Regular	0.003	251-003090	251-003090B
0.1250	1/8	0.188	0.125	1.500	—	Stub	0.003	251-003105	251-003105B
		0.375	0.125	1.500	—	Regular	0.003	251-003110	251-003110B
0.0312	1/32	0.062	0.125	2.500	0.312	X/Long	0.003	251-003020	251-003020B
					0.187	Long	0.003	251-003015	251-003015B
0.0469	3/64	0.094	0.125	2.500	0.470	X/Long	0.003	251-003040	251-003040B
					0.282	Long	0.003	251-003035	251-003035B
0.0625	1/16	0.094	0.125	2.500	0.625	X/Long	0.003	251-003060	251-003060B
					0.375	Long	0.003	251-003055	251-003055B
0.0781	5/64	0.156	0.125	2.500	0.781	X/Long	0.003	251-003080	251-003080B
					0.468	Long	0.003	251-003075	251-003075B
0.0938	3/32	0.186	0.125	2.500	0.938	X/Long	0.003	251-003100	251-003100B
					0.562	Long	0.003	251-003095	251-003095B
0.1250	1/8	0.250	0.125	2.500	1.250	X/Long	0.003	251-003120	251-003120B
					0.750	Long	0.003	251-003115	251-003115B

ATOMIC 4



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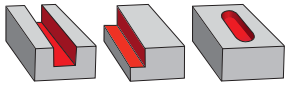

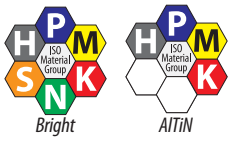

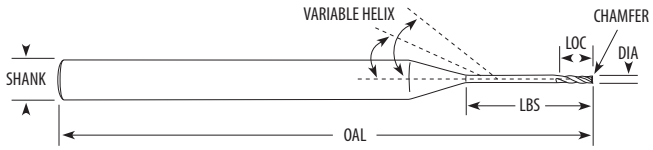

DIA Tolerance: ±0.0005" LOC Tolerance: +0.0000 / +0.0120" Shank Tolerance: +0.0000/-0.0003"

DIA		LOC	Shank	OAL	LBS	Length	Chamfer	Bright	AlTiN
0.0312	1/32	0.047	0.125	1.500	—	Stub	0.003	251-004005	251-004005B
		0.093	0.125	1.500	—	Regular	0.003	251-004010	251-004010B
0.0469	3/64	0.071	0.125	1.500	—	Stub	0.003	251-004025	251-004025B
		0.141	0.125	1.500	—	Regular	0.003	251-004030	251-004030B
0.0625	1/16	0.093	0.125	1.500	—	Stub	0.003	251-004045	251-004045B
		0.186	0.125	1.500	—	Regular	0.003	251-004050	251-004050B

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ATOMIC 4 CONTINUED

DIA		LOC	SHANK	OAL	LBS	LENGTH	CHAMFER	BRIGHT	ALTIN
0.0781	5/64	0.117	0.125	1.500	—	Stub	0.003	251-004065	251-004065B
		0.234	0.125	1.500	—	Regular	0.003	251-004070	251-004070B
0.0938	3/32	0.140	0.125	1.500	—	Stub	0.003	251-004085	251-004085B
		0.279	0.125	1.500	—	Regular	0.003	251-004090	251-004090B
0.1250	1/8	0.188	0.125	1.500	—	Stub	0.003	251-004105	251-004105B
		0.375	0.125	1.500	—	Regular	0.003	251-004110	251-004110B
0.0312	1/32	0.062	0.125	2.500	0.312	X/Long	0.003	251-004020	251-004020B
					0.187	Long	0.003	251-004015	251-004015B
0.0469	3/64	0.094	0.125	2.500	0.470	X/Long	0.003	251-004040	251-004040B
					0.282	Long	0.003	251-004035	251-004035B
0.0625	1/16	0.094	0.125	2.500	0.625	X/Long	0.003	251-004060	251-004060B
					0.375	Long	0.003	251-004055	251-004055B
0.0781	5/64	0.156	0.125	2.500	0.781	X/Long	0.003	251-004080	251-004080B
					0.468	Long	0.003	251-004075	251-004075B
0.0938	3/32	0.186	0.125	2.500	0.938	X/Long	0.003	251-004100	251-004100B
					0.562	Long	0.003	251-004095	251-004095B
0.1250	1/8	0.250	0.125	2.500	1.250	X/Long	0.003	251-004120	251-004120B
					0.750	Long	0.003	251-004115	251-004115B

MILLING RECOMMENDATIONS

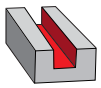
ATOMIC 3 ATOMIC 4

PROFILING

Surface Feet Per Minute (SFM)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM	Inches Per Tooth (IPT) Cutting Diameter 0.015	0.031	0.047	0.062	0.078	0.093	0.125
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	400	0.00007	0.00015	0.00023	0.00027	0.00034	0.00040	0.00054
	Medium/High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	300							
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	200							
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	400	0.00007	0.00015	0.00023	0.00027	0.00034	0.00040	0.00054
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	200							
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		> 28 Rc	150							
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	70	0.00004	0.00008	0.00015	0.00023	0.00027	0.00034	0.00040
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	150							
Hardened Materials		H	45-55 Rc	100	0.00010	0.00030	0.00050	0.00140	0.00180	0.00210	0.00300
Cast-Iron	Gray: SAE J431, ASTM A48	K	160 - 200 HB	400	0.00007	0.00015	0.00023	0.00027	0.00034	0.00040	0.00054
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		200 - 250 HB	250							
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		100	0.00004	0.00008	0.00015	0.00023	0.00027	0.00034	0.00040

SLOTTING



Surface Feet Per Minute (SFM)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM	Inches Per Tooth (IPT) Cutting Diameter 0.015	0.031	0.047	0.062	0.078	0.093	0.125
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	400	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005
	Medium/High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	300					0.0003	0.0003	0.0004
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	200					0.0002	0.0003	0.0004
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	400	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	200			0.0002	0.0002	0.0003	0.0003	0.0004
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		> 28 Rc	150			0.0001	0.0001	0.0002	0.0002	0.0003
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	70	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	150							
Hardened Materials		H	35 - 45 Rc	100	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
Cast-Iron	Gray: SAE J431, ASTM A48	K	160 - 200 HB	400	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		200 - 250 HB	250						0.0003	0.0004
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		750	0.0002	0.0003	0.0005	0.0006	0.0007	0.0008	0.0011

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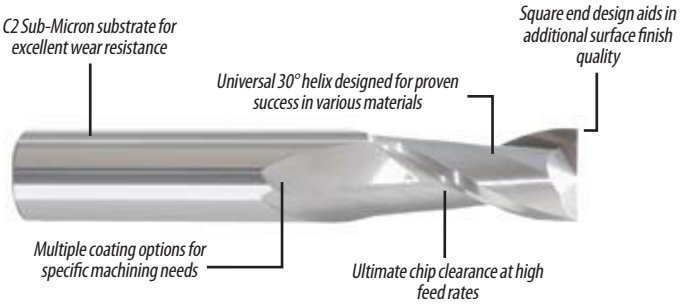
2 FLUTE - SINGLE END SQUARE



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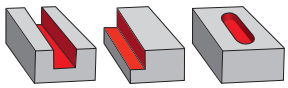
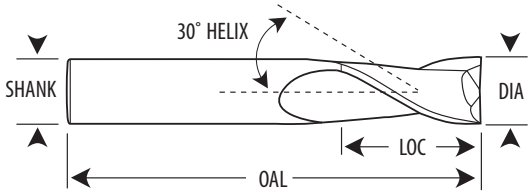


Bright & TiN

TiCN & AlTiN



DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
1/64	0.0156	3/64	1/8	1-1/2	Regular	204-001000	204-000995	—	204-000997
1/32	0.0313	1/16	1/8	1-1/2	Stub	202-001001	202-001002	202-001003	202-001004
		1/8	1/8	1-1/2	Regular	204-001001	204-001002	204-001003	204-001005
1.0mm	0.0394	4.0mm	3.0mm	39.0mm	Regular	204-001275	204-001270A	204-001270C	204-001270B
3/64	0.0469	3/32	1/8	1-1/2	Stub	202-001010	202-001011	202-001012	202-001013
		1/8	1/8	1-1/2	Regular	204-001010	204-001011	204-021010	204-001013
1.5mm	0.0591	5.0mm	3.0mm	39.0mm	Regular	204-001285	204-001285A	204-001285C	204-001285B
1/16	0.0625	1/8	1/8	1-1/2	Stub	202-001020	202-001021	202-001022	202-001023
		1/4	1/8	1-1/2	Regular	204-001020	204-001021	204-001022	204-001023
5/64	0.0781	5/32	1/8	1-1/2	Stub	202-001030	202-001031	202-001032	202-001033
		1/4	1/8	1-1/2	Regular	204-001030	204-001032	204-001033	204-001036
2.0mm	0.0787	8.0mm	3.0mm	39.0mm	Regular	204-001295	—	—	204-001295B
3/32	0.0938	3/16	1/8	1-1/2	Stub	202-001040	202-001041	202-001042	202-001043
		3/8	1/8	1-1/2	Regular	204-001040	204-001041	204-001042	204-001043
2.5mm	0.0984	9.5mm	3.0mm	39.0mm	Regular	204-001301	204-001297A	204-001297C	204-001297B
7/64	0.1094	7/32	1/8	1-1/2	Stub	202-001050	202-001051	202-001052	202-001053
		3/8	1/8	1-1/2	Regular	204-001050	204-001052	204-021050	204-001055
3.0mm	0.1181	12.0mm	3.0mm	39.0mm	Regular	204-001313	204-001311A	204-001311C	204-001311B
1/8	0.1250	1/4	1/8	1-1/2	Stub	202-001060	202-001061	202-001062	202-001063
		1/2	1/8	1-1/2	Regular	204-001060	204-001061	204-001062	204-001063
		3/4	1/8	2-1/4	Long	213-001001	213-001002	213-001003	213-001004
		1	1/8	3	X/Long	216-001001	216-001002	216-001003	216-001004
3.5mm	0.1378	12.0mm	4.0mm	51.0mm	Regular	204-001321	204-001321A	204-001321C	204-001321B
9/64	0.1406	9/32	3/16	2	Stub	202-001070	202-001071	202-001072	202-001073
		9/16	3/16	2	Regular	204-001070	204-001072	204-021070	204-001074
5/32	0.1563	5/16	3/16	2	Stub	202-001080	202-001081	202-001082	202-001083
		9/16	3/16	2	Regular	204-001080	204-001081	204-001083	204-001084
		3/4	3/16	2-1/2	Long	213-001005	213-001006	213-001007	213-001008
		1-1/8	3/16	3	X/Long	216-001005	216-001006	216-001007	216-001008
4.0mm	0.1575	14.0mm	4.0mm	51.0mm	Regular	204-001330	204-001330A	204-001330C	204-001330B
11/64	0.1719	5/16	3/16	2	Stub	202-001090	202-001091	202-001092	202-001093
		9/16	3/16	2	Regular	204-001090	204-001092	204-021090	204-001094

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2 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
4.5mm	0.1772	16.0mm	5.0mm	51.0mm	Regular	204-001341	204-001341A	204-001341C	204-001341B
3/16	0.1875	3/8	3/16	2	Stub	202-001100	202-001101	202-001102	202-001103
		5/8	3/16	2	Regular	204-001100	204-001101	204-001103	204-001104
		3/4	3/16	2-1/2	Long	213-001012	213-001013	213-001016	213-001014
		1-1/8	3/16	3	X/Long	216-001010	216-001011	216-001012	216-001013
5.0mm	0.1969	16.0mm	5.0mm	51.0mm	Regular	204-001351	204-001351A	204-001351C	204-001351B
13/64	0.2031	3/8	1/4	2	Stub	202-001110	202-001111	202-001112	202-001113
		5/8	1/4	2-1/2	Regular	204-001110	204-001112	204-021110	204-001114
7/32	0.2188	7/16	1/4	2	Stub	202-001120	202-001121	202-001122	202-001123
		5/8	1/4	2-1/2	Regular	204-001120	204-001121	204-001123	204-001124
15/64	0.2344	7/16	1/4	2	Stub	202-001125	202-001126	202-001127	202-001128
		3/4	1/4	2-1/2	Regular	204-001125	204-001127	204-021125	204-001129
6.0mm	0.2362	19.0mm	6.0mm	63.0mm	Regular	204-001361	204-001361A	204-001361C	204-001361B
1/4	0.2500	1/2	1/4	2	Stub	202-001130	202-001131	202-001132	202-001133
		3/4	1/4	2-1/2	Regular	204-001130	204-001131	204-001133	204-001134
		1-1/8	1/4	3	Long	213-001020	213-001021	213-001022	213-001023
		1-1/2	1/4	4	X/Long	216-001020	216-001021	216-001022	216-001023
		1-1/2	1/4	6	Ext XX/Long	216-001025	216-001027	216-001028	216-001029
17/64	0.2656	3/4	5/16	2-1/2	Regular	204-001135	204-001137	204-021181	204-001139
7.0mm	0.2756	19.0mm	8.0mm	63.0mm	Regular	204-001371	204-001371A	204-001371C	204-001371B
9/32	0.2813	1/2	5/16	2	Stub	202-001140	202-001141	202-001142	202-001143
		3/4	5/16	2-1/2	Regular	204-001140	204-001141	204-001143	204-001144
19/64	0.2969	13/16	5/16	2-1/2	Regular	204-001145	204-001148	204-021145	204-031145
5/16	0.3125	1/2	5/16	2	Stub	202-001150	202-001151	202-001152	202-001153
		13/16	5/16	2-1/2	Regular	204-001150	204-001151	204-001155	204-001153
		1-1/8	5/16	3	Long	213-001030	213-001031	213-001032	213-001033
		1-1/2	5/16	6	Ext XX/Long	216-001034	216-001035	216-001036	216-001034A
		1-5/8	5/16	4	X/Long	216-001030	216-001031	216-001032	216-001033
8.0mm	0.3150	20.0mm	8.0mm	63.0mm	Regular	204-001381	204-001381A	204-001381C	204-001381B
21/64	0.3281	1	3/8	2-1/2	Regular	204-001154	204-001157	204-021154	204-031154
11/32	0.3438	1	3/8	2-1/2	Regular	204-001160	204-001162	204-001163	204-001164
9.0mm	0.3543	22.0mm	10.0mm	63.0mm	Regular	204-001391	204-001391A	204-001391C	204-001391B
23/64	0.3594	1	3/8	2-1/2	Regular	204-001165	204-001166	204-021165	204-031165
3/8	0.3750	5/8	3/8	2	Stub	202-001170	202-001171	202-001172	202-001173
		1	3/8	2-1/2	Regular	204-001170	204-001171	204-001179	204-001173
		1-1/8	3/8	3	Long	213-001040	213-001009	213-001015	213-001010
		1-1/2	3/8	6	Ext XX/Long	216-001045	216-001046	216-001047	216-001048
		1-3/4	3/8	4	X/Long	216-001040	216-001041	216-001042	216-001043
25/64	0.3906	1	7/16	2-3/4	Regular	204-001175	204-001178	204-021175	204-031175
10.0mm	0.3937	22.0mm	10.0mm	76.0mm	Regular	204-001400	204-001400A	204-001400C	204-001400B
13/32	0.4063	1	7/16	2-3/4	Regular	204-001180	204-001182	204-021180	204-001184
27/64	0.4219	1	7/16	2-3/4	Regular	204-001185	204-001187	204-021185	204-031185
11.0mm	0.4331	25.0mm	12.0mm	76.0mm	Regular	204-001410	204-001410A	204-001410C	204-001410B

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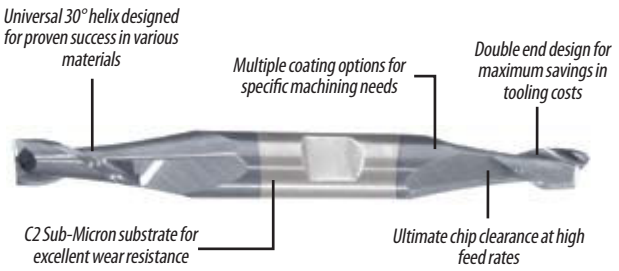
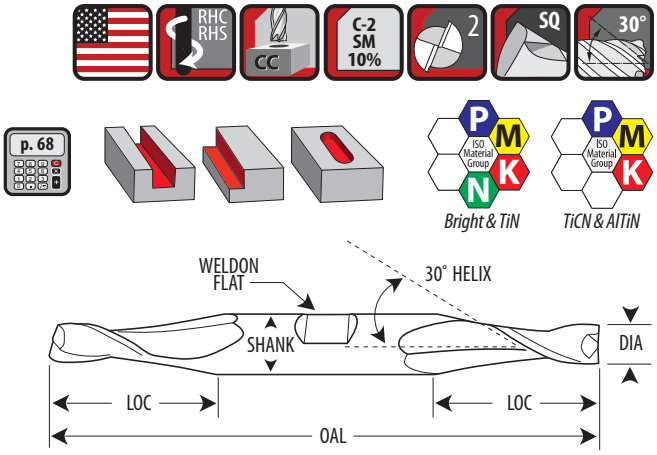
2 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
7/16	0.4375	5/8	7/16	2-1/2	Stub	202-001190	202-001191	202-001192	202-001193
		1	7/16	2-3/4	Regular	204-001190	204-001191	204-001189	204-001198
		2	7/16	4	Long	213-001050	213-001051	213-001053	213-001052
		3	7/16	6	X/Long	216-001050	216-001051	216-001052	216-001053
29/64	0.4531	1	1/2	3	Regular	204-001192	204-001194	204-021192	204-031192
15/32	0.4688	1	1/2	3	Regular	204-001193	204-001197	204-021193	204-001196
12.0mm	0.4724	25.0mm	12.0mm	76.0mm	Regular	204-001420	204-001420A	204-001420C	204-001420B
31/64	0.4844	1	1/2	3	Regular	204-001195	204-001199	204-021195	204-031195
1/2	0.5000	5/8	1/2	2-1/2	Stub	202-001200	202-001201	202-001202	202-001203
1/2	0.5000	1	1/2	3	Regular	204-001200	204-001201	204-001202	204-001205
		1-1/4	1/2	3	Regular	204-001200A	204-001200AA	204-001200C	204-001205A
		1-1/2	1/2	4	Medium	213-001059	213-001056	213-001062	213-001063
		1-1/2	1/2	6	Ext X/Long	216-001053A	216-001057	216-001058	216-001059
		2	1/2	4	Long	213-001060	213-001061	213-001065	213-001064
		3	1/2	6	X/Long	216-001054	216-001061	216-001062	216-001063
33/64	0.5156	1-1/4	9/16	3-1/2	Regular	204-001206	204-001206A	204-001206C	204-001206B
17/32	0.5313	1-1/4	9/16	3-1/2	Regular	204-001207	204-001207A	204-001207C	204-001207B
14.0mm	0.5512	32.0mm	14.0mm	90.0mm	Regular	204-001430	204-001430A	204-001430C	204-001430B
9/16	0.5625	1-1/4	9/16	3-1/2	Regular	204-001210	204-001209	204-001211	204-001212
5/8	0.6250	3/4	5/8	3	Stub	202-001220	202-001221	202-001222	202-001223
		1-1/4	5/8	3-1/2	Regular	204-001220	204-001222	204-001225	204-001224
		1-1/2	5/8	6	Ext X/Long	216-001074	216-001076	216-001075	216-001074A
		2-1/4	5/8	5	Long	213-001070	213-001071	213-001072	213-001073
		3	5/8	6	X/Long	216-001070	216-001071	216-001072	216-001073
16.0mm	0.6299	38.0mm	16.0mm	102.0mm	Regular	204-001440	204-001440A	204-001440C	204-001440B
11/16	0.6875	1-1/2	3/4	4	Regular	204-001230	204-001231	204-001233	204-001232
18.0mm	0.7087	38.0mm	18.0mm	102.0mm	Regular	204-001450	204-001450A	204-001450C	204-001450B
3/4	0.7500	1	3/4	3	Stub	202-001240	202-001241	202-001242	202-001243
		1-1/2	3/4	4	Regular	204-001240	204-001241	204-001243	204-001242
		1-1/2	3/4	6	Ext X/Long	216-001084	216-001085	216-001086	216-001084A
		2-1/4	3/4	5	Long	213-001080	213-001081	213-001082	213-001083
		3	3/4	6	X/Long	216-001080	216-001081	216-001082	216-001083
		4	3/4	7	XX/Long	216-001087	216-001087A	216-001087C	216-001087B
20.0mm	0.7874	38.0mm	20.0mm	102.0mm	Regular	204-001460	204-001460A	204-001460C	204-001460B
22.0mm	0.8661	38.0mm	22.0mm	102.0mm	Regular	204-001470	—	—	204-001470B
7/8	0.8750	1-1/2	7/8	4	Regular	204-001250	204-001251	204-001252	204-001253
25.0mm	0.9843	38.0mm	25.0mm	102.0mm	Regular	204-001480	—	—	204-001480B
1	1.0000	1-1/2	1	4	Regular	204-001260	204-001261	204-001262	204-001263
		1-1/2	1	6	Ext X/Long	216-001095	216-001097	216-001098	216-001096
		2-1/4	1	5	Long	213-001090	213-001091	213-001092	213-001093
		3	1	6	X/Long	216-001090	216-001091	216-001092	216-001093
		4	1	7	XX/Long	216-001099	216-001099A	216-001099C	216-001099B

2 FLUTE - DOUBLE END SQUARE

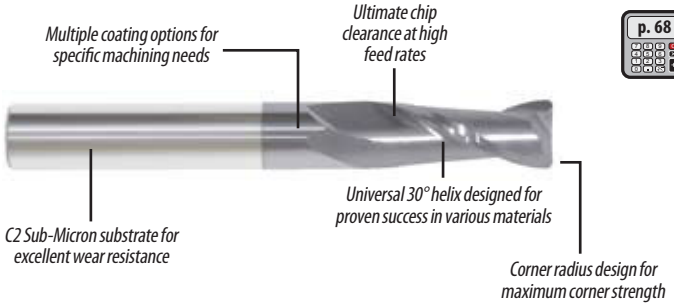




DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Flat	Length	Bright	TiN	TiCN	AlTiN
1/32	0.0313	1/16	1/8	1-1/2	No	Stub	234-001001	234-001002	234-001003	234-001004
3/64	0.0469	3/32	1/8	1-1/2	No	Stub	234-001010	234-001011	234-021010	234-031010
1/16	0.0625	1/8	1/8	1-1/2	No	Stub	234-001011A	234-001021	234-001022	234-001015
5/64	0.0781	1/8	1/8	1-1/2	No	Stub	234-001012	234-001013	234-001014	234-001024
3/32	0.0938	3/16	1/8	1-1/2	No	Stub	234-001030	234-001031	234-001033	234-001034
7/64	0.1094	3/16	1/8	1-1/2	No	Stub	234-001035	234-001036	234-001037	234-001038
1/8	0.1250	1/4	1/8	1-1/2	No	Stub	234-001040	234-001041	234-021040	234-001044
		3/8	3/8	3	Yes	Regular	237-001001	—	—	237-001004
9/64	0.1406	5/16	3/16	2	No	Stub	234-001042	234-001043	234-001048	234-001049
5/32	0.1563	5/16	3/16	2	No	Stub	234-001050	234-001051	234-001052	234-001054
		7/16	3/8	3	Yes	Regular	237-001010	—	—	237-001013
11/64	0.1719	5/16	3/16	2	No	Stub	234-001055	234-001056	234-001057	234-001058
3/16	0.1875	3/8	3/16	2	No	Stub	234-001060	234-001061	234-021061	234-001059
		1/2	3/8	3	Yes	Regular	237-001020	—	—	237-001023
13/64	0.2031	1/2	1/4	2-1/2	No	Stub	234-001063	234-001064	234-001065	234-001066
7/32	0.2188	1/2	1/4	2-1/2	No	Stub	234-001070	234-001071	234-001072	234-001074
		9/16	3/8	3-1/2	Yes	Regular	237-001030	—	—	237-001033
15/64	0.2344	1/2	1/4	2-1/2	No	Stub	234-001075	234-001076	234-001077	234-001078
1/4	0.2500	1/2	1/4	2-1/2	No	Stub	234-001080	234-001081	234-021081	234-001084
		5/8	3/8	3-1/2	Yes	Regular	237-001040	—	—	237-001043
9/32	0.2813	1/2	5/16	2-1/2	No	Stub	234-001082	234-001086	234-001087	234-001088
		11/16	3/8	3-1/2	Yes	Regular	237-001050	—	—	237-001053
5/16	0.3125	1/2	5/16	2-1/2	No	Stub	234-001090	234-001091	234-001092	234-001093
		3/4	3/8	3-1/2	Yes	Regular	237-001060	—	—	237-001063
11/32	0.3438	9/16	3/8	2-1/2	No	Stub	234-001094	234-001095	234-001096	234-001098
		3/4	3/8	3-1/2	Yes	Regular	237-001070	—	—	237-001073
3/8	0.3750	9/16	3/8	2-1/2	No	Stub	234-001100	234-001101	234-001102	234-001104
		3/4	3/8	3-1/2	Yes	Regular	237-001080	237-001081	—	237-001083
7/16	0.4375	9/16	7/16	2-3/4	No	Stub	234-001110	234-001111	234-021111	234-001114
		7/8	1/2	4	Yes	Regular	237-001090	—	—	237-001093
1/2	0.5000	5/8	1/2	3	No	Stub	234-001120	234-001121	234-021121	234-001124
		1	1/2	4	Yes	Regular	237-001100	—	—	237-001103

2 FLUTE - SINGLE END CORNER RADIUS



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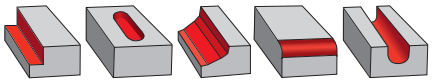
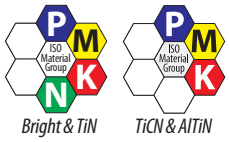
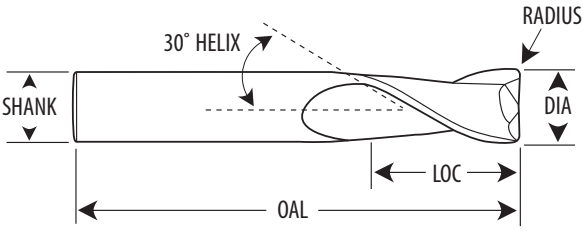






DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Radius	Bright	TiN	TiCN	AlTiN
1/8	0.1250	1/2	1/8	1-1/2	Regular	0.010	204-602300	204-602301	204-602302	204-602303
						0.015	204-602306	204-602307	204-602308	204-602309
						0.020	204-602312	204-602313	204-602314	204-602315
						0.030	204-602318	204-602319	204-602320	204-602321
3/16	0.1875	5/8	3/16	2	Regular	0.010	204-602424	204-602425	204-602426	204-602427
						0.015	204-602430	204-602431	204-602432	204-602433
						0.020	204-602436	204-602437	204-602438	204-602439
						0.030	204-602442	204-602443	204-602444	204-602445
						0.045	204-602448	204-602449	204-602450	204-602451
						0.060	204-602452	—	—	—
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.015	204-602551	204-602552	204-602553	204-602554
						0.020	204-602557	204-602558	204-602559	204-602560
						0.025	204-602563	204-602564	204-602565	204-602566
						0.030	204-602569	204-602570	204-602571	204-602572
						0.045	204-602575	204-602576	204-602577	204-602578
						0.060	204-602581	204-602582	204-602583	204-602584
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.015	204-602684	204-602685	204-602686	204-602687
						0.020	204-602690	204-602691	204-602692	204-602693
						0.025	204-602696	204-602697	204-602698	204-602699
						0.030	204-602702	204-602703	204-602704	204-602705
						0.045	204-602708	204-602709	204-602710	204-602711
						0.060	204-602714	204-602715	204-602716	204-602717
3/8	0.3750	1	3/8	2-1/2	Regular	0.015	204-602820	204-602821	204-602822	204-602823
						0.020	204-602826	204-602827	204-602828	204-602829
						0.025	204-602832	204-602833	204-602834	204-602835
						0.030	204-602838	204-602839	204-602840	204-602841
						0.045	204-602844	204-602845	204-602846	204-602847
						0.060	204-602850	204-602851	204-602852	204-602853
						0.090	204-602856	204-602857	204-602858	204-602859
						0.125	204-999375	—	—	—

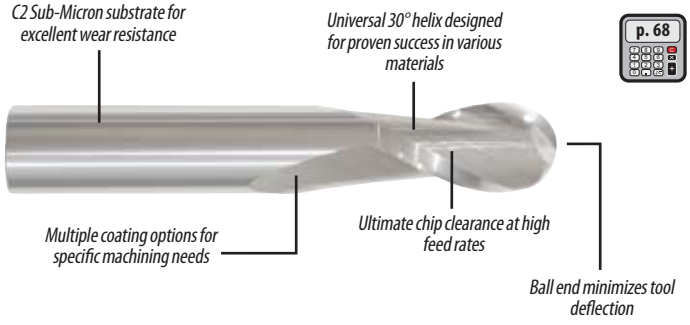
To Order Contact: Exact Tooling / www.exacttooling.com / sales@exacttooling.com / 888-988-8820

2 FLUTE - SINGLE END - RADIUS CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Radius	Bright	TiN	TiCN	AlTiN
7/16	0.4375	1	7/16	2-3/4	Regular	0.015	204-602961	204-602962	204-602963	204-602964
						0.020	204-602967	204-602968	204-602969	204-602970
						0.025	204-602974	204-602975	204-602976	204-602977
						0.030	204-602980	204-602981	204-602982	204-602983
						0.045	204-602986	204-602987	204-602988	204-602989
						0.060	204-602992	204-602993	204-602994	204-602995
						0.090	204-602998	204-602999	204-603000	204-603001
1/2	0.5000	1	1/2	3	Regular	0.015	204-603003	204-603004	204-603005	204-603006
						0.020	204-603009	204-603010	204-603011	204-603012
						0.025	204-603015	204-603016	204-603017	204-603018
						0.030	204-603021	204-603022	204-603023	204-603024
						0.045	204-603027	204-603028	204-603029	204-603030
						0.060	204-603033	204-603034	204-603035	204-603036
						0.090	204-603039	204-603040	204-603041	204-603042
						0.125	204-603045	204-603046	204-603047	204-603048
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	0.015	204-603150	204-603151	204-603152	204-603153
						0.020	204-603156	204-603157	204-603158	204-603159
						0.025	204-603162	204-603163	204-603164	204-603165
						0.030	204-603168	204-603169	204-603170	204-603171
						0.045	204-603174	204-603175	204-603176	204-603177
						0.060	204-603180	204-603181	204-603182	204-603183
						0.090	204-603186	204-603187	204-603188	204-603189
						0.125	204-603192	204-603193	204-603194	204-603195
						0.250	204-603196	—	—	—
3/4	0.7500	1-1/2	3/4	4	Regular	0.015	204-603297	204-603298	204-603299	204-603300
						0.020	204-603303	204-603304	204-603305	204-603306
						0.025	204-603309	204-603310	204-603311	204-603312
						0.030	204-603315	204-603316	204-603317	204-603318
						0.045	204-603321	204-603322	204-603323	204-603324
						0.060	204-603327	204-603328	204-603329	204-603330
						0.090	204-603333	204-603334	204-603335	204-603336
						0.125	204-603339	204-603340	204-603341	204-603342
						0.190	204-603345	204-603346	204-603347	204-603348
						0.250	204-603349	—	—	—
1	1.0000	1-1/2	1	4	Regular	0.015	204-603450	204-603451	204-603452	204-603453
						0.020	204-603456	204-603457	204-603458	204-603459
						0.025	204-603462	204-603463	204-603464	204-603465
						0.030	204-603468	204-603469	204-603470	204-603471
						0.045	204-603474	204-603475	204-603476	204-603477
						0.060	204-603480	204-603481	204-603482	204-603483
						0.090	204-603486	204-603487	204-603488	204-603489
						0.125	204-603492	204-603493	204-603494	204-603495
						0.190	204-603498	204-603499	204-603500	204-603501
						0.250	204-603504	204-603505	204-603506	204-603507

To Order Contact: Exact Tooling / www.exacttooling.com / sales@exacttooling.com / 888-988-8820

2 FLUTE - SINGLE END BALLNOSE



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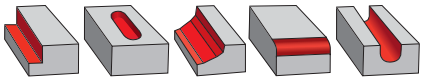
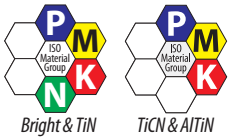
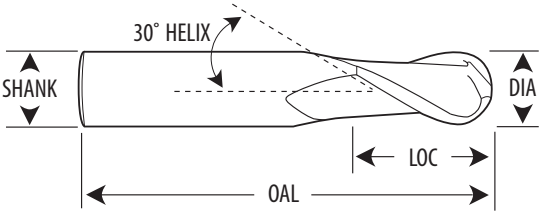






DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
1/64	0.0156	3/64	1/8	1-1/2	Regular	221-001000	221-000995	221-000996	221-000997
1/32	0.0313	1/16	1/8	1-1/2	Stub	219-001001	219-001002	219-001003	219-001004
		1/8	1/8	1-1/2	Regular	221-001005	221-001006	221-021005	221-001016
1.0mm	0.0394	4.0mm	3.0mm	39.0mm	Regular	221-001395	221-001400A	221-001400C	221-001400B
3/64	0.0469	3/32	1/8	1-1/2	Stub	219-001010	219-001011	219-001012	219-001013
		1/8	1/8	1-1/2	Regular	221-001007	221-001004	221-021007	221-001013
1.5mm	0.0591	5.0mm	3.0mm	39.0mm	Regular	221-001410	221-001410A	221-001410C	221-001410B
1/16	0.0625	1/8	1/8	1-1/2	Stub	219-001020	219-001021	219-001022	219-001023
		1/4	1/8	1-1/2	Regular	221-001008AA	221-001002	221-000999	221-001003
5/64	0.0781	5/32	1/8	1-1/2	Stub	219-001025	219-011025	219-021025	219-031025
		1/4	1/8	1-1/2	Regular	221-001009	221-001008	221-021009	221-001018
2.0mm	0.0787	8.0mm	3.0mm	39.0mm	Regular	221-001420	221-001420A	221-001420C	221-001420B
3/32	0.0938	3/16	1/8	1-1/2	Stub	219-001030	219-001031	219-001032	219-001033
		3/8	1/8	1-1/2	Regular	221-001010	221-001011	221-001012	221-001019
2.5mm	0.0984	9.5mm	3.0mm	39.0mm	Regular	221-001425	221-001425A	221-001425C	221-001425B
7/64	0.1094	7/32	1/8	1-1/2	Stub	219-001035	219-011035	219-021035	219-031035
		3/8	1/8	1-1/2	Regular	221-001014	221-001015	221-021014	221-001017
3.0mm	0.1181	12.0mm	3.0mm	39.0mm	Regular	221-001430	221-001430A	221-001430C	221-001430B
1/8	0.1250	1/4	1/8	1-1/2	Stub	219-001040	219-001041	219-001042	219-001043
		1/2	1/8	1-1/2	Regular	221-001020	221-001021	221-001026	221-001023
		3/4	1/8	2-1/4	Long	224-001001	224-001002	224-001003	224-001004
		1	1/8	3	X/Long	227-001001	227-001002	227-001003	227-001004
3.5mm	0.1378	12.0mm	4.0mm	51.0mm	Regular	221-001435	221-001435A	221-001435C	221-001435B
9/64	0.1406	9/32	3/16	2	Stub	219-001045	219-011045	219-021045	219-031045
		9/16	3/16	2	Regular	221-001024	221-001025	221-021024	221-001027
5/32	0.1563	5/16	3/16	2	Stub	219-001050	219-001051	219-001052	219-001053
		9/16	3/16	2	Regular	221-001030	221-001031	221-001032	221-001033
		3/4	3/16	2-1/2	Long	224-001005	224-001006	224-001007	224-001008
		1-1/8	3/16	3	X/Long	227-001005	227-001006	227-001007	227-001008
4.0mm	0.1575	14.0mm	4.0mm	51.0mm	Regular	221-001440	221-001440A	221-001440C	221-001440B

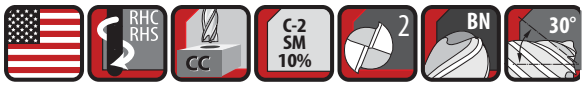
2 FLUTE - SINGLE END - BALLNOSE CONTINUED

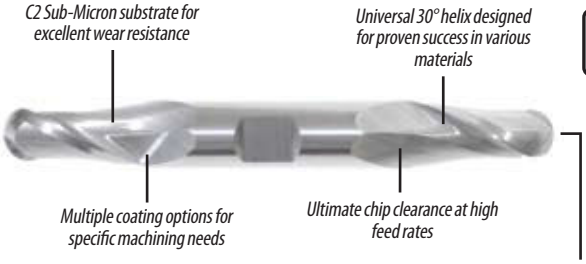
DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
11/64	0.1719	5/16	3/16	2	Stub	219-001055	219-011055	219-021055	219-031055
		9/16	3/16	2	Regular	221-001034	221-001035	221-021034	221-001037
4.5mm	0.1772	16.0mm	5.0mm	51.0mm	Regular	221-001445	221-001445A	221-001445C	221-001445B
3/16	0.1875	3/8	3/16	2	Stub	219-001060	219-001061	219-001062	219-001063
		5/8	3/16	2	Regular	221-001040	221-001041	221-001042	221-001043
		3/4	3/16	2-1/2	Long	224-001012	224-001013	224-001014	224-001015
		1-1/8	3/16	3	X/Long	227-001010	227-001011	227-001012	227-001013
5.0mm	0.1969	16.0mm	5.0mm	51.0mm	Regular	221-001450	221-001450A	221-001450C	221-001450B
13/64	0.2031	3/8	1/4	2	Stub	219-001065	219-011065	219-021065	219-031065
		5/8	1/4	2-1/2	Regular	221-001044	221-001045	221-021044	221-001047
7/32	0.2188	7/16	1/4	2	Stub	219-001070	219-001071	219-001072	219-001073
		5/8	1/4	2-1/2	Regular	221-001050	221-001051	221-001052	221-001053
15/64	0.2344	7/16	1/4	2	Stub	219-001075	219-011075	219-021075	219-031075
		3/4	1/4	2-1/2	Regular	221-001054	221-001055	221-021054	221-001057
6.0mm	0.2362	19.0mm	6.0mm	63.0mm	Regular	221-001460	221-001460A	221-001460C	221-001460B
1/4	0.2500	1/2	1/4	2	Stub	219-001080	219-001081	219-001082	219-001083
		3/4	1/4	2-1/2	Regular	221-001060	221-001061	221-001059	221-001062
		1-1/8	1/4	3	Long	224-001020	224-001021	224-001022	224-001023
		1-1/2	1/4	4	X/Long	227-001020	227-001021	227-001022	227-001023
		1-1/2	1/4	6	Ext XX/Long	227-001025	227-001027	227-001028	227-001029
17/64	0.2656	3/4	5/16	2-1/2	Regular	221-001063	221-001064	221-001065	221-001066
7.0mm	0.2756	19.0mm	8.0mm	63.0mm	Regular	221-001470	221-001470A	221-001470C	221-001470B
9/32	0.2813	3/4	5/16	2-1/2	Regular	221-001070	221-001071	221-001072	221-001073
19/64	0.2969	13/16	5/16	2-1/2	Regular	221-001075	221-001076	221-001077	221-001078
5/16	0.3125	1/2	5/16	2	Stub	219-001090	219-001091	219-001092	219-001093
		13/16	5/16	2-1/2	Regular	221-001080	221-001081	221-001082	221-001079
		1-1/8	5/16	3	Long	224-001030	224-001031	224-001032	224-001033
		1-1/2	5/16	6	Ext XX/Long	227-001033A	227-001033C	227-001033D	227-001033B
		1-5/8	5/16	4	X/Long	227-001030	227-001031	227-001032	227-001033
8.0mm	0.3150	20.0mm	8.0mm	63.0mm	Regular	221-001480	221-001480A	221-001480C	221-001480B
21/64	0.3281	1	3/8	2-1/2	Regular	221-001083	221-001084	221-021083	221-031083
11/32	0.3438	1	3/8	2-1/2	Regular	221-001085	221-001086	221-001165	221-001087
9.0mm	0.3543	22.0mm	10.0mm	63.0mm	Regular	221-001490	221-001490A	221-001490C	221-001490B
23/64	0.3594	1	3/8	2-1/2	Regular	221-001088	221-001089	221-021088	221-031088
3/8	0.3750	5/8	3/8	2	Stub	219-001100	219-001101	219-001102	219-001103
		1	3/8	2-1/2	Regular	221-001090	221-001095	221-001167	221-001091
		1-1/8	3/8	3	Long	224-001040	224-001041	224-001042	224-001044
		1-1/2	3/8	6	Ext XX/Long	227-001035	227-001049	227-001037	227-001035A
		1-3/4	3/8	4	X/Long	227-001040	227-001041	227-001042	227-001043
25/64	0.3906	1	7/16	2-3/4	Regular	221-001093	221-001094	221-021093	221-031093

2 FLUTE - SINGLE END - BALLNOSE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
10.0mm	0.3937	22.0mm	10.0mm	76.0mm	Regular	221-001500	221-001500A	221-001500C	221-001500B
13/32	0.4063	1	7/16	2-3/4	Regular	221-001096	221-001097	221-021096	221-001118
27/64	0.4219	1	7/16	2-3/4	Regular	221-001098	221-001099	221-021099	221-031099
11.0mm	0.4331	25.0mm	12.0mm	76.0mm	Regular	221-001510	—	221-001510C	221-001510B
7/16	0.4375	5/8	7/16	2-1/2	Stub	219-001110	219-001111	219-001112	219-001113
		1	7/16	2-3/4	Regular	221-001100	221-001101	221-001104	221-001119
		2	7/16	4	Long	224-001050	224-001051	224-001052	224-001053
		3	7/16	6	X/Long	227-001050	227-001051	227-001052	227-001053
29/64	0.4531	1	1/2	3	Regular	221-001102	221-001103	221-021102	221-031102
15/32	0.4688	1	1/2	3	Regular	221-001105	221-001106	221-021105	221-001123
12.0mm	0.4724	25.0mm	12.0mm	76.0mm	Regular	221-001520	221-001520A	221-001520C	221-001520B
31/64	0.4844	1	1/2	3	Regular	221-001108	221-001109	221-021108	221-031108
1/2	0.5000	5/8	1/2	2-1/2	Stub	219-001120	219-001121	219-001122	219-001123
		1	1/2	3	Regular	221-001110	221-001115	221-001116	221-001117
		1-1/2	1/2	4	Medium	224-001059	224-001059A	224-001059C	224-001059B
		1-1/2	1/2	6	Ext X/Long	227-001053A	227-001057	227-001058	227-001059
		2	1/2	4	Long	224-001060	224-001061	224-001062	224-001063
		3	1/2	6	X/Long	227-001054	227-001061	227-001062	227-001064
14.0mm	0.5512	32.0mm	14.0mm	90.0mm	Regular	221-001540	221-001540A	221-001540C	221-001540B
9/16	0.5625	1-1/4	9/16	3-1/2	Regular	221-001120	221-001121	221-001125	221-001124
5/8	0.6250	3/4	5/8	3	Stub	219-001130	219-001131	219-001132	219-001133
		1-1/4	5/8	3-1/2	Regular	221-001130	221-001131	221-001133	221-001134
		1-1/2	5/8	6	Ext X/Long	227-001073A	227-001073C	227-001073D	227-001073B
		2-1/4	5/8	5	Long	224-001070	224-001071	224-001072	224-001073
		3	5/8	6	X/Long	227-001070	227-001071	227-001072	227-001074
16.0mm	0.6299	32.0mm	16.0mm	102.0mm	Regular	221-001560	221-001560A	221-001560C	221-001560B
11/16	0.6875	1-1/2	3/4	4	Regular	221-001140	221-001141	221-021140	221-031140
18.0mm	0.7087	38.0mm	18.0mm	102.0mm	Regular	221-001580	221-001580A	221-001580C	221-001580B
3/4	0.7500	1	3/4	3	Stub	219-001140	219-001141	219-001142	219-001143
		1-1/2	3/4	4	Regular	221-001150	221-001151	221-001153	221-001154
		1-1/2	3/4	6	Ext X/Long	227-001085	227-001085A	227-001085B	227-001086
		2-1/4	3/4	5	Long	224-001080	224-001081	224-001082	224-001083
		3	3/4	6	X/Long	227-001080	227-001081	227-001082	227-001084
20.0mm	0.7874	38.0mm	20.0mm	102.0mm	Regular	221-001600	221-001600A	221-001600C	221-001600B
22.0mm	0.8661	38.0mm	22.0mm	102.0mm	Regular	221-001620	—	—	221-001620B
7/8	0.8750	1-1/2	7/8	4	Regular	221-001155	221-001156	221-021155	221-001158
25.0mm	0.9843	38.0mm	25.0mm	102.0mm	Regular	221-001650	—	—	221-001650B
1	1.0000	1-1/2	1	4	Regular	221-001160	221-001161	221-001163	221-001164
		1-1/2	1	6	Ext X/Long	227-001088	227-001088A	227-001088C	227-001089
		2-1/4	1	5	Long	224-001090	224-001091	224-001092	224-001093
		3	1	6	X/Long	227-001090	227-001091	227-001092	227-001094

2 FLUTE - DOUBLE END BALLNOSE





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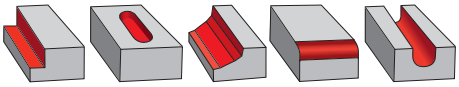

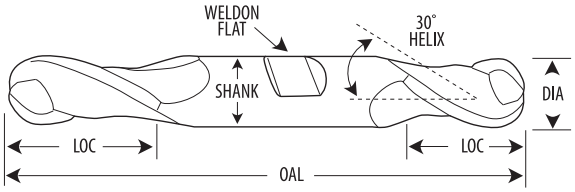

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Flat	Length	Bright	TiN	TiCN	AlTiN
1/32	0.0313	1/16	1/8	1-1/2	No	Stub	240-001001	240-001005	240-021001	240-031001
3/64	0.0469	3/32	1/8	1-1/2	No	Stub	240-001001A	240-001011	240-021010	240-031010
1/16	0.0625	1/8	1/8	1-1/2	No	Stub	240-001002	240-001021	240-021002	240-031003
5/64	0.0781	1/8	1/8	1-1/2	No	Stub	240-001003	240-001013	240-021003	240-031002
3/32	0.0938	3/16	1/8	1-1/2	No	Stub	240-001003A	240-001031	240-021030	240-031030
7/64	0.1094	3/16	1/8	1-1/2	No	Stub	240-001004	240-001036	240-021004	240-031004
1/8	0.1250	1/4	1/8	1-1/2	No	Stub	240-001040	240-001041	240-021040	240-031040
		3/8	3/8	3	Yes	Regular	243-001001	—	—	243-001004
9/64	0.1406	5/16	3/16	2	No	Stub	240-001044	240-001043	240-021044	240-031044
5/32	0.1563	5/16	3/16	2	No	Stub	240-001050	240-001051	240-021050	240-031050
		7/16	3/8	3	Yes	Regular	243-001010	—	—	243-001013
11/64	0.1719	5/16	3/16	2	No	Stub	240-001055	240-001056	240-001057	240-031055
3/16	0.1875	3/8	3/16	2	No	Stub	240-001060	240-001061	240-021060	240-031060
		1/2	3/8	3	Yes	Regular	243-001020	—	—	243-001023
13/64	0.2031	1/2	1/4	2-1/2	No	Stub	240-001065	240-001066	240-021065	240-031065
7/32	0.2188	1/2	1/4	2-1/2	No	Stub	240-001070	240-001071	240-021070	240-031070
		9/16	3/8	3-1/2	Yes	Regular	243-001030	—	—	243-001033
15/64	0.2344	1/2	1/4	2-1/2	No	Stub	240-001075	240-001076	240-021075	240-031075
1/4	0.2500	1/2	1/4	2-1/2	No	Stub	240-001080	240-001081	240-021080	240-031080
		5/8	3/8	3-1/2	Yes	Regular	243-001040	—	—	243-001043
9/32	0.2813	1/2	5/16	2-1/2	No	Stub	240-001085	240-001086	240-021085	240-031085
		11/16	3/8	3-1/2	Yes	Regular	243-001050	—	—	243-001053
5/16	0.3125	1/2	5/16	2-1/2	No	Stub	240-001090	240-001091	240-021090	240-031090
		3/4	3/8	3-1/2	Yes	Regular	243-001060	—	—	243-001063
11/32	0.3438	9/16	3/8	2-1/2	No	Stub	240-001094	240-001095	240-021094	240-031094
		3/4	3/8	3-1/2	Yes	Regular	243-001070	—	—	243-001073
3/8	0.3750	9/16	3/8	2-1/2	No	Stub	240-001100	240-001101	240-021100	240-031100
		3/4	3/8	3-1/2	Yes	Regular	243-001080	—	—	243-001083
7/16	0.4375	9/16	7/16	2-3/4	No	Stub	240-001110	240-001111	240-021110	240-031110
		7/8	1/2	4	Yes	Regular	243-001090	—	—	243-001093
1/2	0.5000	5/8	1/2	3	No	Stub	240-001120	240-001121	240-021120	240-031120
		1	1/2	4	Yes	Regular	243-001100	—	—	243-001103

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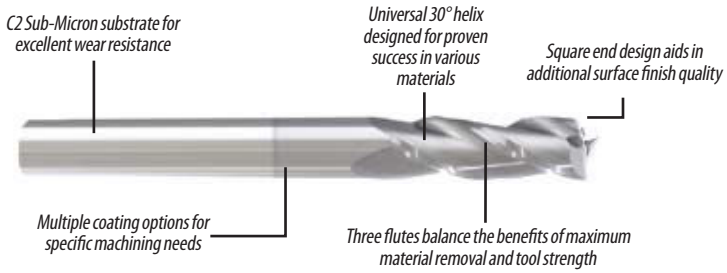
3 FLUTE - SINGLE END SQUARE



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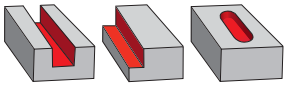
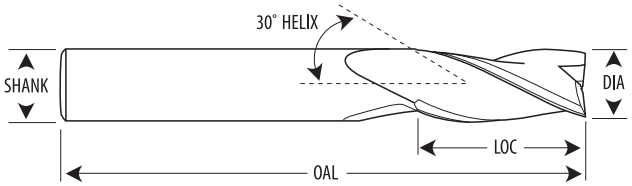


Bright & TiN

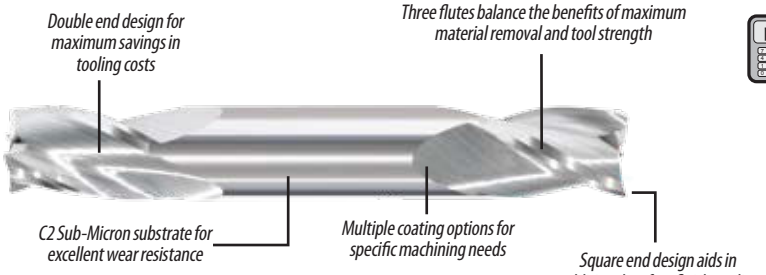
TiCN & AlTiN

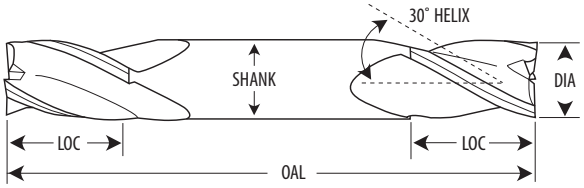


DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
1/32	0.0313	1/8	1/8	1-1/2	Regular	205-001001	205-001002	205-001003	205-001004
3/64	0.0469	1/8	1/8	1-1/2	Regular	205-001020	205-001021	205-001022	205-001023
1/16	0.0625	1/4	1/8	1-1/2	Regular	205-001030	205-001031	205-001032	205-001033
5/64	0.0781	1/4	1/8	1-1/2	Regular	205-001040	205-001041	205-001042	205-001043
3/32	0.0938	3/8	1/8	1-1/2	Regular	205-001050	205-001051	205-001052	205-001053
7/64	0.1094	3/8	1/8	1-1/2	Regular	205-001060	205-001061	205-001062	205-001063
1/8	0.1250	1/2	1/8	1-1/2	Regular	205-001070	205-001071	205-001072	205-001073
5/32	0.1563	9/16	3/16	2	Regular	205-001090	205-001091	205-001092	205-001093
3/16	0.1875	5/8	3/16	2	Regular	205-001110	205-001111	205-001112	205-001113
7/32	0.2188	5/8	1/4	2-1/2	Regular	205-001130	205-001131	205-001132	205-001133
1/4	0.2500	3/4	1/4	2-1/2	Regular	205-001140	205-001143	205-021140	205-031140
9/32	0.2813	3/4	5/16	2-1/2	Regular	205-001150	205-001151	205-001152	205-001153
5/16	0.3125	13/16	5/16	2-1/2	Regular	205-001160	205-001161	205-001162	205-001163
3/8	0.3750	1	3/8	2-1/2	Regular	205-001180	205-001184	205-001185	205-001186
25/64	0.3906	1	7/16	2-3/4	Regular	205-001188	—	—	—
7/16	0.4375	1	7/16	2-3/4	Regular	205-001200	205-001201	205-001202	205-001203
1/2	0.5000	1	1/2	3	Regular	205-001210	205-001214	205-001215	205-001216
9/16	0.5625	1-1/4	9/16	3-1/2	Regular	205-001220	—	—	205-001223
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	205-001230	205-001231	205-001232	205-001233
3/4	0.7500	1-1/2	3/4	4	Regular	205-001250	205-001251	205-001252	205-001253
1	1.0000	1-1/2	1	4	Regular	205-001270	205-001271	205-001272	205-001273

3 FLUTE - DOUBLE END SQUARE

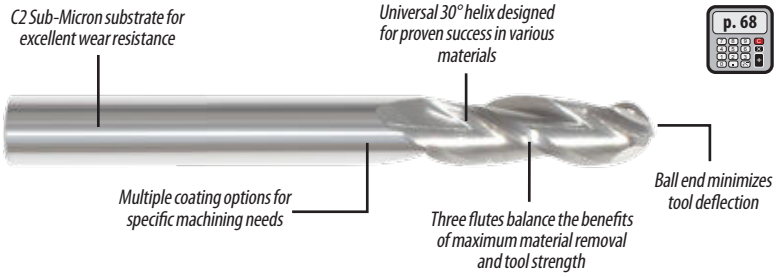




DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Flat	Length	Bright
1/32	0.0313	1/16	1/8	1-1/2	No	Stub	235-001001
3/64	0.0469	3/32	1/8	1-1/2	No	Stub	235-001010
1/16	0.0625	1/8	1/8	1-1/2	No	Stub	235-001020
3/32	0.0938	3/16	1/8	1-1/2	No	Stub	235-001030
1/8	0.1250	1/4	1/8	1-1/2	No	Stub	235-001040
5/32	0.1563	5/16	3/16	2	No	Stub	235-001050
3/16	0.1875	3/8	3/16	2	No	Stub	235-001060
7/32	0.2188	1/2	1/4	2-1/2	No	Stub	235-001070
1/4	0.2500	1/2	1/4	2-1/2	No	Stub	235-001080
5/16	0.3125	1/2	5/16	2-1/2	No	Stub	235-001090
3/8	0.3750	9/16	3/8	2-1/2	No	Stub	235-001100
7/16	0.4375	9/16	7/16	2-3/4	No	Stub	235-001110
1/2	0.5000	5/8	1/2	3	No	Stub	235-001120

3 FLUTE - SINGLE END BALLNOSE



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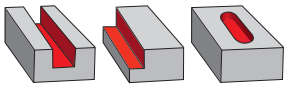
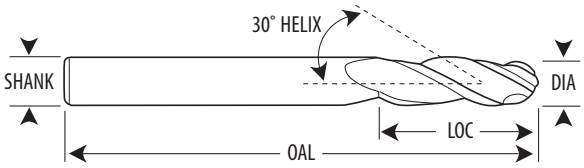
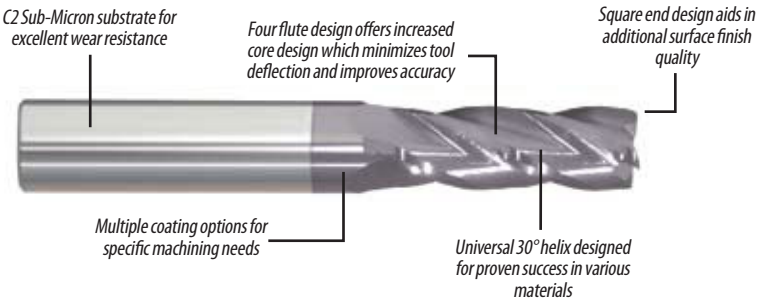




DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
1/32	0.0313	1/8	1/8	1-1/2	Regular	222-001001	222-001002	222-001003	222-001004
3/64	0.0469	1/8	1/8	1-1/2	Regular	222-001020	222-001021	222-001022	222-001023
1/16	0.0625	1/4	1/8	1-1/2	Regular	222-001030	222-001031	222-001032	222-001033
5/64	0.0781	1/4	1/8	1-1/2	Regular	222-001040	222-001041	222-001042	222-001043
3/32	0.0938	3/8	1/8	1-1/2	Regular	222-001050	222-001051	222-001052	222-001053
7/64	0.1094	3/8	1/8	1-1/2	Regular	222-001060	222-001061	222-001062	222-001063
1/8	0.1250	1/2	1/8	1-1/2	Regular	222-001070	222-001071	222-001072	222-001073
5/32	0.1563	9/16	3/16	2	Regular	222-001090	222-001091	222-001092	222-001093
3/16	0.1875	5/8	3/16	2	Regular	222-001110	222-001111	222-001112	222-001113
7/32	0.2188	5/8	1/4	2-1/2	Regular	222-001130	222-001131	222-001132	222-001133
1/4	0.2500	3/4	1/4	2-1/2	Regular	222-001140	222-001141	222-001142	222-001143
9/32	0.2813	3/4	5/16	2-1/2	Regular	222-001150	222-001151	222-001152	222-001153
5/16	0.3125	13/16	5/16	2-1/2	Regular	222-001160	222-001161	222-001162	222-001163
3/8	0.3750	1	3/8	2-1/2	Regular	222-001180	222-001181	222-001182	222-001183
7/16	0.4375	1	7/16	2-3/4	Regular	222-001200	222-001201	222-001202	222-001203
1/2	0.5000	1	1/2	3	Regular	222-001210	222-001211	222-001212	222-001213
9/16	0.5625	1-1/4	9/16	3-1/2	Regular	222-001220	222-001221	222-001222	222-001223
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	222-001230	222-001231	222-001232	222-001233
3/4	0.7500	1-1/2	3/4	4	Regular	222-001250	222-001251	222-001252	222-001253
1	1.0000	1-1/2	1	4	Regular	222-001270	222-001271	222-001272	222-001273

4 FLUTE - SINGLE END SQUARE



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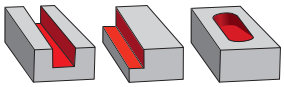

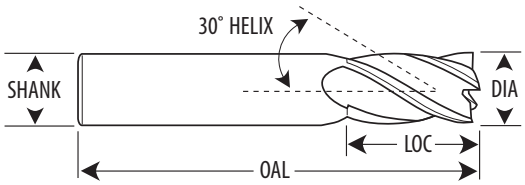

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
1/64	0.0156	3/64	1/8	1-1/2	Regular	206-001000	206-000995	206-000996	206-000997
1/32	0.0313	1/16	1/8	1-1/2	Stub	203-001001	203-001002	203-001003	203-001004
		1/8	1/8	1-1/2	Regular	206-001001	206-001002	206-001003	206-001005
1.0mm	0.0394	4.0mm	3.0mm	39.0mm	Regular	206-001275	206-001275A	206-001270AA	206-001272
3/64	0.0469	3/32	1/8	1-1/2	Stub	203-001010	203-001011	203-001012	203-001013
		1/8	1/8	1-1/2	Regular	206-001010	206-001011	206-001013	206-001015
1.5mm	0.0591	5.0mm	3.0mm	39.0mm	Regular	206-001285	206-001285A	206-001285C	206-001287
1/16	0.0625	1/8	1/8	1-1/2	Stub	203-001020	203-001021	203-001022	203-001023
		1/4	1/8	1-1/2	Regular	206-001020	206-001021	206-001022	206-001027
5/64	0.0781	5/32	1/8	1-1/2	Stub	203-001030	203-001031	203-001032	203-001033
		1/4	1/8	1-1/2	Regular	206-001030	206-001031	206-001032	206-001036
2.0mm	0.0787	8.0mm	3.0mm	39.0mm	Regular	206-001295	206-001295A	206-001295C	206-001292
3/32	0.0938	3/16	1/8	1-1/2	Stub	203-001040	203-001041	203-001042	203-001043
		3/8	1/8	1-1/2	Regular	206-001040	206-001041	206-001042	206-001044
2.5mm	0.0984	9.5mm	3.0mm	39.0mm	Regular	206-001300	206-001300A	206-001300C	206-001302
7/64	0.1094	7/32	1/8	1-1/2	Stub	203-001050	203-001051	203-001052	203-001053
		3/8	1/8	1-1/2	Regular	206-001050	206-001051	206-001052	206-001053
3.0mm	0.1181	12.0mm	3.0mm	39.0mm	Regular	206-001313	—	206-001313C	206-001314
1/8	0.1250	1/4	1/8	1-1/2	Stub	203-001060	203-001061	203-001062	203-001063
		1/2	1/8	1-1/2	Regular	206-001060	206-001061	206-001063	206-001067
		3/4	1/8	2-1/4	Long	215-001001	215-001002	215-001003	215-001004
		1	1/8	3	X/Long	218-001001	218-001002	218-001003	218-001004
3.5mm	0.1378	12.0mm	4.0mm	51.0mm	Regular	206-001320	206-001320A	206-001320C	206-001322
9/64	0.1406	9/32	3/16	2	Stub	203-001070	203-001071	203-001072	203-001073
		9/16	3/16	2	Regular	206-001070	206-001071	206-001072	206-001073

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4 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
5/32	0.1563	5/16	3/16	2	Stub	203-001080	203-001081	203-001082	203-001083
		9/16	3/16	2	Regular	206-001080	206-001081	206-001082	206-001083
		3/4	3/16	2-1/2	Long	215-001005	215-001006	215-001007	215-001008
		1-1/8	3/16	3	X/Long	218-001005	218-001006	218-001007	218-001008
4.0mm	0.1575	14.0mm	4.0mm	51.0mm	Regular	206-001330	206-001330A	206-001330C	206-001330B
11/64	0.1719	5/16	3/16	2	Stub	203-001090	203-001091	203-001092	203-001093
		9/16	3/16	2	Regular	206-001090	206-001091	206-021090	206-001093
4.5mm	0.1772	16.0mm	5.0mm	51.0mm	Regular	206-001340	206-001340A	206-001340C	206-001340B
3/16	0.1875	3/8	3/16	2	Stub	203-001100	203-001101	203-001105	203-001103
		5/8	3/16	2	Regular	206-001100	206-001101	206-001102	206-001107
		3/4	3/16	2-1/2	Long	215-001012	215-001013	215-001014	215-001015
		1	3/16	4	X/Long	218-001015	218-001015A	218-001015B	218-001015C
		1-1/8	3/16	3	X/Long	218-001010	218-001011	218-001012	218-001013
5.0mm	0.1969	16.0mm	5.0mm	51.0mm	Regular	206-001350	206-001350A	206-001350C	206-001350B
13/64	0.2031	3/8	1/4	2	Stub	203-001110	203-001111	203-001112	203-001113
		5/8	1/4	2-1/2	Regular	206-001110	206-001111	206-021110	206-001113
7/32	0.2188	7/16	1/4	2	Stub	203-001120	203-001121	203-001122	203-001123
		5/8	1/4	2-1/2	Regular	206-001120	206-001121	206-001122	206-001123
15/64	0.2344	7/16	1/4	2	Stub	203-001125	203-001126	203-001127	203-001128
		3/4	1/4	2-1/2	Regular	206-001125	206-001126	206-021125	206-001128
6.0mm	0.2362	19.0mm	6.0mm	63.0mm	Regular	206-001360	206-001360A	206-001360C	206-001360B
1/4	0.2500	1/2	1/4	2	Stub	203-001130	203-001131	203-001132	203-001133
		3/4	1/4	2-1/2	Regular	206-001130	206-001131	206-001132	206-001137
		1	1/4	4	Ext X/Long	218-001019	218-001019A	218-001019C	218-001019B
		1-1/8	1/4	3	Long	215-001020	215-001021	215-001022	215-001023
		1-1/2	1/4	4	X/Long	218-001020	218-001021	218-001024	218-001023
		1-1/2	1/4	6	Ext XX/Long	218-001025	218-001026	218-001027	218-001028
17/64	0.2656	3/4	5/16	2-1/2	Regular	206-001133	206-001135	206-021133	206-001136
7.0mm	0.2756	19.0mm	8.0mm	63.0mm	Regular	206-001370	206-001370A	206-001370C	206-001372
9/32	0.2813	1/2	5/16	2	Stub	203-001140	203-001141	203-001142	203-001143
		3/4	5/16	2-1/2	Regular	206-001140	206-001142	206-001143	206-001144
19/64	0.2969	13/16	5/16	2-1/2	Regular	206-001147	206-001145	206-021147	206-031147
5/16	0.3125	1/2	5/16	2	Stub	203-001150	203-001151	203-001152	203-001153
		13/16	5/16	2-1/2	Regular	206-001150	206-001151	206-001152	206-001153
		1-1/8	5/16	3	Long	215-001030	215-001033	215-001029	215-001028
		1-1/2	5/16	6	Ext XX/Long	218-001029	218-001029AA	218-001029B	218-001029A
		1-5/8	5/16	4	X/Long	218-001030	218-001031	218-001032	218-001033
8.0mm	0.3150	20.0mm	8.0mm	63.0mm	Regular	206-001380	206-001380A	206-001380C	206-001380B

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4 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
21/64	0.3281	1	3/8	2-1/2	Regular	206-001154	206-001157	206-021154	206-031154
11/32	0.3438	1	3/8	2-1/2	Regular	206-001160	206-001161	206-001162	206-001163
9.0mm	0.3543	22.0mm	10.0mm	63.0mm	Regular	206-001390	206-001390A	206-001390C	206-001390B
23/64	0.3594	1	3/8	2-1/2	Regular	206-001169	206-001165	206-021169	206-031169
3/8	0.3750	5/8	3/8	2	Stub	203-001170	203-001171	203-001172	203-001173
		1	3/8	2-1/2	Regular	206-001170	206-001171	206-001176	206-001177
		1	3/8	4	X/Long	218-001035	218-001035A	218-001037C	218-001037
		1-1/8	3/8	3	Long	215-001040	215-001041	215-001044	215-001043
		1-1/2	3/8	6	Ext XX/Long	218-001045	218-001046	218-001048	218-001047
		1-3/4	3/8	4	X/Long	218-001040	218-001039	218-001036	218-001038
25/64	0.3906	1	7/16	2-3/4	Regular	206-001175	206-001178	206-021175	206-031175
10.0mm	0.3937	22.0mm	10.0mm	76.0mm	Regular	206-001400	—	206-001400C	206-001402
13/32	0.4063	1	7/16	2-3/4	Regular	206-001180	206-001181	206-001182	206-001183
27/64	0.4219	1	7/16	2-3/4	Regular	206-001185	206-001187	206-021185	206-031185
11.0mm	0.4331	25.0mm	12.0mm	76.0mm	Regular	206-001410	206-001410A	206-001410C	206-001412
7/16	0.4375	5/8	7/16	2-1/2	Stub	203-001190	203-001191	203-001192	203-001193
		1	7/16	2-3/4	Regular	206-001190	206-001191	206-001192	206-001193
		2	7/16	4	Long	215-001050	215-001051	215-001052	215-001053
		3	7/16	6	X/Long	218-001050	218-001051	218-001052	218-001053
29/64	0.4531	1	1/2	3	Regular	206-001195	206-001194	206-021195	206-031195
15/32	0.4688	1	1/2	3	Regular	206-001198	206-001196	206-021198	206-001206
12.0mm	0.4724	25.0mm	12.0mm	76.0mm	Regular	206-001420	206-001420A	206-001420C	206-001420B
31/64	0.4844	1	1/2	3	Regular	206-001199	206-001197	206-021199	206-031199
1/2	0.5000	5/8	1/2	2-1/2	Stub	203-001200	203-001201	203-001202	203-001203
		1	1/2	3	Regular	206-001200	206-001201	206-001204	206-001207
		1	1/2	4	Small/Medium	215-001054	215-001054A	215-001054C	215-001054B
		1-1/4	1/2	3	Regular	206-001203	206-001203B	206-001203C	206-001203A
		1-1/2	1/2	4	Medium	215-001059	215-001058	215-001057	215-001056
		1-1/2	1/2	6	Ext X/Long	218-001053A	218-001061	218-001062	218-001059
		2	1/2	4	Long	215-001060	215-001063	215-001065	215-001067
		3	1/2	6	X/Long	218-001053AA	218-001056	218-001057	218-001058
		4	1/2	7	XXX/Long	218-001150	—	—	218-001150B
		5	1/2	8	XXX/Long	218-001151	—	—	218-001151B
33/64	0.5156	1-1/4	9/16	3-1/2	Regular	206-001208	206-001208A	206-001208B	206-001218
17/32	0.5313	1-1/4	9/16	3-1/2	Regular	206-001209	206-001209A	206-001209C	206-001219
14.0mm	0.5512	32.0mm	14.0mm	90.0mm	Regular	206-001430	206-001430A	206-001430C	206-001430B
9/16	0.5625	1-1/4	9/16	3-1/2	Regular	206-001210	206-001211	206-001212	206-001213
19/32	0.5938	1-1/4	5/8	3-1/2	Regular	206-001217	206-001217A	206-001217C	206-001217B

4 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
		3/4	5/8	3	Stub	203-001220	203-001221	203-001222	203-001223
		1-1/4	5/8	3-1/2	Regular	206-001220	206-001221	206-001225	206-001226
		1-1/2	5/8	6	Ext X/Long	218-001074	218-001075	218-001076	218-001074A
		2-1/4	5/8	5	Long	215-001070	215-001071	215-001072	215-001073
5/8	0.6250	3	5/8	6	X/Long	218-001070	218-001071	218-001072	218-001073
		4	5/8	7	XXX/Long	218-001152	—	—	218-001152B
		5	5/8	8	XXX/Long	218-001153	—	—	218-001153B
		6	5/8	9	XXX/Long	218-001154	—	—	218-001154B
16.0mm	0.6299	32.0mm	16.0mm	102.0mm	Regular	206-001440	206-001440A	206-001440C	206-001442
41/64	0.6406	1-1/2	3/4	4	Regular	206-001236	206-001236A	206-001236C	206-001237
21/32	0.6563	1-1/2	3/4	4	Regular	206-001228	206-001228A	206-001228C	206-001228B
11/16	0.6875	1-1/2	3/4	4	Regular	206-001230	206-001231	206-001232	206-001233
18.0mm	0.7087	38.0mm	18.0mm	102.0mm	Regular	206-001450	206-001450A	206-001450C	206-001452
47/64	0.7344	1-1/2	3/4	4	Regular	206-001237F	206-001237FA	206-001237FC	206-001237FB
		1	3/4	3	Stub	203-001240	203-001241	203-001242	203-001243
		1	3/4	4	Regular	206-001238	—	—	206-001238B
		1-1/2	3/4	4	Regular	206-001239	206-001241	206-001243	206-001244
		1-1/2	3/4	6	Ext X/Long	218-001101	218-001101A	218-001101B	218-001102
		2-1/4	3/4	5	Long	215-001080	215-001081	215-001082	215-001083
3/4	0.7500	3	3/4	6	X/Long	218-001080	218-001082	218-001086	218-001079
		4	3/4	7	XX/Long	218-001081	218-001083	218-001087	218-001084
		5	3/4	8	XXX/Long	218-001155	—	—	218-001155B
		6	3/4	9	XXX/Long	218-001156	—	—	218-001156B
		8	3/4	12	XXX/Long	218-001157	—	—	218-001157B
20.0mm	0.7874	38.0mm	20.0mm	102.0mm	Regular	206-001460	206-001460A	206-001460C	206-001460B
13/16	0.8125	1-1/2	7/8	4	Regular	206-001245	206-001245A	206-001245C	206-001246
22.0mm	0.8661	38.0mm	22.0mm	102.0mm	Regular	206-001470	206-001470A	206-001470C	206-001470B
7/8	0.8750	1-1/2	7/8	4	Regular	206-001250	206-001251	206-001252	206-001254
15/16	0.9375	1-1/2	1	4	Regular	206-001255	206-001255A	206-001255C	206-001256
25.0mm	0.9843	38.0mm	25.0mm	102.0mm	Regular	206-001480	206-001480A	206-001480C	206-001480B
		1	1	3	Stub	203-001260	203-001261	203-001262	203-001263
		1	1	4	Regular	206-001259	—	—	206-001259B
		1-1/2	1	4	Regular	206-001260	206-001261	206-001263	206-001264
		1-1/2	1	6	Ext X/Long	218-001103	218-001105	218-001106	218-001104
		2-1/4	1	5	Long	215-001090	215-001091	215-001092	215-001093
1	1.0000	3	1	6	X/Long	218-001090	218-001088	218-001097	218-001094
		4	1	7	XX/Long	218-001091	218-001089	218-001098	218-001095
		5	1	8	XXX/Long	218-001158	—	—	218-001158B
		6	1	9	XXX/Long	218-001159	—	—	218-001159B
		7	1	10	XXX/Long	218-001160	—	—	218-001160B
		8	1	12	XXX/Long	218-001161	—	—	218-001161B
1-1/4	1.2500	2	1-1/4	4-1/2	Regular	206-001266	206-001266A	206-001266C	206-001266B

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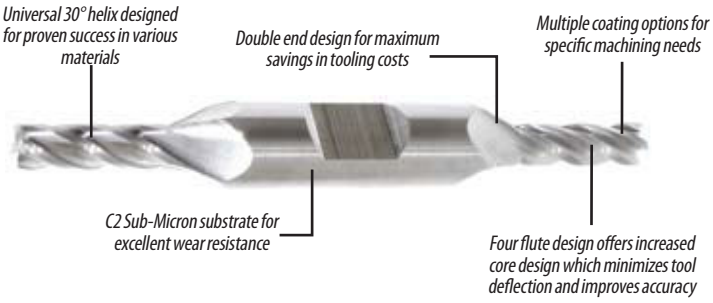
4 FLUTE - DOUBLE END SQUARE



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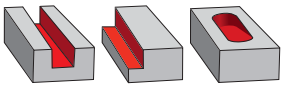
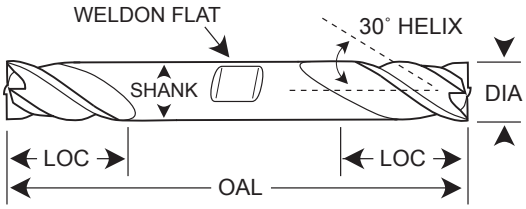
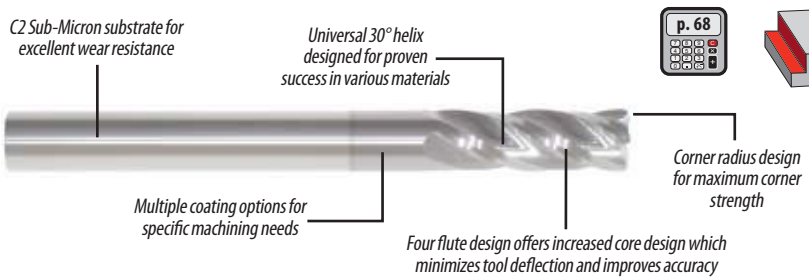




DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Flat	Length	Bright	TiN	TiCN	AlTiN
1/32	0.0313	1/16	1/8	1-1/2	No	Stub	236-001001	236-001011	236-001003	236-001004
3/64	0.0469	3/32	1/8	1-1/2	No	Stub	236-001010	236-001012	236-001013	236-001014
1/16	0.0625	1/8	1/8	1-1/2	No	Stub	236-001020	236-001021	236-001028	236-031025
5/64	0.0781	1/8	1/8	1-1/2	No	Stub	236-001025	236-001026	236-021025	236-001027
3/32	0.0938	3/16	1/8	1-1/2	No	Stub	236-001030	236-001031	236-001037	236-001034
7/64	0.1094	3/16	1/8	1-1/2	No	Stub	236-001035	236-001036	236-021036	236-031035
1/8	0.1250	1/4	1/8	1-1/2	No	Stub	236-001040	236-001041	236-001045	236-001047
		3/8	3/8	3	Yes	Regular	239-001001	239-001002	—	239-001003
9/64	0.1406	5/16	3/16	2	No	Stub	236-001042	236-001044	236-021044	236-031042
5/32	0.1563	5/16	3/16	2	No	Stub	236-001050	236-001051	236-001053	236-001054
		7/16	3/8	3	Yes	Regular	239-001010	—	—	239-001013
11/64	0.1719	5/16	3/16	2	No	Stub	236-001055	236-001056	236-021055	236-001057
3/16	0.1875	3/8	3/16	2	No	Stub	236-001060	236-001061	236-001062	236-001064
		1/2	3/8	3	Yes	Regular	239-001020	239-001021	—	239-001023
13/64	0.2031	1/2	1/4	2-1/2	No	Stub	236-001065	236-001066	236-021065	236-031065
7/32	0.2188	1/2	1/4	2-1/2	No	Stub	236-001070	236-001071	236-001073	236-001074
		9/16	3/8	3-1/2	Yes	Regular	239-001030	—	—	239-001033
15/64	0.2344	1/2	1/4	2-1/2	No	Stub	236-001075	236-001076	236-021075	236-031075
1/4	0.2500	1/2	1/4	2-1/2	No	Stub	236-001080	236-001081	236-001083	236-001085
		5/8	3/8	3-1/2	Yes	Regular	239-001040	239-001041	—	239-001043
9/32	0.2813	1/2	5/16	2-1/2	No	Stub	236-001082	236-001087	236-001088	236-001089
		11/16	3/8	3-1/2	Yes	Regular	239-001050	—	—	239-001053
5/16	0.3125	1/2	5/16	2-1/2	No	Stub	236-001090	236-001091	236-001093	236-001094
		3/4	3/8	3-1/2	Yes	Regular	239-001060	239-001061	—	239-001063
11/32	0.3438	9/16	3/8	2-1/2	No	Stub	236-001092	236-001095	236-001096	236-031092
		3/4	3/8	3-1/2	Yes	Regular	239-001070	—	—	239-001073
3/8	0.3750	9/16	3/8	2-1/2	No	Stub	236-001100	236-001101	236-001102	236-001103
		3/4	3/8	3-1/2	Yes	Regular	239-001080	—	—	239-001083
7/16	0.4375	9/16	7/16	2-3/4	No	Stub	236-001110	236-021111	236-001111	236-031110
		7/8	1/2	4	Yes	Regular	239-001090	—	—	239-001093
1/2	0.5000	5/8	1/2	3	No	Stub	236-001120	236-001121	236-001122	236-001124
		1	1/2	4	Yes	Regular	239-001100	239-001101	239-001102	239-001103

4 FLUTE - SINGLE END CORNER RADIUS



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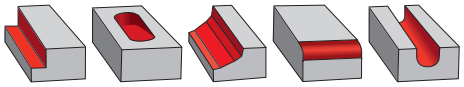
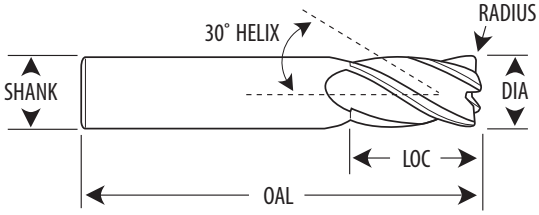




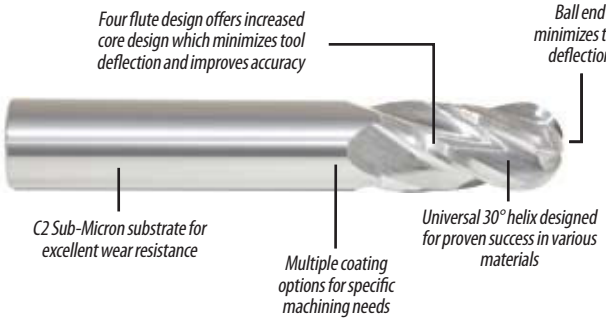
DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Radius	Bright	TiN	TiCN	AlTiN
1/8	0.1250	1/2	1/8	1-1/2	Regular	0.005	206-602297	—	—	206-602298
						0.010	206-602300	206-602301	206-602302	206-602303
						0.015	206-602306	206-602307	206-602308	206-602309
						0.020	206-602312	206-602313	206-602314	206-602315
						0.030	206-602318	206-602319	206-602320	206-602321
3/16	0.1875	5/8	3/16	2	Regular	0.010	206-602424	206-602425	206-602426	206-602427
						0.015	206-602430	206-602431	206-602432	206-602433
						0.020	206-602436	206-602437	206-602438	206-602439
						0.030	206-602442	206-602443	206-602444	206-602445
						0.045	206-602448	206-602449	206-602450	206-602451
						0.050	206-602452	—	—	206-602455
						0.060	206-602453	—	—	206-602456
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.010	206-602548	—	—	206-602549
						0.015	206-602551	206-602552	206-602553	206-602554
						0.020	206-602557	206-602558	206-602559	206-602560
						0.025	206-602563	206-602564	206-602565	206-602566
						0.030	206-602569	206-602570	206-602571	206-602572
						0.045	206-602575	206-602576	206-602577	206-602578
						0.060	206-602581	206-602582	206-602583	206-602584
						0.090	206-602595	—	—	206-602598
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.015	206-602684	206-602685	206-602686	206-602687
						0.020	206-602690	206-602691	206-602692	206-602693
						0.025	206-602696	206-602697	206-602698	206-602699
						0.030	206-602702	206-602703	206-602704	206-602705
						0.045	206-602708	206-602709	206-602710	206-602711
						0.060	206-602714	206-602715	206-602716	206-602717
						0.090	206-602719	—	—	206-602722
						0.125	206-602723	—	—	206-602726
3/8	0.3750	1	3/8	2-1/2	Regular	0.015	206-602820	206-602821	206-602822	206-602823
						0.020	206-602826	206-602827	206-602828	206-602829
						0.025	206-602832	206-602833	206-602834	206-602835
						0.030	206-602838	206-602839	206-602840	206-602841
						0.045	206-602844	206-602845	206-602846	206-602847
						0.060	206-602850	206-602851	206-602852	206-602853
						0.090	206-602856	206-602857	206-602858	206-602859
						0.125	206-602860	—	—	206-602863

4 FLUTE - SINGLE END - RADIUS CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Radius	Bright	TiN	TiCN	AlTiN
7/16	0.4375	1	7/16	2-3/4	Regular	0.015	206-602961	206-602962	206-602963	206-602964
						0.020	206-602967	206-602968	206-602969	206-602970
						0.025	206-602974	206-602975	206-602976	206-602977
						0.030	206-602980	206-602981	206-602982	206-602983
						0.045	206-602986	206-602987	206-602988	206-602989
						0.060	206-602992	206-602993	206-602994	206-602995
						0.090	206-602998	206-602999	206-603000	206-603001
1/2	0.5000	1	1/2	3	Regular	0.015	206-603003	206-603004	206-603005	206-603006
						0.020	206-603009	206-603010	206-603011	206-603012
						0.025	206-603015	206-603016	206-603017	206-603018
						0.030	206-603021	206-603022	206-603023	206-603024
						0.045	206-603027	206-603028	206-603029	206-603030
						0.060	206-603033	206-603034	206-603035	206-603036
						0.090	206-603039	206-603040	206-603041	206-603042
						0.125	206-603045	206-603046	206-603047	206-603048
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	0.015	206-603150	206-603151	206-603152	206-603153
						0.020	206-603156	206-603157	206-603158	206-603159
						0.025	206-603162	206-603163	206-603164	206-603165
						0.030	206-603168	206-603169	206-603170	206-603171
						0.045	206-603174	206-603175	206-603176	206-603177
						0.060	206-603180	206-603181	206-603182	206-603183
						0.090	206-603186	206-603187	206-603188	206-603189
						0.125	206-603192	206-603193	206-603194	206-603195
3/4	0.7500	1-1/2	3/4	4	Regular	0.015	206-603297	206-603298	206-603299	206-603300
						0.020	206-603303	206-603304	206-603305	206-603306
						0.025	206-603309	206-603310	206-603311	206-603312
						0.030	206-603315	206-603316	206-603317	206-603318
						0.045	206-603321	206-603322	206-603323	206-603324
						0.060	206-603327	206-603328	206-603329	206-603330
						0.090	206-603333	206-603334	206-603335	206-603336
						0.125	206-603339	206-603340	206-603341	206-603342
						0.190	206-603345	206-603346	206-603347	206-603348
						0.250	206-603350	—	—	206-603353
1	1.0000	1-1/2	1	4	Regular	0.015	206-603450	206-603451	206-603452	206-603453
						0.020	206-603456	206-603457	206-603458	206-603459
						0.025	206-603462	206-603463	206-603464	206-603465
						0.030	206-603468	206-603469	206-603470	206-603471
						0.045	206-603474	206-603475	206-603476	206-603477
						0.060	206-603480	206-603481	206-603482	206-603483
						0.090	206-603486	206-603487	206-603488	206-603489
						0.125	206-603492	206-603493	206-603494	206-603495
						0.190	206-603498	206-603499	206-603500	206-603501
						0.250	206-603504	206-603505	206-603506	206-603507

4 FLUTE - SINGLE END BALLNOSE



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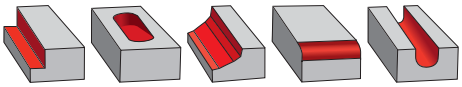

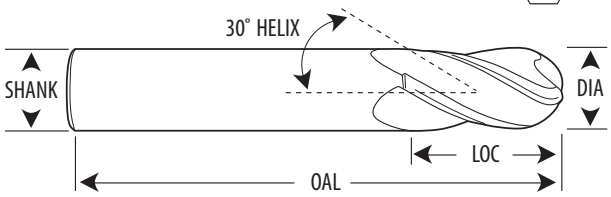

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
1/64	0.0156	3/64	1/8	1-1/2	Regular	223-000998	223-000995	223-020998	223-001007
1/32	0.0313	1/16	1/8	1-1/2	Stub	220-001001	220-001002	220-001003	220-001004
		1/8	1/8	1-1/2	Regular	223-000999	223-001003	223-000996	223-001009
1.0mm	0.0394	4.0mm	3.0mm	39.0mm	Regular	223-001400	223-001400A	223-001400C	223-001400B
3/64	0.0469	3/32	1/8	1-1/2	Stub	220-001010	220-001011	220-001012	220-001013
		1/8	1/8	1-1/2	Regular	223-001000	223-001004	223-021000	223-001014
1.5mm	0.0591	4.5mm	3.0mm	39.0mm	Regular	223-001405	223-001410A	223-001410C	223-001410B
1/16	0.0625	1/8	1/8	1-1/2	Stub	220-001020	220-001022	220-001021	220-001023
		1/4	1/8	1-1/2	Regular	223-001001	223-001002	223-001015	223-001016
5/64	0.0781	5/32	1/8	1-1/2	Stub	220-001025	220-011025	220-021025	220-031025
		1/4	1/8	1-1/2	Regular	223-001005	223-001006	223-001008	223-001019
2.0mm	0.0787	8.0mm	3.0mm	39.0mm	Regular	223-001421	—	—	223-001420B
3/32	0.0938	3/16	1/8	1-1/2	Stub	220-001030	220-001032	220-001031	220-001033
		3/8	1/8	1-1/2	Regular	223-001010	223-001011	223-001012	223-001013
2.5mm	0.0984	9.5mm	3.0mm	39.0mm	Regular	223-001425	223-001425A	223-001425C	223-001425B
7/64	0.1094	7/32	1/8	1-1/2	Stub	220-001035	220-011035	220-021035	220-031035
		3/8	1/8	1-1/2	Regular	223-001017	223-001052	223-021051	223-001039
3.0mm	0.1181	12.0mm	3.0mm	39.0mm	Regular	223-001430	223-001430A	223-001430C	223-001430B
1/8	0.1250	1/4	1/8	1-1/2	Stub	220-001040	220-001042	220-001041	220-001043
		1/2	1/8	1-1/2	Regular	223-001020	223-001021	223-001023	223-001028
		3/4	1/8	2-1/4	Long	226-001001	226-001002	226-001003	226-001004
		1	1/8	3	X/Long	229-001001	229-001002	229-001003	229-001004
3.5mm	0.1378	12.0mm	4.0mm	51.0mm	Regular	223-001435	223-001435A	223-001435C	223-001435B
9/64	0.1406	9/32	3/16	2	Stub	220-001045	220-011045	220-021045	220-031045
		9/16	3/16	2	Regular	223-001025	223-001026	223-001027	223-001029

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4 FLUTE - SINGLE END - BALLNOSE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
5/32	0.1563	5/16	3/16	2	Stub	220-001050	220-001052	220-001051	220-001053
		9/16	3/16	2	Regular	223-001030	223-001031	223-001033	223-001032
		3/4	3/16	2-1/2	Long	226-001005	226-001006	226-001008	226-001007
		1-1/8	3/16	3	X/Long	229-001005	229-001006	229-001008	229-001009
4.0mm	0.1575	14.0mm	4.0mm	51.0mm	Regular	223-001440	223-001440A	223-001440C	223-001440B
11/64	0.1719	5/16	3/16	2	Stub	220-001055	220-011055	220-021055	220-031055
		9/16	3/16	2	Regular	223-001035	223-001055	223-021054	223-001043
4.5mm	0.1772	16.0mm	5.0mm	51.0mm	Regular	223-001445	223-001445A	223-001445C	223-001445B
3/16	0.1875	3/8	3/16	2	Stub	220-001060	220-001062	220-001061	220-001063
		5/8	3/16	2	Regular	223-001040	223-001041	223-001042	223-001034
		3/4	3/16	2-1/2	Long	226-001012	226-001013	226-001014	226-001016
		1	3/16	4	XX/Long	229-001015	—	—	—
		1-1/8	3/16	3	X/Long	229-001010	229-001011	229-001012	229-001014
5.0mm	0.1969	16.0mm	5.0mm	51.0mm	Regular	223-001450	223-001450A	223-001450C	223-001450B
13/64	0.2031	3/8	1/4	2	Stub	220-001065	220-011065	220-021065	220-031065
		5/8	1/4	2-1/2	Regular	223-001046	223-001059	223-021058	223-001047
7/32	0.2188	7/16	1/4	2	Stub	220-001070	220-001072	220-001071	220-001073
		5/8	1/4	2-1/2	Regular	223-001050	223-001056	223-001037	223-001036
15/64	0.2344	7/16	1/4	2	Stub	220-001075	220-011075	220-021075	220-031075
		3/4	1/4	2-1/2	Regular	223-001053	223-001057	223-021053	223-001045
6.0mm	0.2362	19.0mm	6.0mm	63.0mm	Regular	223-001460	223-001460A	223-001460C	223-001460B
1/4	0.2500	1/2	1/4	2	Stub	220-001080	220-001082	220-001081	220-001083
		3/4	1/4	2-1/2	Regular	223-001060	223-001062	223-001063	223-001066
		1	1/4	4	X/Long	229-001019	—	—	—
		1-1/8	1/4	3	Long	226-001020	226-001021	226-001022	226-001024
		1-1/2	1/4	4	X/Long	229-001020	229-001021	229-001022	229-001024
		1-1/2	1/4	6	Ext XX/Long	229-001026	229-001026A	229-001026C	229-001027
17/64	0.2656	3/4	5/16	2-1/2	Regular	223-001061	223-001064	223-021061	223-031061
7.0mm	0.2756	19.0mm	8.0mm	63.0mm	Regular	223-001470	223-001470A	223-001470C	223-001470B
9/32	0.2813	3/4	5/16	2-1/2	Regular	223-001070	223-001065	223-001067	223-001068
19/64	0.2969	13/16	5/16	2-1/2	Regular	223-001071	223-001072	223-021071	223-031071

4 FLUTE - SINGLE END - BALLNOSE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
		1/2	5/16	2	Stub	220-001090	220-001092	220-001091	220-001093
		13/16	5/16	2-1/2	Regular	223-001080	223-001082	223-001083	223-001073
5/16	0.3125	1-1/8	5/16	3	Long	226-001030	226-001031	226-001032	226-001034
		1-1/2	5/16	6	Ext XX/Long	229-001035	229-001035A	229-001035C	229-001036
		1-5/8	5/16	4	X/Long	229-001030	229-001031	229-001032	229-001034
8.0mm	0.3150	20.0mm	8.0mm	63.0mm	Regular	223-001480	223-001480A	223-001480C	223-001480B
21/64	0.3281	1	3/8	2-1/2	Regular	223-001084	223-001085	223-021084	223-031084
11/32	0.3438	1	3/8	2-1/2	Regular	223-001086	223-001087	223-001169	223-001115
9.0mm	0.3543	22.0mm	10.0mm	63.0mm	Regular	223-001490	223-001490A	223-001490C	223-001490B
23/64	0.3594	1	3/8	2-1/2	Regular	223-001088	223-001089	223-021088	223-031088
		5/8	3/8	2	Stub	220-001100	220-001101	220-001102	220-001103
		1	3/8	2-1/2	Regular	223-001090	223-001092	223-001093	223-001116
3/8	0.3750	1-1/8	3/8	3	Long	226-001040	226-001041	226-001042	226-001044
		1-1/2	3/8	6	Ext XX/Long	229-001046	229-001048	229-001049	229-001047
		1-3/4	3/8	4	X/Long	229-001040	229-001041	229-001042	229-001044
25/64	0.3906	1	7/16	2-3/4	Regular	223-001094	223-001096	223-021094	223-031094
10.0mm	0.3937	22.0mm	10.0mm	76.0mm	Regular	223-001500	223-001500A	223-001500C	223-001500B
13/32	0.4063	1	7/16	2-3/4	Regular	223-001095	223-001097	223-021095	223-001117
27/64	0.4219	1	7/16	2-3/4	Regular	223-001098	223-001099	223-021098	223-031098
11.0mm	0.4331	25.0mm	12.0mm	76.0mm	Regular	223-001510	223-001510A	223-001510C	223-001510B
		5/8	7/16	2-1/2	Stub	220-001110	220-001111	220-001112	220-001113
		1	7/16	2-3/4	Regular	223-001100	223-001101	223-001102	223-001118
7/16	0.4375	2	7/16	4	Long	226-001050	226-001051	226-001052	226-001054
		3	7/16	6	X/Long	229-001050	229-001051	229-001052	229-001053
29/64	0.4531	1	1/2	3	Regular	223-001103	223-001104	223-021103	223-031103
15/32	0.4688	1	1/2	3	Regular	223-001105	223-001107	223-001121	223-001119
12.0mm	0.4724	25.0mm	12.0mm	76.0mm	Regular	223-001520	223-001520A	223-001520C	223-001520B
31/64	0.4844	1	1/2	3	Regular	223-001109	223-001108	223-021108	223-031108
		5/8	1/2	2-1/2	Stub	220-001120	220-001121	220-001122	220-001123
		1	1/2	3	Regular	223-001110	223-001111	223-001112	223-001114
		1-1/2	1/2	4	Medium	226-001059	226-001057	226-001058	226-001059A
1/2	0.5000	1-1/2	1/2	6	Ext X/Long	229-001053A	229-001055	229-001056	229-001057
		2	1/2	4	Long	226-001060	226-001061	226-001062	226-001064
		3	1/2	6	X/Long	229-001053AA	229-001066	229-001067	229-001068

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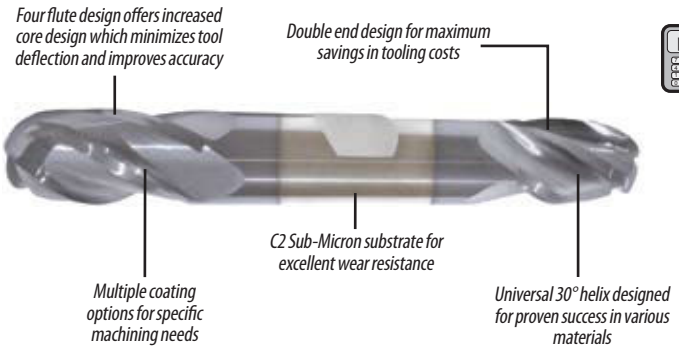
4 FLUTE - SINGLE END - BALLNOSE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
14.0mm	0.5512	32.0mm	14.0mm	90.0mm	Regular	223-001540	223-001540A	223-001540C	223-001540B
9/16	0.5625	1-1/4	9/16	3-1/2	Regular	223-001120	223-001125	223-001126	223-001127
		3/4	5/8	3	Stub	220-001130	220-001131	220-001132	220-001133
		1-1/4	5/8	3-1/2	Regular	223-001130	223-001131	223-001132	223-001135
5/8	0.6250	1-1/2	5/8	6	Ext X/Long	229-001076	229-001076A	229-001076C	229-001077
		2-1/4	5/8	5	Long	226-001070	226-001071	226-001072	226-001074
		3	5/8	6	X/Long	229-001070	229-001071	229-001072	229-001074
16.0mm	0.6299	32.0mm	16.0mm	102.0mm	Regular	223-001560	223-001560A	223-001560C	223-001560B
11/16	0.6875	1-1/2	3/4	4	Regular	223-001140	223-001155	223-021156	223-001167
18.0mm	0.7087	38.0mm	18.0mm	102.0mm	Regular	223-001580	223-001580A	223-001580C	223-001580B
		1	3/4	3	Stub	220-001140	220-001141	220-001142	220-001143
		1-1/2	3/4	4	Regular	223-001150	223-001151	223-001152	223-001154
3/4	0.7500	1-1/2	3/4	6	Ext X/Long	229-001085	229-001085A	229-001085C	229-001086
		2-1/4	3/4	5	Long	226-001080	226-001081	226-001082	226-001084
		3	3/4	6	X/Long	229-001080	229-001081	229-001082	229-001084
20.0mm	0.7874	38.0mm	20.0mm	102.0mm	Regular	223-001600	223-001600A	223-001600C	223-001600B
22.0mm	0.8661	38.0mm	22.0mm	102.0mm	Regular	223-001620	—	—	223-001620B
7/8	0.8750	1-1/2	7/8	4	Regular	223-001157	223-001159	223-021157	223-001165
25.0mm	0.9843	38.0mm	25.0mm	102.0mm	Regular	223-001650	—	—	223-001650B
		1-1/2	1	4	Regular	223-001160	223-001161	223-001162	223-001163
		1-1/2	1	6	Ext X/Long	229-001095	229-001095A	229-001095C	229-001096
1	1.0000	2-1/4	1	5	Long	226-001090	226-001091	226-001092	226-001097
		3	1	6	X/Long	229-001090	229-001091	229-001092	229-001094

4 FLUTE - DOUBLE END BALLNOSE



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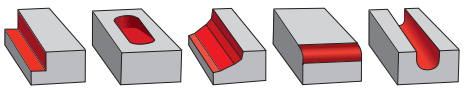

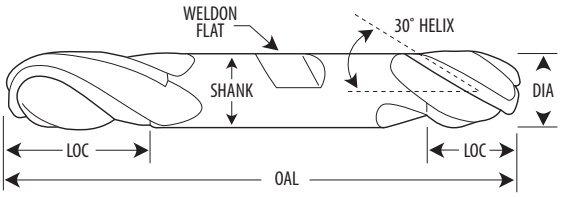

DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Flat	Length	Bright	TiN	TiCN	AlTiN
1/32	0.0313	1/16	1/8	1-1/2	No	Stub	242-001001	242-001011	242-021001	242-031011
3/64	0.0469	3/32	1/8	1-1/2	No	Stub	242-001010	242-001012	242-021010	242-031012
1/16	0.0625	1/8	1/8	1-1/2	No	Stub	242-001010A	242-001021	242-001022	242-031026
5/64	0.0781	1/8	1/8	1-1/2	No	Stub	242-001019	242-001026	242-001027	242-031021
3/32	0.0938	3/16	1/8	1-1/2	No	Stub	242-001030	242-001031	242-001032	242-031031
7/64	0.1094	3/16	1/8	1-1/2	No	Stub	242-001035	242-001036	242-001037	242-031036
1/8	0.1250	1/4	1/8	1-1/2	No	Stub	242-001040	242-001041	242-001042	242-001043
		3/8	3/8	3	Yes	Regular	245-001001	245-001002	—	245-001003
9/64	0.1406	5/16	3/16	2	No	Stub	242-001044	242-001045	242-001046	242-031044
5/32	0.1563	5/16	3/16	2	No	Stub	242-001050	242-001051	242-001052	242-001053
		7/16	3/8	3	Yes	Regular	245-001010	—	—	245-001013
11/64	0.1719	5/16	3/16	2	No	Stub	242-001055	242-001056	242-001057	242-031055
3/16	0.1875	3/8	3/16	2	No	Stub	242-001060	242-001061	242-001062	242-001063
		1/2	3/8	3	Yes	Regular	245-001020	—	—	245-001023
13/64	0.2031	1/2	1/4	2-1/2	No	Stub	242-001065	242-001066	242-001067	242-031065
7/32	0.2188	1/2	1/4	2-1/2	No	Stub	242-001070	242-001071	242-001072	242-031070
		9/16	3/8	3-1/2	Yes	Regular	245-001030	—	—	245-001033
15/64	0.2344	1/2	1/4	2-1/2	No	Stub	242-001075	242-001076	242-001077	242-031075
1/4	0.2500	1/2	1/4	2-1/2	No	Stub	242-001080	242-001081	242-001082	242-001083
		5/8	3/8	3-1/2	Yes	Regular	245-001040	245-001041	—	245-001043
9/32	0.2813	1/2	5/16	2-1/2	No	Stub	242-001085	242-001087	242-001088	242-031085
		11/16	3/8	3-1/2	Yes	Regular	245-001050	—	—	245-001053
5/16	0.3125	1/2	5/16	2-1/2	No	Stub	242-001090	242-001091	242-001093	242-001094
		3/4	3/8	3-1/2	Yes	Regular	245-001060	—	—	245-001063
11/32	0.3438	9/16	3/8	2-1/2	No	Stub	242-001092	242-001095	242-001096	242-031092
		3/4	3/8	3-1/2	Yes	Regular	245-001070	—	—	245-001073
3/8	0.3750	9/16	3/8	2-1/2	No	Stub	242-001100	242-001101	242-001102	242-001104
		3/4	3/8	3-1/2	Yes	Regular	245-001080	—	—	245-001083
7/16	0.4375	9/16	7/16	2-3/4	No	Stub	242-001110	242-001111	242-001112	242-001114
		7/8	1/2	4	Yes	Regular	245-001090	—	—	245-001093
1/2	0.5000	5/8	1/2	3	No	Stub	242-001120	242-001121	242-001122	242-001124
		1	1/2	4	Yes	Regular	245-001100	—	—	245-001103

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MILLING RECOMMENDATIONS - GENERAL PURPOSE ENDMILLS

PROFILING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM based on RDOC: Cutting Diameter Engaged 5%	10%	20%	30%	50%	IPT* (BASELINE): Cutting Diameter 5/16	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	1050	700	385	375	350	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
Steels	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX	P	28 - 38 Rc	630	420	320	250	210						
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	525	350	300	275	250	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	650	600	550	500	450	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
Stainless Steel	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347	M	≤ 28 Rc	525	400	350	300	250						
Stainless Steel	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	> 28 Rc	525	400	350	300	250						
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	265	200	175	150	100	0.0014	0.0016	0.0023	0.0027	0.0032	0.0045
Super Alloys	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S	≤ 42 Rc	230	200	175	150	125						
Hardened Materials		H	45-55 Rc	250	240	230	210	200	0.0018	0.0021	0.0030	0.0036	0.0042	0.0060
Hardened Materials		H	55-65 Rc	200	180	160	150	100	0.0013	0.0014	0.0021	0.0024	0.0029	0.0041
Cast-Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	425	400	375	350	300	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
Cast-Iron	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K	> 240 HB	320	300	250	225	200						
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		1000	960	920	880	840	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090

***CHIP THINNING Adjustments**

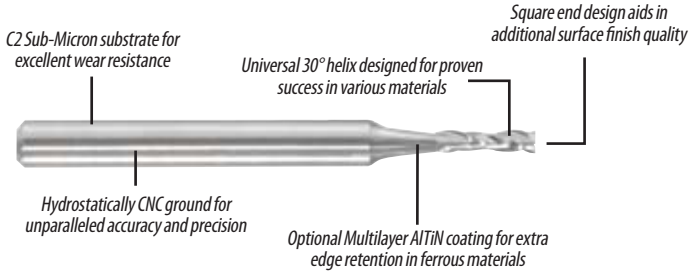
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x

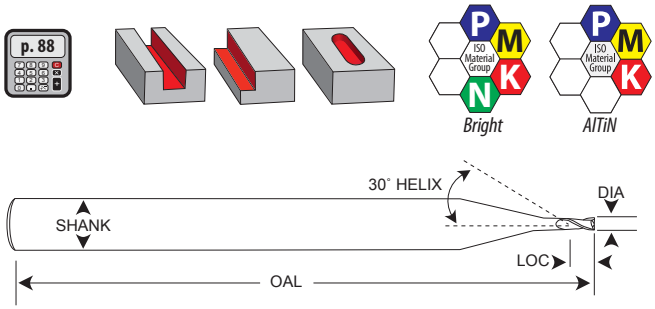
SLOTTING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM: Cutting Diameter Engaged 25%	50%	100%	IPT* (BASELINE): Cutting Diameter 5/16	3/8	1/2	5/8	3/4	1
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	385	370	350	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
Steels	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX	P	28 - 38 Rc	245	230	2210						
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	210	195	175	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	385	370	350	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
Stainless Steel	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347	M	≤ 28 Rc	245	210	175						
Stainless Steel	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	> 28 Rc	210	195	175						
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	125	105	90	0.0008	0.0010	0.0013	0.0016	0.0017	0.0026
Super Alloys	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S	≤ 42 Rc	100	90	80						
Hardened Materials		H	34-45 Rc	245	230	210	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
Hardened Materials		H	45-55 Rc	175	160	140	0.0008	0.0010	0.0013	0.0016	0.0020	0.0025
Hardened Materials		H	55-65 Rc	150	125	100	0.0004	0.0005	0.0008	0.0008	0.0010	0.0012
Cast-Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	450	400	350	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
Cast-Iron	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K	> 240 HB	300	250	225						
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		750	600	450	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050

2 FLUTE SQUARE





ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"
DIA TOLERANCE: ±0.0005" LOC TOLERANCE: +0.0000 / +0.0120" SHANK TOLERANCE: +0.0000/-0.0003"

DIA	LOC	Length	Bright	AlTiN
0.005	0.008	Stub	250-300100	—
	0.015	Regular	250-100010	—
0.006	0.009	Stub	250-300110	—
	0.018	Regular	250-200110	—
0.007	0.011	Stub	250-300120	—
	0.021	Regular	250-200120	—
0.008	0.012	Stub	250-300130	—
	0.024	Regular	250-200130	—
0.009	0.014	Stub	250-300140	—
	0.027	Regular	250-200140	—
0.010	0.015	Stub	250-300150	250-300150B
	0.030	Regular	250-100030	250-100030B
0.011	0.017	Stub	250-300160	250-300160B
	0.033	Regular	250-200160	250-200160B
0.012	0.018	Stub	250-300170	250-300170B
	0.036	Regular	250-200170	250-200170B
0.013	0.020	Stub	250-300180	250-300180B
	0.039	Regular	250-200180	250-200180B
0.014	0.021	Stub	250-300190	250-300190B
	0.042	Regular	250-200190	250-200190B
0.015	0.023	Stub	250-300200	250-300200B
	0.045	Regular	250-100050	250-100050B
0.016	0.024	Stub	250-300210	250-300210B
	0.048	Regular	250-200210	250-200210B
0.017	0.026	Stub	250-300220	250-300220B
	0.051	Regular	250-200220	250-200220B
0.018	0.027	Stub	250-300230	250-300230B
	0.054	Regular	250-200230	250-200230B
0.019	0.029	Stub	250-300240	250-300240B
	0.057	Regular	250-200240	250-200240B
0.020	0.030	Stub	250-300250	250-300250B
	0.060	Regular	250-100070	250-100070B
0.021	0.032	Stub	250-300260	250-300260B
	0.063	Regular	250-200260	250-200260B
0.022	0.033	Stub	250-300270	250-300270B
	0.066	Regular	250-200270	250-200270B
0.023	0.035	Stub	250-300280	250-300280B
	0.069	Regular	250-200280	250-200280B
0.024	0.036	Stub	250-300290	250-300290B
	0.072	Regular	250-200290	250-200290B

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2 FLUTE - SQUARE CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Bright	AlTiN
0.025	0.038	Stub	250-300300	250-300300B
	0.075	Regular	250-100090	250-100090B
0.026	0.039	Stub	250-300310	250-300310B
	0.078	Regular	250-200310	250-200310B
0.027	0.041	Stub	250-300320	250-300320B
	0.081	Regular	250-200320	250-200320B
0.028	0.042	Stub	250-300330	250-300330B
	0.084	Regular	250-200330	250-200330B
0.029	0.044	Stub	250-300340	250-300340B
	0.087	Regular	250-200340	250-200340B
0.030	0.045	Stub	250-300350	250-300350B
	0.090	Regular	250-100110	250-100110B
0.031	0.047	Stub	250-300360	250-300360B
	0.093	Regular	250-200360	250-200360B
0.032	0.048	Stub	250-300370	250-300370B
	0.096	Regular	250-200370	250-200370B
0.033	0.050	Stub	250-300380	250-300380B
	0.099	Regular	250-200380	250-200380B
0.034	0.051	Stub	250-300390	250-300390B
	0.102	Regular	250-200390	250-200390B
0.035	0.053	Stub	250-300400	250-300400B
	0.105	Regular	250-100130	250-100130B
0.036	0.054	Stub	250-300410	250-300410B
	0.108	Regular	250-200410	250-200410B
0.037	0.056	Stub	250-300420	250-300420B
	0.111	Regular	250-200420	250-200420B
0.038	0.057	Stub	250-300430	250-300430B
	0.114	Regular	250-200430	250-200430B
0.039	0.059	Stub	250-300440	250-300440B
	0.117	Regular	250-200440	250-200440B
0.040	0.060	Stub	250-300450	250-300450B
	0.120	Regular	250-100150	250-100150B
0.041	0.062	Stub	250-300460	250-300460B
	0.123	Regular	250-200460	250-200460B
0.042	0.063	Stub	250-300470	250-300470B
	0.126	Regular	250-200470	250-200470B
0.043	0.065	Stub	250-300480	250-300480B
	0.129	Regular	250-200480	250-200480B
0.044	0.066	Stub	250-300490	250-300490B
	0.132	Regular	250-200490	250-200490B
0.045	0.068	Stub	250-300500	250-300500B
	0.135	Regular	250-100170	250-100170B
0.046	0.069	Stub	250-300510	250-300510B
	0.138	Regular	250-200510	250-200510B
0.047	0.071	Stub	250-300520	250-300520B
	0.141	Regular	250-200520	250-200520B
0.048	0.072	Stub	250-300530	250-300530B
	0.144	Regular	250-200530	250-200530B
0.049	0.074	Stub	250-300540	250-300540B
	0.147	Regular	250-200540	250-200540B
0.050	0.075	Stub	250-300550	250-300550B
	0.150	Regular	250-100190	250-100190B

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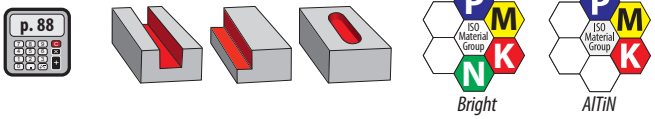
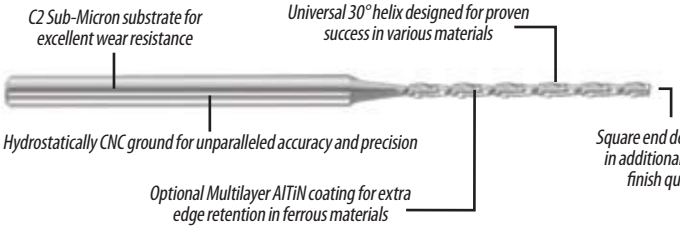
2 FLUTE - SQUARE CONTINUED

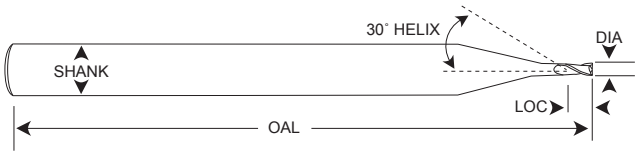
ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Bright	AlTiN
0.051	0.077	Stub	250-300560	250-300560B
	0.153	Regular	250-200560	250-200560B
0.052	0.078	Stub	250-300570	250-300570B
	0.156	Regular	250-200570	250-200570B
0.053	0.080	Stub	250-300580	250-300580B
	0.159	Regular	250-200580	250-200580B
0.054	0.081	Stub	250-300590	250-300590B
	0.162	Regular	250-200590	250-200590B
0.055	0.083	Stub	250-300600	250-300600B
	0.165	Regular	250-100210	250-100210B
0.056	0.084	Stub	250-300610	250-300610B
	0.168	Regular	250-200610	250-200610B
0.057	0.086	Stub	250-300620	250-300620B
	0.171	Regular	250-200620	250-200620B
0.058	0.087	Stub	250-300630	250-300630B
	0.174	Regular	250-200630	250-200630B
0.059	0.089	Stub	250-300640	250-300640B
	0.177	Regular	250-200640	250-200640B
0.060	0.090	Stub	250-300650	250-300650B
	0.180	Regular	250-100230	250-100230B
0.061	0.092	Stub	250-300660	250-300660B
	0.183	Regular	250-200660	250-200660B
0.062	0.093	Stub	250-300670	250-300670B
	0.186	Regular	250-200670	250-200670B
0.063	0.095	Stub	250-300680	250-300680B
	0.189	Regular	250-200680	250-200680B
0.064	0.096	Stub	250-300690	250-300690B
	0.192	Regular	250-200690	250-200690B
0.065	0.098	Stub	250-300700	250-300700B
	0.195	Regular	250-100250	250-100250B
0.070	0.105	Stub	250-300750	250-300750B
	0.210	Regular	250-100270	250-100270B
0.075	0.113	Stub	250-300800	250-300800B
	0.225	Regular	250-100290	250-100290B
0.080	0.120	Stub	250-300850	250-300850B
	0.240	Regular	250-100310	250-100310B
0.085	0.128	Stub	250-300900	250-300900B
	0.255	Regular	250-100330	250-100330B
0.090	0.135	Stub	250-300950	250-300950B
	0.270	Regular	250-100350	250-100350B
0.095	0.143	Stub	250-301000	250-301000B
	0.285	Regular	250-100370	250-100370B
0.100	0.150	Stub	250-301050	250-301050B
	0.300	Regular	250-100390	250-100390B
0.105	0.158	Stub	250-301100	250-301100B
	0.315	Regular	250-100401	250-100401B
0.110	0.165	Stub	250-301150	250-301150B
	0.330	Regular	250-100403	250-100403B
0.115	0.173	Stub	250-301200	250-301200B
	0.345	Regular	250-100406	250-100406B
0.120	0.180	Stub	250-301250	250-301250B
	0.360	Regular	250-100408	250-100408B

2 FLUTE - LONG SQUARE



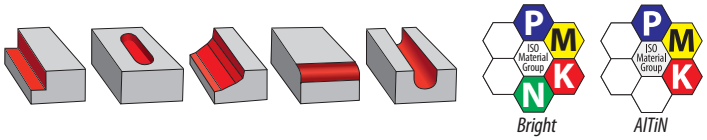


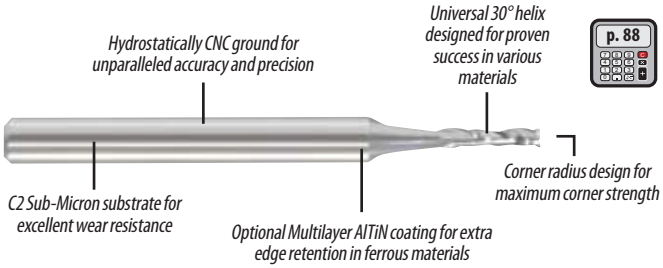


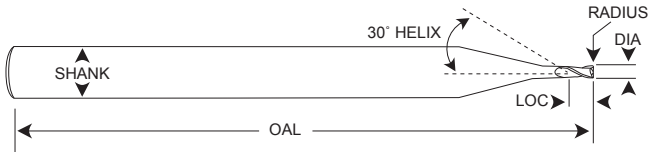
DIA Tolerance: ±0.0005" LOC Tolerance: +0.0000 / +0.0120" Shank Tolerance: +0.0000/-0.0003"

DIA		LOC	Shank	OAL	Length	Bright	AlTiN
0.0156	1/64	0.125	0.125	2.500	Long	251-001000	251-001000B
0.0312	1/32	0.250	0.125	2.500	Long	251-001001	251-001001B
		0.375	0.125	2.500	Long	251-001002	251-001002B
0.0469	3/64	0.250	0.125	2.500	Long	251-001010	251-001010B
		0.375	0.125	2.500	Long	251-001011	251-001011B
		0.500	0.125	2.500	Long	251-001013	251-001013B
0.0625	1/16	0.500	0.125	2.500	Long	251-001020	251-001020B
		0.750	0.125	2.500	Long	251-001021	251-001021B
		1.000	0.125	2.500	Long	251-001022	251-001022B
0.0781	5/64	0.500	0.125	2.500	Long	251-001030	251-001030B
0.0938	3/32	0.500	0.125	2.500	Long	251-001040	251-001040B
		0.750	0.125	2.500	Long	251-001041	251-001041B

2 FLUTE CORNER RADIUS







All Shank Diameters = 0.125" All OAL = 1.500"
DIA Tolerance: ±0.0005" LOC Tolerance: +0.0000 / +0.0120" Shank Tolerance: +0.0000/-0.0003"

DIA	LOC	Length	Corner Radius	Bright	AlTiN
0.010	0.015	Stub	.002	250-6201002	250-6201002B
	0.030	Regular	.002	250-5201002	250-5201002B
0.015	0.023	Stub	.002	250-6201502	250-6201502B
	0.045	Regular	.002	250-5201502	250-5201502B
0.020	0.030	Stub	.005	250-6202005	250-6202005B
	0.060	Regular	.005	250-5202005	250-5202005B
0.025	0.038	Stub	.005	250-6202505	250-6202505B
	0.075	Regular	.005	250-5202505	250-5202505B
0.030	0.045	Stub	.005	250-6203005	250-6203005B
			.010	250-6203010	250-6203010B
	0.090	Regular	.005	250-5203005	250-5203005B
			.010	250-5203010	250-5203010B

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2 FLUTE - RADIUS CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Corner Radius	Bright	AlTiN
0.031	0.047	Stub	.005	250-6203105	250-6203105B
			.010	250-6203110	250-6203110B
	0.093	Regular	.005	250-5203105	250-5203105B
			.010	250-5203110	250-5203110B
0.035	0.053	Stub	.005	250-6203505	250-6203505B
			.010	250-6203510	250-6203510B
	0.105	Regular	.005	250-5203505	250-5203505B
			.010	250-5203510	250-5203510B
0.040	0.060	Stub	.005	250-6204005	250-6204005B
			.010	250-6204010	250-6204010B
	0.120	Regular	.005	250-5204005	250-5204005B
			.010	250-5204010	250-5204010B
0.045	0.068	Stub	.005	250-6204505	250-6204505B
			.010	250-6204510	250-6204510B
			.015	250-6204515	250-6204515B
	0.135	Regular	.005	250-5204505	250-5204505B
			.010	250-5204510	250-5204510B
			.015	250-5204515	250-5204515B
0.047	0.071	Stub	.005	250-6204705	250-6204705B
			.010	250-6204710	250-6204710B
			.015	250-6204715	250-6204715B
	0.141	Regular	.005	250-5204705	250-5204705B
			.010	250-5204710	250-5204710B
			.015	250-5204715	250-5204715B
0.050	0.075	Stub	.005	250-6205005	250-6205005B
			.010	250-6205010	250-6205010B
			.015	250-6205015	250-6205015B
	0.150	Regular	.005	250-5205005	250-5205005B
			.010	250-5205010	250-5205010B
			.015	250-5205015	250-5205015B
0.055	0.083	Stub	.005	250-6205505	250-6205505B
			.010	250-6205510	250-6205510B
			.015	250-6205515	250-6205515B
	0.165	Regular	.005	250-5205505	250-5205505B
			.010	250-5205510	250-5205510B
			.015	250-5205515	250-5205515B
0.060	0.090	Stub	.005	250-6206005	250-6206005B
			.010	250-6206010	250-6206010B
			.015	250-6206015	250-6206015B
	0.180	Regular	.005	250-5206005	250-5206005B
			.010	250-5206010	250-5206010B
			.015	250-5206015	250-5206015B
0.062	0.093	Stub	.005	250-6206205	250-6206205B
			.010	250-6206210	250-6206210B
			.015	250-6206215	250-6206215B
	0.186	Regular	.005	250-5206205	250-5206205B
			.010	250-5206210	250-5206210B
			.015	250-5206215	250-5206215B
0.065	0.098	Stub	.005	250-6206505	250-6206505B
			.010	250-6206510	250-6206510B
			.015	250-6206515	250-6206515B
	0.195	Regular	.005	250-5206505	250-5206505B
			.010	250-5206510	250-5206510B
			.015	250-5206515	250-5206515B
0.070	0.105	Stub	.005	250-6207005	250-6207005B
			.010	250-6207010	250-6207010B
			.015	250-6207015	250-6207015B
	0.210	Regular	.005	250-5207005	250-5207005B
			.010	250-5207010	250-5207010B
			.015	250-5207015	250-5207015B
0.075	0.113	Stub	.005	250-6207505	250-6207505B
			.010	250-6207510	250-6207510B
			.015	250-6207515	250-6207515B
	0.225	Regular	.005	250-5207505	250-5207505B
			.010	250-5207510	250-5207510B
			.015	250-5207515	250-5207515B

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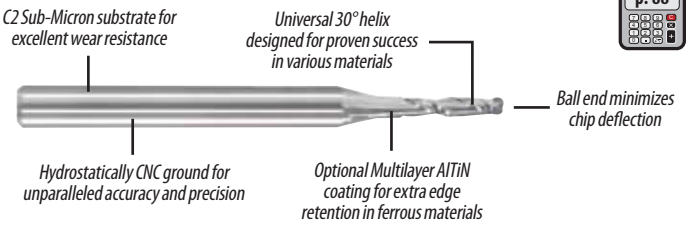
2 FLUTE - RADIUS CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Corner Radius	Bright	AlTiN
0.078	0.117	Stub	.005	250-6207805	250-6207805B
			.010	250-6207810	250-6207810B
			.015	250-6207815	250-6207815B
	0.234	Regular	.005	250-5207805	250-5207805B
			.010	250-5207810	250-5207810B
			.015	250-5207815	250-5207815B
0.080	0.120	Stub	.005	250-6208005	250-6208005B
			.010	250-6208010	250-6208010B
			.015	250-6208015	250-6208015B
	0.240	Regular	.005	250-5208005	250-5208005B
			.010	250-5208010	250-5208010B
			.015	250-5208015	250-5208015B
0.085	0.128	Stub	.005	250-6208505	250-6208505B
			.010	250-6208510	250-6208510B
			.015	250-6208515	250-6208515B
	0.255	Regular	.005	250-5208505	250-5208505B
			.010	250-5208510	250-5208510B
			.015	250-5208515	250-5208515B
0.090	0.135	Stub	.005	250-6209005	250-6209005B
			.010	250-6209010	250-6209010B
			.015	250-6209015	250-6209015B
	0.270	Regular	.005	250-5209005	250-5209005B
			.010	250-5209010	250-5209010B
			.015	250-5209015	250-5209015B
0.093	0.140	Stub	.005	250-6209305	250-6209305B
			.010	250-6209310	250-6209310B
			.015	250-6209315	250-6209315B
	0.279	Regular	.005	250-5209305	250-5209305B
			.010	250-5209310	250-5209310B
			.015	250-5209315	250-5209315B
0.095	0.143	Stub	.005	250-6209505	250-6209505B
			.010	250-6209510	250-6209510B
			.015	250-6209515	250-6209515B
	0.285	Regular	.005	250-5209505	250-5209505B
			.010	250-5209510	250-5209510B
			.015	250-5209515	250-5209515B
0.100	0.150	Stub	.005	250-6210005	250-6210005B
			.010	250-6210010	250-6210010B
			.015	250-6210015	250-6210015B
	0.300	Regular	.005	250-5210005	250-5210005B
			.010	250-5210010	250-5210010B
			.015	250-5210015	250-5210015B
0.105	0.158	Stub	.010	250-6210510	250-6210510B
			.015	250-6210515	250-6210515B
			.020	250-6210520	250-6210520B
	0.315	Regular	.010	250-5210510	250-5210510B
			.015	250-5210515	250-5210515B
			.020	250-5210520	250-5210520B
0.110	0.165	Stub	.010	250-6211010	250-6211010B
			.015	250-6211015	250-6211015B
			.020	250-6211020	250-6211020B
	0.330	Regular	.010	250-5211010	250-5211010B
			.015	250-5211015	250-5211015B
			.020	250-5211020	250-5211020B
0.115	0.173	Stub	.010	250-6211510	250-6211510B
			.015	250-6211515	250-6211515B
			.020	250-6211520	250-6211520B
	0.345	Regular	.010	250-5211510	250-5211510B
			.015	250-5211515	250-5211515B
			.020	250-5211520	250-5211520B
0.120	0.180	Stub	.010	250-6212010	250-6212010B
			.015	250-6212015	250-6212015B
			.020	250-6212020	250-6212020B
	0.360	Regular	.010	250-5212010	250-5212010B
			.015	250-5212015	250-5212015B
			.020	250-5212020	250-5212020B

2 FLUTE BALLNOSE



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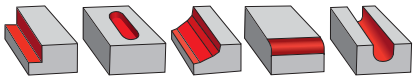

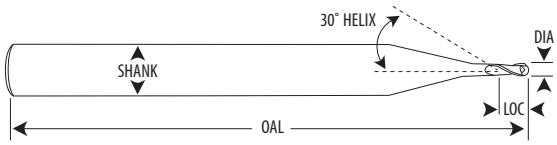

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"
DIA TOLERANCE: ±0.0005" LOC TOLERANCE: +0.0000 / +0.0120" SHANK TOLERANCE: +0.0000/-0.0003"

DIA	LOC	Length	Bright	AlTiN
0.010	0.015	Stub	250-360100	250-360100B
	0.030	Regular	250-320010	250-320010B
0.011	0.033	Regular	250-320011	250-320011B
0.012	0.036	Regular	250-320012	250-320012B
0.013	0.039	Regular	250-320013	250-320013B
0.014	0.042	Regular	250-320014	250-320014B
0.015	0.023	Stub	250-360200	250-360200B
	0.045	Regular	250-320015	250-320015B
0.016	0.048	Regular	250-320016	250-320016B
0.017	0.051	Regular	250-320017	250-320017B
0.018	0.054	Regular	250-320018	250-320018B
0.019	0.057	Regular	250-320019	250-320019B
0.020	0.030	Stub	250-360250	250-360250B
	0.060	Regular	250-320020	250-320020B
0.021	0.063	Regular	250-320021	250-320021B
0.022	0.066	Regular	250-320022	250-320022B
0.023	0.069	Regular	250-320023	250-320023B
0.024	0.072	Regular	250-320024	250-320024B
0.025	0.038	Stub	250-360300	250-360300B
	0.075	Regular	250-320025	250-320025B
0.026	0.078	Regular	250-320026	250-320026B
0.027	0.081	Regular	250-320027	250-320027B
0.028	0.084	Regular	250-320028	250-320028B
0.029	0.087	Regular	250-320029	250-320029B
0.030	0.045	Stub	250-360350	250-360350B
	0.090	Regular	250-320030	250-320030B
0.031	0.093	Regular	250-320031	250-320031B
0.032	0.096	Regular	250-320032	250-320032B
0.033	0.099	Regular	250-320033	250-320033B
0.034	0.102	Regular	250-320034	250-320034B
0.035	0.053	Stub	250-360400	250-360400B
	0.105	Regular	250-320035	250-320035B
0.036	0.108	Regular	250-320036	250-320036B
0.037	0.111	Regular	250-320037	250-320037B
0.038	0.114	Regular	250-320038	250-320038B

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2 FLUTE - BALLNOSE CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

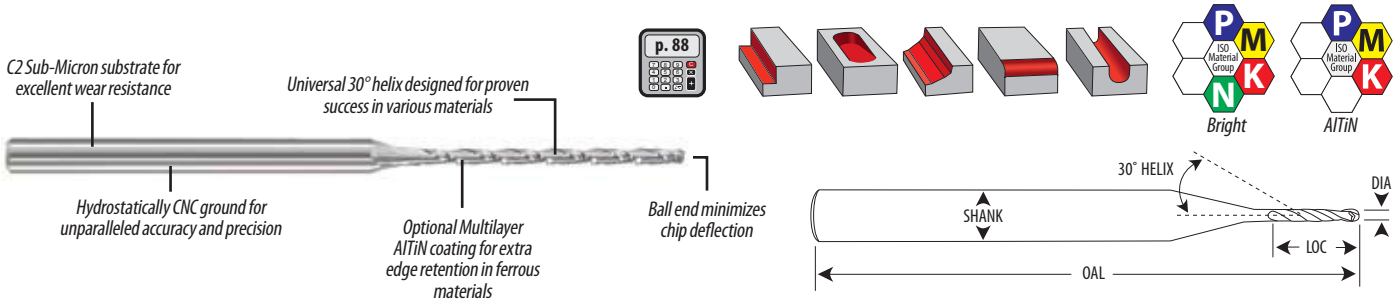
DIA	LOC	Length	Bright	AlTiN
0.039	0.117	Regular	250-320039	250-320039B
0.040	0.060	Stub	250-360450	250-360450B
	0.120	Regular	250-320040	250-320040B
0.041	0.123	Regular	250-320041	250-320041B
0.042	0.126	Regular	250-320042	250-320042B
0.043	0.129	Regular	250-320043	250-320043B
0.044	0.132	Regular	250-320044	250-320044B
0.045	0.068	Stub	250-360500	250-360500B
	0.135	Regular	250-320045	250-320045B
0.046	0.138	Regular	250-320046	250-320046B
0.047	0.141	Regular	250-320047	250-320047B
0.048	0.144	Regular	250-320048	250-320048B
0.049	0.147	Regular	250-320049	250-320049B
0.050	0.075	Stub	250-360550	250-360550B
	0.150	Regular	250-320050	250-320050B
0.051	0.153	Regular	250-320051	250-320051B
0.052	0.156	Regular	250-320052	250-320052B
0.053	0.159	Regular	250-320053	250-320053B
0.054	0.162	Regular	250-320054	250-320054B
0.055	0.083	Stub	250-360600	250-360600B
	0.165	Regular	250-320055	250-320055B
0.056	0.168	Regular	250-320056	250-320056B
0.057	0.171	Regular	250-320057	250-320057B
0.058	0.174	Regular	250-320058	250-320058B
0.059	0.177	Regular	250-320059	250-320059B
0.060	0.090	Stub	250-360620	250-360620B
	0.180	Regular	250-320060	250-320060B
0.061	0.183	Regular	250-320061	250-320061B
0.062	0.186	Regular	250-320062	250-320062B
0.063	0.189	Regular	250-320063	250-320063B
0.064	0.192	Regular	250-320064	250-320064B
0.065	0.098	Stub	250-360640	250-360640B
	0.195	Regular	250-320065	250-320065B
0.070	0.105	Stub	250-360660	250-360660B
	0.210	Regular	250-320070	250-320070B
0.075	0.113	Stub	250-360680	250-360680B
	0.225	Regular	250-320075	250-320075B
0.080	0.120	Stub	250-360700	250-360700B
	0.240	Regular	250-320080	250-320080B
0.085	0.128	Stub	250-360720	250-360720B
	0.255	Regular	250-320085	250-320085B
0.090	0.135	Stub	250-360740	250-360740B
	0.270	Regular	250-320090	250-320090B
0.095	0.143	Stub	250-360760	250-360760B
	0.285	Regular	250-320095	250-320095B

2 FLUTE - BALLNOSE CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Bright	AlTiN
0.100	0.150	Stub	250-360780	250-360780B
	0.300	Regular	250-320100	250-320100B
0.105	0.158	Stub	250-360800	250-360800B
	0.315	Regular	250-320105	250-320105B
0.110	0.165	Stub	250-360820	250-360820B
	0.330	Regular	250-320110	250-320110B
0.115	0.173	Stub	250-360840	250-360840B
	0.345	Regular	250-320115	250-320115B
0.120	0.180	Stub	250-360860	250-360860B
	0.360	Regular	250-320120	250-320120B

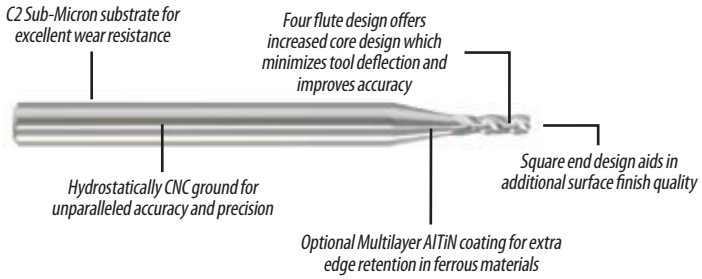
2 FLUTE - LONG BALLNOSE

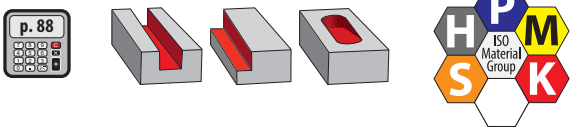


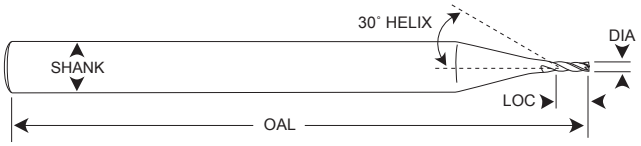
DIA TOLERANCE: ±0.0005" LOC TOLERANCE: +0.0000 / +0.0120" SHANK TOLERANCE: +0.0000/-0.0003"

DIA		LOC	Shank	OAL	Length	Bright	AlTiN
0.0156	1/64	0.125	0.125	2.500	Long	251-001100	251-001100B
0.0312	1/32	0.250	0.125	2.500	Long	251-001101	251-001101B
		0.375	0.125	2.500	Long	251-001102	251-001102B
0.0469	3/64	0.250	0.125	2.500	Long	251-001110	251-001110B
		0.375	0.125	2.500	Long	251-001111	251-001111B
		0.500	0.125	2.500	Long	251-001112	251-001112B
0.0625	1/16	0.500	0.125	2.500	Long	251-001120	251-001120B
		0.750	0.125	2.500	Long	251-001121	251-001121B
		1.000	0.125	2.500	Long	251-001122	251-001122B
0.0781	5/64	0.500	0.125	2.500	Long	251-001130	251-001130B
0.0938	3/32	0.500	0.125	2.500	Long	251-001140	251-001140B
		0.750	0.125	2.500	Long	251-001141	251-001141B

4 FLUTE SQUARE







ALL SHANK DIAMETERS = 0.125" **ALL OAL = 1.500"**
DIA TOLERANCE: ±0.0005" LOC TOLERANCE: +0.0000 / +0.0120" SHANK TOLERANCE: +0.0000/-0.0003"

DIA	LOC	Length	Bright	AlTiN
0.005	0.008	Stub	250-305100	—
	0.015	Regular	250-100410	—
0.006	0.009	Stub	250-305110	—
	0.018	Regular	250-205110	—
0.007	0.011	Stub	250-305120	—
	0.021	Regular	250-205120	—
0.008	0.012	Stub	250-305130	—
	0.024	Regular	250-205130	—
0.009	0.014	Stub	250-305140	—
	0.027	Regular	250-205140	—
0.010	0.015	Stub	250-305150	250-305150B
	0.030	Regular	250-100430	250-100430B
0.011	0.017	Stub	250-305160	250-305160B
	0.033	Regular	250-205160	250-205160B
0.012	0.018	Stub	250-305170	250-305170B
	0.036	Regular	250-205170	250-205170B
0.013	0.020	Stub	250-305180	250-305180B
	0.039	Regular	250-205180	250-205180B
0.014	0.021	Stub	250-305190	250-305190B
	0.042	Regular	250-205190	250-205190B
0.015	0.023	Stub	250-305200	250-305200B
	0.045	Regular	250-100450	250-100450B
0.016	0.024	Stub	250-305210	250-305210B
	0.048	Regular	250-205210	250-205210B
0.017	0.026	Stub	250-305220	250-305220B
	0.051	Regular	250-205220	250-205220B
0.018	0.027	Stub	250-305230	250-305230B
	0.054	Regular	250-205230	250-205230B
0.019	0.029	Stub	250-305240	250-305240B
	0.057	Regular	250-205240	250-205240B
0.020	0.030	Stub	250-305250	250-305250B
	0.060	Regular	250-100470	250-100470B
0.021	0.032	Stub	250-305260	250-305260B
	0.063	Regular	250-205260	250-205260B
0.022	0.033	Stub	250-305270	250-305270B
	0.066	Regular	250-205270	250-205270B
0.023	0.035	Stub	250-305280	250-305280B
	0.069	Regular	250-205280	250-205280B

To Order Contact: Exact Tooling / www.exacttooling.com / sales@exacttooling.com / 888-988-8820

4 FLUTE - SQUARE CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Bright	AlTiN
0.024	0.036	Stub	250-305290	250-305290B
	0.072	Regular	250-205290	250-205290B
0.025	0.038	Stub	250-305300	250-305300B
	0.075	Regular	250-100490	250-100490B
0.026	0.039	Stub	250-305310	250-305310B
	0.078	Regular	250-205310	250-205310B
0.027	0.041	Stub	250-305320	250-305320B
	0.081	Regular	250-205320	250-205320B
0.028	0.042	Stub	250-305330	250-305330B
	0.084	Regular	250-205330	250-205330B
0.029	0.044	Stub	250-305340	250-305340B
	0.087	Regular	250-205340	250-205340B
0.030	0.045	Stub	250-305350	250-305350B
	0.090	Regular	250-100510	250-100510B
0.031	0.047	Stub	250-305360	250-305360B
	0.093	Regular	250-205360	250-205360B
0.032	0.048	Stub	250-305370	250-305370B
	0.096	Regular	250-205370	250-205370B
0.033	0.050	Stub	250-305380	250-305380B
	0.099	Regular	250-205380	250-205380B
0.034	0.051	Stub	250-305390	250-305390B
	0.102	Regular	250-205390	250-205390B
0.035	0.053	Stub	250-305400	250-305400B
	0.105	Regular	250-100530	250-100530B
0.036	0.054	Stub	250-305410	250-305410B
	0.108	Regular	250-205410	250-205410B
0.037	0.056	Stub	250-305420	250-305420B
	0.111	Regular	250-205420	250-205420B
0.038	0.057	Stub	250-305430	250-305430B
	0.114	Regular	250-205430	250-205430B
0.039	0.059	Stub	250-305440	250-305440B
	0.117	Regular	250-205440	250-205440B
0.040	0.060	Stub	250-305450	250-305450B
	0.120	Regular	250-100550	250-100550B
0.041	0.062	Stub	250-305460	250-305460B
	0.123	Regular	250-205460	250-205460B
0.042	0.063	Stub	250-305470	250-305470B
	0.126	Regular	250-205470	250-205470B
0.043	0.065	Stub	250-305480	250-305480B
	0.129	Regular	250-205480	250-205480B
0.044	0.066	Stub	250-305490	250-305490B
	0.132	Regular	250-205490	250-205490B
0.045	0.068	Stub	250-305500	250-305500B
	0.135	Regular	250-100570	250-100570B
0.046	0.069	Stub	250-305510	250-305510B
	0.138	Regular	250-205510	250-205510B
0.047	0.071	Stub	250-305520	250-305520B
	0.141	Regular	250-205520	250-205520B
0.048	0.072	Stub	250-305530	250-305530B
	0.144	Regular	250-205530	250-205530B

To Order Contact: Exact Tooling / www.exacttooling.com / sales@exacttooling.com / 888-988-8820

4 FLUTE - SQUARE CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

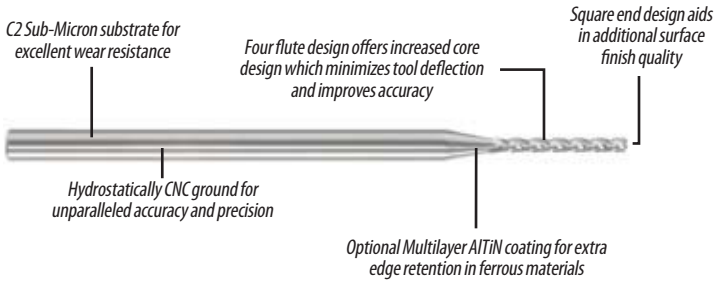
DIA	LOC	Length	Bright	AlTiN
0.049	0.074	Stub	250-305540	250-305540B
	0.147	Regular	250-205540	250-205540B
0.050	0.075	Stub	250-305550	250-305550B
	0.150	Regular	250-100590	250-100590B
0.051	0.077	Stub	250-305560	250-305560B
	0.153	Regular	250-205560	250-205560B
0.052	0.078	Stub	250-305570	250-305570B
	0.156	Regular	250-205570	250-205570B
0.053	0.080	Stub	250-305580	250-305580B
	0.159	Regular	250-205580	250-205580B
0.054	0.081	Stub	250-305590	250-305590B
	0.162	Regular	250-205590	250-205590B
0.055	0.083	Stub	250-305600	250-305600B
	0.165	Regular	250-100610	250-100610B
0.056	0.084	Stub	250-305610	250-305610B
	0.168	Regular	250-205610	250-205610B
0.057	0.086	Stub	250-305620	250-305620B
	0.171	Regular	250-205620	250-205620B
0.058	0.087	Stub	250-305630	250-305630B
	0.174	Regular	250-205630	250-205630B
0.059	0.089	Stub	250-305640	250-305640B
	0.177	Regular	250-205640	250-205640B
0.060	0.090	Stub	250-305650	250-305650B
	0.180	Regular	250-100630	250-100630B
0.061	0.092	Stub	250-305660	250-305660B
	0.183	Regular	250-205660	250-205660B
0.062	0.093	Stub	250-305670	250-305670B
	0.186	Regular	250-205670	250-205670B
0.063	0.095	Stub	250-305680	250-305680B
	0.189	Regular	250-205680	250-205680B
0.064	0.096	Stub	250-305690	250-305690B
	0.192	Regular	250-205690	250-205690B
0.065	0.098	Stub	250-305700	250-305700B
	0.195	Regular	250-100650	250-100650B
0.070	0.105	Stub	250-305750	250-305750B
	0.210	Regular	250-100670	250-100670B
0.075	0.113	Stub	250-305800	250-305800B
	0.225	Regular	250-100690	250-100690B
0.080	0.120	Stub	250-305850	250-305850B
	0.240	Regular	250-100710	250-100710B
0.085	0.128	Stub	250-305900	250-305900B
	0.255	Regular	250-100730	250-100730B
0.090	0.135	Stub	250-305950	250-305950B
	0.270	Regular	250-100750	250-100750B
0.095	0.143	Stub	250-306000	250-306000B
	0.285	Regular	250-100770	250-100770B

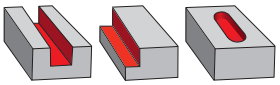
4 FLUTE - SQUARE CONTINUED

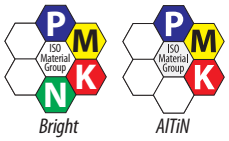
ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

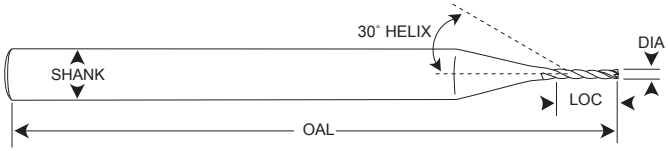
DIA	LOC	Length	Bright	AlTiN
0.100	0.150	Stub	250-306050	250-306050B
	0.300	Regular	250-100790	250-100790B
0.105	0.158	Stub	250-306100	250-306100B
	0.315	Regular	250-100801	250-100801B
0.110	0.165	Stub	250-306150	250-306150B
	0.330	Regular	250-100803	250-100803B
0.115	0.173	Stub	250-306200	250-306200B
	0.345	Regular	250-100805	250-100805B
0.120	0.180	Stub	250-306250	250-306250B
	0.360	Regular	250-100807	250-100807B

4 FLUTE - LONG SQUARE





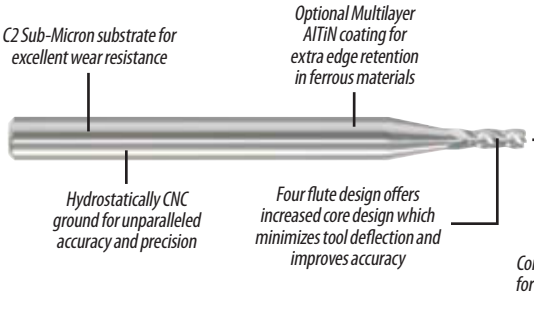




DIA TOLERANCE: ±0.0005" LOC TOLERANCE: +0.0000 / +0.0120" SHANK TOLERANCE: +0.0000/-0.0003"

DIA		LOC	Shank	OAL	Length	Bright	AlTiN
0.0156	1/64	0.125	0.125	2.500	Long	251-002000	251-002000B
0.0312	1/32	0.250	0.125	2.500	Long	251-002001	251-002001B
		0.375	0.125	2.500	Long	251-002002	251-002002B
0.0469	3/64	0.250	0.125	2.500	Long	251-002010	251-002010B
		0.375	0.125	2.500	Long	251-002011	251-002011B
		0.500	0.125	2.500	Long	251-002013	251-002013B
0.0625	1/16	0.500	0.125	2.500	Long	251-002020	251-002020B
		0.750	0.125	2.500	Long	251-002021	251-002021B
		1.000	0.125	2.500	Long	251-002022	251-002022B
0.0781	5/64	0.500	0.125	2.500	Long	251-002030	251-002030B
0.0938	3/32	0.500	0.125	2.500	Long	251-002040	251-002040B
		0.750	0.125	2.500	Long	251-002041	251-002041B

4 FLUTE CORNER RADIUS



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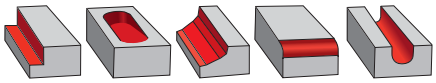

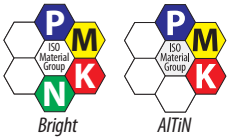

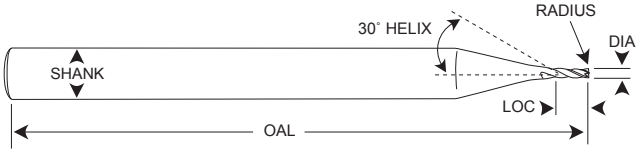

ALL SHANK DIAMETERS = 0.125" **ALL OAL = 1.500"**
DIA TOLERANCE: ±0.0005" LOC TOLERANCE: +0.0000 / +0.0120" SHANK TOLERANCE: +0.0000/-0.0003"

DIA	LOC	Length	Corner Radius	Bright	AlTiN
0.010	0.015	Stub	.002	250-6401002	250-6401002B
	0.030	Regular	.002	250-5401002	250-5401002B
0.015	0.023	Stub	.002	250-6401502	250-6401502B
	0.045	Regular	.002	250-5401502	250-5401502B
0.020	0.030	Stub	.005	250-6402005	250-6402005B
	0.060	Regular	.005	250-5402005	250-5402005B
0.025	0.038	Stub	.005	250-6402505	250-6402505B
	0.075	Regular	.005	250-5402505	250-5402505B
0.030	0.045	Stub	.005	250-6403005	250-6403005B
			.010	250-6403010	250-6403010B
	0.090	Regular	.005	250-5403005	250-5403005B
			.010	250-5403010	250-5403010B
0.031	0.047	Stub	.005	250-6403105	250-6403105B
			.010	250-6403110	250-6403110B
	0.093	Regular	.005	250-5403105	250-5403105B
			.010	250-5403110	250-5403110B
0.035	0.053	Stub	.005	250-6403505	250-6403505B
			.010	250-6403510	250-6403510B
	0.105	Regular	.005	250-5403505	250-5403505B
			.010	250-5403510	250-5403510B
0.040	0.060	Stub	.005	250-6404005	250-6404005B
			.010	250-6404010	250-6404010B
	0.120	Regular	.005	250-5404005	250-5404005B
			.010	250-5404010	250-5404010B
0.045	0.068	Stub	.005	250-6404505	250-6404505B
			.010	250-6404510	250-6404510B
			.015	250-6404515	250-6404515B
	0.135	Regular	.005	250-5404505	250-5404505B
			.010	250-5404510	250-5404510B
			.015	250-5404515	250-5404515B
0.047	0.071	Stub	.005	250-6404705	250-6404705B
			.010	250-6404710	250-6404710B
			.015	250-6404715	250-6404715B
	0.141	Regular	.005	250-5404705	250-5404705B
			.010	250-5404710	250-5404710B
			.015	250-5404715	250-5404715B
0.050	0.075	Stub	.005	250-6405005	250-6405005B
			.010	250-6405010	250-6405010B
			.015	250-6405015	250-6405015B
	0.150	Regular	.005	250-5405005	250-5405005B
			.010	250-5405010	250-5405010B
			.015	250-5405015	250-5405015B

4 FLUTE - RADIUS CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Corner Radius	Bright	AlTiN
0.055	0.083	Stub	.005	250-6405505	250-6405505B
			.010	250-6405510	250-6405510B
			.015	250-6405515	250-6405515B
	0.165	Regular	.005	250-5405505	250-5405505B
			.010	250-5405510	250-5405510B
			.015	250-5405515	250-5405515B
0.060	0.090	Stub	.005	250-6406005	250-6406005B
			.010	250-6406010	250-6406010B
			.015	250-6406015	250-6406015B
	0.180	Regular	.005	250-5406005	250-5406005B
			.010	250-5406010	250-5406010B
			.015	250-5406015	250-5406015B
0.062	0.093	Stub	.005	250-6406205	250-6406205B
			.010	250-6406210	250-6406210B
			.015	250-6406215	250-6406215B
	0.186	Regular	.005	250-5406205	250-5406205B
			.010	250-5406210	250-5406210B
			.015	250-5406215	250-5406215B
0.065	0.098	Stub	.005	250-6406505	250-6406505B
			.010	250-6406510	250-6406510B
			.015	250-6406515	250-6406515B
	0.195	Regular	.005	250-5406505	250-5406505B
			.010	250-5406510	250-5406510B
			.015	250-5406515	250-5406515B
0.070	0.105	Stub	.005	250-6407005	250-6407005B
			.010	250-6407010	250-6407010B
			.015	250-6407015	250-6407015B
	0.210	Regular	.005	250-5407005	250-5407005B
			.010	250-5407010	250-5407010B
			.015	250-5407015	250-5407015B
0.075	0.113	Stub	.005	250-6407505	250-6407505B
			.010	250-6407510	250-6407510B
			.015	250-6407515	250-6407515B
	0.225	Regular	.005	250-5407505	250-5407505B
			.010	250-5407510	250-5407510B
			.015	250-5407515	250-5407515B
0.078	0.117	Stub	.005	250-6407805	250-6407805B
			.010	250-6407810	250-6407810B
			.015	250-6407815	250-6407815B
	0.234	Regular	.005	250-5407805	250-5407805B
			.010	250-5407810	250-5407810B
			.015	250-5407815	250-5407815B
0.080	0.120	Stub	.005	250-6408005	250-6408005B
			.010	250-6408010	250-6408010B
			.015	250-6408015	250-6408015B
	0.240	Regular	.005	250-5408005	250-5408005B
			.010	250-5408010	250-5408010B
			.015	250-5408015	250-5408015B
0.085	0.128	Stub	.005	250-6408505	250-6408505B
			.010	250-6408510	250-6408510B
			.015	250-6408515	250-6408515B
	0.255	Regular	.005	250-5408505	250-5408505B
			.010	250-5408510	250-5408510B
			.015	250-5408515	250-5408515B

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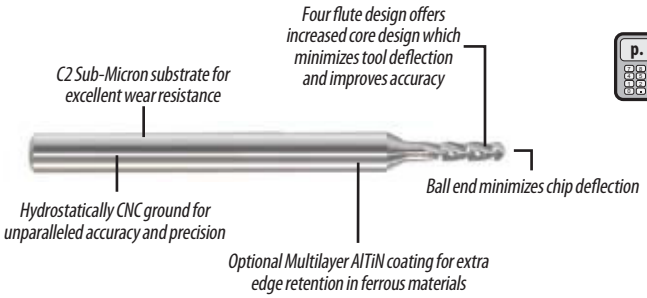
4 FLUTE - RADIUS CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Corner Radius	Bright	AlTiN
0.090	0.135	Stub	.005	250-6409005	250-6409005B
			.010	250-6409010	250-6409010B
			.015	250-6409015	250-6409015B
	0.270	Regular	.005	250-5409005	250-5409005B
			.010	250-5409010	250-5409010B
			.015	250-5409015	250-5409015B
0.093	0.140	Stub	.005	250-6409305	250-6409305B
			.010	250-6409310	250-6409310B
			.015	250-6409315	250-6409315B
	0.279	Regular	.005	250-5409305	250-5409305B
			.010	250-5409310	250-5409310B
			.015	250-5409315	250-5409315B
0.095	0.143	Stub	.005	250-6409505	250-6409505B
			.010	250-6409510	250-6409510B
			.015	250-6409515	250-6409515B
	0.285	Regular	.005	250-5409505	250-5409505B
			.010	250-5409510	250-5409510B
			.015	250-5409515	250-5409515B
0.100	0.150	Stub	.005	250-6410005	250-6410005B
			.010	250-6410010	250-6410010B
			.015	250-6410015	250-6410015B
	0.300	Regular	.005	250-5410005	250-5410005B
			.010	250-5410010	250-5410010B
			.015	250-5410015	250-5410015B
0.105	0.158	Stub	.010	250-6410510	250-6410510B
			.015	250-6410515	250-6410515B
			.020	250-6410520	250-6410520B
	0.315	Regular	.010	250-5410510	250-5410510B
			.015	250-5410515	250-5410515B
			.020	250-5410520	250-5410520B
0.110	0.165	Stub	.010	250-6411010	250-6411010B
			.015	250-6411015	250-6411015B
			.020	250-6411020	250-6411020B
	0.330	Regular	.010	250-5411010	250-5411010B
			.015	250-5411015	250-5411015B
			.020	250-5411020	250-5411020B
0.115	0.173	Stub	.010	250-6411510	250-6411510B
			.015	250-6411515	250-6411515B
			.020	250-6411520	250-6411520B
	0.345	Regular	.010	250-5411510	250-5411510B
			.015	250-5411515	250-5411515B
			.020	250-5411520	250-5411520B
0.120	0.180	Stub	.010	250-6412010	250-6412010B
			.015	250-6412015	250-6412015B
			.020	250-6412020	250-6412020B
	0.360	Regular	.010	250-5412010	250-5412010B
			.015	250-5412015	250-5412015B
			.020	250-5412020	250-5412020B

4 FLUTE BALLNOSE



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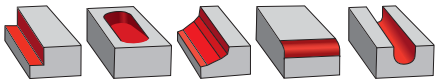

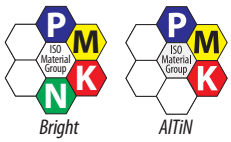

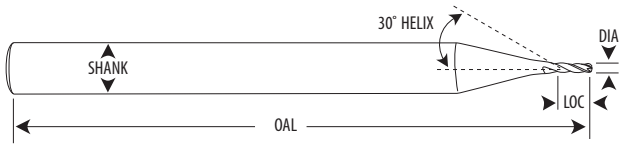

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"
DIA TOLERANCE: ±0.0005" LOC TOLERANCE: +0.0000 / +0.0120" SHANK TOLERANCE: +0.0000/-0.0003"

DIA	LOC	Length	Bright	AlTiN
0.010	0.015	Stub	250-370150	250-370150B
	0.030	Regular	250-340010	250-340010B
0.011	0.033	Regular	250-340011	250-340011B
0.012	0.036	Regular	250-340012	250-340012B
0.013	0.039	Regular	250-340013	250-340013B
0.014	0.042	Regular	250-340014	250-340014B
0.015	0.023	Stub	250-370200	250-370200B
	0.045	Regular	250-340015	250-340015B
0.016	0.048	Regular	250-340016	250-340016B
0.017	0.051	Regular	250-340017	250-340017B
0.018	0.054	Regular	250-340018	250-340018B
0.019	0.057	Regular	250-340019	250-340019B
0.020	0.030	Stub	250-370250	250-370250B
	0.060	Regular	250-340020	250-340020B
0.021	0.063	Regular	250-340021	250-340021B
0.022	0.066	Regular	250-340022	250-340022B
0.023	0.069	Regular	250-340023	250-340023B
0.024	0.072	Regular	250-340024	250-340024B
0.025	0.038	Stub	250-370300	250-370300B
	0.075	Regular	250-340025	250-340025B
0.026	0.078	Regular	250-340026	250-340026B
0.027	0.081	Regular	250-340027	250-340027B
0.028	0.084	Regular	250-340028	250-340028B
0.029	0.087	Regular	250-340029	250-340029B
0.030	0.045	Stub	250-370350	250-370350B
	0.090	Regular	250-340030	250-340030B
0.031	0.093	Regular	250-340031	250-340031B
0.032	0.096	Regular	250-340032	250-340032B
0.033	0.099	Regular	250-340033	250-340033B
0.034	0.102	Regular	250-340034	250-340034B
0.035	0.053	Stub	250-370400	250-370400B
	0.105	Regular	250-340035	250-340035B
0.036	0.108	Regular	250-340036	250-340036B
0.037	0.111	Regular	250-340037	250-340037B
0.038	0.114	Regular	250-340038	250-340038B

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4 FLUTE - BALLNOSE CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Bright	AlTiN
0.039	0.117	Regular	250-340039	250-340039B
0.040	0.060	Stub	250-370450	250-370450B
	0.120	Regular	250-340040	250-340040B
0.041	0.123	Regular	250-340041	250-340041B
0.042	0.126	Regular	250-340042	250-340042B
0.043	0.129	Regular	250-340043	250-340043B
0.044	0.132	Regular	250-340044	250-340044B
0.045	0.068	Stub	250-370500	250-370500B
	0.135	Regular	250-340045	250-340045B
0.046	0.138	Regular	250-340046	250-340046B
0.047	0.141	Regular	250-340047	250-340047B
0.048	0.144	Regular	250-340048	250-340048B
0.049	0.147	Regular	250-340049	250-340049B
0.050	0.075	Stub	250-370550	250-370550B
	0.150	Regular	250-340050	250-340050B
0.051	0.153	Regular	250-340051	250-340051B
0.052	0.156	Regular	250-340052	250-340052B
0.053	0.159	Regular	250-340053	250-340053B
0.054	0.162	Regular	250-340054	250-340054B
0.055	0.083	Stub	250-370600	250-370600B
	0.165	Regular	250-340055	250-340055B
0.056	0.168	Regular	250-340056	250-340056B
0.057	0.171	Regular	250-340057	250-340057B
0.058	0.174	Regular	250-340058	250-340058B
0.059	0.177	Regular	250-340059	250-340059B
0.060	0.090	Stub	250-370620	250-370620B
	0.180	Regular	250-340060	250-340060B
0.061	0.183	Regular	250-340061	250-340061B
0.062	0.186	Regular	250-340062	250-340062B
0.063	0.189	Regular	250-340063	250-340063B
0.064	0.192	Regular	250-340064	250-340064B
0.065	0.098	Stub	250-370640	250-370640B
	0.195	Regular	250-340065	250-340065B
0.070	0.105	Stub	250-370660	250-370660B
	0.210	Regular	250-340070	250-340070B
0.075	0.113	Stub	250-370680	250-370680B
	0.225	Regular	250-340075	250-340075B
0.080	0.120	Stub	250-370700	250-370700B
	0.240	Regular	250-340080	250-340080B
0.085	0.128	Stub	250-370720	250-370720B
	0.255	Regular	250-340085	250-340085B
0.090	0.135	Stub	250-370740	250-370740B
	0.270	Regular	250-340090	250-340090B
0.095	0.143	Stub	250-370760	250-370760B
	0.285	Regular	250-340095	250-340095B

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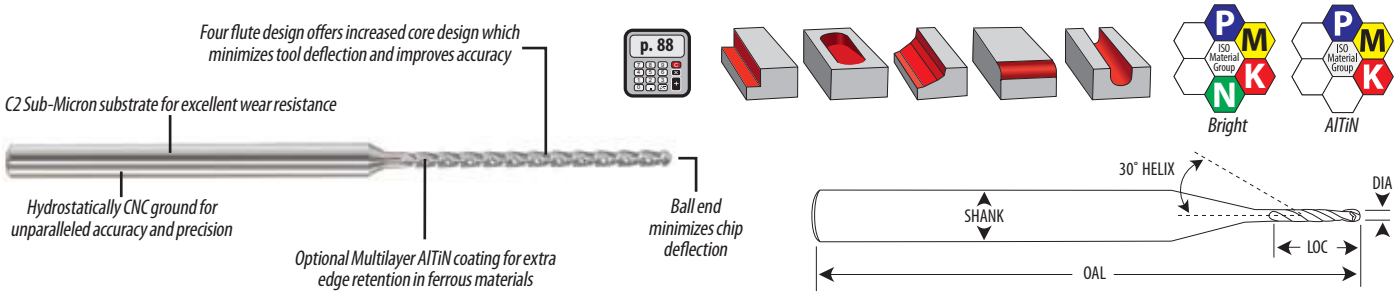
4 FLUTE - BALLNOSE CONTINUED

ALL SHANK DIAMETERS = 0.125" ALL OAL = 1.500"

DIA	LOC	Length	Bright	AlTiN
0.100	0.150	Stub	250-370780	250-370780B
	0.300	Regular	250-340100	250-340100B
0.105	0.158	Stub	250-370800	250-370800B
	0.315	Regular	250-340105	250-340105B
0.110	0.165	Stub	250-370820	250-370820B
	0.330	Regular	250-340110	250-340110B
0.115	0.173	Stub	250-370840	250-370840B
	0.345	Regular	250-340115	250-340115B
0.120	0.180	Stub	250-370860	250-370860B
	0.360	Regular	250-340120	250-340120B

4 FLUTE - LONG BALLNOSE



DIA TOLERANCE: ±0.0005" LOC TOLERANCE: +0.0000 / +0.0120" SHANK TOLERANCE: +0.0000/-0.0003"

DIA		LOC	Shank	OAL	Length	Bright	AlTiN
0.0156	1/64	0.125	0.125	2.500	Long	251-002100	251-002100B
0.0312	1/32	0.250	0.125	2.500	Long	251-002101	251-002101B
		0.375	0.125	2.500	Long	251-002102	251-002102B
0.0469	3/64	0.250	0.125	2.500	Long	251-002110	251-002110B
		0.375	0.125	2.500	Long	251-002111	251-002111B
		0.500	0.125	2.500	Long	251-002112	251-002112B
0.0625	1/16	0.500	0.125	2.500	Long	251-002120	251-002120B
		0.750	0.125	2.500	Long	251-002121	251-002121B
		1.000	0.125	2.500	Long	251-002122	251-002122B
0.0781	5/64	0.500	0.125	2.500	Long	251-002130	251-002130B
0.0938	3/32	0.500	0.125	2.500	Long	251-002140	251-002140B
		0.750	0.125	2.500	Long	251-002141	251-002141B

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MILLING RECOMMENDATIONS - GP MINIATURE ENDMILLS

PROFILING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)

Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM	Inches Per Tooth (IPT) Cutting Diameter 0.015	0.031	0.047	0.062	0.078	0.093	0.125	0.187	0.250
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	400	0.00007	0.00015	0.00023	0.00027	0.00034	0.00040	0.00054	0.00081	0.00100
	Medium/High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX	P	28 - 38 Rc	300									
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	200									
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	400	0.00007	0.00015	0.00023	0.00027	0.00034	0.00040	0.00054	0.00081	0.00100
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347	M	≤ 28 Rc	200									
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	> 28 Rc	150									
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	70	0.00004	0.00008	0.00015	0.00023	0.00027	0.00034	0.00040	0.00054	0.00080
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S	≤ 42 Rc	150									
Hardened Materials		H	45-55 Rc	100	0.00010	0.00030	0.00050	0.00140	0.00180	0.00210	0.00300	0.00360	0.00420
Cast-Iron	Gray: SAE J431, ASTM A48	K	160 - 200 HB	400	0.00007	0.00015	0.00023	0.00027	0.00034	0.00040	0.00054	0.00081	0.00100
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K	200 - 250 HB	250									
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		100	0.00004	0.00008	0.00015	0.00023	0.00027	0.00034	0.00040	0.00054	0.00080

SLOTTING

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)

Inches Per Tooth (IPT)

Workpiece Material Group			Hardness	SFM	Inches Per Tooth (IPT) Cutting Diameter 0.015	0.031	0.047	0.062	0.078	0.093	0.125	0.187	0.250
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	400	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005	0.0007	0.0010
	Medium/High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX	P	28 - 38 Rc	300					0.0003	0.0003	0.0004	0.0007	0.0009
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	200					0.0002	0.0003	0.0004	0.0006	0.0008
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	400	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005	0.0007	0.0010
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347	M	≤ 28 Rc	200			0.0002	0.0002	0.0003	0.0003	0.0004	0.0007	0.0009
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	> 28 Rc	150			0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	70	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S	≤ 42 Rc	150									
Hardened Materials		H	35 - 45 Rc	100	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004
Cast-Iron	Gray: SAE J431, ASTM A48	K	160 - 200 HB	400	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005	0.0007	0.0010
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K	200 - 250 HB	250						0.0003	0.0004	0.0007	0.0009
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N		750	0.0002	0.0003	0.0005	0.0006	0.0007	0.0008	0.0011	0.0017	0.0022

Diamond Cut Routers

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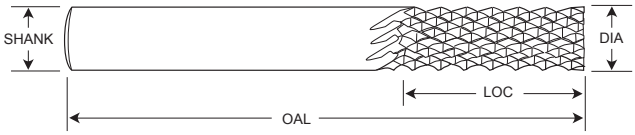
Routinely used on printed circuit boards, plastics, epoxy resins, and various composite materials

Multiple end-types available for specific routing applications

Diamond-cut flute geometry provides maximum cutting action and smooth/clean surfaces/edges



Style A
No End Cut

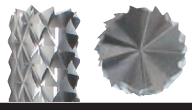
Edge routing
Smoothing
Finishing

Shank Tolerance: +0.0000/-0.0005"

DIA	Dec In	LOC	Shank	OAL	Style A
1/16	0.0625	3/16	1/8	1-1/2	780-001001
3/32	0.0938	3/8	1/8	1-1/2	780-001010
1/8	0.1250	1/2	1/8	1-1/2	780-001020
3/16	0.1875	5/8	3/16	2	780-001030
			1/4	2	780-001040
1/4	0.2500	3/4	1/4	2	780-001050
				2-1/2	780-001060
		1	1/4	3	780-001070
5/16	0.3125	1	5/16	2-1/2	780-001080
3/8	0.3750	1	3/8	2-1/2	780-001090
1/2	0.5000	1	1/2	3	780-001100

Style B
Burr End Cut

Grooving
Bottom Cutting

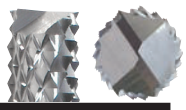


Shank Tolerance: +0.0000/-0.0005"

DIA	Dec In	LOC	Shank	OAL	Style B
1/16	0.0625	3/16	1/8	1-1/2	781-001001
3/32	0.0938	3/8	1/8	1-1/2	781-001010
1/8	0.1250	1/2	1/8	1-1/2	781-001020
3/16	0.1875	5/8	3/16	2	781-001030
			1/4	2	781-001040
1/4	0.2500	3/4	1/4	2	781-001050
				2-1/2	781-001060
		1	1/4	3	781-001070
5/16	0.3125	1	5/16	2-1/2	781-001080
3/8	0.3750	1	3/8	2-1/2	781-001090
1/2	0.5000	1	1/2	3	781-001100

Style C
End Mill Style

Grooving
Bottom Cutting



Shank Tolerance: +0.0000/-0.0005"

DIA	Dec In	LOC	Shank	OAL	Style C
1/16	0.0625	3/16	1/8	1-1/2	782-001001
3/32	0.0938	3/8	1/8	1-1/2	782-001010
1/8	0.1250	3/8	1/8	1-1/2	782-001020
3/16	0.1875	5/8	3/16	2	782-001030
			1/4	2	782-001040
1/4	0.2500	3/4	1/4	2	782-001050
				2-1/2	782-001060
		1	1/4	3	782-001070
5/16	0.3125	1	5/16	2-1/2	782-001080
3/8	0.3750	1	3/8	2-1/2	782-001090
1/2	0.5000	1	1/2	3	782-001100

Style D
Drill Point

Plunge feeding
135° Drill Point

Shank Tolerance: +0.0000/-0.0005"

DIA	Dec In	LOC	Shank	OAL	Style D
1/16	0.0625	3/16	1/8	1-1/2	783-001001
3/32	0.0938	3/8	1/8	1-1/2	783-001010
1/8	0.1250	3/8	1/8	1-1/2	783-001020
3/16	0.1875	5/8	3/16	2	783-001030
			1/4	2	783-001040
1/4	0.2500	3/4	1/4	2	783-001050
				2-1/2	783-001060
		1	1/4	3	783-001070
5/16	0.3125	1	5/16	2-1/2	783-001080
3/8	0.3750	1	3/8	2-1/2	783-001090
1/2	0.5000	1	1/2	3	783-001100

Style F
Fishtail End

Plunge feeding

Shank Tolerance: +0.0000/-0.0005"

DIA	Dec In	LOC	Shank	OAL	Style F
1/16	0.0625	3/16	1/8	1-1/2	784-001001
3/32	0.0938	3/8	1/8	1-1/2	784-001010
1/8	0.1250	1/2	1/8	1-1/2	784-001020
3/16	0.1875	5/8	3/16	2	784-001030
			1/4	2	784-001040
1/4	0.2500	3/4	1/4	2	784-001050
				2-1/2	784-001060
		1	1/4	3	784-001070
5/16	0.3125	1	5/16	2-1/2	784-001080
3/8	0.3750	1	3/8	2-1/2	784-001090
1/2	0.5000	1	1/2	3	784-001100

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STRAIGHT FLUTE ROUTERS

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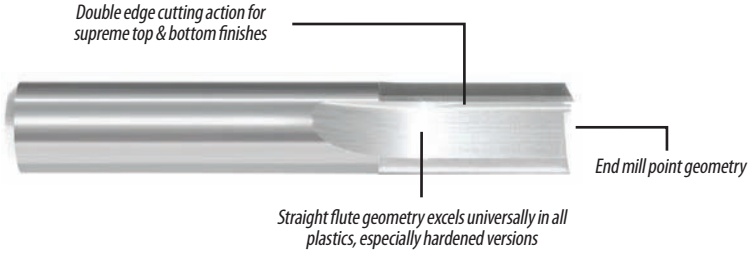
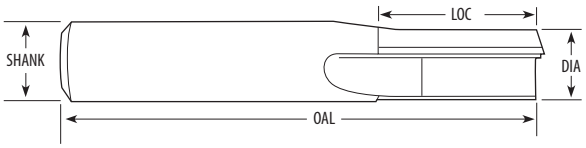




SHANK TOLERANCE: +0.0000/-0.0005"

Flutes	DIA	Dec In	LOC	Shank	OAL	Bright
2	3/32	0.0938	3/8	1/8	1-1/2	787-920001
	1/8	0.1250	1/2	1/8	1-1/2	787-920002
	3/16	0.1875	5/8	3/16	2	787-920003
	1/4	0.2500	3/4	1/4	2-1/2	787-920004
	5/16	0.3125	13/16	5/16	2-1/2	787-920005
	3/8	0.3750	7/8	3/8	2-1/2	787-920006
	7/16	0.4375	1	7/16	2-1/2	787-920007
	1/2	0.5000	1	1/2	3	787-920008
3	3/32	0.0938	3/8	1/8	1-1/2	787-930001
	1/8	0.1250	1/2	1/8	1-1/2	787-930002
	3/16	0.1875	5/8	3/16	2	787-930003
	1/4	0.2500	3/4	1/4	2-1/2	787-930004
	5/16	0.3125	13/16	5/16	2-1/2	787-930005
	3/8	0.3750	7/8	3/8	2-1/2	787-930006
	7/16	0.4375	1	7/16	2-1/2	787-930007
	1/2	0.5000	1	1/2	3	787-930008

ROUTING RECOMMENDATIONS

Inch per Minute (IPM)

Diameter	RPM	IPM
1/16	20, 000 – 35, 000	30-55
3/32	12, 000 – 25, 000	25-50
1/8	9, 000 – 18, 000	23-46
3/16	6, 000 – 12, 000	18-36
1/4	5, 000 – 10, 000	17-34
5/16	3, 500 – 7, 000	15-30
3/8	2.500 – 5, 000	12-24
1/2	2, 000 - 4, 000	10-20

DRILL MILLS
2 FLUTE

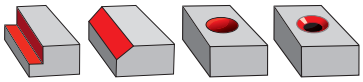
One tool – five applications: drill, mill, chamfer, spot & countersink

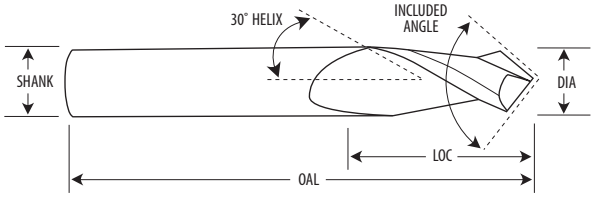
Two flute design optimizes drilling, spotting, and countersinking processes

Multiple tooling operations eliminates downtime & tooling costs

Ideal for job shop and other environments that require versatile tooling

Different included angles provide additional machining customization





DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005" INCLUDE ANGLE ±1.0°

SIZE	Dec In	LOC	Shank	OAL	Included Angle	Bright	AlTiN
1/8	0.1250	1/2	1/8	1-1/2	60°	208-621250	208-621253
					82°	208-822125	208-822125B
					90°	208-000125	208-010125
3/16	0.1875	5/8	3/16	2	60°	208-621870	208-621873
					82°	208-822187	208-822187B
					90°	208-000187	208-010187
1/4	0.2500	3/4	1/4	2-1/2	60°	208-622500	208-622503
					82°	208-822250	208-822250B
					90°	208-000250	208-010250
5/16	0.3125	13/16	5/16	2-1/2	60°	208-623120	208-623123
					90°	208-000312	208-010312
3/8	0.3750	1	3/8	2-1/2	60°	208-623750	208-623753
					82°	208-822375	208-822375B
					90°	208-000375	208-010375
7/16	0.4375	1	7/16	2-3/4	60°	208-624370	208-624373
					90°	208-000437	208-010437
1/2	0.5000	1	1/2	3	60°	208-625000	208-625003
					82°	208-822500	208-822500B
					90°	208-000500	208-010500
5/8	0.6250	1-1/4	5/8	3-1/2	60°	208-626250	208-626253
					90°	208-000625	208-010625
3/4	0.7500	1-1/2	3/4	4	60°	208-627500	208-627503
					90°	208-000750	208-010750
					120°	208-912750	208-912750B

DRILL MILLS
4 FLUTE

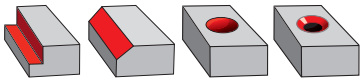
One tool – five applications: drill, mill, chamfer, spot & countersink

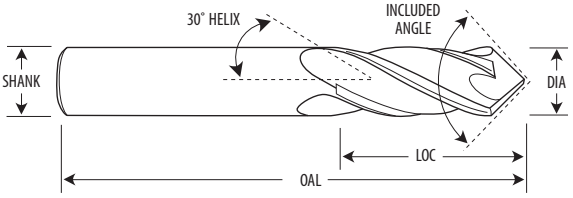
Multiple tooling operations eliminates downtime & tooling costs

Different included angles provide additional machining customization

Four flute design optimizes milling and chamfering processes

Ideal for job shop and other environments that require versatile tooling

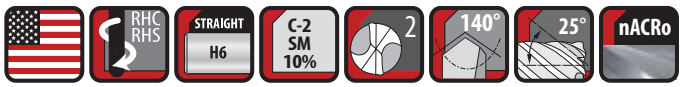


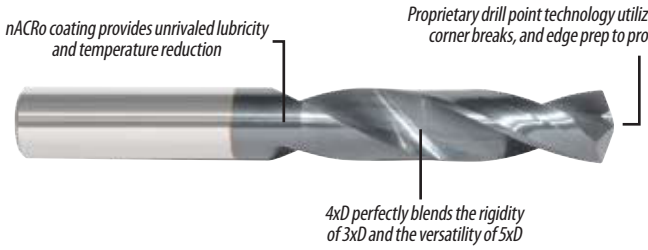


DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005" INCLUDE ANGLE ±1.0°

SIZE	Dec In	LOC	Shank	OAL	Included Angle	Bright	AlTiN
1/8	0.1250	1/2	1/8	1-1/2	60	208-641250	208-641253
					82	208-824125	208-824125B
					90	208-400125	208-420125
3/16	0.1875	5/8	3/16	2	60	208-641870	208-641873
					82	208-824187	208-824188
					90	208-400187	208-420187
1/4	0.2500	3/4	1/4	2-1/2	60	208-642500	208-642503
					82	208-824250	208-824253
					90	208-400250	208-420250
					120	208-662500	208-662503
5/16	0.3125	13/16	5/16	2-1/2	60	208-643120	208-643123
					90	208-400312	208-420312
3/8	0.3750	1	3/8	2-1/2	60	208-643750	208-643753
					82	208-824375	208-824378
					90	208-400375	208-420375
					120	208-663750	208-663753
7/16	0.4375	1	7/16	2-3/4	60	208-644370	208-644373
					90	208-400437	208-420437
1/2	0.5000	1	1/2	3	60	208-645000	208-645003
					82	208-824500	208-824503
					90	208-400500	208-420500
					120	208-665000	208-665003
5/8	0.6250	1-1/4	5/8	3-1/2	60	208-646250	208-646253
					90	208-400625	208-420625
3/4	0.7500	1-1/2	3/4	4	60	208-647500	208-647503
					90	208-400750	208-420750

APERTURE 4X





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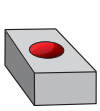

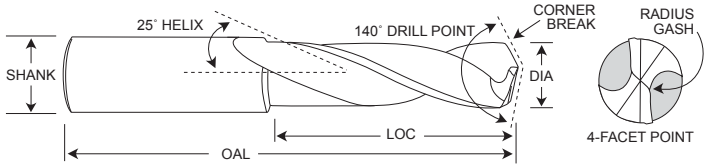

DIAMETER TOLERANCE: +0.0000 / -0.0005" SHANK TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	Shank	OAL	nACRo®
3/64	0.0469	0.281	1/8	1-1/2	434-000469B
#55	0.0520	0.309	0.0520	1-1/2	434-000520B
#54	0.0550	0.325	0.0550	1-1/2	434-000550B
1.5mm	0.0591	8.8mm	3mm	38mm	434-000591B
#53	0.0595	0.348	0.0595	1-1/2	434-000595B
1/16	0.0625	0.363	1/8	1-1/2	434-000625B
#52	0.0635	0.365	0.0635	1-1/2	434-000635B
#50	0.0700	0.399	0.0700	2	434-000700B
#49	0.0730	0.412	0.0730	2	434-000730B
#48	0.0760	0.426	0.0760	2	434-000760B
5/64	0.0781	0.433	1/8	2	434-000781B
2mm	0.0787	10.9mm	3mm	38mm	434-000787B
#46	0.0810	0.446	0.0810	2	434-000810B
#45	0.0820	0.447	0.0820	2	434-000820B
#44	0.0860	0.464	0.0860	2	434-000860B
#43	0.0890	0.476	0.0890	2	434-000890B
#42	0.0935	0.496	0.0935	2	434-000935B
3/32	0.0938	0.492	1/8	2	434-000938B
#41	0.0960	0.499	0.0960	2	434-000960B
#40	0.0980	0.505	0.0980	2	434-000980B
2.5mm	0.0984	12.5mm	3mm	38mm	434-000984B
#39	0.0995	0.507	0.0995	2	434-000995B
#38	0.1015	0.513	0.1015	2	434-001015B
#37	0.1040	0.520	0.1040	2	434-001040B
#36	0.1065	0.527	0.1065	2	434-001065B
7/64	0.1094	0.536	1/8	2	434-001094B
3mm	0.1181	14.1mm	3mm	38mm	434-001181B
#31	0.1200	0.582	0.1200	2	434-001200B
1/8	0.1250	0.600	1/8	2	434-001250B
#30	0.1285	0.610	0.1285	2	434-001285B
#29	0.1360	0.639	0.1360	2	434-001360B
3.5mm	0.1378	15.6mm	4mm	50mm	434-001378B
#28	0.1405	0.653	0.1405	2	434-001405B
9/64	0.1406	0.647	3/16	2	434-001406B
#25	0.1495	0.680	0.1495	2-1/2	434-001495B
5/32	0.1563	0.703	3/16	2-1/2	434-001562B
4mm	0.1575	16.8mm	4mm	50mm	434-001575B
#21	0.1590	0.708	0.1590	2-1/2	434-001590B
#20	0.1610	0.644	0.1610	2-1/2	434-001610B
11/64	0.1719	0.688	3/16	2-1/2	434-001719B
#16	0.1770	0.708	0.1770	2-1/2	434-001770B

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APERTURE 4X CONTINUED

DIAMETER TOLERANCE: +0.0000 / -0.0005" SHANK TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	Shank	OAL	nACRo®
4.5mm	0.1772	18mm	5mm	50mm	434-001772B
3/16	0.1875	0.750	3/16	2-1/2	434-001875B
#11	0.1910	0.764	0.1910	2-1/2	434-001910B
#10	0.1935	0.774	0.1935	2-1/2	434-001935B
5mm	0.1969	20mm	5mm	50mm	434-001969B
#7	0.2010	0.804	0.2010	2-1/2	434-002010B
13/64	0.2031	0.812	1/4	2-1/2	434-002031B
#5	0.2055	0.822	0.2055	2-1/2	434-002055B
#3	0.2130	0.852	0.2130	2-1/2	434-002130B
7/32	0.2188	0.875	1/4	2-1/2	434-002188B
15/64	0.2344	0.938	1/4	2-1/2	434-002344B
6mm	0.2362	24mm	6mm	63mm	434-002362B
1/4	0.2500	1.000	1/4	2-1/2	434-002500B
6.5mm	0.2559	26mm	8mm	75mm	434-002559B
F	0.2570	1.028	0.2570	3	434-002570B
17/64	0.2656	1.062	5/16	3	434-002656B
I	0.2720	1.088	0.2720	3	434-002720B
7mm	0.2756	28mm	8mm	75mm	434-002756B
9/32	0.2813	1.125	5/16	3	434-002812B
7.5mm	0.2953	30mm	8mm	75mm	434-002953B
19/64	0.2969	1.188	5/16	3	434-002969B
5/16	0.3125	1.250	5/16	3	434-003125B
8mm	0.3150	32mm	8mm	75mm	434-003150B
21/64	0.3281	1.313	3/8	3	434-003281B
Q	0.3320	1.328	0.3320	3	434-003320B
8.5mm	0.3346	34mm	10mm	100mm	434-003346B
11/32	0.3438	1.375	3/8	3	434-003438B
9mm	0.3543	36mm	10mm	100mm	434-003543B
23/64	0.3594	1.438	3/8	3	434-003594B
U	0.3680	1.472	0.3680	3	434-003680B
9.5mm	0.3740	38mm	10mm	100mm	434-003740B
3/8	0.3750	1.500	3/8	3	434-003750B
25/64	0.3906	1.563	7/16	4	434-003906B
10mm	0.3937	40mm	10mm	100mm	434-003937B
13/32	0.4063	1.625	7/16	4	434-004063B
10.5mm	0.4134	42mm	12mm	100mm	434-004134B
27/64	0.4219	1.688	7/16	4	434-004219B
11mm	0.4331	44mm	12mm	100mm	434-004331B
7/16	0.4375	1.750	7/16	4	434-004375B
11.5mm	0.4528	46mm	12mm	100mm	434-004528B
29/64	0.4531	1.813	1/2	4	434-004531B
12mm	0.4724	48mm	12mm	100mm	434-004724B
31/64	0.4844	1.938	1/2	4	434-004844B
12.5mm	0.4921	50mm	14mm	100mm	434-004921B
1/2	0.5000	2.000	1/2	4	434-005000B
13mm	0.5118	52mm	14mm	100mm	434-005118B
33/64	0.5156	2.063	9/16	4	434-005156B
17/32	0.5313	2.125	9/16	4	434-005313B
13.5mm	0.5315	54mm	14mm	100mm	434-005315B
35/64	0.5469	2.188	9/16	4	434-005469B
9/16	0.5625	2.250	9/16	4	434-005625B
37/64	0.5781	2.313	5/8	5	434-005781B
19/32	0.5938	2.375	5/8	5	434-005938B
5/8	0.6250	2.500	5/8	5	434-006250B
21/32	0.6563	2.428	3/4	5	434-006563B
11/16	0.6875	2.544	3/4	5	434-006875B
3/4	0.7500	2.775	3/4	5	434-007500B

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DRILLING RECOMMENDATIONS

APERTURE 4X

Surface Feet Per Minute (SFM) *Inches Per Revolution (IPR)*

Workpiece Material Group		Hardness		IPR Cutting Tool Diameter 3/64	1/16	1/8	5/32	3/16	1/4	5/16	3/8	1/2	9/16	5/8	3/4
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	SFM:	405	400	390	380	370	360	350	340	320	300	275	265
		≤ 28 Rc	IPR:	.001-.002	.002-.003	.003-.005	.004-.006	.005-.007	.0055-.0080	.006-.009	.007-.010	.008-.011	.009-.014	.010-.014	.011-.015
	Medium/High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX	P	SFM:	350	340	330	320	310	300	290	280	270	265	260	260
		28 - 38 Rc	IPR:	.001-.002	.002-.003	.003-.005	.004-.006	.005-.007	.0055-.0080	.006-.009	.007-.010	.008-.011	.009-.014	.010-.014	.011-.015
Tool & Die Steels	A2, H13, L6, P20, S7	P	SFM:	210	200	200	190	190	185	185	180	180	175	175	170
		28 - 44 Rc	IPR:	.0004-.0008	.0008-.0012	.0014-.0030	.0024-.0040	.003-.005	.0035-.0060	.006-.009	.007-.010	.008-.011	.009-.014	.010-.014	.011-.015
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	SFM:	360	355	350	340	330	320	310	300	275	250	225	200
		≤ 28 Rc	IPR:	.001-.002	.002-.003	.003-.005	.004-.006	.005-.007	.0055-.0080	.006-.009	.007-.010	.008-.011	.009-.014	.010-.014	.011-.015
	Moderately Difficult, 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	SFM:	150	145	140	135	130	125	120	115	110	105	100	95
		≤ 28 Rc	IPR:	.001-.002	.002-.003	.003-.005	.004-.006	.005-.007	.0055-.0080	.006-.009	.007-.010	.008-.011	.009-.014	.010-.014	.011-.015
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	SFM:	160	150	140	130	120	110	110	105	105	100	100	95
		> 28 Rc	IPR:	.0004-.0012	.001-.002	.0020-.0033	.0024-.0035	.0030-.0043	.0031-.0050	.003-.006	.005-.009	.007-.009	.008-.010	.009-.011	.009-.013
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	SFM:	100	90	85	80	75	70	65	60	55	50	45	40
		≤ 42 Rc	IPR:	.0004-.0012	.001-.002	.0014-.0033	.0016-.0035	.002-.004	.0023-.0043	.003-.005	.004-.006	.005-.007	.005-.008	.006-.008	.009-.010
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S	SFM:	150	140	130	125	120	115	110	105	100	100	90	90
		≤ 42 Rc	IPR:	.0004-.0012	.001-.002	.003-.004	.004-.006	.005-.007	.0055-.0080	.006-.009	.007-.010	.008-.011	.008-.010	.010-.014	.011-.015
Cast Iron	Gray: SAE J431, ASTM A48	K	SFM:	500	490	480	470	460	430	410	400	390	370	360	350
		≤ 240 HB	IPR:	.001-.002	.002-.003	.003-.005	.004-.006	.005-.007	.0055-.0080	.006-.009	.007-.010	.008-.011	.009-.014	.010-.014	.011-.015
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K	SFM:	300	290	280	270	260	250	240	230	220	210	200	190
		> 240 HB	IPR:	.001-.002	.002-.003	.003-.005	.004-.006	.005-.007	.0055-.0080	.006-.009	.007-.010	.008-.011	.009-.014	.010-.014	.011-.015

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N/C SPOT DRILLS

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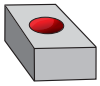
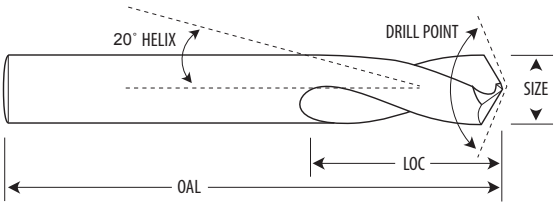


The spotting operation begins the holemaking process

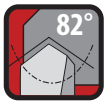
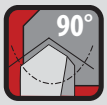
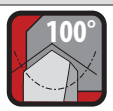
Precise and accurate holes are possible by true centering with a spot drill

Choose a spotting drill angle equal or greater than the subsequent drill angle

90°: Pre-chamfer a hole.
120: use for spotting 118° jobber drills.
140°: Use for spotting 135-140° HP drills



DIAMETER TOLERANCE: +0.0000 / -0.0005" SHANK TOLERANCE: +0.0000 / -0.0005" INCLUDE ANGLE ±1.0°

Included Angle	SIZE	Dec In	LOC	Shank	OAL	Bright	AlTiN
	1/4	0.2500	3/4	1/4	2-1/2	402-250082	402-250082B
	3/8	0.3750	1	3/8	2-1/2	402-375082	402-375082B
	1/2	0.5000	1-1/4	1/2	3	402-500082	402-500082B
	1/8	0.1250	5/8	1/8	2	402-125090	402-125090B
	3/16	0.1875	3/4	3/16	2	402-187090	402-187090B
	1/4	0.2500	3/4	1/4	2-1/2	402-250090	402-250090B
	5/16	0.3125	1	5/16	2-1/2	402-312090	402-312090B
	3/8	0.3750	1	3/8	2-1/2	402-375090	402-375090B
	1/2	0.5000	1-1/4	1/2	3	402-500090	402-500090B
	1/4	0.2500	3/4	1/4	2-1/2	402-250100	402-250100B
	3/8	0.3750	1	3/8	2-1/2	402-375100	402-375100B
	1/2	0.5000	1-1/4	1/2	3	402-500100	402-500100B

Included Angle	SIZE	Dec In	LOC	Shank	OAL	Bright	AlTiN
	1/8	0.1250	5/8	1/8	2	402-125120	402-125120B
	3/16	0.1875	3/4	3/16	2	402-187120	402-187120B
	1/4	0.2500	3/4	1/4	2-1/2	402-250120	402-250120B
	5/16	0.3125	1	5/16	2-1/2	402-312120	402-312120B
	3/8	0.3750	1	3/8	2-1/2	402-375120	402-375120B
	1/2	0.5000	1-1/4	1/2	3	402-500120	402-500120B

Included Angle	SIZE	Dec In	LOC	Shank	OAL	Bright	AlTiN
	1/8	0.1250	5/8	1/8	2	402-125140	402-125140B
	3/16	0.1875	3/4	3/16	2	402-187140	402-187140B
	1/4	0.2500	3/4	1/4	2-1/2	402-250140	402-250140B
	5/16	0.3125	1	5/16	2-1/2	402-312140	402-312140B
	3/8	0.3750	1	3/8	2-1/2	402-375140	402-375140B
	1/2	0.5000	1-1/4	1/2	3	402-500140	402-500140B

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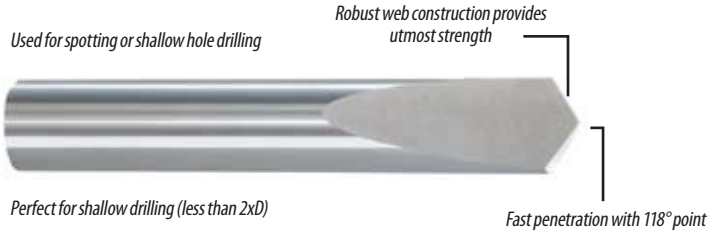
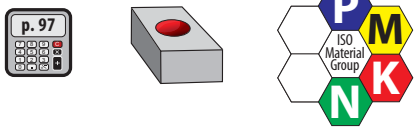
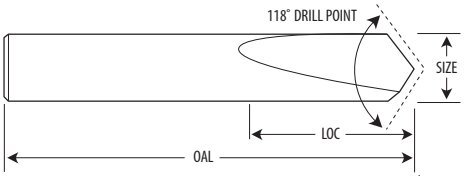
SPADE DRILLS







DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright
1/32	0.0313	3/16	1-1/2	400-001002
3/64	0.0469	7/32	1-1/2	400-001005
1/16	0.0625	5/16	1-1/2	400-001007
3/32	0.0938	7/16	1-1/2	400-001010
7/64	0.1094	7/16	1-1/2	400-001011
1/8	0.1250	1/2	1-1/2	400-001020
9/64	0.1406	1/2	2	400-001021
5/32	0.1563	9/16	2	400-001030
11/64	0.1719	9/16	2	400-001031
3/16	0.1875	11/16	2	400-001040
7/32	0.2188	19/32	2	400-001050
1/4	0.2500	11/16	2	400-001060
9/32	0.2813	7/8	2-1/2	400-001070
5/16	0.3125	7/8	2-1/2	400-001080
11/32	0.3438	15/16	2-1/2	400-001090
3/8	0.3750	1-1/8	2-1/2	400-001100
13/32	0.4063	1-1/8	2-3/4	400-001110
7/16	0.4375	1-3/16	2-3/4	400-001120
15/32	0.4688	1-3/16	3	400-001130
1/2	0.5000	1-3/16	3	400-001140

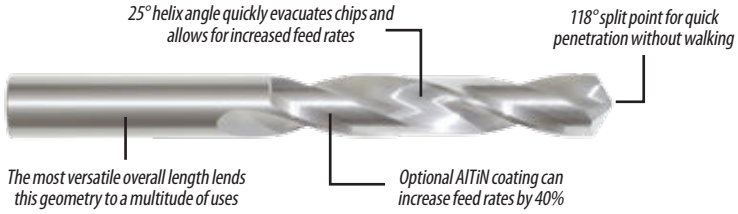
DRILLING RECOMMENDATIONS - N/C SPOT DRILLS - SPADE DRILLS

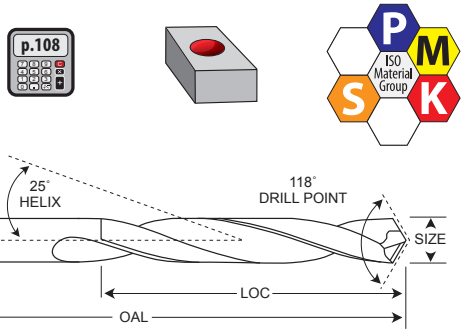
Drill Point Depth (DPD)

Drill Point Angle	(DPD) Factor	Drill Point Angle	(DPD) Factor
60°	0.866 x DIA = point depth	118°	0.300 x DIA = point depth
82°	0.575 x DIA = point depth	120°	0.288 x DIA = point depth
90°	0.500 x DIA = point depth	135°	0.207 x DIA = point depth

Workpiece Material Group			Hardness	Surface Feet Per Minute (SFM) SFM	Inches Per Revolution (IPR) (IPR) Cutting Tool Diameter 1/32	1/16	1/8	1/4	3/8	1/2
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	175	0.0005	0.0010	0.0015	0.0030	0.0040	0.0050
	Medium/High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	165						
Tool & Die Steels	A2, H13, L6, P20, S7		28 - 44 Rc	150						
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	125						
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		> 28 Rc	60						
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	40						
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	80						
Hardened Materials		H	35 - 45 Rc	50						
Cast-Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	275						
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	175						

TWIST DRILLS
JOBBER LENGTH





DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	TiN	AlTiN
#80	0.0135	3/16	1-1/4	450-300135	450-300135A	450-300135B
#79	0.0145	3/16	1-1/4	450-300145	450-300145A	450-300145B
1/64	0.0156	3/16	1-1/4	450-100156	450-100156A	450-100156B
#78	0.0160	3/16	1-1/4	450-300160	450-300160A	450-300160B
#77	0.0180	3/16	1-1/4	450-300180	450-300180A	450-300180B
#76	0.0200	1/4	1-1/4	450-300200	450-300200A	450-300200B
#75	0.0210	1/4	1-1/4	450-300210	450-300210A	450-300210B
#74	0.0225	1/4	1-1/4	450-300225	450-300225A	450-300225B
#73	0.0240	1/4	1-1/4	450-300240	450-300240A	450-300240B
#72	0.0250	5/16	1-1/4	450-300250	450-300250A	450-300250B
#71	0.0260	5/16	1-1/4	450-300260	450-300260A	450-300260B
#70	0.0280	5/16	1-1/4	450-300280	450-300280A	450-300280B
#69	0.0292	5/16	1-1/4	450-300292	450-300292A	450-300292B
#68	0.0310	5/16	1-1/4	450-300310	450-300310A	450-300310B
1/32	0.0313	5/16	1-1/4	450-100312	450-100312A	450-100312B
#67	0.0320	5/16	1-1/4	450-300320	450-300320A	450-300320B
#66	0.0330	5/16	1-1/4	450-300330	450-300330A	450-300330B
#65	0.0350	5/8	1-3/8	450-300350	450-300350A	450-300350B
#64	0.0360	5/8	1-3/8	450-300360	450-300360A	450-300360B
#63	0.0370	5/8	1-3/8	450-300370	450-300370A	450-300370B
#62	0.0380	5/8	1-3/8	450-300380	450-300380A	450-300380B
#61	0.0390	5/8	1-3/8	450-300390	450-300390A	450-300390B
1mm	0.0394	16mm	38mm	450-400394	450-400394A	450-400394B
#60	0.0400	3/4	1-1/2	450-300400	450-300400A	450-300400B
#59	0.0410	3/4	1-1/2	450-300410	450-300410A	450-300410B
#58	0.0420	3/4	1-1/2	450-300420	450-300420A	450-300420B
#57	0.0430	3/4	1-1/2	450-300430	450-300430A	450-300430B
#56	0.0465	3/4	1-1/2	450-300465	450-300465A	450-300465B
3/64	0.0469	3/4	1-1/2	450-100469	450-100469A	450-100469B
#55	0.0520	3/4	1-1/2	450-300520	450-300520A	450-300520B
#54	0.0550	3/4	1-1/2	450-300550	450-300550A	450-300550B
1.5mm	0.0591	19mm	38mm	450-400591	450-400591A	450-400591B
#53	0.0595	3/4	1-1/2	450-300595	450-300595A	450-300595B
1/16	0.0625	3/4	1-1/2	450-100625	450-100625A	450-100625B
#52	0.0635	3/4	1-1/2	450-300635	450-300635A	450-300635B
#51	0.0670	3/4	1-1/2	450-300670	450-300670A	450-300670B
#50	0.0700	7/8	1-3/4	450-300700	450-300700A	450-300700B
#49	0.0730	7/8	1-3/4	450-300730	450-300730A	450-300730B
#48	0.0760	7/8	1-3/4	450-300760	450-300760A	450-300760B
5/64	0.0781	7/8	1-3/4	450-100781	450-100781A	450-100781B
#47	0.0785	7/8	1-3/4	450-300785	450-300785A	450-300785B
2mm	0.0787	22mm	45mm	450-400787	450-400787A	450-400787B
#46	0.0810	7/8	1-3/4	450-300810	450-300810A	450-300810B

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TWIST DRILLS - JOBBER LENGTH CONTINUED

DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	TiN	AlTiN
#45	0.0820	7/8	1-3/4	450-300820	450-300820A	450-300820B
#44	0.0860	1	2	450-300860	450-300860A	450-300860B
#43	0.0890	1	2	450-300890	450-300890A	450-300890B
#42	0.0935	1	2	450-300935	450-300935A	450-300935B
3/32	0.0938	1	2	450-100938	450-100938A	450-100938B
#41	0.0960	1	2	450-300960	450-300960A	450-300960B
#40	0.0980	1	2	450-300980	450-300980A	450-300980B
2.5mm	0.0984	25mm	51mm	450-400984	450-400984A	450-400984B
#39	0.0995	1-1/4	2-1/4	450-300995	450-300995A	450-300995B
#38	0.1015	1-1/4	2-1/4	450-301015	450-301015A	450-301015B
#37	0.1040	1-1/4	2-1/4	450-301040	450-301040A	450-301040B
#36	0.1065	1-1/4	2-1/4	450-301065	450-301065A	450-301065B
7/64	0.1094	1-1/4	2-1/4	450-101094	450-101094A	450-101094B
#35	0.1100	1-1/4	2-1/4	450-301100	450-301100A	450-301100B
#34	0.1110	1-1/4	2-1/4	450-301110	450-301110A	450-301110B
#33	0.1130	1-1/4	2-1/4	450-301130	450-301130A	450-301130B
#32	0.1160	1-1/4	2-1/4	450-301160	450-301160A	450-301160B
3mm	0.1181	32mm	57mm	450-401181	450-401181A	450-401181B
#31	0.1200	1-1/4	2-1/4	450-301200	450-301200A	450-301200B
1/8	0.1250	1-1/4	2-1/4	450-101250	450-101250A	450-101250B
#30	0.1285	1-1/4	2-1/4	450-301285	450-301285A	450-301285B
#29	0.1360	1-3/8	2-1/2	450-301360	450-301360A	450-301360B
3.5mm	0.1378	35mm	64mm	450-401378	450-401378A	450-401378B
#28	0.1405	1-3/8	2-1/2	450-301405	450-301405A	450-301405B
9/64	0.1406	1-3/8	2-1/2	450-101406	450-101406A	450-101406B
#27	0.1440	1-3/8	2-1/2	450-301440	450-301440A	450-301440B
#26	0.1470	1-3/8	2-1/2	450-301470	450-301470A	450-301470B
#25	0.1495	1-3/8	2-1/2	450-301495	450-301495A	450-301495B
#24	0.1520	1-3/8	2-1/2	450-301520	450-301520A	450-301520B
#23	0.1540	1-3/8	2-1/2	450-301540	450-301540A	450-301540B
5/32	0.1563	1-3/8	2-1/2	450-101562	450-101562A	450-101562B
#22	0.1570	1-3/8	2-1/2	450-301570	450-301570A	450-301570B
4mm	0.1575	35mm	64mm	450-401575	450-401575A	450-401575B
#21	0.1590	1-3/8	2-1/2	450-301590	450-301590A	450-301590B
#20	0.1610	1-3/8	2-1/2	450-301610	450-301610A	450-301610B
#19	0.1660	1-5/8	2-3/4	450-301660	450-301660A	450-301660B
#18	0.1695	1-5/8	2-3/4	450-301695	450-301695A	450-301695B
11/64	0.1719	1-5/8	2-3/4	450-101719	450-101719A	450-101719B
#17	0.1730	1-5/8	2-3/4	450-301730	450-301730A	450-301730B
#16	0.1770	1-5/8	2-3/4	450-301770	450-301770A	450-301770B
4.5mm	0.1772	41mm	70mm	450-401772	450-401772A	450-401772B
#15	0.1800	1-5/8	2-3/4	450-301800	450-301800A	450-301800B
#14	0.1820	1-5/8	2-3/4	450-301820	450-301820A	450-301820B
#13	0.1850	1-5/8	2-3/4	450-301850	450-301850A	450-301850B
3/16	0.1875	1-5/8	2-3/4	450-101875	450-101875A	450-101875B
#12	0.1890	1-5/8	2-3/4	450-301890	450-301890A	450-301890B
#11	0.1910	1-5/8	2-3/4	450-301910	450-301910A	450-301910B
#10	0.1935	1-5/8	2-3/4	450-301935	450-301935A	450-301935B
#9	0.1960	1-3/4	3	450-301960	450-301960A	450-301960B
5mm	0.1969	45mm	76mm	450-401969	450-401969A	450-401969B
#8	0.1990	1-3/4	3	450-301990	450-301990A	450-301990B
#7	0.2010	1-3/4	3	450-302010	450-302010A	450-302010B
13/64	0.2031	1-3/4	3	450-102031	450-102031A	450-102031B
#6	0.2040	1-3/4	3	450-302040	450-302040A	450-302040B
#5	0.2055	1-3/4	3	450-302055	450-302055A	450-302055B
#4	0.2090	1-3/4	3	450-302090	450-302090A	450-302090B
#3	0.2130	1-3/4	3	450-302130	450-302130A	450-302130B
5.5mm	0.2165	45mm	76mm	450-402165	450-402165A	450-402165B
7/32	0.2188	1-3/4	3	450-102188	450-102188A	450-102188B
#2	0.2210	1-3/4	3	450-302210	450-302210A	450-302210B

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TWIST DRILLS - JOBBER LENGTH CONTINUED

DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	TiN	AlTiN
#1	0.2280	1-3/4	3	450-302280	450-302280A	450-302280B
A	0.2340	2	3-1/4	450-202340	450-202340A	450-202340B
15/64	0.2344	2	3-1/4	450-102344	450-102344A	450-102344B
6mm	0.2362	51mm	83mm	450-402362	450-402362A	450-402362B
B	0.2380	2	3-1/4	450-202380	450-202380A	450-202380B
C	0.2420	2	3-1/4	450-202420	450-202420A	450-202420B
D	0.2460	2	3-1/4	450-202460	450-202460A	450-202460B
E	0.2500	2	3-1/4	450-202500	450-202500A	450-202500B
1/4	0.2500	2	3-1/4	450-102500	450-102500A	450-102500B
6.5mm	0.2559	51mm	83mm	450-402559	450-402559A	450-402559B
F	0.2570	2	3-1/4	450-202570	450-202570A	450-202570B
G	0.2610	2-1/8	3-1/2	450-202610	450-202610A	450-202610B
17/64	0.2656	2-1/8	3-1/2	450-102656	450-102656A	450-102656B
H	0.2660	2-1/8	3-1/2	450-202660	450-202660A	450-202660B
I	0.2720	2-1/8	3-1/2	450-202720	450-202720A	450-202720B
7mm	0.2756	54mm	89mm	450-402756	450-402756A	450-402756B
J	0.2770	2-1/8	3-1/2	450-202770	450-202770A	450-202770B
K	0.2810	2-1/8	3-1/2	450-202810	450-202810A	450-202810B
9/32	0.2813	2-1/8	3-1/2	450-102812	450-102812A	450-102812B
L	0.2900	2-1/8	3-1/2	450-202900	450-202900A	450-202900B
M	0.2950	2-3/8	3-3/4	450-202950	450-202950A	450-202950B
7.5mm	0.2953	60mm	95mm	450-402953	450-402953A	450-402953B
19/64	0.2969	2-3/8	3-3/4	450-102969	450-102969A	450-102969B
N	0.3020	2-3/8	3-3/4	450-203020	450-203020A	450-203020B
5/16	0.3125	2-3/8	3-3/4	450-103125	450-103125A	450-103125B
8mm	0.3150	60mm	95mm	450-403150	450-403150A	450-403150B
O	0.3160	2-3/8	3-3/4	450-203160	450-203160A	450-203160B
P	0.3230	2-3/8	3-3/4	450-203230	450-203230A	450-203230B
21/64	0.3281	2-1/2	4	450-103281	450-103281A	450-103281B
Q	0.3320	2-1/2	4	450-203320	450-203320A	450-203320B
8.5mm	0.3346	64mm	102mm	450-403346	450-403346A	450-403346B
R	0.3390	2-1/2	4	450-203390	450-203390A	450-203390B
11/32	0.3438	2-1/2	4	450-103438	450-103438A	450-103438B
S	0.3480	2-1/2	4	450-203480	450-203480A	450-203480B
9mm	0.3543	64mm	102mm	450-403543	450-403543A	450-403543B
T	0.3580	2-3/4	4-1/4	450-203580	450-203580A	450-203580B
23/64	0.3594	2-3/4	4-1/4	450-103594	450-103594A	450-103594B
U	0.3680	2-3/4	4-1/4	450-203680	450-203680A	450-203680B
9.5mm	0.3740	70mm	108mm	450-403740	450-403740A	450-403740B
3/8	0.3750	2-3/4	4-1/4	450-103750	450-103750A	450-103750B
V	0.3770	2-3/4	4-1/4	450-203770	450-203770A	450-203770B
W	0.3860	2-7/8	4-1/2	450-203860	450-203860A	450-203860B
25/64	0.3906	2-7/8	4-1/2	450-103906	450-103906A	450-103906B
10mm	0.3937	73mm	114mm	450-403937	450-403937A	450-403937B
X	0.3970	2-7/8	4-1/2	450-203970	450-203970A	450-203970B
Y	0.4040	2-7/8	4-1/2	450-204040	450-204040A	450-204040B
13/32	0.4063	2-7/8	4-1/2	450-104062	450-104062A	450-104062B
Z	0.4130	2-7/8	4-1/2	450-204130	450-204130A	450-204130B
10.5mm	0.4134	73mm	114mm	450-404134	450-404134A	450-404134B
27/64	0.4219	2-7/8	4-1/2	450-104219	450-104219A	450-104219B
11mm	0.4331	73mm	114mm	450-404331	450-404331A	450-404331B
7/16	0.4375	2-7/8	4-1/2	450-104375	450-104375A	450-104375B
11.5mm	0.4528	76mm	121mm	450-404528	450-404528A	450-404528B
29/64	0.4531	3	4-3/4	450-104531	450-104531A	450-104531B
15/32	0.4688	3	4-3/4	450-104688	450-104688A	450-104688B
12mm	0.4724	76mm	121mm	450-404724	450-404724A	450-404724B
31/64	0.4844	3	4-3/4	450-104844	450-104844A	450-104844B
12.5mm	0.4921	76mm	121mm	450-404921	450-404921A	450-404921B
1/2	0.5000	3	4-3/4	450-105000	450-105000A	450-105000B

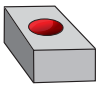
STUB DRILLS
SCREW MACHINE LENGTH

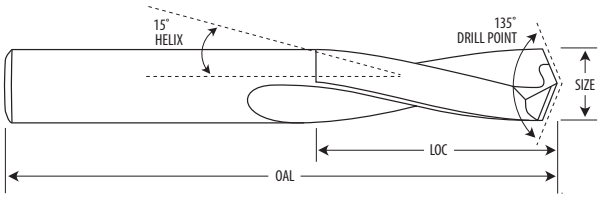
Also known as screw machine or shorty drills

A relaxed 15° helix is designed for slower feed rates found on the most demanding jobs

One of the few drill designs capable for use on all six ISO material categories

135° split point possesses the strength to pierce the hardest materials





DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	TiN	AlTiN
1/32	0.0313	1/2	1-1/2	460-100312	—	460-100312B
1mm	0.0394	13mm	38mm	460-400394	—	460-400394B
#60	0.0400	1/2	1-1/2	460-300400	—	460-300400B
#59	0.0410	1/2	1-1/2	460-300410	—	460-300410B
#58	0.0420	1/2	1-1/2	460-300420	—	460-300420B
#57	0.0430	1/2	1-1/2	460-300430	—	460-300430B
#56	0.0465	1/2	1-1/2	460-300465	—	460-300465B
3/64	0.0469	1/2	1-1/2	460-100469	—	460-100469B
#55	0.0520	1/2	1-1/2	460-300520	—	460-300520B
#54	0.0550	1/2	1-1/2	460-300550	—	460-300550B
1.5mm	0.0591	13mm	38mm	460-400591	—	460-400591B
#53	0.0595	1/2	1-1/2	460-300595	—	460-300595B
1/16	0.0625	5/8	1-5/8	460-100625	460-100625A	460-100625B
#52	0.0635	11/16	1-11/16	460-300635	—	460-300635B
#51	0.0670	11/16	1-11/16	460-300670	—	460-300670B
#50	0.0700	11/16	1-11/16	460-300700	—	460-300700B
#49	0.0730	11/16	1-11/16	460-300730	—	460-300730B
#48	0.0760	11/16	1-11/16	460-300760	—	460-300760B
5/64	0.0781	11/16	1-11/16	460-100781	460-100781A	460-100781B
#47	0.0785	3/4	1-3/4	460-300785	—	460-300785B
2mm	0.0787	19mm	45mm	460-400787	—	460-400787B
#46	0.0810	3/4	1-3/4	460-300810	—	460-300810B
#45	0.0820	3/4	1-3/4	460-300820	—	460-300820B
#44	0.0860	3/4	1-3/4	460-300860	—	460-300860B
#43	0.0890	3/4	1-3/4	460-300890	—	460-300890B
#42	0.0935	3/4	1-3/4	460-300935	—	460-300935B
3/32	0.0938	3/4	1-3/4	460-100938	460-100938A	460-100938B
#41	0.0960	13/16	1-13/16	460-300960	—	460-300960B
#40	0.0980	13/16	1-13/16	460-300980	—	460-300980B
2.5mm	0.0984	21mm	46mm	460-400984	—	460-400984B
#39	0.0995	13/16	1-13/16	460-300995	—	460-300995B
#38	0.1015	13/16	1-13/16	460-301015	—	460-301015B
#37	0.1040	13/16	1-13/16	460-301040	—	460-301040B
#36	0.1065	13/16	1-13/16	460-301065	—	460-301065B
7/64	0.1094	13/16	1-13/16	460-101094	460-101094A	460-101094B
#35	0.1100	7/8	1-7/8	460-301100	—	460-301100B
#34	0.1110	7/8	1-7/8	460-301110	—	460-301110B
#33	0.1130	7/8	1-7/8	460-301130	—	460-301130B

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STUB DRILLS - SCREW MACHINE LENGTH CONTINUED

DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	TiN	AlTiN
#32	0.1160	7/8	1-7/8	460-301160	—	460-301160B
3mm	0.1181	22mm	48mm	460-401181	—	460-401181B
#31	0.1200	7/8	1-7/8	460-301200	—	460-301200B
1/8	0.1250	7/8	1-7/8	460-101250	460-101250A	460-101250B
#30	0.1285	15/16	1-15/16	460-301285	—	460-301285B
#29	0.1360	15/16	1-15/16	460-301360	—	460-301360B
3.5mm	0.1378	24mm	49mm	460-401378	—	460-401378B
#28	0.1405	15/16	1-15/16	460-301405	—	460-301405B
9/64	0.1406	15/16	1-15/16	460-101406	460-101406A	460-101406B
#27	0.1440	1	2-1/16	460-301440	—	460-301440B
#26	0.1470	1	2-1/16	460-301470	—	460-301470B
#25	0.1495	1	2-1/16	460-301495	—	460-301495B
#24	0.1520	1	2-1/16	460-301520	—	460-301520B
#23	0.1540	1	2-1/16	460-301540	—	460-301540B
5/32	0.1563	1	2-1/16	460-101562	460-101562A	460-101562B
#22	0.1570	1-1/16	2-1/8	460-301570	—	460-301570B
4mm	0.1575	27mm	54mm	460-401575	—	460-401575B
#21	0.1590	1-1/16	2-1/8	460-301590	—	460-301590B
#20	0.1610	1-1/16	2-1/8	460-301610	—	460-301610B
#19	0.1660	1-1/16	2-1/8	460-301660	—	460-301660B
#18	0.1695	1-1/16	2-1/8	460-301695	—	460-301695B
11/64	0.1719	1-1/16	2-1/8	460-101719	460-101719A	460-101719B
#17	0.1730	1-1/8	2-3/16	460-301730	—	460-301730B
#16	0.1770	1-1/8	2-3/16	460-301770	—	460-301770B
4.5mm	0.1772	29mm	56mm	460-401772	—	460-401772B
#15	0.1800	1-1/8	2-3/16	460-301800	—	460-301800B
#14	0.1820	1-1/8	2-3/16	460-301820	—	460-301820B
#13	0.1850	1-1/8	2-3/16	460-301850	—	460-301850B
3/16	0.1875	1-1/8	2-3/16	460-101875	460-101875A	460-101875B
#12	0.1890	1-3/16	2-1/4	460-301890	—	460-301890B
#11	0.1910	1-3/16	2-1/4	460-301910	—	460-301910B
#10	0.1935	1-3/16	2-1/4	460-301935	—	460-301935B
#9	0.1960	1-3/16	2-1/4	460-301960	—	460-301960B
5mm	0.1969	30mm	57mm	460-401969	—	460-401969B
#8	0.1990	1-3/16	2-1/4	460-301990	—	460-301990B
#7	0.2010	1-3/16	2-1/4	460-302010	—	460-302010B
13/64	0.2031	1-3/16	2-1/4	460-102031	460-102031A	460-102031B
#6	0.2040	1-1/4	2-3/8	460-302040	—	460-302040B
#5	0.2055	1-1/4	2-3/8	460-302055	—	460-302055B
#4	0.2090	1-1/4	2-3/8	460-302090	—	460-302090B
#3	0.2130	1-1/4	2-3/8	460-302130	—	460-302130B
5.5mm	0.2165	32mm	60mm	460-402165	—	460-402165B
7/32	0.2188	1-1/4	2-3/8	460-102188	460-102188A	460-102188B
#2	0.2210	1-5/16	2-7/16	460-302210	—	460-302210B
#1	0.2280	1-5/16	2-7/16	460-302280	—	460-302280B
A	0.2340	1-5/16	2-7/16	460-202340	—	460-202340B
15/64	0.2344	1-5/16	2-7/16	460-102344	460-102344A	460-102344B
6mm	0.2362	33mm	62mm	460-402362	—	460-402362B
B	0.2380	1-3/8	2-1/2	460-202380	—	460-202380B
C	0.2420	1-3/8	2-1/2	460-202420	—	460-202420B
D	0.2460	1-3/8	2-1/2	460-202460	—	460-202460B
E	0.2500	1-3/8	2-1/2	460-202500	—	460-202500B
1/4	0.2500	1-3/8	2-1/2	460-102500	460-102500A	460-102500B
6.5mm	0.2559	35mm	64mm	460-402559	—	460-402559B
F	0.2570	1-7/16	2-5/8	460-202570	—	460-202570B

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STUB DRILLS - SCREW MACHINE LENGTH CONTINUED

DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	TiN	AlTiN
G	0.2610	1-7/16	2-5/8	460-202610	—	460-202610B
17/64	0.2656	1-7/16	2-5/8	460-102656	460-102656A	460-102656B
H	0.2660	1-1/2	2-11/16	460-202660	—	460-202660B
I	0.2720	1-1/2	2-11/16	460-202720	—	460-202720B
7mm	0.2756	38mm	68mm	460-402756	—	460-402756B
J	0.2770	1-1/2	2-11/16	460-202770	—	460-202770B
K	0.2810	1-1/2	2-11/16	460-202810	—	460-202810B
9/32	0.2813	1-1/2	2-11/16	460-102812	460-102812A	460-102812B
L	0.2900	1-9/16	2-3/4	460-202900	—	460-202900B
M	0.2950	1-9/16	2-3/4	460-202950	—	460-202950B
7.5mm	0.2953	40mm	70mm	460-402953	—	460-402953B
19/64	0.2969	1-9/16	2-3/4	460-102969	460-102969A	460-102969B
N	0.3020	1-5/8	2-13/16	460-203020	—	460-203020B
5/16	0.3125	1-5/8	2-13/16	460-103125	460-103125A	460-103125B
8mm	0.3150	41mm	72mm	460-403150	—	460-403150B
O	0.3160	1-11/16	2-15/16	460-203160	—	460-203160B
P	0.3230	1-11/16	2-15/16	460-203230	—	460-203230B
21/64	0.3281	1-11/16	2-15/16	460-103281	460-103281A	460-103281B
Q	0.3320	1-11/16	3	460-203320	—	460-203320B
8.5mm	0.3346	43mm	76mm	460-403346	—	460-403346B
R	0.3390	1-11/16	3	460-203390	—	460-203390B
11/32	0.3438	1-11/16	3	460-103438	460-103438A	460-103438B
S	0.3480	1-3/4	3-1/16	460-203480	—	460-203480B
9mm	0.3543	45mm	78mm	460-403543	—	460-403543B
T	0.3580	1-3/4	3-1/16	460-203580	—	460-203580B
23/64	0.3594	1-3/4	3-1/16	460-103594	460-103594A	460-103594B
U	0.3680	1-13/16	3-1/8	460-203680	—	460-203680B
9.5mm	0.3740	46mm	79mm	460-403740	—	460-403740B
3/8	0.3750	1-13/16	3-1/8	460-103750	460-103750A	460-103750B
V	0.3770	1-7/8	3-1/4	460-203770	—	460-203770B
W	0.3860	1-7/8	3-1/4	460-203860	—	460-203860B
25/64	0.3906	1-7/8	3-1/4	460-103906	460-103906A	460-103906B
10mm	0.3937	48mm	83mm	460-403937	—	460-403937B
X	0.3970	1-15/16	3-5/16	460-203970	—	460-203970B
Y	0.4040	1-15/16	3-5/16	460-204040	—	460-204040B
13/32	0.4063	1-15/16	3-5/16	460-104062	460-104062A	460-104062B
Z	0.4130	2	3-3/8	460-204130	—	460-204130B
10.5mm	0.4134	51mm	86mm	460-404134	—	460-404134B
27/64	0.4219	2	3-3/8	460-104219	460-104219A	460-104219B
11mm	0.4331	51mm	86mm	460-404331	—	460-404331B
7/16	0.4375	2-1/16	3-7/16	460-104375	460-104375A	460-104375B
11.5mm	0.4528	52mm	88mm	460-404528	—	460-404528B
29/64	0.4531	2-1/8	3-9/16	460-104531	460-104531A	460-104531B
15/32	0.4688	2-1/8	3-5/8	460-104688	460-104688A	460-104688B
12mm	0.4724	54mm	92mm	460-404724	—	460-404724B
31/64	0.4844	2-3/16	3-11/16	460-104844	460-104844A	460-104844B
12.5mm	0.4921	56mm	94mm	460-404921	—	460-404921B
1/2	0.5000	2-1/4	3-3/4	460-105000	460-105000A	460-105000B
33/64	0.5156	2-3/8	3-7/8	460-105156	—	460-105156B
17/32	0.5313	2-3/8	3-7/8	460-105312	—	460-105312B
35/64	0.5469	2-1/2	4	460-105469	—	460-105469B
9/16	0.5625	2-1/2	4	460-105625	—	460-105625B
5/8	0.6250	2-3/4	4-1/4	460-106250	—	460-106250B
11/16	0.6875	3	4-5/8	460-106875	—	460-106875B
3/4	0.7500	3-1/8	5	460-107500	—	460-107500B

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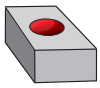
STRAIGHT FLUTE DRILLS
JOBBER LENGTH

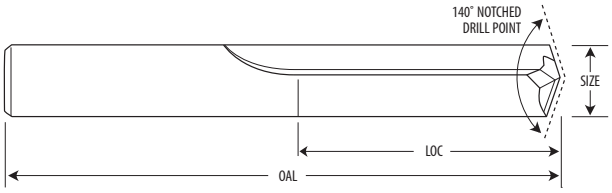
Offers pinpoint accuracy and reamer quality finishes

A straight flute design combined with a 140° split point eases even the most difficult jobs

Dual purpose: can also be used as a salvage or reclaim tool

For the most demanding applications, straight flute drills perform consistently in the harshest environments





DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	AlTiN
1/32	0.0313	1/2	1-1/2	470-100312	470-100312B
#65	0.0350	1/2	1-1/2	470-300350	470-300350B
#64	0.0360	1/2	1-1/2	470-300360	470-300360B
#63	0.0370	1/2	1-1/2	470-300370	470-300370B
#62	0.0380	1/2	1-1/2	470-300380	470-300380B
#61	0.0390	1/2	1-1/2	470-300390	470-300390B
1mm	0.0394	13mm	38mm	470-400394	470-400394B
#60	0.0400	1/2	1-1/2	470-300400	470-300400B
#59	0.0410	1/2	1-1/2	470-300410	470-300410B
#58	0.0420	1/2	1-1/2	470-300420	470-300420B
#57	0.0430	1/2	1-1/2	470-300430	470-300430B
#56	0.0465	1/2	1-1/2	470-300465	470-300465B
3/64	0.0469	1/2	1-1/2	470-100469	470-100469B
#55	0.0520	1/2	1-1/2	470-300520	470-300520B
#54	0.0550	1/2	1-1/2	470-300550	470-300550B
1.5mm	0.0591	13mm	38mm	470-400591	470-400591B
#53	0.0595	1/2	1-1/2	470-300595	470-300595B
1/16	0.0625	5/8	1-5/8	470-100625	470-100625B
#52	0.0635	11/16	1-11/16	470-300635	470-300635B
#51	0.0670	11/16	1-11/16	470-300670	470-300670B
#50	0.0700	11/16	1-11/16	470-300700	470-300700B
#49	0.0730	11/16	1-11/16	470-300730	470-300730B
#48	0.0760	11/16	1-11/16	470-300760	470-300760B
5/64	0.0781	11/16	1-11/16	470-100781	470-100781B
#47	0.0785	3/4	1-3/4	470-300785	470-300785B
2mm	0.0787	19mm	45mm	470-400787	470-400787B
#46	0.0810	3/4	1-3/4	470-300810	470-300810B
#45	0.0820	3/4	1-3/4	470-300820	470-300820B
#44	0.0860	3/4	1-3/4	470-300860	470-300860B
#43	0.0890	3/4	1-3/4	470-300890	470-300890B
#42	0.0935	3/4	1-3/4	470-300935	470-300935B
3/32	0.0938	3/4	1-3/4	470-100938	470-100938B
#41	0.0960	13/16	1-13/16	470-300960	470-300960B
#40	0.0980	13/16	1-13/16	470-300980	470-300980B
2.5mm	0.0984	21mm	46mm	470-400984	470-400984B
#39	0.0995	13/16	1-13/16	470-300995	470-300995B
#38	0.1015	13/16	1-13/16	470-301015	470-301015B
#37	0.1040	13/16	1-13/16	470-301040	470-301040B
#36	0.1065	13/16	1-13/16	470-301065	470-301065B
7/64	0.1094	13/16	1-13/16	470-101094	470-101094B
#35	0.1100	7/8	1-7/8	470-301100	470-301100B

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STRAIGHT FLUTE DRILL - JOBBER LENGTH CONTINUED

DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	AlTiN
#34	0.1110	7/8	1-7/8	470-301110	470-301110B
#33	0.1130	7/8	1-7/8	470-301130	470-301130B
#32	0.1160	7/8	1-7/8	470-301160	470-301160B
3mm	0.1181	22mm	48mm	470-401181	470-401181B
#31	0.1200	7/8	1-7/8	470-301200	470-301200B
1/8	0.1250	7/8	1-7/8	470-101250	470-101250B
#30	0.1285	15/16	1-15/16	470-301285	470-301285B
#29	0.1360	15/16	1-15/16	470-301360	470-301360B
3.5mm	0.1378	24mm	49mm	470-401378	470-401378B
#28	0.1405	15/16	1-15/16	470-301405	470-301405B
9/64	0.1406	15/16	1-15/16	470-101406	470-101406B
#27	0.1440	1	2-1/16	470-301440	470-301440B
#26	0.1470	1	2-1/16	470-301470	470-301470B
#25	0.1495	1	2-1/16	470-301495	470-301495B
#24	0.1520	1	2-1/16	470-301520	470-301520B
#23	0.1540	1	2-1/16	470-301540	470-301540B
5/32	0.1563	1	2-1/16	470-101562	470-101562B
#22	0.1570	1-1/16	2-1/8	470-301570	470-301570B
4mm	0.1575	27mm	54mm	470-401575	470-401575B
#21	0.1590	1-1/16	2-1/8	470-301590	470-301590B
#20	0.1610	1-1/16	2-1/8	470-301610	470-301610B
#19	0.1660	1-1/16	2-1/8	470-301660	470-301660B
#18	0.1695	1-1/16	2-1/8	470-301695	470-301695B
11/64	0.1719	1-1/16	2-1/8	470-101719	470-101719B
#17	0.1730	1-1/8	2-3/16	470-301730	470-301730B
#16	0.1770	1-1/8	2-3/16	470-301770	470-301770B
4.5mm	0.1772	29mm	56mm	470-401772	470-401772B
#15	0.1800	1-1/8	2-3/16	470-301800	470-301800B
#14	0.1820	1-1/8	2-3/16	470-301820	470-301820B
#13	0.1850	1-1/8	2-3/16	470-301850	470-301850B
3/16	0.1875	1-1/8	2-3/16	470-101875	470-101875B
#12	0.1890	1-3/16	2-1/4	470-301890	470-301890B
#11	0.1910	1-3/16	2-1/4	470-301910	470-301910B
#10	0.1935	1-3/16	2-1/4	470-301935	470-301935B
#9	0.1960	1-3/16	2-1/4	470-301960	470-301960B
5mm	0.1969	30mm	57mm	470-401969	470-401969B
#8	0.1990	1-3/16	2-1/4	470-301990	470-301990B
#7	0.2010	1-3/16	2-1/4	470-302010	470-302010B
13/64	0.2031	1-3/16	2-1/4	470-102031	470-102031B
#6	0.2040	1-1/4	2-3/8	470-302040	470-302040B
#5	0.2055	1-1/4	2-3/8	470-302055	470-302055B
#4	0.2090	1-1/4	2-3/8	470-302090	470-302090B
#3	0.2130	1-1/4	2-3/8	470-302130	470-302130B
5.5mm	0.2165	32mm	60mm	470-402165	470-402165B
7/32	0.2188	1-1/4	2-3/8	470-102188	470-102188B
#2	0.2210	1-5/16	2-7/16	470-302210	470-302210B
#1	0.2280	1-5/16	2-7/16	470-302280	470-302280B
A	0.2340	1-5/16	2-7/16	470-202340	470-202340B
15/64	0.2344	1-5/16	2-7/16	470-102344	470-102344B
6mm	0.2362	33mm	62mm	470-402362	470-402362B
B	0.2380	1-3/8	2-1/2	470-202380	470-202380B
C	0.2420	1-3/8	2-1/2	470-202420	470-202420B
D	0.2460	1-3/8	2-1/2	470-202460	470-202460B
1/4	0.2500	1-3/8	2-1/2	470-102500	470-102500B
E	0.2500	1-3/8	2-1/2	470-202500	470-202500B
6.5mm	0.2559	35mm	64mm	470-402559	470-402559B

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STRAIGHT FLUTE DRILL - JOBBER LENGTH CONTINUED

DIAMETER TOLERANCE: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	Bright	AlTiN
F	0.2570	1-7/16	2-5/8	470-202570	470-202570B
G	0.2610	1-7/16	2-5/8	470-202610	470-202610B
17/64	0.2656	1-7/16	2-5/8	470-102656	470-102656B
H	0.2660	1-1/2	2-11/16	470-202660	470-202660B
I	0.2720	1-1/2	2-11/16	470-202720	470-202720B
7mm	0.2756	38mm	68mm	470-402756	470-402756B
J	0.2770	1-1/2	2-11/16	470-202770	470-202770B
K	0.2810	1-1/2	2-11/16	470-202810	470-202810B
9/32	0.2813	1-1/2	2-11/16	470-102812	470-102812B
L	0.2900	1-9/16	2-3/4	470-202900	470-202900B
M	0.2950	1-9/16	2-3/4	470-202950	470-202950B
7.5mm	0.2953	38mm	70mm	470-402953	470-402953B
19/64	0.2969	1-9/16	2-3/4	470-102969	470-102969B
N	0.3020	1-5/8	2-13/16	470-203020	470-203020B
5/16	0.3125	1-5/8	2-13/16	470-103125	470-103125B
8mm	0.3150	41mm	71mm	470-403150	470-403150B
O	0.3160	1-11/16	2-15/16	470-203160	470-203160B
P	0.3230	1-11/16	2-15/16	470-203230	470-203230B
21/64	0.3281	1-11/16	2-15/16	470-103281	470-103281B
Q	0.3320	1-11/16	3	470-203320	470-203320B
8.5mm	0.3346	43mm	76mm	470-403346	470-403346B
R	0.3390	1-11/16	3	470-203390	470-203390B
11/32	0.3438	1-11/16	3	470-103438	470-103438B
S	0.3480	1-3/4	3-1/16	470-203480	470-203480B
9mm	0.3543	45mm	78mm	470-403543	470-403543B
T	0.3580	1-3/4	3-1/16	470-203580	470-203580B
23/64	0.3594	1-3/4	3-1/16	470-103594	470-103594B
U	0.3680	1-13/16	3-1/8	470-203680	470-203680B
9.5mm	0.3740	46mm	79mm	470-403740	470-403740B
3/8	0.3750	1-13/16	3-1/8	470-103750	470-103750B
V	0.3770	1-7/8	3-1/4	470-203770	470-203770B
W	0.3860	1-7/8	3-1/4	470-203860	470-203860B
25/64	0.3906	1-7/8	3-1/4	470-103906	470-103906B
10mm	0.3937	48mm	83mm	470-403937	470-403937B
X	0.3970	1-15/16	3-5/16	470-203970	470-203970B
Y	0.4040	1-15/16	3-5/16	470-204040	470-204040B
13/32	0.4063	1-15/16	3-5/16	470-104062	470-104062B
Z	0.4130	2	3-3/8	470-204130	470-204130B
10.5mm	0.4134	51mm	86mm	470-404134	470-404134B
27/64	0.4219	2	3-3/8	470-104219	470-104219B
11mm	0.4331	51mm	86mm	470-404331	470-404331B
7/16	0.4375	2-1/16	3-7/16	470-104375	470-104375B
11.5mm	0.4528	52mm	87mm	470-404528	470-404528B
29/64	0.4531	2-1/8	3-9/16	470-104531	470-104531B
15/32	0.4688	2-1/8	3-5/8	470-104688	470-104688B
12mm	0.4724	54mm	92mm	470-404724	470-404724B
31/64	0.4844	2-3/16	3-11/16	470-104844	470-104844B
12.5mm	0.4921	56mm	94mm	470-404921	470-404921B
1/2	0.5000	2-1/4	3-3/4	470-105000	470-105000B
33/64	0.5156	1-1/8	3-1/2	470-105156	470-105156B
17/32	0.5313	1-1/8	3-1/2	470-105312	470-105312B
35/64	0.5469	1-1/8	3-1/2	470-105469	470-105469B
9/16	0.5625	1-1/8	4	470-105625	470-105625B
5/8	0.6250	1-1/4	4	470-106250	470-106250B
11/16	0.6875	1-1/2	4	470-106875	470-106875B
3/4	0.7500	1-1/2	4	470-107500	470-107500B

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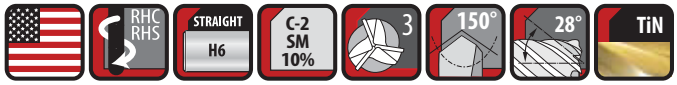
3 Flute Drills



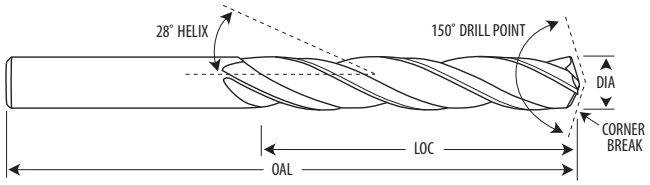
Performs exceedingly well in short-chip materials like steel, iron, brass, and bronze

Universally rated for use on all ISO materials

Rapid penetration and the utmost in accuracy are made possible due to a three-fluted design complemented by a 150° split point

Proprietary drill point technology utilizes a perfected combination of facets, corner breaks, and edge prep to produce the strongest cutting action

No preliminary drilling or spotting operations needed



Diameter Tolerance: +0.0000 / -0.0005"

SIZE	Dec In	LOC	OAL	TiN
3.0mm	0.1181	32mm	57mm	453-401181B
1/8	0.1250	1-1/4	2-1/4	453-101250B
9/64	0.1406	1-3/8	2-1/2	453-101406B
5/32	0.1563	1-3/8	2-1/2	453-101562B
4.0mm	0.1575	35mm	64mm	453-401575B
11/64	0.1719	1-5/8	2-3/4	453-101719B
3/16	0.1875	1-5/8	2-3/4	453-101875B
5.0mm	0.1969	45mm	76mm	453-401969B
13/64	0.2031	1-3/4	3	453-102031B
7/32	0.2188	1-3/4	3	453-102188B
15/64	0.2344	2	3-1/4	453-102344B
6.0mm	0.2362	51mm	83mm	453-402362B
1/4	0.2500	2	3-1/4	453-102500B
17/64	0.2656	2-1/8	3-1/2	453-102656B
7.0mm	0.2756	54mm	89mm	453-402756B
9/32	0.2813	2-1/8	3-1/2	453-102812B
19/64	0.2969	2-3/8	3-3/4	453-102969B
5/16	0.3125	2-3/8	3-3/4	453-103125B
8.0mm	0.3150	60mm	95mm	453-403150B
21/64	0.3281	2-1/2	4	453-103281B
11/32	0.3438	2-1/2	4	453-103438B
9.0mm	0.3543	64mm	102mm	453-403543B
23/64	0.3594	2-3/4	4-1/4	453-103594B
3/8	0.3750	2-3/4	4-1/4	453-103750B
25/64	0.3906	2-7/8	4-1/2	453-103906B
10.0mm	0.3937	73mm	114mm	453-403937B
13/32	0.4063	2-7/8	4-1/2	453-104062B
27/64	0.4219	2-7/8	4-1/2	453-104219B
11.0mm	0.4331	73mm	114mm	453-404331B
7/16	0.4375	2-7/8	4-1/2	453-104375B
29/64	0.4531	3	4-3/4	453-104531B
15/32	0.4688	3	4-3/4	453-104688B
12.0mm	0.4724	76mm	121mm	453-404724B
31/64	0.4844	3	4-3/4	453-104844B
1/2	0.5000	3	4-3/4	453-105000B
17/32	0.5313	3	4-3/4	453-105312B
14.0mm	0.5512	89mm	146mm	453-405512B
9/16	0.5625	3-1/2	5-3/4	453-105625B
5/8	0.6250	3-1/2	5-3/4	453-106250B
16.0mm	0.6299	90mm	146mm	453-406299B
3/4	0.7500	4	5-3/4	453-107500B

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DRILLING RECOMMENDATIONS - TWIST DRILLS - STUB DRILLS - STRAIGHT FLUTE DRILLS - 3 FLUTE DRILLS

Workpiece Material Group			Hardness	Surface Feet Per Minute (SFM) SFM	Inches Per Revolution (IPR) (IPR) Cutting Tool Diameterv 1/32	1/16	1/8	1/4	3/8	1/2	5/8	3/4
Steels	Free Machining & Low Carbon, 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	175	0.0010	0.0020	0.0030	0.0060	0.0080	0.0100	0.0110	0.0120
	Medium / High Carbon, Alloys, & Easy to Machine Tool Steels		28 - 38 Rc	165								
Tool & Die Steels	A2, D2, H13, L6, P20, S7	P	28 - 44 Rc	150								
Stainless Steels	Moderately Difficult to Machine, Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316 316L, 321, 347	M	≤ 28 Rc	140	0.0010	0.0020	0.0030	0.0060	0.0080	0.0100	0.0110	0.0120
	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics		> 28 Rc	60	0.0003	0.0005	0.0020	0.0040	0.0050	0.0060	0.0080	0.0100
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	60	0.0003	0.0005	0.0020	0.0040	0.0050	0.0060	0.0080	0.0100
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	80								
Hardened Materials		H	45 to 65 Rc	50	0.0003	0.0010	0.0010	0.0010	0.0020	0.0020	0.0020	0.0030
Cast Iron	Gray, SAE J431, ASTM A48	K	≤ 240 HB	175	0.0010	0.0020	0.0030	0.0060	0.0080	0.0100	0.0110	0.0120
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	175								
Non-Ferrous	Aluminium, Brass, Broze, Copper, Plastics	N		300	0.0003	0.0005	0.0020	0.0040	0.0050	0.0060	0.0080	0.0100
	Kevlar/Graphite			375								

NOTE: ALL RECOMMENDATIONS ARE CONSIDERED AS STARTING PARAMETERS ONLY

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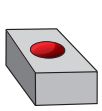
COMBINATION DRILL & COUNTERSINKS

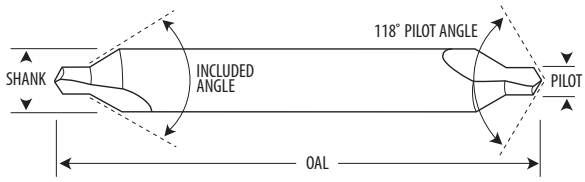
p.110



Also known as Center Drills

Multipurpose tool: drill, chamfer, deburr & countersink

Thick body and small point promote sturdiness and consistency, making the tool suitable for use in all materials



DIAMETER TOLERANCE: +0.0000 / -0.0005" INCLUDED ANGLE : ±1.0°

Included Angle	SIZE	Pilot DIA	Shank	OAL	Length	Bright	TiN	AlTiN
60°	00	0.0265	1/8	1-1/2	Regular	300-001001	300-001501	300-001001B
	0	1/32	1/8	1-1/2	Regular	300-001002	300-001502	300-001002B
	1	3/64	1/8	1-1/2	Regular	300-001003	300-001503	300-001003B
	2	5/64	3/16	1-7/8	Regular	300-001004	300-001504	300-001004B
	3	7/64	1/4	2	Regular	300-001005	300-001505	300-001005B
	4	1/8	5/16	2-1/8	Regular	300-001006	300-001506	300-001006B
	5	3/16	7/16	2-3/4	Regular	300-001007	300-001507	300-001007B
	6	7/32	1/2	3	Regular	300-001008	300-001508	300-001008B
	7	1/4	5/8	3-1/4	Regular	300-001009	300-001509	300-001009B
	8	5/16	3/4	3-1/2	Regular	300-001010	300-001510	300-001010B
82°	00	0.0265	1/8	1-1/2	Regular	300-002001	—	300-002001B
	0	1/32	1/8	1-1/2	Regular	300-002002	—	300-002002B
	1	3/64	1/8	1-1/2	Regular	300-002003	—	300-002003B
	2	5/64	3/16	1-7/8	Regular	300-002004	—	300-002004B
	3	7/64	1/4	2	Regular	300-002005	—	300-002005B
	4	1/8	5/16	2-1/8	Regular	300-002006	—	300-002006B
	5	3/16	7/16	2-3/4	Regular	300-002007	—	300-002007B
	6	7/32	1/2	3	Regular	300-002008	—	300-002008B
	7	1/4	5/8	3-1/4	Regular	300-002009	—	300-002009B
	8	5/16	3/4	3-1/2	Regular	300-002010	—	300-002010B
90°	00	0.0265	1/8	1-1/2	Regular	300-003001	—	300-003001B
	0	1/32	1/8	1-1/2	Regular	300-003002	—	300-003002B
	1	3/64	1/8	1-1/2	Regular	300-003003	—	300-003003B
	2	5/64	3/16	1-7/8	Regular	300-003004	—	300-003004B
	3	7/64	1/4	2	Regular	300-003005	—	300-003005B
	4	1/8	5/16	2-1/8	Regular	300-003006	—	300-003006B
	5	3/16	7/16	2-3/4	Regular	300-003007	—	300-003007B
	6	7/32	1/2	3	Regular	300-003008	—	300-003008B
	7	1/4	5/8	3-1/4	Regular	300-003009	—	300-003009B
	8	5/16	3/4	3-1/2	Regular	300-003010	—	300-003010B

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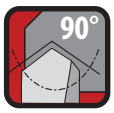
COMBINATION DRILL & COUNTERSINKS CONTINUED

DIAMETER TOLERANCE: +0.0000 / -0.0005" INCLUDED ANGLE : ±1.0°

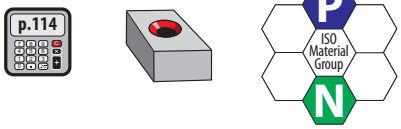
Included Angle	SIZE	Pilot DIA	Shank	OAL	Length	Bright	TiN	AlTiN
	1	3/64	1/8	4	Long	300-005001	300-005501	300-005001B
	2	5/64	3/16	4	Long	300-005002	300-005502	300-005002B
	3	7/64	1/4	4	Long	300-005003	300-005503	300-005003B
	4	1/8	5/16	4	Long	300-005004	300-005504	300-005004B
	5	3/16	7/16	6	Long	300-005005	300-005505	300-005005B
	6	7/32	1/2	6	Long	300-005006	300-005506	300-005006B
	7	1/4	5/8	6	Long	300-005007	300-005507	300-005007B
	8	5/16	3/4	6	Long	300-005008	300-005508	300-005008B
	1	3/64	1/8	4	Long	300-006001	—	300-006001B
	2	5/64	3/16	4	Long	300-006002	—	300-006002B
	3	7/64	1/4	4	Long	300-006003	—	300-006003B
	4	1/8	5/16	4	Long	300-006004	—	300-006004B
	5	3/16	7/16	6	Long	300-006005	—	300-006005B
	6	7/32	1/2	6	Long	300-006006	—	300-006006B
	7	1/4	5/8	6	Long	300-006007	—	300-006007B
	8	5/16	3/4	6	Long	300-006008	—	300-006008B
	1	3/64	1/8	4	Long	300-007001	—	300-007001B
	2	5/64	3/16	4	Long	300-007002	—	300-007002B
	3	7/64	1/4	4	Long	300-007003	—	300-007003B
	4	1/8	5/16	4	Long	300-007004	—	300-007004B
	5	3/16	7/16	6	Long	300-007005	—	300-007005B
	6	7/32	1/2	6	Long	300-007006	—	300-007006B
	7	1/4	5/8	6	Long	300-007007	—	300-007007B
	8	5/16	3/4	6	Long	300-007008	—	300-007008B

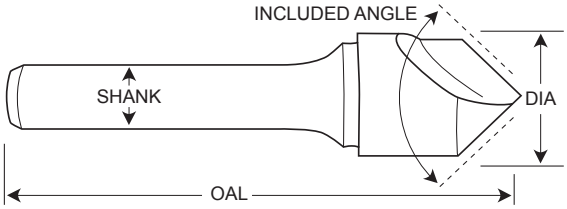
DRILLING RECOMMENDATIONS - COMBINATION DRILL & COUNTERSINKS

Workpiece Material Group			Hardness	SFM (Surface Feet Per Minute)	1/32	1/16	1/8	1/4	3/8	1/2
					Drill Point Depth (DPD) (DPD) Pilot Diameter					
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	175	0.0005	0.0010	0.0015	0.0030	0.0040	0.0050
	Medium/High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX		28 - 38 Rc	165						
Tool & Die Steels	A2, H13, L6, P20, S7	P	28 - 44 Rc	150						
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	≤ 28 Rc	125						
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60 , 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347		> 28 Rc	60						
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy	S	≤ 42 Rc	40						
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		≤ 42 Rc	80						
Hardened Materials		H	35 - 45 Rc	50						
Cast Iron	Gray: SAE J431, ASTM A48	K	≤ 240 HB	275						
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	175						

Single Flute

60° - designed espeically for creating holes that will be used between centers
82° - creates holes that match the angle of the most popular screw heads
90° - creates holes that match the angle the second most popular screw heads





Single End

				Included Angle				
				60°	82°	90°	100°	120°
DIA	Dec In	Shank	OAL	Bright	Bright	Bright	Bright	Bright
1/8	0.1250	1/8	1-1/2	331-001050	331-001060	331-001070	331-001080	331-001090
3/16	0.1875	3/16	2	331-002050	331-002060	331-002070	331-002080	331-002090
1/4	0.2500	1/4	2	331-003050	331-003060	331-003070	331-003080	331-003090
3/8	0.3750	1/4	2-1/2	331-005050	331-005060	331-005070	331-005080	331-005090
1/2	0.5000	1/4	2-1/2	331-006050	331-006060	331-006070	331-006080	331-006090
5/8	0.6250	1/4	2-1/2	331-007050	331-007060	331-007070	331-007080	331-007090
3/4	0.7500	3/8	3	331-008050	331-008060	331-008070	331-008080	331-008090
1	1.0000	1/2	3	331-010050	331-010060	331-010070	331-010080	331-010090
1-1/4	1.2500	3/4	3-1/2	331-011050	331-011060	331-011070	331-011080	331-011090
1-1/2	1.5000	3/4	3-1/2	331-012050	331-012060	331-012070	331-012080	331-012090

Double End

				Included Angle					
				60°	82°	90°	100°	110°	120°
DIA	Dec In	Shank	OAL	Bright	Bright	Bright	Bright	Bright	Bright
1/8	0.1250	1/8	1-1/2	331-201050	331-201060	331-201070	331-201080	331-201090	331-201100
3/16	0.1875	3/16	2	331-202050	331-202060	331-202070	331-202080	331-202090	331-202200
1/4	0.2500	1/4	2	331-203050	331-203060	331-203070	331-203080	331-203090	331-203100
5/16	0.3125	5/16	2-1/8	331-204050	331-204060	331-204070	331-204080	331-204090	331-204100
3/8	0.3750	3/8	2-1/2	331-205050	331-205060	331-205070	331-205080	331-205090	331-205100
1/2	0.5000	1/2	3	331-206050	331-206060	331-206070	331-206080	331-206090	331-206100
5/8	0.6250	5/8	3-1/4	331-207050	331-207060	331-207070	331-207080	331-207090	331-207100
3/4	0.7500	3/4	3-1/2	331-208050	331-208060	331-208070	331-208080	331-208090	331-208100

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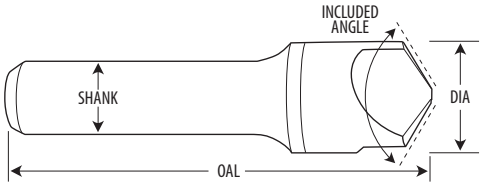
3 FLUTE

≤ 1/4" Diameters: Solid Carbide
> 1/4" Diameters: Brazed HSS shank with a carbide head)

Three Flute design offers the best chip clearance for non-ferrous materials

60° - designed espeically for creating holes that will be used between centers
82° - creates holes that match the angle of the most popular screw heads
90° - creates holes that match the angle the second most popular screw heads



SINGLE END

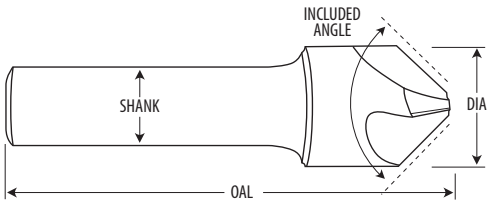
				Included Angle				
				60°	82°	90°	100°	120°
DIA	Dec In	Shank	OAL	Bright	Bright	Bright	Bright	Bright
1/8	0.1250	1/8	1-1/2	333-001050	333-001060	333-001070	333-001080	333-001090
3/16	0.1875	3/16	2	333-002050	333-002060	333-002070	333-002080	333-002090
1/4	0.2500	1/4	2	333-003050	333-003060	333-003070	333-003080	333-003090
3/8	0.3750	1/4	2-1/2	333-005050	333-005060	333-005070	333-005080	333-005090
1/2	0.5000	1/4	2-1/2	333-006050	333-006060	333-006070	333-006080	333-006090
5/8	0.6250	3/8	2-3/4	333-007050	333-007060	333-007070	333-007080	333-007090
3/4	0.7500	3/8	3	333-008050	333-008060	333-008070	333-008080	333-008090
1	1.0000	1/2	3	333-010050	333-010060	333-010070	333-010080	333-010090
1-1/4	1.2500	3/4	3-1/2	333-011050	333-011060	333-011070	333-011080	333-011090
1-1/2	1.5000	3/4	3-1/2	333-012050	333-012060	333-012070	333-012080	333-012090

4 FLUTE

≤ 1/4" Diameters: Solid Carbide
> 1/4" Diameters: Brazed HSS shank with a carbide head)

Four Flute design offers the best chip clearance for ferrous materials

60° - designed espeically for creating holes that will be used between centers
82° - creates holes that match the angle of the most popular screw heads
90° - creates holes that match the angle the second most popular screw heads



SINGLE END

				Included Angle				
				60°	82°	90°	100°	120°
DIA	Dec In	Shank	OAL	Bright	Bright	Bright	Bright	Bright
1/8	0.1250	1/8	1-1/2	334-001050	334-001060	334-001070	334-001080	334-001090
1/4	0.2500	1/4	2	334-003050	334-003060	334-003070	334-003080	334-003090
3/8	0.3750	1/4	2-1/2	334-005050	334-005060	334-005070	334-005080	334-005090
1/2	0.5000	3/8	2-1/2	334-006050	334-006060	334-006070	334-006080	334-006090
5/8	0.6250	3/8	2-1/2	334-007050	334-007060	334-007070	334-007080	334-007090
3/4	0.7500	1/2	3	334-008050	334-008060	334-008070	334-008080	334-008090
1	1.0000	1/2	3	334-010050	334-010060	334-010070	334-010080	334-010090

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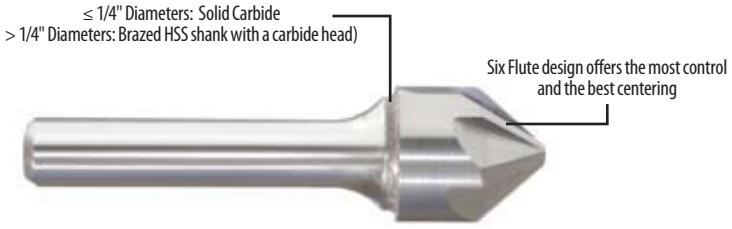
4 Flute Countersinks Continued

Double End

DIA	Dec In	Shank	OAL	Drill Point	Included Angle 60° Bright	82° Bright	90° Bright	100° Bright	110° Bright	120° Bright
1/8	0.1250	1/8	1-1/2	No	334-201050	334-201060	334-201070	334-201080	334-201090	334-201100
				Yes	334-301050	334-301060	334-301070	334-301080	334-301090	334-301100
3/16	0.1875	3/16	2	No	334-202050	334-202060	334-202070	334-202080	334-202090	334-202100
				Yes	334-302050	334-302060	334-302070	334-302080	334-302090	334-302100
1/4	0.2500	1/4	2	No	334-203050	334-203060	334-203070	334-203080	334-203090	334-203100
				Yes	334-303050	334-303060	334-303070	334-303080	334-303090	334-303100
5/16	0.3125	5/16	2-1/8	No	334-204050	334-204060	334-204070	334-204080	334-204090	334-204100
				Yes	334-304050	334-304060	334-304070	334-304080	334-304090	334-304100
3/8	0.3750	3/8	2-1/2	No	334-205050	334-205060	334-205070	334-205080	334-205090	334-205100
				Yes	334-305050	334-305060	334-305070	334-305080	334-305090	334-305100
1/2	0.5000	1/2	3	No	334-206050	334-206060	334-206070	334-206080	334-206090	334-206100
				Yes	334-306050	334-306060	334-306070	334-306080	334-306090	334-306100
5/8	0.6250	5/8	3-1/4	No	334-207050	334-207060	334-207070	334-207080	334-207090	334-207100
				Yes	334-307050	334-307060	334-307070	334-307080	334-307090	334-307100
3/4	0.7500	3/4	3-1/2	No	334-208050	334-208060	334-208070	334-208080	334-208090	334-208100
				Yes	334-308050	334-308060	334-308070	334-308080	334-308090	334-308100

6 Flute



60° - designed espeically for creating holes that will be used between centers
82° - creates holes that match the angle of the most popular screw heads
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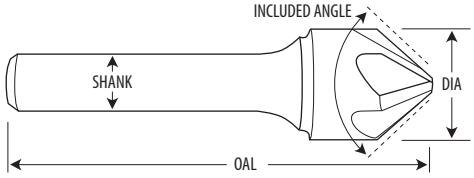

Single End

DIA	Dec In	Shank	OAL	Included Angle 60° Bright	82° Bright	90° Bright	100° Bright	120° Bright
1/8	0.1250	1/8	1-1/2	336-001050	336-001060	336-001070	336-001080	336-001090
3/16	0.1875	3/16	2	336-002050	336-002060	336-002070	336-002080	336-002090
1/4	0.2500	1/4	2	336-003050	336-003060	336-003070	336-003080	336-003090
5/16	0.3125	1/4	2	336-004050	336-004060	336-004070	336-004080	336-004090
3/8	0.3750	1/4	2-1/2	336-005050	336-005060	336-005070	336-005080	336-005090
1/2	0.5000	1/4	2-1/2	336-006050	336-006060	336-006070	336-006080	336-006090
5/8	0.6250	3/8	2-3/4	336-007050	336-007060	336-007070	336-007080	336-007090
3/4	0.7500	3/8	3	336-008050	336-008060	336-008070	336-008080	336-008090
7/8	0.8750	1/2	3	336-009050	336-009060	336-009070	336-009080	336-009090
1	1.0000	1/2	3	336-010050	336-010060	336-010070	336-010080	336-010090
1-1/4	1.2500	3/4	3-1/2	336-011050	336-011060	336-011070	336-011080	336-011090
1-1/2	1.5000	3/4	3-1/2	336-012050	336-012060	336-012070	336-012080	336-012090

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6 FLUTE COUNTERSINKS CONTINUED

DOUBLE END

DIA	Dec In	Shank	OAL	Included Angle 60° Bright	82° Bright	90° Bright
1/8	0.1250	1/8	1-1/2	336-201050	336-201060	336-201070
3/16	0.1875	3/16	2	336-202050	336-202060	336-202070
1/4	0.2500	1/4	2	336-203050	336-203060	336-203070
5/16	0.3125	5/16	2-1/8	336-204050	336-204060	336-204070
3/8	0.3750	3/8	2-1/2	336-205050	336-205060	336-205070
1/2	0.5000	1/2	3	336-206050	336-206060	336-206070
5/8	0.6250	5/8	3-1/4	336-207050	336-207060	336-207070
3/4	0.7500	3/4	3-1/2	336-208050	336-208060	336-208070

COUNTERSINKING RECOMMENDATIONS

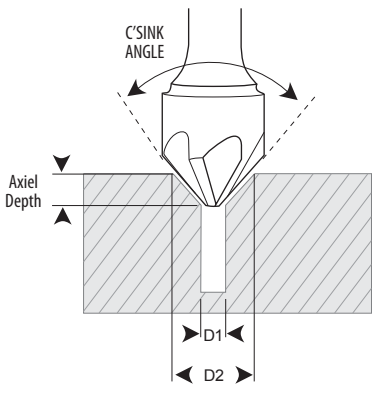
Surface Feet Per Minute (SFM)

Workpiece Material Group			SFM
Steel	Mild (.2 - .3 carbon)	P	120-170
	Mild (.4 - .5 carbon)		80-150
	Forgings		50-80
	Alloys (300 - 400 Brinnell)		30-50
Tool & Die Steels	A2, D2, H13, L6, P20, S7		60-100
Stainless Steels	Free Machining	M	80-125
	Work Hardening		50-75
Super Alloys	Inconel	S	23-35
	High Temp, Nimonics, Monel, Hastelloy		50-75
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		60-90
Hardened Materials	High Tensile (35 - 40 Rc)	H	40-60
	High Tensile (40 - 45 Rc)		35-55
	High Tensile (45 - 50 Rc)		25-40
	High Tensile (50 - 55 Rc)		15-20
Cast-Iron	Gray: SAE J431, ASTM A48	K	125-225
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		100-175
	Hard Chilled		20-35
Non-Ferrous	Aluminum / Aluminum Alloys	N	300-500
	Brass / Bronze		150-250
	Magnesium / Magnesium Alloys & Plastics		250-400

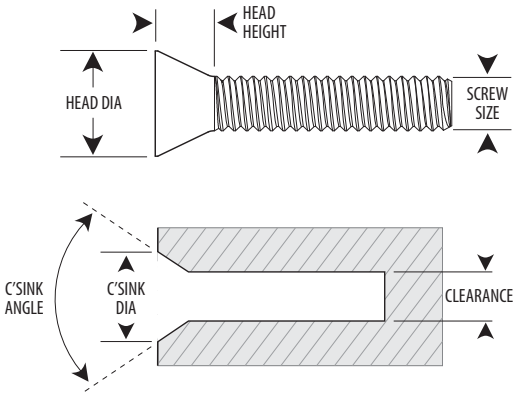
Screw Size		Screw Head Diameter	Screw Head Height	Countersink Diameter		CLEARANCE Close		CLEARANCE Free	
#2	0.086	0.168	0.064	3/16	0.214	3/32	0.094	# 36	0.106
#4	0.112	0.218	0.083	1/4	0.272	1/8	0.125	# 29	0.136
#6	0.138	0.263	0.097	5/16	0.324	# 23	0.154	# 18	0.170
#8	0.164	0.311	0.112	3/8	0.376	#15	0.180	# 9	0.196
#10	0.190	0.359	0.127	3/8	0.428	# 5	0.206	# 2	0.221
1/4	0.250	0.480	0.161	1/2	0.548	17/64	0.266	9/32	0.281
5/16	0.313	0.600	0.198	5/8	0.673	21/64	0.328	11/32	0.344
3/8	0.375	0.720	0.234	3/4	0.798	25/64	0.391	13/32	0.406
7/16	0.438	0.781	0.234	7/8	0.861	29/64	0.453	15/32	0.469
1/2	0.500	0.872	0.251	1	1.000	33/64	0.516	17/32	0.531
5/8	0.625	1.112	0.324	1-1/4	1.250	41/64	0.641	21/32	0.656
3/4	0.750	1.355	0.396	1-1/2	1.500	49/64	0.766	25/32	0.781
7/8	0.875	1.604	0.468	1-3/4	1.750	57/64	0.891	29/32	0.906
1	1.000	1.841	0.540	2	2.000	1-1/64	1.016	1-1/32	1.031

DIAMETER GAIN FOR AXIAL DEPTH .001"

Included Angle	Diameter Gain
30°	0.0005"
45°	0.0008"
60°	0.0010"
82°	0.0017"
90°	0.0020"
100°	0.0028"
120°	0.0034"



D2-D1 = Diameter Gain



CARBIDE CHUCKING REAMERS
SPIRAL FLUTE

Expand an existing hole to a precise size or create a perfect hole finish

Special decimal sizes and tolerances available with fast turnaround

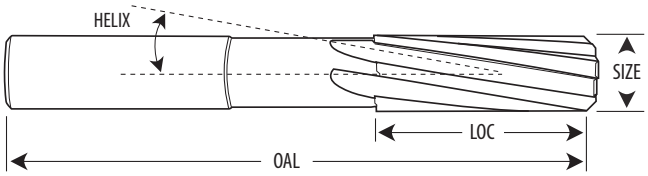
Best suited for blind holes - spiral flute geometry pulls chips out of the hole

45° chamfer angle naturally guides and eases the reamer into the hole

Reduced neck for through-hole clearance

Ultra-tight tolerances for extreme exactness

p.124



† **Full shank reduction *in lieu of reduced neck***

DIAMETER TOLERANCES: ≤ 1/4" DIA: +0.0000 / +0.0002" > 1/4" DIA: +0.0000 / +0.0003"

Flutes	SIZE		LOC	OAL	Helix	Bright
	3/64 †	0.0469	3/8	1-1/2	15°	550-001003
	1/16	0.0625	3/8	1-1/2	15°	550-001004
	5/64	0.0781	1/4	1-3/4	15°	550-001005
	3/32	0.0938	1/2	2	15°	550-001006
	7/64	0.1094	5/8	2-1/4	15°	550-001007
	1/8	0.1250	5/8	2-1/4	15°	550-001008
4	9/64	0.1406	.75	2-1/2	10°	550-001009
	5/32	0.1563	3/4	2-1/2	10°	550-001010
	11/64	0.1719	7/8	2-3/4	10°	550-001011
	3/16	0.1875	7/8	2-3/4	10°	550-001012
	13/64	0.2031	1	3	10°	550-001013
	7/32	0.2188	1	3	10°	550-001014
	15/64	0.2344	1	3	10°	550-001015
	1/4	0.2500	1	3	10°	550-001016
	17/64	0.2656	1-1/8	3-1/4	10°	550-001017
	9/32	0.2813	1-1/8	3-1/4	10°	550-001018
6	5/16	0.3125	1-1/8	3-1/4	10°	550-001020
	3/8	0.3750	1-1/4	3-1/2	10°	550-001024
	13/32	0.4063	1-1/4	3-1/2	10°	550-001026
	7/16	0.4375	1-3/8	4	10°	550-001028
	1/2	0.5000	1-1/2	4	10°	550-001032

CARBIDE CHUCKING REAMERS
STRAIGHT FLUTE

Expand an existing hole to a precise size or create a perfect hole finish

Reduced neck for through-hole clearance

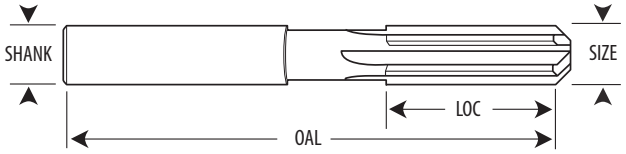
Best suited for through holes - Straight flute geometry pushes chips through the hole

45° chamfer angle naturally guides and eases the reamer into the hole

Special decimal sizes and tolerances available with fast turnaround

Ultra-tight tolerances for extreme exactness

p.124



† **Full shank reduction** ***in lieu of reduced neck***

SIZE	Flutes	LOC	OAL	Bright
0.0245 †	4	1/4	1-1/2	500-0000245
0.0265 †	4	1/4	1-1/2	500-0000265
0.0275 †	4	1/4	1-1/2	500-0000275
0.0280 † **#70**	4	1/4	1-1/2	500-003070
0.0285 †	4	1/4	1-1/2	500-0000285
0.0290 †	4	1/4	1-1/2	500-0000290
0.0292 † **#69**	4	1/4	1-1/2	500-003069
0.0295 †	4	1/4	1-1/2	500-0000295
0.0300 †	4	1/4	1-1/2	500-0000300
0.0305 †	4	1/4	1-1/2	500-0000305
0.0310 † **#68**	4	1/4	1-1/2	500-003068
0.0313 † **1/32**	4	1/4	1-1/2	500-001002
0.0315 †	4	1/4	1-1/2	500-0000315
0.0320 † **#67**	4	1/4	1-1/2	500-003067
0.0325 †	4	1/4	1-1/2	500-0000325
0.0330 † **#66**	4	1/4	1-1/2	500-003066
0.0335 †	4	1/4	1-1/2	500-0000335
0.0340 †	4	1/4	1-1/2	500-0000340
0.0345 †	4	1/4	1-1/2	500-0000345
0.0350 † **#65**	4	1/4	1-1/2	500-003065
0.0355 †	4	1/4	1-1/2	500-0000355
0.0360 † **#64**	4	1/4	1-1/2	500-003064
0.0365 †	4	1/4	1-1/2	500-0000365
0.0370 † **#63**	4	1/4	1-1/2	500-003063
0.0375 †	4	1/4	1-1/2	500-0000375
0.0380 † **#62**	4	1/4	1-1/2	500-003062
0.0385 †	4	1/4	1-1/2	500-0000385
0.0390 † **#61**	4	1/4	1-1/2	500-003061
0.0394 † **1.0mm**	4	6mm	38mm	500-004001
0.0395 †	4	1/4	1-1/2	500-0000395
0.0400 † **#60**	4	1/4	1-1/2	500-003060
0.0405 †	4	1/4	1-1/2	500-0000405
0.0410 † **#59**	4	1/4	1-1/2	500-003059
0.0415 †	4	1/4	1-1/2	500-0000415
0.0420 † **#58**	4	3/8	1-1/2	500-003058
0.0425 †	4	3/8	1-1/2	500-0000425
0.0430 † **#57**	4	3/8	1-1/2	500-003057
0.0435 †	4	3/8	1-1/2	500-0000435
0.0440 †	4	3/8	1-1/2	500-0000440
0.0445 †	4	3/8	1-1/2	500-0000445
0.0450 †	4	3/8	1-1/2	500-0000450
0.0455 †	4	3/8	1-1/2	500-0000455
0.0460 †	4	3/8	1-1/2	500-0000460
0.0465 † **#56**	4	3/8	1-1/2	500-003056
0.0469 † **3/64**	4	3/8	1-1/2	500-001003
0.0470 †	4	3/8	1-1/2	500-0000470
0.0475 †	4	3/8	1-1/2	500-0000475
0.0480 †	4	3/8	1-1/2	500-0000480
0.0485 †	4	3/8	1-1/2	500-0000485
0.0490 †	4	3/8	1-1/2	500-0000490
0.0495 †	4	3/8	1-1/2	500-0000495

≤ 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0002"
> 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0003"

SIZE	Flutes	LOC	OAL	Bright
0.0500	4	3/8	1-1/2	500-0000500
0.0505	4	3/8	1-1/2	500-0000505
0.0510	4	3/8	1-1/2	500-0000510
0.0515	4	3/8	1-1/2	500-0000515
0.0520 **#55**	4	3/8	1-1/2	500-003055
0.0525	4	3/8	1-1/2	500-0000525
0.0530	4	3/8	1-1/2	500-0000530
0.0535	4	3/8	1-1/2	500-0000535
0.0540	4	3/8	1-1/2	500-0000540
0.0545	4	3/8	1-1/2	500-0000545
0.0550 **#54**	4	3/8	1-1/2	500-003054
0.0555	4	3/8	1-1/2	500-0000555
0.0560	4	3/8	1-1/2	500-0000560
0.0565	4	3/8	1-1/2	500-0000565
0.0570	4	3/8	1-1/2	500-0000570
0.0575	4	3/8	1-1/2	500-0000575
0.0580	4	3/8	1-1/2	500-0000580
0.0585	4	3/8	1-1/2	500-0000585
0.0590	4	3/8	1-1/2	500-0000590
0.0591 **1.5mm**	4	10mm	38mm	500-004001.5
0.0595 **#53**	4	3/8	1-1/2	500-003053
0.0600	4	3/8	1-1/2	500-0000600
0.0605	4	3/8	1-1/2	500-0000605
0.0610	4	3/8	1-1/2	500-0000610
0.0615	4	3/8	1-1/2	500-0000615
0.0620	4	3/8	1-1/2	500-0000620
0.0622	4	3/8	1-1/2	500-0000622
0.0623	4	3/8	1-1/2	500-0000623
0.0625 **1/16**	4	3/8	1-1/2	500-001004
0.0630	4	3/8	1-1/2	500-0000630
0.0635 **#52**	4	3/8	1-1/2	500-003052
0.0640	4	3/8	1-1/2	500-0000640
0.0645	4	3/8	1-1/2	500-0000645
0.0650	4	3/8	1-1/2	500-0000650
0.0655	4	1/2	1-3/4	500-0000655
0.0660	4	1/2	1-3/4	500-0000660
0.0665	4	1/2	1-3/4	500-0000665
0.0670 **#51**	4	1/2	1-3/4	500-003051
0.0675	4	1/2	1-3/4	500-0000675
0.0680	4	1/2	1-3/4	500-0000680
0.0685	4	1/2	1-3/4	500-0000685
0.0690	4	1/2	1-3/4	500-0000690
0.0695	4	1/2	1-3/4	500-0000695
0.0700 **#50**	4	1/2	1-3/4	500-003050
0.0705	4	1/2	1-3/4	500-0000705
0.0710	4	1/2	1-3/4	500-0000710
0.0715	4	1/2	1-3/4	500-0000715
0.0720	4	1/2	1-3/4	500-0000720
0.0725	4	1/2	1-3/4	500-0000725
0.0730 **#49**	4	1/2	1-3/4	500-003049
0.0735	4	1/2	1-3/4	500-0000735
0.0740	4	1/2	1-3/4	500-0000740

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STRAIGHT FLUTE CONTINUED

≤ 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0002"
> 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0003"

SIZE		Flutes	LOC	OAL	Bright
0.0745		4	1/2	1-3/4	500-0000745
0.0750		4	1/2	1-3/4	500-0000750
0.0755		4	1/2	1-3/4	500-0000755
0.0760	**#48**	4	1/2	1-3/4	500-003048
0.0765		4	1/2	1-3/4	500-0000765
0.0770		4	1/2	1-3/4	500-0000770
0.0775		4	1/2	1-3/4	500-0000775
0.0780		4	1/2	1-3/4	500-0000780
0.0781	**5/64**	4	1/2	1-3/4	500-001005
0.0785	**#47**	4	1/2	1-3/4	500-003047
0.0787	**2.0mm**	4	13mm	44mm	500-004002
0.0790		4	1/2	1-3/4	500-0000790
0.0795		4	1/2	1-3/4	500-0000795
0.0800		4	1/2	1-3/4	500-0000800
0.0805		4	1/2	1-3/4	500-0000805
0.0810	**#46**	4	1/2	1-3/4	500-003046
0.0815		4	1/2	2	500-0000815
0.0820	**#45**	4	1/2	2	500-003045
0.0825		4	1/2	2	500-0000825
0.0830		4	1/2	2	500-0000830
0.0835		4	1/2	2	500-0000835
0.0840		4	1/2	2	500-0000840
0.0845		4	1/2	2	500-0000845
0.0850		4	1/2	2	500-0000850
0.0855		4	1/2	2	500-0000855
0.0860	**#44**	4	1/2	2	500-003044
0.0865		4	1/2	2	500-0000865
0.0870		4	1/2	2	500-0000870
0.0875		4	1/2	2	500-0000875
0.0880		4	1/2	2	500-0000880
0.0885		4	1/2	2	500-0000885
0.0890	**#43**	4	1/2	2	500-003043
0.0895		4	1/2	2	500-0000895
0.0900		4	1/2	2	500-0000900
0.0905		4	1/2	2	500-0000905
0.0910		4	1/2	2	500-0000910
0.0915		4	1/2	2	500-0000915
0.0920		4	1/2	2	500-0000920
0.0925		4	1/2	2	500-0000925
0.0930		4	1/2	2	500-0000930
0.0933		4	1/2	2	500-0000933
0.0935	**#42**	4	1/2	2	500-003042
0.0937		4	1/2	2	500-0000937
0.0938	**3/32**	4	1/2	2	500-001006
0.0940		4	1/2	2	500-0000940
0.0945		4	1/2	2	500-0000945
0.0950		4	1/2	2	500-0000950
0.0955		4	1/2	2	500-0000955
0.0960	**#41**	4	1/2	2	500-003041
0.0965		4	1/2	2	500-0000965
0.0970		4	5/8	2-1/4	500-0000970
0.0975		4	5/8	2-1/4	500-0000975
0.0980	**#40**	4	5/8	2-1/4	500-003040
0.0984	**2.5mm**	4	16mm	57mm	500-004002.5
0.0985		4	5/8	2-1/4	500-0000985
0.0990		4	5/8	2-1/4	500-0000990
0.0995	**#39**	4	5/8	2-1/4	500-003039
0.0995		4	5/8	2-1/4	500-0000995
0.1000		4	5/8	2-1/4	500-0001000
0.1005		4	5/8	2-1/4	500-0001005
0.1010		4	5/8	2-1/4	500-0001010
0.1015		4	5/8	2-1/4	500-0001015
0.1015	**#38**	4	5/8	2-1/4	500-003038
0.1020		4	5/8	2-1/4	500-0001020
0.1025		4	5/8	2-1/4	500-0001025
0.1030		4	5/8	2-1/4	500-0001030
0.1035		4	5/8	2-1/4	500-0001035
0.1040	**#37**	4	5/8	2-1/4	500-003037
0.1045		4	5/8	2-1/4	500-0001045

SIZE		Flutes	LOC	OAL	Bright
0.1050		4	5/8	2-1/4	500-0001050
0.1055		4	5/8	2-1/4	500-0001055
0.1060		4	5/8	2-1/4	500-0001060
0.1065	**#36**	4	5/8	2-1/4	500-003036
0.1070		4	5/8	2-1/4	500-0001070
0.1075		4	5/8	2-1/4	500-0001075
0.1080		4	5/8	2-1/4	500-0001080
0.1085		4	5/8	2-1/4	500-0001085
0.1090		4	5/8	2-1/4	500-0001090
0.1094	**7/64**	4	5/8	2-1/4	500-001007
0.1095		4	5/8	2-1/4	500-0001095
0.1100	**#35**	4	5/8	2-1/4	500-003035
0.1105		4	5/8	2-1/4	500-0001105
0.1110	**#34**	4	5/8	2-1/4	500-003034
0.1115		4	5/8	2-1/4	500-0001115
0.1120		4	5/8	2-1/4	500-0001120
0.1125		4	5/8	2-1/4	500-0001125
0.1130	**#33**	4	5/8	2-1/4	500-003033
0.1135		4	5/8	2-1/4	500-0001135
0.1140		4	5/8	2-1/4	500-0001140
0.1145		4	5/8	2-1/4	500-0001145
0.1150		4	5/8	2-1/4	500-0001150
0.1155		4	5/8	2-1/4	500-0001155
0.1160	**#32**	4	5/8	2-1/4	500-003032
0.1165		4	5/8	2-1/4	500-0001165
0.1170		4	5/8	2-1/4	500-0001170
0.1175		4	5/8	2-1/4	500-0001175
0.1180		4	5/8	2-1/4	500-0001180
0.1181	**3.0mm**	4	16mm	57mm	500-004003
0.1185		4	5/8	2-1/4	500-0001185
0.1190		4	5/8	2-1/4	500-0001190
0.1195		4	5/8	2-1/4	500-0001195
0.1200	**#31**	4	5/8	2-1/4	500-003031
0.1205		4	5/8	2-1/4	500-0001205
0.1210		4	5/8	2-1/4	500-0001210
0.1215		4	5/8	2-1/4	500-0001215
0.1220		4	5/8	2-1/4	500-0001220
0.1225		4	5/8	2-1/4	500-0001225
0.1230	**D/P**	4	5/8	2-1/4	500-0001230
0.1235		4	5/8	2-1/4	500-0001235
0.1240	**U/S**	4	5/8	2-1/4	500-0001240
0.1245		4	5/8	2-1/4	500-0001245
0.1247	**D/P**	4	5/8	2-1/4	500-0001247
0.1250	**1/8**	4	5/8	2-1/4	500-001008
0.1255		4	5/8	2-1/4	500-0001255
0.1260	**O/S**	4	5/8	2-1/4	500-0001260
0.1265		4	5/8	2-1/4	500-0001265
0.1270		4	5/8	2-1/4	500-0001270
0.1275		4	5/8	2-1/4	500-0001275
0.1280		4	5/8	2-1/4	500-0001280
0.1285	**#30**	4	5/8	2-1/4	500-003030
0.1290		4	5/8	2-1/4	500-0001290
0.1295		4	5/8	2-1/4	500-0001295
0.1300		4	5/8	2-1/4	500-0001300
0.1305		4	3/4	2-1/2	500-0001305
0.1310		4	3/4	2-1/2	500-0001310
0.1315		4	3/4	2-1/2	500-0001315
0.1320		4	3/4	2-1/2	500-0001320
0.1325		4	3/4	2-1/2	500-0001325
0.1330		4	3/4	2-1/2	500-0001330
0.1335		4	3/4	2-1/2	500-0001335
0.1340		4	3/4	2-1/2	500-0001340
0.1345		4	3/4	2-1/2	500-0001345
0.1350		4	3/4	2-1/2	500-0001350
0.1355		4	3/4	2-1/2	500-0001355
0.1360	**#29**	4	3/4	2-1/2	500-003029
0.1365		4	3/4	2-1/2	500-0001365
0.1370		4	3/4	2-1/2	500-0001370
0.1375		4	3/4	2-1/2	500-0001375

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STRAIGHT FLUTE CONTINUED

≤ 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0002"
> 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0003"

SIZE		Flutes	LOC	OAL	Bright
0.1378	3.5mm	4	19mm	64mm	500-004003.5
0.1380		4	3/4	2-1/2	500-0001380
0.1385		4	3/4	2-1/2	500-0001385
0.1390		4	3/4	2-1/2	500-0001390
0.1395		4	3/4	2-1/2	500-0001395
0.1400		4	3/4	2-1/2	500-0001400
0.1405	#28	4	3/4	2-1/2	500-003028
0.1406	9/64	4	3/4	2-1/2	500-001009
0.1410		4	3/4	2-1/2	500-0001410
0.1415		4	3/4	2-1/2	500-0001415
0.1420		4	3/4	2-1/2	500-0001420
0.1425		4	3/4	2-1/2	500-0001425
0.1430		4	3/4	2-1/2	500-0001430
0.1435		4	3/4	2-1/2	500-0001435
0.1440	#27	4	3/4	2-1/2	500-003027
0.1445		4	3/4	2-1/2	500-0001445
0.1450		4	3/4	2-1/2	500-0001450
0.1455		4	3/4	2-1/2	500-0001455
0.1460		4	3/4	2-1/2	500-0001460
0.1465		4	3/4	2-1/2	500-0001465
0.1470	#26	4	3/4	2-1/2	500-003026
0.1475		4	3/4	2-1/2	500-0001475
0.1480		4	3/4	2-1/2	500-0001480
0.1485		4	3/4	2-1/2	500-0001485
0.1490		4	3/4	2-1/2	500-0001490
0.1495	#25	4	3/4	2-1/2	500-003025
0.1500		4	3/4	2-1/2	500-0001500
0.1505		4	3/4	2-1/2	500-0001505
0.1507		4	3/4	2-1/2	500-0001507
0.1510		4	3/4	2-1/2	500-0001510
0.1515		4	3/4	2-1/2	500-0001515
0.1520	#24	4	3/4	2-1/2	500-003024
0.1525		4	3/4	2-1/2	500-0001525
0.1530		4	3/4	2-1/2	500-0001530
0.1535		4	3/4	2-1/2	500-0001535
0.1540	#23	4	3/4	2-1/2	500-003023
0.1541		4	3/4	2-1/2	500-0001541
0.1545		4	3/4	2-1/2	500-0001545
0.1550		4	3/4	2-1/2	500-0001550
0.1555		4	3/4	2-1/2	500-0001555
0.1560		4	3/4	2-1/2	500-0001560
0.1563	5/32	4	3/4	2-1/2	500-001010
0.1565		4	3/4	2-1/2	500-0001565
0.1570	#22	4	3/4	2-1/2	500-003022
0.1575	4.0mm	4	19mm	64mm	500-004004
0.1575		4	3/4	2-1/2	500-0001575
0.1580		4	3/4	2-1/2	500-0001580
0.1585		4	3/4	2-1/2	500-0001585
0.1590	#21	4	3/4	2-1/2	500-003021
0.1595		4	3/4	2-1/2	500-0001595
0.1600		4	3/4	2-1/2	500-0001600
0.1605		4	3/4	2-1/2	500-0001605
0.1610	#20	4	7/8	2-3/4	500-003020
0.1615		4	7/8	2-3/4	500-0001615
0.1620		4	7/8	2-3/4	500-0001620
0.1625		4	7/8	2-3/4	500-0001625
0.1630		4	7/8	2-3/4	500-0001630
0.1635		4	7/8	2-3/4	500-0001635
0.1640		4	7/8	2-3/4	500-0001640
0.1645		4	7/8	2-3/4	500-0001645
0.1650		4	7/8	2-3/4	500-0001650
0.1655		4	7/8	2-3/4	500-0001655
0.1660	#19	4	7/8	2-3/4	500-003019
0.1665		4	7/8	2-3/4	500-0001665
0.1670		4	7/8	2-3/4	500-0001670
0.1675		4	7/8	2-3/4	500-0001675
0.1680		4	7/8	2-3/4	500-0001680
0.1685		4	7/8	2-3/4	500-0001685
0.1690		4	7/8	2-3/4	500-0001690
0.1695	#18	4	7/8	2-3/4	500-003018
0.1700		4	7/8	2-3/4	500-0001700
0.1705		4	7/8	2-3/4	500-0001705
0.1710		4	7/8	2-3/4	500-0001710
0.1715		4	7/8	2-3/4	500-0001715
0.1719	11/64	4	7/8	2-3/4	500-001011
0.1720		4	7/8	2-3/4	500-0001720
0.1725		4	7/8	2-3/4	500-0001725
0.1730	#17	4	7/8	2-3/4	500-003017
0.1735		4	7/8	2-3/4	500-0001735
0.1740		4	7/8	2-3/4	500-0001740
0.1745		4	7/8	2-3/4	500-0001745
0.1750		4	7/8	2-3/4	500-0001750
0.1755		4	7/8	2-3/4	500-0001755
0.1760		4	7/8	2-3/4	500-0001760
0.1765		4	7/8	2-3/4	500-0001765
0.1770	#16	4	7/8	2-3/4	500-003016
0.1772	4.5mm	4	22mm	70mm	500-004004.5
0.1775		4	7/8	2-3/4	500-0001775
0.1780		4	7/8	2-3/4	500-0001780
0.1785		4	7/8	2-3/4	500-0001785
0.1790		4	7/8	2-3/4	500-0001790
0.1795		4	7/8	2-3/4	500-0001795
0.1800	#15	4	7/8	2-3/4	500-003015
0.1805		4	7/8	2-3/4	500-0001805
0.1810		4	7/8	2-3/4	500-0001810
0.1814		4	7/8	2-3/4	500-0001814
0.1815		4	7/8	2-3/4	500-0001815
0.1820	#14	4	7/8	2-3/4	500-003014
0.1825		4	7/8	2-3/4	500-0001825
0.1830		4	7/8	2-3/4	500-0001830
0.1835		4	7/8	2-3/4	500-0001835
0.1840		4	7/8	2-3/4	500-0001840
0.1845		4	7/8	2-3/4	500-0001845
0.1850	#13	4	7/8	2-3/4	500-003013
0.1855	D/P	4	7/8	2-3/4	500-0001855
0.1860		4	7/8	2-3/4	500-0001860
0.1865	U/S	4	7/8	2-3/4	500-0001865
0.1867		4	7/8	2-3/4	500-0001867
0.1870		4	7/8	2-3/4	500-0001870
0.1872		4	7/8	2-3/4	500-0001872
0.1875	3/16	4	7/8	2-3/4	500-001012
0.1877		4	7/8	2-3/4	500-0001877
0.1880		4	7/8	2-3/4	500-0001880
0.1885	O/S	4	7/8	2-3/4	500-0001885
0.1890	#12	4	7/8	2-3/4	500-003012
0.1895		4	7/8	2-3/4	500-0001895
0.1900		4	7/8	2-3/4	500-0001900
0.1905		4	7/8	2-3/4	500-0001905
0.1910	#11	4	7/8	2-3/4	500-003011
0.1915		4	7/8	2-3/4	500-0001915
0.1920		4	1	3	500-0001920
0.1925		4	1	3	500-0001925
0.1930		4	1	3	500-0001930
0.1935	#10	4	1	3	500-003010
0.1935		4	1	3	500-0001935
0.1940		4	1	3	500-0001940
0.1945		4	1	3	500-0001945
0.1950		4	1	3	500-0001950
0.1955		4	1	3	500-0001955
0.1960	#9	4	1	3	500-003009
0.1965		4	1	3	500-0001965
0.1969	5.0mm	4	25mm	76mm	500-004005
0.1970		4	1	3	500-0001970
0.1975		4	1	3	500-0001975
0.1980		4	1	3	500-0001980
0.1985		4	1	3	500-0001985
0.1990	#8	4	1	3	500-003008
0.1995		4	1	3	500-0001995

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STRAIGHT FLUTE CONTINUED

≤ 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0002"
> 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0003"

SIZE		Flutes	LOC	OAL	Bright
0.2000		4	1	3	500-0002000
0.2005		4	1	3	500-0002005
0.2010	**#7**	4	1	3	500-003007
0.2015		4	1	3	500-0002015
0.2020		4	1	3	500-0002020
0.2025		4	1	3	500-0002025
0.2030		4	1	3	500-0002030
0.2031	**13/64**	4	1	3	500-001013
0.2035		4	1	3	500-0002035
0.2040	**#6**	4	1	3	500-003006
0.2045		4	1	3	500-0002045
0.2050		4	1	3	500-0002050
0.2055	**#5**	4	1	3	500-003005
0.2060		4	1	3	500-0002060
0.2065		4	1	3	500-0002065
0.2070		4	1	3	500-0002070
0.2075		4	1	3	500-0002075
0.2080		4	1	3	500-0002080
0.2085		4	1	3	500-0002085
0.2090	**#4**	4	1	3	500-003004
0.2095		4	1	3	500-0002095
0.2100		4	1	3	500-0002100
0.2105		4	1	3	500-0002105
0.2110		4	1	3	500-0002110
0.2115		4	1	3	500-0002115
0.2120		4	1	3	500-0002120
0.2125		4	1	3	500-0002125
0.2130	**#3**	4	1	3	500-003003
0.2135		4	1	3	500-0002135
0.2140		4	1	3	500-0002140
0.2145		4	1	3	500-0002145
0.2150		4	1	3	500-0002150
0.2155		4	1	3	500-0002155
0.2160		4	1	3	500-0002160
0.2165	**5.5mm**	4	25mm	76mm	500-004005.5
0.2170		4	1	3	500-0002170
0.2175		4	1	3	500-0002175
0.2177		4	1	3	500-0002177
0.2180		4	1	3	500-0002180
0.2185		4	1	3	500-0002185
0.2188	**7/32**	4	1	3	500-001014
0.2190		4	1	3	500-0002190
0.2195		4	1	3	500-0002195
0.2200		4	1	3	500-0002200
0.2205		4	1	3	500-0002205
0.2210	**#2**	4	1	3	500-003002
0.2215		4	1	3	500-0002215
0.2220		4	1	3	500-0002220
0.2225		4	1	3	500-0002225
0.2230		4	1	3	500-0002230
0.2235		4	1	3	500-0002235
0.2240		4	1	3	500-0002240
0.2245		4	1	3	500-0002245
0.2250		4	1	3	500-0002250
0.2255		4	1	3	500-0002255
0.2260		4	1	3	500-0002260
0.2265		4	1	3	500-0002265
0.2270		4	1	3	500-0002270
0.2275		4	1	3	500-0002275
0.2280	**#1**	4	1	3	500-003001
0.2285		4	1	3	500-0002285
0.2290		4	1	3	500-0002290
0.2295		4	1	3	500-0002295
0.2300		4	1	3	500-0002300
0.2305		4	1	3	500-0002305
0.2310		4	1	3	500-0002310
0.2315		4	1	3	500-0002315
0.2320		4	1	3	500-0002320
0.2325		4	1	3	500-0002325
0.2330		4	1	3	500-0002330
0.2335		4	1	3	500-0002335
0.2340	**A**	4	1	3	500-002000
0.2344	**15/64**	4	1	3	500-001015
0.2345		4	1	3	500-0002345
0.2350		4	1	3	500-0002350
0.2355		4	1	3	500-0002355
0.2360		4	1	3	500-0002360
0.2362	**6.0mm**	4	25mm	76mm	500-004006
0.2365		4	1	3	500-0002365
0.2370		4	1	3	500-0002370
0.2375		4	1	3	500-0002375
0.2380	**B**	4	1	3	500-002001
0.2385		4	1	3	500-0002385
0.2390		4	1	3	500-0002390
0.2395		4	1	3	500-0002395
0.2400		4	1	3	500-0002400
0.2405		4	1	3	500-0002405
0.2410		4	1	3	500-0002410
0.2415		4	1	3	500-0002415
0.2420	**C**	4	1	3	500-002002
0.2425		4	1	3	500-0002425
0.2430		4	1	3	500-0002430
0.2435		4	1	3	500-0002435
0.2440		4	1	3	500-0002440
0.2445		4	1	3	500-0002445
0.2450		4	1	3	500-0002450
0.2455		4	1	3	500-0002455
0.2460	**D**	4	1	3	500-002003
0.2465		4	1	3	500-0002465
0.2470		4	1	3	500-0002470
0.2475		4	1	3	500-0002475
0.2480		4	1	3	500-0002480
0.2485		4	1	3	500-0002485
0.2490		4	1	3	500-0002490
0.2495		4	1	3	500-0002495
0.2498		4	1	3	500-0002498
0.2500	**1/4**	4	1	3	500-001016
0.2500	**E**	4	1	3	500-002004
0.2502		4	1	3	500-0002502
0.2505		4	1	3	500-0002505
0.2510		4	1	3	500-0002510
0.2515		4	1	3	500-0002515
0.2520		4	1	3	500-0002520
0.2525		4	1	3	500-0002525
0.2530		4	1	3	500-0002530
0.2535		4	1	3	500-0002535
0.2540		4	1	3	500-0002540
0.2545		4	1	3	500-0002545
0.2550		4	1	3	500-0002550
0.2555		6	1	3	500-0002555
0.2559	**6.5mm**	6	29mm	83mm	500-004006.5
0.2560		6	1-1/8	3-1/4	500-0002560
0.2565		6	1-1/8	3-1/4	500-0002565
0.2570	**F**	6	1-1/8	3-1/4	500-002005
0.2575		6	1-1/8	3-1/4	500-0002575
0.2580		6	1-1/8	3-1/4	500-0002580
0.2585		6	1-1/8	3-1/4	500-0002585
0.2590		6	1-1/8	3-1/4	500-0002590
0.2595		6	1-1/8	3-1/4	500-0002595
0.2600		6	1-1/8	3-1/4	500-0002600
0.2605		6	1-1/8	3-1/4	500-0002605
0.2610	**G**	6	1-1/8	3-1/4	500-002006
0.2615		6	1-1/8	3-1/4	500-0002615
0.2620		6	1-1/8	3-1/4	500-0002620
0.2625		6	1-1/8	3-1/4	500-0002625
0.2630		6	1-1/8	3-1/4	500-0002630
0.2635		6	1-1/8	3-1/4	500-0002635
0.2640		6	1-1/8	3-1/4	500-0002640

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STRAIGHT FLUTE CONTINUED

≤ 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0002"
> 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0003"

SIZE	Flutes	LOC	OAL	Bright
0.2645	6	1-1/8	3-1/4	500-0002645
0.2650	6	1-1/8	3-1/4	500-0002650
0.2655	6	1-1/8	3-1/4	500-0002655
0.2656 **17/64**	6	1-1/8	3-1/4	500-001017
0.2660 **H**	6	1-1/8	3-1/4	500-002007
0.2665	6	1-1/8	3-1/4	500-0002665
0.2670	6	1-1/8	3-1/4	500-0002670
0.2675	6	1-1/8	3-1/4	500-0002675
0.2680	6	1-1/8	3-1/4	500-0002680
0.2685	6	1-1/8	3-1/4	500-0002685
0.2690	6	1-1/8	3-1/4	500-0002690
0.2695	6	1-1/8	3-1/4	500-0002695
0.2700	6	1-1/8	3-1/4	500-0002700
0.2705	6	1-1/8	3-1/4	500-0002705
0.2710	6	1-1/8	3-1/4	500-0002710
0.2715	6	1-1/8	3-1/4	500-0002715
0.2720 **I**	6	1-1/8	3-1/4	500-002008
0.2725	6	1-1/8	3-1/4	500-0002725
0.2730	6	1-1/8	3-1/4	500-0002730
0.2735	6	1-1/8	3-1/4	500-0002735
0.2740	6	1-1/8	3-1/4	500-0002740
0.2745	6	1-1/8	3-1/4	500-0002745
0.2750	6	1-1/8	3-1/4	500-0002750
0.2755	6	1-1/8	3-1/4	500-0002755
0.2756 **7.0mm**	6	29mm	83mm	500-004007
0.2760	6	1-1/8	3-1/4	500-0002760
0.2765	6	1-1/8	3-1/4	500-0002765
0.2770 **J**	6	1-1/8	3-1/4	500-002009
0.2775	6	1-1/8	3-1/4	500-0002775
0.2780	6	1-1/8	3-1/4	500-0002780
0.2785	6	1-1/8	3-1/4	500-0002785
0.2790	6	1-1/8	3-1/4	500-0002790
0.2795	6	1-1/8	3-1/4	500-0002795
0.2800	6	1-1/8	3-1/4	500-0002800
0.2805	6	1-1/8	3-1/4	500-0002805
0.2810 **K**	6	1-1/8	3-1/4	500-002010
0.2813 **9/32**	6	1-1/8	3-1/4	500-001018
0.2815	6	1-1/8	3-1/4	500-0002815
0.2818	6	1-1/8	3-1/4	500-0002818
0.2820	6	1-1/8	3-1/4	500-0002820
0.2825	6	1-1/8	3-1/4	500-0002825
0.2830	6	1-1/8	3-1/4	500-0002830
0.2835	6	1-1/8	3-1/4	500-0002835
0.2840	6	1-1/8	3-1/4	500-0002840
0.2845	6	1-1/8	3-1/4	500-0002845
0.2850	6	1-1/8	3-1/4	500-0002850
0.2855	6	1-1/8	3-1/4	500-0002855
0.2860	6	1-1/8	3-1/4	500-0002860
0.2865	6	1-1/8	3-1/4	500-0002865
0.2870	6	1-1/8	3-1/4	500-0002870
0.2875	6	1-1/8	3-1/4	500-0002875
0.2880	6	1-1/8	3-1/4	500-0002880
0.2885	6	1-1/8	3-1/4	500-0002885
0.2890	6	1-1/8	3-1/4	500-0002890
0.2895	6	1-1/8	3-1/4	500-0002895
0.2900 **L**	6	1-1/8	3-1/4	500-002011
0.2905	6	1-1/8	3-1/4	500-0002905
0.2910	6	1-1/8	3-1/4	500-0002910
0.2915	6	1-1/8	3-1/4	500-0002915
0.2920	6	1-1/8	3-1/4	500-0002920
0.2925	6	1-1/8	3-1/4	500-0002925
0.2930	6	1-1/8	3-1/4	500-0002930
0.2935	6	1-1/8	3-1/4	500-0002935
0.2940	6	1-1/8	3-1/4	500-0002940
0.2945	6	1-1/8	3-1/4	500-0002945
0.2950 **M**	6	1-1/8	3-1/4	500-002012
0.2953 **7.5mm**	6	29mm	83mm	500-004007.5
0.2955	6	1-1/8	3-1/4	500-0002955
0.2960	6	1-1/8	3-1/4	500-0002960

SIZE	Flutes	LOC	OAL	Bright
0.2965	6	1-1/8	3-1/4	500-0002965
0.2969 **19/64**	6	1-1/8	3-1/4	500-001019
0.2970	6	1-1/8	3-1/4	500-0002970
0.2975	6	1-1/8	3-1/4	500-0002975
0.2980	6	1-1/8	3-1/4	500-0002980
0.2985	6	1-1/8	3-1/4	500-0002985
0.2990	6	1-1/8	3-1/4	500-0002990
0.2995	6	1-1/8	3-1/4	500-0002995
0.3000	6	1-1/8	3-1/4	500-0003000
0.3005	6	1-1/8	3-1/4	500-0003005
0.3010	6	1-1/8	3-1/4	500-0003010
0.3015	6	1-1/8	3-1/4	500-0003015
0.3020 **N**	6	1-1/8	3-1/4	500-002013
0.3025	6	1-1/8	3-1/4	500-0003025
0.3030	6	1-1/8	3-1/4	500-0003030
0.3035	6	1-1/8	3-1/4	500-0003035
0.3040	6	1-1/8	3-1/4	500-0003040
0.3045	6	1-1/8	3-1/4	500-0003045
0.3050	6	1-1/8	3-1/4	500-0003050
0.3055	6	1-1/8	3-1/4	500-0003055
0.3060	6	1-1/8	3-1/4	500-0003060
0.3065	6	1-1/8	3-1/4	500-0003065
0.3070	6	1-1/8	3-1/4	500-0003070
0.3075	6	1-1/8	3-1/4	500-0003075
0.3080	6	1-1/8	3-1/4	500-0003080
0.3085	6	1-1/8	3-1/4	500-0003085
0.3090	6	1-1/8	3-1/4	500-0003090
0.3095	6	1-1/8	3-1/4	500-0003095
0.3100	6	1-1/8	3-1/4	500-0003100
0.3105 **D/P**	6	1-1/8	3-1/4	500-0003105
0.3110	6	1-1/8	3-1/4	500-0003110
0.3115	6	1-1/8	3-1/4	500-0003115
0.3120	6	1-1/8	3-1/4	500-0003120
0.3125 **5/16**	6	1-1/8	3-1/4	500-001020
0.3130	6	1-1/8	3-1/4	500-0003130
0.3135	6	1-1/8	3-1/4	500-0003135
0.3140	6	1-1/8	3-1/4	500-0003140
0.3145	6	1-1/8	3-1/4	500-0003145
0.3150 **8.0mm**	6	29mm	83mm	500-004008
0.3155	6	1-1/8	3-1/4	500-0003155
0.3160 **O**	6	1-1/8	3-1/4	500-002014
0.3165	6	1-1/8	3-1/4	500-0003165
0.3170	6	1-1/4	3-1/2	500-0003170
0.3175	6	1-1/4	3-1/2	500-0003175
0.3177	6	1-1/4	3-1/2	500-0003177
0.3180	6	1-1/4	3-1/2	500-0003180
0.3185	6	1-1/4	3-1/2	500-0003185
0.3190	6	1-1/4	3-1/2	500-0003190
0.3195	6	1-1/4	3-1/2	500-0003195
0.3200	6	1-1/4	3-1/2	500-0003200
0.3205	6	1-1/4	3-1/2	500-0003205
0.3210	6	1-1/4	3-1/2	500-0003210
0.3215	6	1-1/4	3-1/2	500-0003215
0.3220	6	1-1/4	3-1/2	500-0003220
0.3225	6	1-1/4	3-1/2	500-0003225
0.3230 **P**	6	1-1/4	3-1/2	500-002015
0.3235	6	1-1/4	3-1/2	500-0003235
0.3240	6	1-1/4	3-1/2	500-0003240
0.3245	6	1-1/4	3-1/2	500-0003245
0.3250	6	1-1/4	3-1/2	500-0003250
0.3255	6	1-1/4	3-1/2	500-0003255
0.3260	6	1-1/4	3-1/2	500-0003260
0.3265	6	1-1/4	3-1/2	500-0003265
0.3270	6	1-1/4	3-1/2	500-0003270
0.3275	6	1-1/4	3-1/2	500-0003275
0.3280	6	1-1/4	3-1/2	500-0003280
0.3281 **21/64**	6	1-1/4	3-1/2	500-001021
0.3285	6	1-1/4	3-1/2	500-0003285
0.3290	6	1-1/4	3-1/2	500-0003290

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STRAIGHT FLUTE CONTINUED

≤ 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0002"
> 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0003"

SIZE	Flutes	LOC	OAL	Bright
0.3295	6	1-1/4	3-1/2	500-0003295
0.3300	6	1-1/4	3-1/2	500-0003300
0.3305	6	1-1/4	3-1/2	500-0003305
0.3310	6	1-1/4	3-1/2	500-0003310
0.3315	6	1-1/4	3-1/2	500-0003315
0.3320 **Q**	6	1-1/4	3-1/2	500-002016
0.3325	6	1-1/4	3-1/2	500-0003325
0.3330	6	1-1/4	3-1/2	500-0003330
0.3335	6	1-1/4	3-1/2	500-0003335
0.3340	6	1-1/4	3-1/2	500-0003340
0.3345	6	1-1/4	3-1/2	500-0003345
0.3346 **8.5mm**	6	32mm	89mm	500-004008.5
0.3350	6	1-1/4	3-1/2	500-0003350
0.3355	6	1-1/4	3-1/2	500-0003355
0.3360	6	1-1/4	3-1/2	500-0003360
0.3365	6	1-1/4	3-1/2	500-0003365
0.3370	6	1-1/4	3-1/2	500-0003370
0.3375	6	1-1/4	3-1/2	500-0003375
0.3380	6	1-1/4	3-1/2	500-0003380
0.3385	6	1-1/4	3-1/2	500-0003385
0.3390 **R**	6	1-1/4	3-1/2	500-002017
0.3395	6	1-1/4	3-1/2	500-0003395
0.3400	6	1-1/4	3-1/2	500-0003400
0.3405	6	1-1/4	3-1/2	500-0003405
0.3410	6	1-1/4	3-1/2	500-0003410
0.3415	6	1-1/4	3-1/2	500-0003415
0.3420	6	1-1/4	3-1/2	500-0003420
0.3425	6	1-1/4	3-1/2	500-0003425
0.3430	6	1-1/4	3-1/2	500-0003430
0.3435	6	1-1/4	3-1/2	500-0003435
0.3438 **11/32**	6	1-1/4	3-1/2	500-001022
0.3440	6	1-1/4	3-1/2	500-0003440
0.3445	6	1-1/4	3-1/2	500-0003445
0.3450	6	1-1/4	3-1/2	500-0003450
0.3455	6	1-1/4	3-1/2	500-0003455
0.3460	6	1-1/4	3-1/2	500-0003460
0.3465	6	1-1/4	3-1/2	500-0003465
0.3470	6	1-1/4	3-1/2	500-0003470
0.3475	6	1-1/4	3-1/2	500-0003475
0.3480 **S**	6	1-1/4	3-1/2	500-002018
0.3485	6	1-1/4	3-1/2	500-0003485
0.3490	6	1-1/4	3-1/2	500-0003490
0.3495	6	1-1/4	3-1/2	500-0003495
0.3500	6	1-1/4	3-1/2	500-0003500
0.3505	6	1-1/4	3-1/2	500-0003505
0.3510	6	1-1/4	3-1/2	500-0003510
0.3515	6	1-1/4	3-1/2	500-0003515
0.3520	6	1-1/4	3-1/2	500-0003520
0.3525	6	1-1/4	3-1/2	500-0003525
0.3530	6	1-1/4	3-1/2	500-0003530
0.3535	6	1-1/4	3-1/2	500-0003535
0.3540	6	1-1/4	3-1/2	500-0003540
0.3543 **9.0mm**	6	32mm	89mm	500-004009
0.3545	6	1-1/4	3-1/2	500-0003545
0.3550	6	1-1/4	3-1/2	500-0003550
0.3555	6	1-1/4	3-1/2	500-0003555
0.3560	6	1-1/4	3-1/2	500-0003560
0.3565	6	1-1/4	3-1/2	500-0003565
0.3570	6	1-1/4	3-1/2	500-0003570
0.3575	6	1-1/4	3-1/2	500-0003575
0.3580 **T**	6	1-1/4	3-1/2	500-002019
0.3585	6	1-1/4	3-1/2	500-0003585
0.3590	6	1-1/4	3-1/2	500-0003590
0.3594 **23/64**	6	1-1/4	3-1/2	500-001023
0.3595	6	1-1/4	3-1/2	500-0003595
0.3600	6	1-1/4	3-1/2	500-0003600
0.3605	6	1-1/4	3-1/2	500-0003605
0.3610	6	1-1/4	3-1/2	500-0003610
0.3615	6	1-1/4	3-1/2	500-0003615

SIZE	Flutes	LOC	OAL	Bright
0.3620	6	1-1/4	3-1/2	500-0003620
0.3625	6	1-1/4	3-1/2	500-0003625
0.3630	6	1-1/4	3-1/2	500-0003630
0.3635	6	1-1/4	3-1/2	500-0003635
0.3640	6	1-1/4	3-1/2	500-0003640
0.3645	6	1-1/4	3-1/2	500-0003645
0.3650	6	1-1/4	3-1/2	500-0003650
0.3655	6	1-1/4	3-1/2	500-0003655
0.3660	6	1-1/4	3-1/2	500-0003660
0.3665	6	1-1/4	3-1/2	500-0003665
0.3670	6	1-1/4	3-1/2	500-0003670
0.3675	6	1-1/4	3-1/2	500-0003675
0.3680 **U**	6	1-1/4	3-1/2	500-002020
0.3685	6	1-1/4	3-1/2	500-0003685
0.3690	6	1-1/4	3-1/2	500-0003690
0.3695	6	1-1/4	3-1/2	500-0003695
0.3700	6	1-1/4	3-1/2	500-0003700
0.3705	6	1-1/4	3-1/2	500-0003705
0.3710	6	1-1/4	3-1/2	500-0003710
0.3715	6	1-1/4	3-1/2	500-0003715
0.3720	6	1-1/4	3-1/2	500-0003720
0.3725	6	1-1/4	3-1/2	500-0003725
0.3730 **D/P**	6	1-1/4	3-1/2	500-0003730
0.3735	6	1-1/4	3-1/2	500-0003735
0.3740 **U/S**	6	1-1/4	3-1/2	500-0003740
0.3740 **9.5mm**	6	32mm	89mm	500-004009.5
0.3745 **D/P**	6	1-1/4	3-1/2	500-0003745
0.3750 **3/8**	6	1-1/4	3-1/2	500-001024
0.3755	6	1-1/4	3-1/2	500-0003755
0.3760 **O/S**	6	1-1/4	3-1/2	500-0003760
0.3765	6	1-1/4	3-1/2	500-0003765
0.3767	6	1-1/4	3-1/2	500-0003767
0.3770 **V**	6	1-1/4	3-1/2	500-002021
0.3775	6	1-1/4	3-1/2	500-0003775
0.3780	6	1-1/4	3-1/2	500-0003780
0.3785	6	1-1/4	3-1/2	500-0003785
0.3790	6	1-1/4	3-1/2	500-0003790
0.3795	6	1-1/4	3-1/2	500-0003795
0.3800	6	1-1/4	3-1/2	500-0003800
0.3805	6	1-1/4	3-1/2	500-0003805
0.3810	6	1-1/4	3-1/2	500-0003810
0.3815	6	1-1/4	3-1/2	500-0003815
0.3820	6	1-1/4	3-1/2	500-0003820
0.3825	6	1-1/4	3-1/2	500-0003825
0.3830	6	1-1/4	3-1/2	500-0003830
0.3835	6	1-1/4	3-1/2	500-0003835
0.3840	6	1-1/4	3-1/2	500-0003840
0.3845	6	1-1/4	3-1/2	500-0003845
0.3850	6	1-1/4	3-1/2	500-0003850
0.3855	6	1-1/4	3-1/2	500-0003855
0.3860 **W**	6	1-1/4	3-1/2	500-002022
0.3865	6	1-1/4	3-1/2	500-0003865
0.3870	6	1-1/4	3-1/2	500-0003870
0.3875	6	1-1/4	3-1/2	500-0003875
0.3880	6	1-1/4	3-1/2	500-0003880
0.3885	6	1-1/4	3-1/2	500-0003885
0.3890	6	1-1/4	3-1/2	500-0003890
0.3895	6	1-1/4	3-1/2	500-0003895
0.3900	6	1-1/4	3-1/2	500-0003900
0.3905	6	1-1/4	3-1/2	500-0003905
0.3906 **25/64**	6	1-1/4	3-1/2	500-001025
0.3910	6	1-1/4	3-1/2	500-0003910
0.3915	6	1-1/4	3-1/2	500-0003915
0.3920	6	1-1/4	3-1/2	500-0003920
0.3925	6	1-1/4	3-1/2	500-0003925
0.3930	6	1-1/4	3-1/2	500-0003930
0.3935	6	1-1/4	3-1/2	500-0003935
0.3937 **10.0mm**	6	32mm	89mm	500-004010
0.3940	6	1-1/4	3-1/2	500-0003940

STRAIGHT FLUTE CONTINUED

≤ 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0002"
> 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0003"

SIZE		Flutes	LOC	OAL	Bright
0.3945		6	1-1/4	3-1/2	500-0003945
0.3950		6	1-1/4	3-1/2	500-0003950
0.3955		6	1-1/4	3-1/2	500-0003955
0.3960		6	1-1/4	3-1/2	500-0003960
0.3965		6	1-1/4	3-1/2	500-0003965
0.3970	X	6	1-1/4	3-1/2	500-002023
0.3975		6	1-1/4	3-1/2	500-0003975
0.3980		6	1-1/4	3-1/2	500-0003980
0.3985		6	1-1/4	3-1/2	500-0003985
0.3990		6	1-1/4	3-1/2	500-0003990
0.3995		6	1-1/4	3-1/2	500-0003995
0.4000		6	1-1/4	3-1/2	500-0004000
0.4005		6	1-1/4	3-1/2	500-0004005
0.4010		6	1-1/4	3-1/2	500-0004010
0.4015		6	1-1/4	3-1/2	500-0004015
0.4020		6	1-1/4	3-1/2	500-0004020
0.4025		6	1-1/4	3-1/2	500-0004025
0.4030		6	1-1/4	3-1/2	500-0004030
0.4035		6	1-1/4	3-1/2	500-0004035
0.4040	Y	6	1-1/4	3-1/2	500-002024
0.4045		6	1-1/4	3-1/2	500-0004045
0.4050		6	1-1/4	3-1/2	500-0004050
0.4055		6	1-1/4	3-1/2	500-0004055
0.4060		6	1-1/4	3-1/2	500-0004060
0.4063	13/32	6	1-1/4	3-1/2	500-001026
0.4065		6	1-1/4	3-1/2	500-0004065
0.4070		6	1-1/4	3-1/2	500-0004070
0.4075		6	1-1/4	3-1/2	500-0004075
0.4080		6	1-1/4	3-1/2	500-0004080
0.4085		6	1-1/4	3-1/2	500-0004085
0.4090		6	1-1/4	3-1/2	500-0004090
0.4095		6	1-1/4	3-1/2	500-0004095
0.4100		6	1-1/4	3-1/2	500-0004100
0.4105		6	1-1/4	3-1/2	500-0004105
0.4110		6	1-1/4	3-1/2	500-0004110
0.4115		6	1-1/4	3-1/2	500-0004115
0.4120		6	1-1/4	3-1/2	500-0004120
0.4125		6	1-1/4	3-1/2	500-0004125
0.4130	Z	6	1-1/4	3-1/2	500-002025
0.4134	10.5mm	6	32mm	89mm	500-004010.5
0.4135		6	1-1/4	3-1/2	500-0004135
0.4140		6	1-1/4	3-1/2	500-0004140
0.4145		6	1-1/4	3-1/2	500-0004145
0.4150		6	1-1/4	3-1/2	500-0004150
0.4155		6	1-1/4	3-1/2	500-0004155
0.4160		6	1-1/4	3-1/2	500-0004160
0.4165		6	1-3/8	4	500-0004165
0.4170		6	1-3/8	4	500-0004170
0.4175		6	1-3/8	4	500-0004175
0.4180		6	1-3/8	4	500-0004180
0.4185		6	1-3/8	4	500-0004185
0.4190		6	1-3/8	4	500-0004190
0.4195		6	1-3/8	4	500-0004195
0.4200		6	1-3/8	4	500-0004200
0.4205		6	1-3/8	4	500-0004205
0.4210		6	1-3/8	4	500-0004210
0.4215		6	1-3/8	4	500-0004215
0.4219	27/64	6	1-3/8	4	500-001027
0.4225		6	1-3/8	4	500-0004225
0.4230		6	1-3/8	4	500-0004230
0.4235		6	1-3/8	4	500-0004235
0.4240		6	1-3/8	4	500-0004240
0.4245		6	1-3/8	4	500-0004245
0.4250		6	1-3/8	4	500-0004250
0.4255		6	1-3/8	4	500-0004255
0.4260		6	1-3/8	4	500-0004260
0.4265		6	1-3/8	4	500-0004265
0.4270		6	1-3/8	4	500-0004270
0.4275		6	1-3/8	4	500-0004275
0.4280		6	1-3/8	4	500-0004280
0.4285		6	1-3/8	4	500-0004285
0.4290		6	1-3/8	4	500-0004290
0.4295		6	1-3/8	4	500-0004295
0.4300		6	1-3/8	4	500-0004300
0.4305		6	1-3/8	4	500-0004305
0.4310		6	1-3/8	4	500-0004310
0.4315		6	1-3/8	4	500-0004315
0.4320		6	1-3/8	4	500-0004320
0.4325		6	1-3/8	4	500-0004325
0.4330		6	1-3/8	4	500-0004330
0.4331	11.0mm	6	35mm	102mm	500-004011
0.4335		6	1-3/8	4	500-0004335
0.4340		6	1-3/8	4	500-0004340
0.4345		6	1-3/8	4	500-0004345
0.4350		6	1-3/8	4	500-0004350
0.4355	D/P	6	1-3/8	4	500-0004355
0.4360		6	1-3/8	4	500-0004360
0.4365	U/S	6	1-3/8	4	500-0004365
0.4370		6	1-3/8	4	500-0004370
0.4375	7/16	6	1-3/8	4	500-001028
0.4380		6	1-3/8	4	500-0004380
0.4385		6	1-3/8	4	500-0004385
0.4390		6	1-3/8	4	500-0004390
0.4395		6	1-3/8	4	500-0004395
0.4400		6	1-3/8	4	500-0004400
0.4405		6	1-3/8	4	500-0004405
0.4410		6	1-3/8	4	500-0004410
0.4415		6	1-3/8	4	500-0004415
0.4420		6	1-3/8	4	500-0004420
0.4425		6	1-3/8	4	500-0004425
0.4430		6	1-3/8	4	500-0004430
0.4435		6	1-3/8	4	500-0004435
0.4440		6	1-3/8	4	500-0004440
0.4445		6	1-3/8	4	500-0004445
0.4450		6	1-3/8	4	500-0004450
0.4455		6	1-3/8	4	500-0004455
0.4460		6	1-3/8	4	500-0004460
0.4465		6	1-3/8	4	500-0004465
0.4470		6	1-3/8	4	500-0004470
0.4475		6	1-3/8	4	500-0004475
0.4480		6	1-3/8	4	500-0004480
0.4485		6	1-3/8	4	500-0004485
0.4490		6	1-3/8	4	500-0004490
0.4495		6	1-3/8	4	500-0004495
0.4500		6	1-3/8	4	500-0004500
0.4505		6	1-3/8	4	500-0004505
0.4510		6	1-3/8	4	500-0004510
0.4515		6	1-3/8	4	500-0004515
0.4520		6	1-3/8	4	500-0004520
0.4525		6	1-3/8	4	500-0004525
0.4528	11.5mm	6	35mm	102mm	500-004011.5
0.4530		6	1-3/8	4	500-0004530
0.4531	29/64	6	1-3/8	4	500-001029
0.4535		6	1-3/8	4	500-0004535
0.4540		6	1-3/8	4	500-0004540
0.4545		6	1-3/8	4	500-0004545
0.4550		6	1-3/8	4	500-0004550
0.4555		6	1-3/8	4	500-0004555
0.4560		6	1-3/8	4	500-0004560
0.4565		6	1-3/8	4	500-0004565
0.4570		6	1-3/8	4	500-0004570
0.4575		6	1-3/8	4	500-0004575
0.4580		6	1-3/8	4	500-0004580
0.4585		6	1-3/8	4	500-0004585

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STRAIGHT FLUTE CONTINUED

≤ 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0002"
> 1/4" DIAMETER TOLERANCE: +0.0000 / +0.0003"

SIZE	Flutes	LOC	OAL	Bright
0.4590	6	1-3/8	4	500-0004590
0.4595	6	1-3/8	4	500-0004595
0.4600	6	1-3/8	4	500-0004600
0.4605	6	1-3/8	4	500-0004605
0.4610	6	1-3/8	4	500-0004610
0.4615	6	1-3/8	4	500-0004615
0.4620	6	1-3/8	4	500-0004620
0.4625	6	1-3/8	4	500-0004625
0.4630	6	1-3/8	4	500-0004630
0.4635	6	1-3/8	4	500-0004635
0.4640	6	1-3/8	4	500-0004640
0.4645	6	1-3/8	4	500-0004645
0.4650	6	1-3/8	4	500-0004650
0.4655	6	1-3/8	4	500-0004655
0.4660	6	1-3/8	4	500-0004660
0.4665	6	1-3/8	4	500-0004665
0.4670	6	1-3/8	4	500-0004670
0.4675	6	1-3/8	4	500-0004675
0.4680	6	1-3/8	4	500-0004680
0.4685	6	1-3/8	4	500-0004685
0.4688 **15/32**	6	1-3/8	4	500-001030
0.4690	6	1-3/8	4	500-0004690
0.4695	6	1-3/8	4	500-0004695
0.4700	6	1-3/8	4	500-0004700
0.4705	6	1-3/8	4	500-0004705
0.4710	6	1-3/8	4	500-0004710
0.4715	6	1-3/8	4	500-0004715
0.4720	6	1-3/8	4	500-0004720
0.4724 **12.0mm**	6	35mm	102mm	500-004012
0.4725	6	1-3/8	4	500-0004725
0.4730	6	1-3/8	4	500-0004730
0.4735	6	1-3/8	4	500-0004735
0.4740	6	1-3/8	4	500-0004740
0.4745	6	1-3/8	4	500-0004745
0.4750	6	1-3/8	4	500-0004750
0.4755	6	1-3/8	4	500-0004755
0.4760	6	1-3/8	4	500-0004760
0.4765	6	1-3/8	4	500-0004765
0.4770	6	1-3/8	4	500-0004770
0.4775	6	1-3/8	4	500-0004775
0.4780	6	1-3/8	4	500-0004780
0.4785	6	1-1/2	4	500-0004785
0.4790	6	1-1/2	4	500-0004790
0.4795	6	1-1/2	4	500-0004795
0.4800	6	1-1/2	4	500-0004800
0.4805	6	1-1/2	4	500-0004805
0.4810	6	1-1/2	4	500-0004810
0.4815	6	1-1/2	4	500-0004815
0.4820	6	1-1/2	4	500-0004820
0.4825	6	1-1/2	4	500-0004825
0.4830	6	1-1/2	4	500-0004830
0.4835	6	1-1/2	4	500-0004835
0.4840	6	1-1/2	4	500-0004840
0.4844 **31/64**	6	1-1/2	4	500-001031
0.4845	6	1-1/2	4	500-0004845
0.4850	6	1-1/2	4	500-0004850
0.4855	6	1-1/2	4	500-0004855
0.4860	6	1-1/2	4	500-0004860
0.4865	6	1-1/2	4	500-0004865
0.4870	6	1-1/2	4	500-0004870
0.4875	6	1-1/2	4	500-0004875
0.4880	6	1-1/2	4	500-0004880
0.4885	6	1-1/2	4	500-0004885
0.4890	6	1-1/2	4	500-0004890
0.4895	6	1-1/2	4	500-0004895
0.4900	6	1-1/2	4	500-0004900
0.4905	6	1-1/2	4	500-0004905

SIZE	Flutes	LOC	OAL	Bright
0.4910	6	1-1/2	4	500-0004910
0.4915	6	1-1/2	4	500-0004915
0.4921 **12.5mm**	6	38mm	102mm	500-004012.5
0.4925	6	1-1/2	4	500-0004925
0.4930	6	1-1/2	4	500-0004930
0.4935	6	1-1/2	4	500-0004935
0.4940	6	1-1/2	4	500-0004940
0.4945	6	1-1/2	4	500-0004945
0.4950	6	1-1/2	4	500-0004950
0.4955	6	1-1/2	4	500-0004955
0.4960	6	1-1/2	4	500-0004960
0.4965	6	1-1/2	4	500-0004965
0.4970	6	1-1/2	4	500-0004970
0.4975	6	1-1/2	4	500-0004975
0.4980 **D/P**	6	1-1/2	4	500-0004980
0.4985	6	1-1/2	4	500-0004985
0.4990 **U/S**	6	1-1/2	4	500-0004990
0.4995 **D/P**	6	1-1/2	4	500-0004995
0.5000 **1/2**	6	1-1/2	4	500-001032
0.5005	6	1-1/2	4	500-0005005
0.5010 **O/S**	6	1-1/2	4	500-0005010
0.5015	6	1-1/2	4	500-0005015
0.5020	6	1-1/2	4	500-0005020
0.5025	6	1-1/2	4	500-0005025
0.5030	6	1-1/2	4	500-0005030
0.5035	6	1-1/2	4	500-0005035
0.5040	6	1-1/2	4	500-0005040
0.5045	6	1-1/2	4	500-0005045
0.5050	6	1-1/2	4	500-0005050
0.5095	6	1-1/2	4	500-0005095
0.5105	6	1-1/2	4	500-0005105
0.5115	6	1-1/2	4	500-0005115
0.5118 **13.0mm**	6	38mm	102mm	500-004013
0.5495	6	1-1/2	4	500-0005495
0.5505	6	1-1/2	4	500-0005505
0.5512 **14.0mm**	6	38mm	102mm	500-004014
0.5515	6	1-1/2	4	500-0005515
0.5605	6	1-1/2	4	500-0005605
0.5615	6	1-1/2	4	500-0005615
0.5625 **9/16**	6	1-1/2	4	500-001036
0.5645	6	1-3/4	4	500-0005645
0.5885	6	1-3/4	4	500-0005885
0.5895	6	1-3/4	4	500-0005895
0.5906 **15.0mm**	6	44mm	102mm	500-004015
0.6215	6	1-3/4	4	500-0006215
0.6225	6	1-3/4	4	500-0006225
0.6235	6	1-3/4	4	500-0006235
0.6240	6	1-3/4	4	500-0006240
0.6245	6	1-3/4	4	500-0006245
0.6250 **5/8**	6	1-3/4	4	500-001040
0.6255	6	1-3/4	4	500-0006255
0.6260	6	1-3/4	4	500-0006260
0.6265	6	1-3/4	4	500-0006265
0.6270	6	1-3/4	4	500-0006270
0.6275	6	1-3/4	4	500-0006275
0.6285	6	1-3/4	4	500-0006285
0.6295	6	1-3/4	4	500-0006295
0.6299 **16.0mm**	6	44mm	102mm	500-004016
0.6305	6	1-3/4	4	500-0006305
0.6310	6	1-3/4	4	500-0006310
0.7475	6	1-3/4	4	500-0007475
0.7485	6	1-3/4	4	500-0007485
0.7490	6	1-3/4	4	500-0007490
0.7495	6	1-3/4	4	500-0007495
0.7500 **3/4**	6	1-3/4	4	500-001048
0.7505	6	1-3/4	4	500-0007505
0.7510	6	1-3/4	4	500-0007510

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REAMING RECOMMENDATIONS

Workpiece Material Group			Hardness	Surface Feet Per Minute (SFM) SFM	Inches Per Revolution (IPR) (IPR) Reamer Diameter 0.0280 - 0.0625"	0.0626 - 0.1250"	0.1251 - 0.2500"	0.2501 - 0.5000"	0.5001 - 0.7500"
Steels	Free Machining & Low Carbon, 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	P	≤ 28 Rc	200-300	0.0005 - 0.0030	0.0020 - 0.0060	0.0040 - 0.0100	0.0060 - 0.0150	0.0100 - 0.0300
	Medium Carbon & High Carbon, 1030, 4140, 5115		28 - 38 Rc	125-200	0.0005 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100	0.0100 - 0.0200
Tool & Die Steels	A2, D2, H13, L6, P20, S7	P	28 - 44 Rc	50-125	0.0002 - 0.0010	0.0010 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100
Stainless Steels	Austenitic, 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH		≤ 28 Rc	120-190	0.0005 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100	0.0100 - 0.0200
	Ferritic, 18Cr-2Mo, 26Cr-1Mo, 29Cr-4Mo, 29Cr-4Mo- 2Ni	M	≤ 28 Rc	80-120	0.0005 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100	0.0100 - 0.0200
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316 316L, 321, 347		≤ 28 Rc	60-100	0.0002 - 0.0020	0.0010 - 0.0040	0.0020 - 0.0060	0.0040 - 0.0100	0.0060 - 0.0100
Super Alloys	Inconel	S	< 40 Rc	40-70	0.0002 - 0.0010	0.0010 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100
	High Temp, Nimonics, Monel, Hastelloy		< 40 Rc	30-45	0.0002 - 0.0010	0.0010 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0200
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		< 40 Rc	35-50	0.0002 - 0.0020	0.0010 - 0.0040	0.0020 - 0.0060	0.0040 - 0.0100	0.0060 - 0.0200
Hardened Materials		H	23 - 32 Rc	125-200	0.0002 - 0.0020	0.0010 - 0.0040	0.0020 - 0.0060	0.0040 - 0.0100	0.0060 - 0.0200
			32 - 43 Rc	50-125	0.0005 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100	0.0100 - 0.0200
			43 - 52 Rc	35-50	0.0002 - 0.0010	0.0010 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100
			> 50 Rc	15-35	0.0005 - 0.0030	0.0020 - 0.0060	0.0040 - 0.0100	0.0060 - 0.0150	0.0100 - 0.0300
Cast Iron	Gray, SAE J431, ASTM A48	K	≤ 240 HB	150-250	0.0005 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100	0.0100 - 0.0200
	Ductile & Malleable, ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602		> 240 HB	125-200	0.0005 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100	0.0100 - 0.0200
	Martensitic (Hard)		> 240 HB	50-75	0.0002 - 0.0010	0.0010 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100
Non-Ferrous	Aluminum, Aluminum Alloys	N	> 240 HB	500-1000	0.0005 - 0.0020	0.0020 - 0.0060	0.0040 - 0.0100	0.0060 - 0.0150	0.0100 - 0.0300
	Brass, Bronze (Free Machining)		> 240 HB	250-400	0.0005 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100	0.0100 - 0.0200
	Brass, Bronze (Soft)		> 240 HB	150-250	0.0002 - 0.0010	0.0010 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100
	Copper, Bronze (Hard)		> 240 HB	100-150	0.0002 - 0.0010	0.0010 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100
	Magnesium, Magnesium Alloys, Plastics		> 240 HB	500-1000	0.0002 - 0.0010	0.0010 - 0.0020	0.0020 - 0.0040	0.0040 - 0.0060	0.0060 - 0.0100

Workpiece Material Group			Drill Diameter 0.0135	0.0290/0.0280	0.0550/0.0520	0.1130	0.2380	0.3594	0.4844	0.6094	0.7344
			Reamer Diameter 0.0150	0.0320	0.0625	0.1250	0.2500	0.3750	0.5000	0.625	0.75
			TOTAL STOCK ALLOWANCE								
Steels	Low Carbon ≤ 35% C	P	0.0012	0.0025	0.0049	0.0089	0.0100	0.0120	0.0130	0.0150	
	Medium/High Carbon ≥ 35% C		0.0013	0.0028	0.0055	0.0099	0.0110	0.0130	0.0140	0.0160	0.0170
Tool & Die Steels	A2, D2, H13, L6, P20, S7		0.0012	0.0025	0.0049	0.0089	0.0100	0.0120	0.0130	0.0150	
Stainless Steels	Easy, Moderate & Difficult to Machine	M	0.0012	0.0025	0.0049	0.0089	0.0100	0.0120	0.0130	0.0150	0.0160
Super Alloys	Soft	S	0.0012	0.0025	0.0049	0.0089	0.0100	0.0110	0.0130	0.0140	0.0160
	Hard		0.0010	0.0023	0.0044	0.0081	0.0090	0.0100	0.0120	0.0130	0.0140
	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al		0.0013	0.0028	0.0055	0.0099	0.0110	0.0130	0.0140	0.0160	0.0170
Hardened Materials		H	0.0009	0.0020	0.0040	0.0072	0.0080	0.0100	0.0110	0.0130	0.0140
Cast Iron	Cast	K	0.0013	0.0028	0.0055	0.0099	0.0110	0.0130	0.0140	0.0160	0.0180
	Ductile									0.0150	0.0170
Non-Ferrous	Magnesium	N	0.0014	0.0030	0.0060	0.0110	0.0120	0.0150	0.0160	0.0180	0.0200
	Aluminum ≥ 5% SI										
	Aluminum ≤ 5% SI							0.0130	0.0150	0.0160	0.0180
	Brass										
	Bronze, Copper							0.0140	0.0150	0.0170	0.0190

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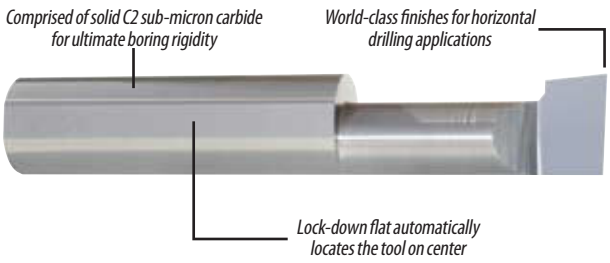
Solid Carbide Boring Bars



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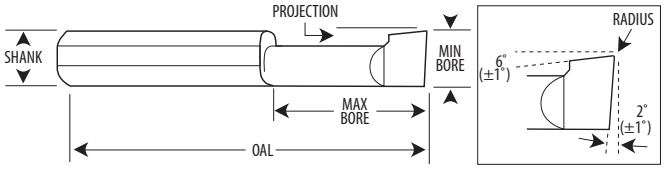

Shank Diameter Tolerance: +0.0000 / -0.0005"

Shank	Minimum Bore	OAL	Maximum Bore	Projection	Radius	Bright
			0.150	0.013	0.004	601-050150
			0.200	0.013	0.004	601-050200
			0.300	0.013	0.004	601-050300
			0.400	0.013	0.004	601-050400
			0.150	0.015	0.004	601-060150
			0.200	0.015	0.004	601-060200
			0.300	0.015	0.004	601-060300
			0.400	0.015	0.004	601-060400
			0.500	0.015	0.004	601-060500
			0.150	0.020	0.004	601-080150
			0.200	0.020	0.004	601-080200
			0.300	0.020	0.004	601-080300
			0.400	0.020	0.004	601-080400
			0.500	0.020	0.004	601-080500
1/8	0.050	1-1/2	0.600	0.020	0.004	601-080600
			0.150	0.025	0.004	601-100150
			0.200	0.025	0.004	601-100200
			0.300	0.025	0.004	601-100300
			0.400	0.025	0.004	601-100400
			0.500	0.025	0.004	601-100500
			0.600	0.025	0.004	601-100600
			0.700	0.025	0.004	601-100700
			0.150	0.028	0.004	601-110150
			0.200	0.028	0.004	601-110200
			0.300	0.028	0.004	601-110300
			0.400	0.028	0.004	601-110400
			0.500	0.028	0.004	601-110500
			0.600	0.028	0.004	601-110600
			0.700	0.028	0.004	601-110700
			0.250	0.030	0.006	601-120250
			0.350	0.030	0.006	601-120350
			0.500	0.030	0.006	601-120500
			0.600	0.030	0.006	601-120600
			0.700	0.030	0.006	601-120700
			0.800	0.030	0.006	601-120800
			0.250	0.035	0.006	601-140250
			0.400	0.035	0.006	601-140400
			0.500	0.035	0.006	601-140500
3/16	0.120	2	0.600	0.035	0.006	601-140600
			0.700	0.035	0.006	601-140700
			0.750	0.035	0.006	601-140750
			0.800	0.035	0.006	601-140800
			1.000	0.040	0.006	601-1601000
			0.250	0.040	0.006	601-160250
			0.400	0.040	0.006	601-160400
			0.500	0.040	0.006	601-160500
			0.600	0.040	0.006	601-160600
			0.750	0.040	0.006	601-160750
			0.900	0.040	0.006	601-160900
			1.000	0.045	0.006	601-1801000
			1.100	0.045	0.006	601-1801100
			1.250	0.045	0.006	601-1801250
1/4	0.180	2-1/2	1.500	0.045	0.006	601-1801500
			0.350	0.045	0.006	601-180350
			0.500	0.045	0.006	601-180500
			0.600	0.045	0.006	601-180600

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Solid Carbide Boring Bars Continued

Shank Diameter Tolerance: +0.0000 / -0.0005"

Shank	Minimum Bore	OAL	Maximum Bore	Projection	Radius	Bright
1/4	0.180	2-1/2	0.750	0.045	0.006	601-180750
			0.900	0.045	0.006	601-180900
			1.000	0.050	0.006	601-2001000
			1.100	0.050	0.006	601-2001100
			1.200	0.050	0.006	601-2001200
			1.300	0.050	0.006	601-2001300
			0.400	0.050	0.006	601-200400
			0.500	0.050	0.006	601-200500
			0.600	0.050	0.006	601-200600
			0.700	0.050	0.006	601-200700
			0.800	0.050	0.006	601-200800
			0.900	0.050	0.006	601-200900
5/16	0.230	2-1/2	1.000	0.058	0.006	601-2301000
			1.100	0.058	0.006	601-2301100
			1.150	0.058	0.006	601-2301150
			1.200	0.058	0.006	601-2301200
			1.250	0.058	0.006	601-2301250
			1.400	0.058	0.006	601-2301400
			1.500	0.058	0.006	601-2301500
			1.600	0.058	0.006	601-2301600
			0.400	0.058	0.006	601-230400
			0.500	0.058	0.006	601-230500
			0.600	0.058	0.006	601-230600
			0.700	0.058	0.006	601-230700
			0.800	0.058	0.006	601-230800
			0.900	0.058	0.006	601-230900
			1.000	0.073	0.006	601-2901000
			1.100	0.073	0.006	601-2901100
			1.250	0.073	0.006	601-2901250
			1.350	0.073	0.006	601-2901350
			1.500	0.073	0.006	601-2901500
			1.600	0.073	0.006	601-2901600
			1.750	0.073	0.006	601-2901750
			0.500	0.073	0.006	601-290500
			0.600	0.073	0.006	601-290600
			0.750	0.073	0.006	601-290750
			0.900	0.073	0.006	601-290900
3/8	0.320	2-1/2	1.000	0.080	0.006	601-3201000
			1.100	0.080	0.006	601-3201100
			1.250	0.080	0.006	601-3201250
			1.500	0.080	0.006	601-3201500
			1.600	0.080	0.006	601-3201600
			1.800	0.080	0.006	601-3201800
			0.500	0.080	0.006	601-320500
			0.600	0.080	0.006	601-320600
			0.750	0.080	0.006	601-320750
			0.900	0.080	0.006	601-320900
		4	2.000	0.080	0.006	601-3202000
			2.500	0.080	0.006	601-3202500
			3.000	0.080	0.006	601-3203000
3/8	0.320	2-1/2	1.000	0.090	0.006	601-3601000
			1.150	0.090	0.006	601-3601150
			1.250	0.090	0.006	601-3601250
			1.500	0.090	0.006	601-3601500
			1.600	0.090	0.006	601-3601600
			1.800	0.090	0.006	601-3601800
			0.500	0.090	0.006	601-360500
			0.600	0.090	0.006	601-360600
			0.750	0.090	0.006	601-360750
			0.900	0.090	0.006	601-360900
		4	2.000	0.090	0.006	601-3602000
			2.500	0.090	0.006	601-3602500
			3.000	0.090	0.006	601-3603000
1/2	0.490	3	1.000	0.123	0.006	601-4901000
			1.250	0.123	0.006	601-4901250
			1.500	0.123	0.006	601-4901500
			0.750	0.123	0.006	601-490750
		4	2.000	0.123	0.006	601-4902000
			2.500	0.123	0.006	601-4902500
			2.600	0.123	0.006	601-4902600
			2.750	0.123	0.006	601-4902750
		6	3.000	0.123	0.006	601-4903000
			3.500	0.123	0.006	601-4903500
			4.000	0.123	0.006	601-4904000
			4.500	0.123	0.006	601-4904500

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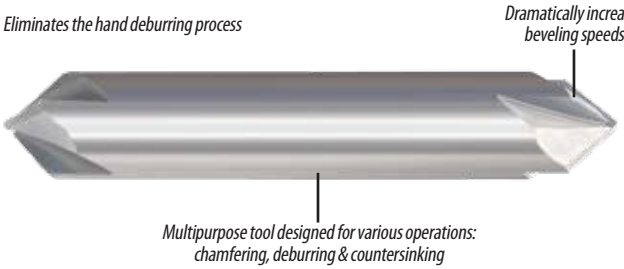
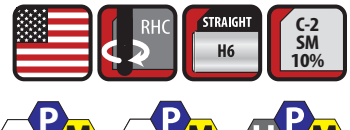
BORING RECOMMENDATIONS

Workpiece Material Group			SFM	Inches Per Tooth (IPT)
Steels	Carbon Steel	P	78-800	0.0005 - 0.0150
	High-Strength		75-600	0.0005 - 0.0150
	Heat Treated Alloys		75-250	0.0005 - 0.0150
	Powdered Metals		75-250	0.0005 - 0.0150
Tool & Die Steels		P	75-500	0.0005 - 0.0150
Stainless Steel		M	75-500	0.0005 - 0.0150
Super Alloys		S	75-300	0.0003 - 0.0100
Hardened Materials		H	60-150	0.0001 - 0.0050
Cast-Iron		K	100-850	0.0005 - 0.0250
Non-Ferrous	Alundum, Brass, Bronze	N	200-2000	0.0005 - 0.0300
	Copper		130-400	0.0005 - 0.0300
	Zinc		150-350	0.0005 - 0.0300
	Acryllics, Fiberglass, Graphites, Nylons, Phenolics, Plastics		200-1000	0.0005 - 0.0300

CHAMFER MILLLS





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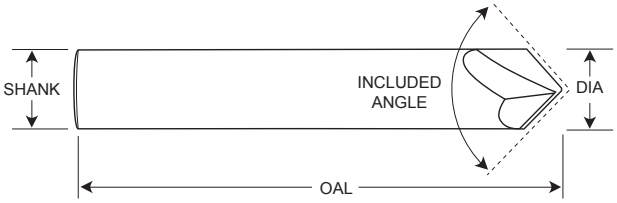
2 Flute Bright | 2 Flute AlTiN | 4 Flute



DIAMETER TOLERANCE: +0.0000 / -0.0005" SHANK TOLERANCE: +0.0000 / -0.0005" INCLUDE ANGLE ±1.0°

SINGLE END

FLUTES	DIA		Shank	OAL	Included Angle 60° Bright	60° AlTiN	82° Bright	82° AlTiN	90° Bright	90° AlTiN
2	1/8	0.1250	1/8	1-1/2	209-062125	209-062125B	209-082125	209-082125B	209-092125	209-092125B
	3/16	0.1875	3/16	2	209-062187	209-062187B	209-082187	209-082187B	209-092187	209-092187B
	1/4	0.2500	1/4	2-1/2	209-062250	209-062250B	209-082250	209-082250B	209-092250	209-092250B
	3/8	0.3750	3/8	2-1/2	209-062375	209-062375B	209-082375	209-082375B	209-092375	209-092375B
	1/2	0.5000	1/2	3	209-062500	209-062500B	209-082500	209-082500B	209-092500	209-092500B
	3/4	0.7500	3/4	3	209-062750	209-062750B	209-082750	209-082750B	209-092750	209-092750B

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CHAMFERMILLLS - SINGLE END CONTINUED

FLUTES	DIA		Shank	OAL	Included Angle 60° Bright	60° AlTiN	82° Bright	82° AlTiN	90° Bright	90° AlTiN
4	1/8	0.1250	1/8	1-1/2	209-064125	209-064125B	209-084125	209-084125B	209-094125	209-094125B
	3/16	0.1875	3/16	2	209-064187	209-064187B	209-084187	209-084187B	209-094187	209-094187B
	1/4	0.2500	1/4	2-1/2	209-064250	209-064250B	209-084250	209-084250B	209-094250	209-094250B
	3/8	0.3750	3/8	2-1/2	209-064375	209-064375B	209-084375	209-084375B	209-094375	209-094375B
	1/2	0.5000	1/2	3	209-064500	209-064500B	209-084500	209-084500B	209-094500	209-094500B
	3/4	0.7500	3/4	3	209-064750	209-064750B	209-084750	209-084750B	209-094750	209-094750B

DOUBLE END

FLUTES	DIA	Dec In	Shank	OAL	Included Angle 60° Bright	90° Bright	90° AlTiN
2	1/8	0.1250	1/8	1-1/2	209-262125	209-292125	209-292125B
	3/16	0.1875	3/16	2	209-262187	209-292187	209-292187B
	1/4	0.2500	1/4	2-1/2	209-262250	209-292250	209-292250B
	3/8	0.3750	3/8	2-1/2	209-262375	209-292375	209-292375B
	1/2	0.5000	1/2	3	209-262500	209-292500	209-292500B
4	1/8	0.1250	1/8	1-1/2	—	209-694125	209-694125B
	3/16	0.1875	3/16	2	—	209-694187	209-694187B
	1/4	0.2500	1/4	2-1/2	—	209-694250	209-694250B
	3/8	0.3750	3/8	2-1/2	—	209-694375	209-694375B
	1/2	0.5000	1/2	3	—	209-694500	209-694500B

CHAMFERING RECOMMENDATIONS

Workpiece Material Group			Surface Feet Per Minute (SFM) SFM	Inches Per Tooth (IPT) (IPT) Chamfer Mill Diameter 1/8 – 3/16"	1/4 – 5/16"	3/8 – 1/2"
Steels	Free Machining & Low/Med/High Carbon, Tool & Die Steels	P	25 – 175	0.0005	0.0010	0.0020
Stainless Steel	Easy/Moderate/Difficult to Machine	M	50 – 150	0.0003	0.0007	0.0015
Super Alloys	High Temp, Nimonics, Inconel, Monel, Hastelloy, Titanium	S	25 – 125	0.0005	0.0010	0.0015
Hardened Materials		H	25 – 100	0.0005	0.0010	0.0015
Cast-Iron	Gray, Ductile & Malleable	K	50 – 250	0.0007	0.0014	0.0021
Non-Ferrous	Aluminum	N	500 – 1000	0.0015	0.0025	0.0035
	Composites		100 – 200	0.0030	0.0060	0.0090
	Copper		400 – 800	0.0010	0.0020	0.0030
	Magnesium		400 – 700	0.0015	0.0025	0.0035
	Plastics		150 – 300	0.0020	0.0030	0.0040

CONICAL ENGRAVING CUTTERS

C-2 SM 10% GRD

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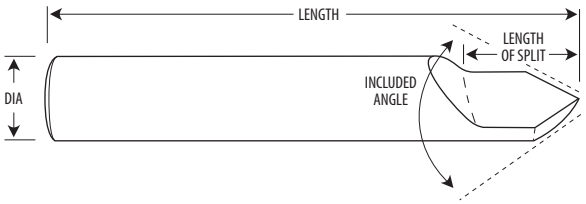
Also known as single flute end mills

Optional double-end geometry offers avenue for additional tooling cost savings

Economical alternative for cutting non-ferrous materials like plastics and phenolics

Along with engraving and marking, also well suited for shallow cutting operations



SINGLE END

DIAMETER TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	Length	Length of Split	Included Angle 30° Bright	Included Angle 60° Bright	Included Angle 90° Bright
1/8	0.1250	1-1/2	3/8	713-125150	716-125150	719-125150
3/16	0.1875	2	7/16	713-187200	716-187200	719-187200
1/4	0.2500	2-1/2	1/2	713-250250	716-250250	719-250250
5/16	0.3125	2-1/2	1/2	713-312250	716-312250	719-312250
3/8	0.3750	2-1/2	1/2	713-375250	716-375250	719-375250
1/2	0.5000	3	5/8	713-500300	716-500300	719-500300

DOUBLE END

DIAMETER TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	Length	Length of Split	Included Angle 30° Bright	Included Angle 60° Bright	Included Angle 90° Bright
1/8	0.1250	1-1/2	3/8	—	—	729-125150
		2	3/8	723-125150	726-125150	—
		3	3/8	723-125300	726-125300	729-125300
3/16	0.1875	2	7/16	723-187200	726-187200	729-187200
		3	7/16	723-187300	726-187300	729-187300
1/4	0.2500	2-1/2	1/2	723-250250	726-250250	729-250250
		4	1/2	723-250400	726-250400	729-250400
5/16	0.3125	2-1/2	1/2	723-312250	726-312250	729-312250
		4	1/2	723-312400	726-312400	729-312400
3/8	0.3750	2-1/2	1/2	723-375250	726-375250	729-375250
		4	1/2	723-375400	726-375400	729-375400
1/2	0.5000	3	5/8	723-500300	726-500300	729-500300
		4	5/8	723-500400	726-500400	729-500400

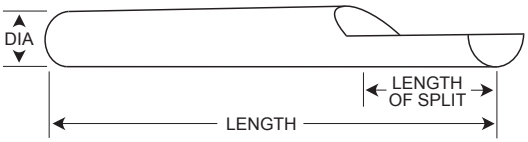
ENGRAVING RECOMMENDATIONS

Workpiece Material Group	RPM	Inches Per Minute (IPM)
Steels (P)	2500 - 5000	02 - 08
	5000 - 10000	08 - 14
Stainless Steels (M)	2500 - 5000	02 - 05
	5000 - 10000	05 - 10
Super Alloys (S)	2500 - 5000	02 - 05
	5000 - 10000	05 - 10
Hardened Materials (H)	2500 - 5000	02 - 05
	5000 - 10000	05 - 10
Cast Iron (K)	2500 - 5000	03 - 08
	5000 - 10000	08 - 14
Non-Ferrous (N)	2500 - 5000	05 - 10
	5000 - 10000	10 - 15

SPLIT END BLANKS

C-2 SM 10% GRD

Offers a solution for custom engraving and specialized marking



DIAMETER TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	Length	Length of Split	Single End Ground	Double End Ground
1/8	0.1250	1-1/2	3/8	710-125150	720-125150
		2	3/8	710-125200	720-125200
		3	3/8	710-125300	720-125300
		4	3/8	710-125400	720-125400
		6	3/8	710-125600	720-125600
3/16	0.1875	2	1/2	710-187200	720-187200
		2-1/2	1/2	710-187250	720-187250
		3	1/2	710-187300	720-187300
		4	1/2	710-187400	720-187400
		6	1/2	710-187600	720-187600
1/4	0.2500	2	1/2	710-250200	720-250200
		2-1/2	1/2	710-250250	720-250250
		3	1/2	710-250300	720-250300
		4	1/2	710-250400	720-250400
		6	1/2	710-250600	720-250600
5/16	0.3125	2-1/2	1/2	710-312250	720-312250
		3	1/2	710-312300	720-312300
		4	1/2	710-312400	720-312400
		6	1/2	710-312600	720-312600
3/8	0.3750	2-1/2	1/2	710-375250	720-375250
		3	1/2	710-375300	720-375300
		4	1/2	710-375400	720-375400
		6	1/2	710-375600	720-375600
7/16	0.4375	2-1/2	5/8	710-437250	720-437250
		3	5/8	710-437300	720-437300
		4	5/8	710-437400	720-437400
		6	5/8	710-437600	720-437600
1/2	0.5000	3	5/8	710-500300	720-500300
		4	5/8	710-500400	720-500400
		6	5/8	710-500600	720-500600

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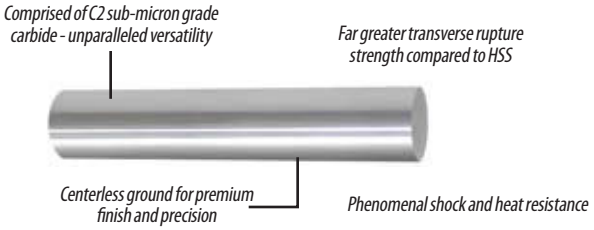
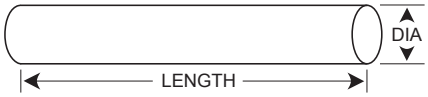
CARBIDE ROD SHORT ROUNDS

C-2 SM 10% GRD





DIAMETER TOLERANCE: +0.0000 / -0.0005"

Style	DIA	Dec In	Length	Ground
SR-44			1/2	702-000300
SR-46	1/8	0.1250	3/4	702-000400
SR-48			1	702-000500
SR-55	5/32	0.1562	5/8	702-000600
SR-63			3/8	702-000700
SR-64			1/2	702-000800
SR-65	3/16	0.1875	5/8	702-000890
SR-66			3/4	702-000900
SR-68			1	702-000950
SR-69			1-1/8	702-001000
SR-77	7/32	0.2188	7/8	702-001100
SR-84			1/2	702-001190
SR-86			3/4	702-001195
SR-88			1	702-001200
SR-810	1/4	0.2500	1-1/4	702-001300
SR-812			1-1/2	702-001400
SR-814			1-3/4	702-001500
SR-1010	5/16	0.3125	1-1/4	702-001600
SR-1210	3/8	0.3750	1-1/2	702-001700
SR-1610	1/2	0.5000	1-1/2	702-001800

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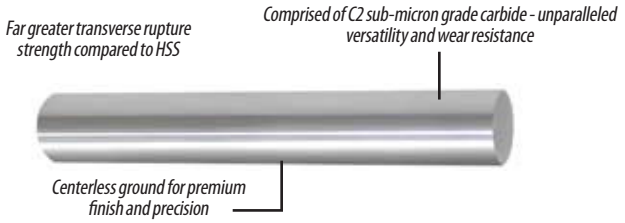
CARBIDE ROD ROUND TOOL BLANKS

C-2 SM 10% GRD



CENTERLESS GROUND

DIAMETER TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	Length	Ground
.025	0.0250	1-1/2	701-001000
1/32	0.0312	1-1/2	701-001150
3/64	0.0469	1-1/2	701-001350
		2	701-001450
1/16	0.0625	1-1/2	701-001550
		3	701-001595
5/64	0.0781	2	701-001750
3/32	0.0938	1-1/2	701-001850
		2	701-001950
		2-1/2	701-002050
		3	701-002055
7/64	0.1094	2	701-002250
		2-1/2	701-002350
1/8	0.1250	1	701-002370
		1-1/8	701-002375
		1-1/4	701-002380
		1-1/2	701-002450
		1-3/4	701-002455
		2	701-002550
		2-1/8	701-002575
		2-1/4	701-002650
		2-1/2	701-002750
		3	701-002850
		4	701-002950
		6	702-005900
5/32	0.1562	1-1/2	701-003050
		2	701-003053
		2-1/2	701-003066
3/16	0.1875	1-1/2	701-003250
		2	701-003350
		2-1/2	701-003550
		2-3/4	701-003585
		3	701-003650
		4	701-003750
		6	702-006300
1/4	0.2500	2	701-003850
		2-1/4	701-003950
		2-1/2	701-004050
		3	701-004150
		4	701-004250
		6	702-006750

DIA	Dec In	Length	Ground
5/16	0.3125	2	701-004350
		2-1/8	701-004360
		2-1/2	701-004450
		3	701-004550
		3-1/4	701-004551
		4	701-004650
		6	702-007150
3/8	0.3750	1-1/2	701-004690
		2	701-004750
		2-1/2	701-004850
		3	701-004950
		3-1/8	701-004959
		3-1/2	701-005050
		4	701-005150
		6	701-005250
7/16	0.4375	2-1/2	701-005350
		2-3/4	701-005450
		3	701-005490
		4	701-005550
		6	701-005650
1/2	0.5000	2	701-005750
		2-1/2	701-005850
		3	701-005950
		3-1/2	701-005975
		4	701-006050
		6	701-006150
9/16	0.5625	3-1/2	701-006250
		6	702-007850
5/8	0.6250	3	701-006280
		3-1/2	701-006350
		4	701-006355
		5	701-006450
		6	701-006550
3/4	0.7500	3	701-006690
		3-1/2	701-006696
		4	701-006750
		5	701-006850
		6	701-006950
		7	701-007050
7/8	0.8750	4	701-007150
		6	702-008150
1	1.0000	4	701-007250
		5	701-007350
		6	701-007450
		7	701-007550

CARBIDE ROD 12" LENGTH

C-2 SM 10%

Comprised of C2 sub-micron grade carbide - unparalleled versatility and wear resistance

Far greater transverse rupture strength compared to HSS

Select unground to apply your own finish and diameter tolerance
Choose centerless ground for premium finish and precision

CENTERLESS GROUND

DIAMETER TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	Length	Ground
1/32	0.0312	12	702-100200
3/64	0.0469	12	702-100350
1/16	0.0625	12	702-100450
5/64	0.0781	12	702-100550
3/32	0.0938	12	702-100650
7/64	0.1094	12	702-100750
1/8	0.1250	12	702-100900
9/64	0.1406	12	702-101000
5/32	0.1562	12	702-101100
11/64	0.1719	12	702-101200
3/16	0.1875	12	702-101300
13/64	0.2031	12	702-101450
7/32	0.2188	12	702-101550
15/64	0.2344	12	702-101650
1/4	0.2500	12	702-101750
17/64	0.2656	12	702-101850
9/32	0.2812	12	702-101950
19/64	0.2969	12	702-102050
5/16	0.3125	12	702-102150
21/64	0.3281	12	702-102250
11/32	0.3438	12	702-102350
23/64	0.3594	12	702-102450
3/8	0.3750	12	702-102550
25/64	0.3906	12	702-102650
13/32	0.4062	12	702-102750
27/64	0.4219	12	702-102770
7/16	0.4375	12	702-102850
29/64	0.4531	12	702-102890
15/32	0.4688	12	702-102950
31/64	0.4844	12	702-102995
1/2	0.5000	12	702-103050
17/32	0.5312	12	702-103080
9/16	0.5625	12	702-103150
5/8	0.6250	12	702-103250
11/16	0.6875	12	702-103350
3/4	0.7500	12	702-103450
13/16	0.8125	12	702-103550
7/8	0.8750	12	702-103650
1	1.0000	12	702-103850

UNGROUND

DIA	Dec In	Length	Unground
1/32	0.0312	12	702-100150
3/64	0.0469	12	702-100300
1/16	0.0625	12	702-100400
5/64	0.0781	12	702-100500
3/32	0.0938	12	702-100600
7/64	0.1094	12	702-100700
1/8	0.1250	12	702-100850
9/64	0.1406	12	702-100950
5/32	0.1562	12	702-101050
11/64	0.1719	12	702-101150
3/16	0.1875	12	702-101250
13/64	0.2031	12	702-101400
7/32	0.2188	12	702-101500
15/64	0.2344	12	702-101600
1/4	0.2500	12	702-101700
17/64	0.2656	12	702-101800
9/32	0.2812	12	702-101900
19/64	0.2969	12	702-102000
5/16	0.3125	12	702-102100
21/64	0.3281	12	702-102200
11/32	0.3438	12	702-102300
23/64	0.3594	12	702-102400
3/8	0.3750	12	702-102500
25/64	0.3906	12	702-102600
13/32	0.4062	12	702-102700
27/64	0.4219	12	702-102760
7/16	0.4375	12	702-102800
29/64	0.4531	12	702-102880
15/32	0.4688	12	702-102900
31/64	0.4844	12	702-102990
1/2	0.5000	12	702-103000
17/32	0.5312	12	702-103070
9/16	0.5625	12	702-103100
5/8	0.6250	12	702-103200
11/16	0.6875	12	702-103300
3/4	0.7500	12	702-103400
13/16	0.8125	12	702-103500
7/8	0.8750	12	702-103600
1	1.0000	12	702-103800

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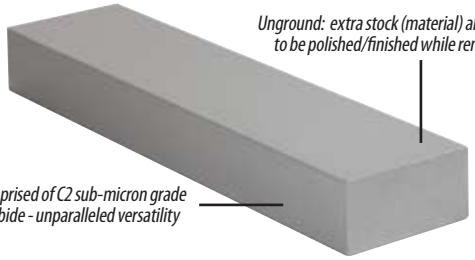
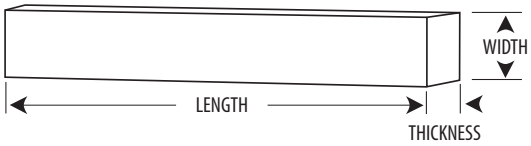
STB & STBL
CARBIDE STRIPS

C-2 SM 10%

UNGRD + Grind Stock



Far greater transverse rupture strength compared to HSS



Used as shims or raw material for custom part & tool making

MINIMUM GRIND STOCK; THICKNESS: +0.008" WIDTH: +0.012" LENGTH +0.008"

Style	Thickness	Dec In	Width	Length	Unground
STB-12	1/32	0.0312	1/16	1	777-001038
STB-12A				1-1/2	777-001039
STB-13A	3/64	0.0469	3/32	13/16	777-001041
STB-13				1	777-001040
STB-22L	1/16	0.0625	1/16	6	777-001042
STB-24A	1/16	0.0625	1/8	1	777-001047
STB-24C				1-1/4	777-001047E
STB-24D				1-1/2	777-001047F
STB-24B				3	777-001047B
STB-24L				6	777-001047G
STB-26A	1/16	0.0625	3/16	1	777-001048
STB-26C				3	777-001048C
STB-26L				6	777-001048H
STB-28A	1/16	0.0625	1/4	1	777-001059
STB-28B				1-1/4	777-001059A
STB-28D				3	777-001060
STB-28L				6	777-001061
STB-210L	1/16	0.0625	5/16	6	777-001062
STB-212L			3/8		777-001067
STB-216L			1/2		777-001067A
STB-220L			5/8		777-001067B
STB-224L			3/4		777-001067C
STB-232L			1		777-001067D
STB-14	5/64	0.0781	1/8	1-1/8	777-001045
STB-34	3/32	0.0938	1/8	5	777-001068
STB-34L				8	777-001068A
STB-36	3/32	0.1250	3/16	1-1/8	777-001064
STB-36A				1-1/4	777-001069
STB-36L				8	777-001069A
STB-38A	3/32	0.1250	1/4	1	777-001050C
STB-38B				1-1/2	777-001050D
STB-38D				5	777-001050
STB-38L				8	777-001050E
STB-310A	3/32	0.1250	5/16	2	777-001065
STB-310B				3	777-001065A
STB-310C				5	777-001066
STB-310L				8	777-001066C
STB-312	3/32	0.1250	3/8	5	777-001070
STB-312C				6	777-001070D
STB-312L				8	777-001070C

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STB STRIPS CONTINUED

MINIMUM GRIND STOCK; THICKNESS: +0.008" WIDTH: +0.012" LENGTH +0.008"

Style	Thickness	Dec In	Width	Length	Unground
STB-316	3/32	0.1250	1/2	6	777-001072
STB-316L				8	777-001072A
STB-320	3/32	0.1250	5/8	6	777-001079
STB-320L				8	777-001079A
STB-324	3/32	0.1250	3/4	6	777-001073
STB-328			7/8		777-001074
STB-332			1		777-001076
STB-336			1-1/8		777-001077
STB-340			1-1/4		777-001078
STB-348			1-1/2		777-001080
STB-44L	1/8	0.1250	1/8	12	777-001083
STB-46	1/8	0.1250	3/16	6	777-001086
STB-46L				12	777-001086A
STB-48A	1/8	0.1250	1/4	1	777-001052C
STB-48B				1-1/4	777-001052D
STB-48F				1-1/2	777-001052E
STB-48C				2-1/4	777-001052F
STB-48D				3	777-001052G
STB-48E				6	777-001052H
STB-48L				12	777-001052I
STB-410A	1/8	0.1250	5/16	1-1/2	777-001080E
STB-410B				3	777-001080F
STB-410				6	777-001080B
STB-410L				12	777-001080G
STB-412D	1/8	0.1250	3/8	1	777-001082
STB-412A				2	777-001081D
STB-412B				3	777-001081
STB-412C				6	777-001082A
STB-412L				12	777-001082E
STB-416A	1/8	0.1250	1/2	1	777-001085
STB-416B				1-1/2	777-001090
STB-416C				3	777-001087
STB-416				6	777-001084
STB-416L				12	777-001084A
STB-420	1/8	0.1250	5/8	6	777-001091
STB-420L				12	777-001091A
STB-424	1/8	0.1250	3/4	6	777-001095
STB-424L				12	777-001095A
STB-428	1/8	0.1250	7/8	6	777-001096
STB-432	1/8	0.1250	1	6	777-001055
STB-432L				12	777-001055A
STB-436	1/8	0.1250	1-1/8	6	777-010555
STB-440			1-1/4		777-0140554
STB-448			1-1/2		777-010553
STB-456			1-3/4		777-010552
STB-512C	5/32	0.1562	3/8	6	777-010551
STB-516			1/2		777-010550
STB-520			5/8		777-010549
STB-524			3/4		777-010548
STB-528			7/8		777-010547
STB-532			1		777-010546
STB-536			1-1/8		777-010545
STB-540			1-1/4		777-010544
STB-544			1-3/8		777-010543
STB-548			1-1/2		777-010542
STB-564			2		777-010541

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STB STRIPS CONTINUED

MINIMUM GRIND STOCK; THICKNESS: +0.008" WIDTH: +0.012" LENGTH +0.008"

Style	Thickness	Dec In	Width	Length	Unground
STB-66L	3/16	0.1875	3/16	12	777-001056
STB-68A				3	777-001058B
STB-68	3/16	0.1875	1/4	6	777-001058
STB-68L				12	777-001058A
STB-610A				3	777-001115
STB-610	3/16	0.1875	5/16	6	777-001116
STB-610L				12	777-001117
STB-612A				3	777-001100A
STB-612	3/16	0.1875	3/8	6	777-001100
STB-612L				12	777-001100B
STB-616A				3	777-001110
STB-616	3/16	0.1875	1/2	6	777-001110A
STB-616L				12	777-001110B
STB-620A				3	777-001057A
STB-620	3/16	0.1875	5/8	6	777-001057
STB-620L				12	777-001057B
STB-624B				2	777-001051B
STB-624A	3/16	0.1875	3/4	4	777-001051A
STB-624				6	777-001051
STB-624L				12	777-001051C
STB-628	3/16	0.1875	7/8	6	777-001151
STB-632			1	6	777-001114A
STB-632L				12	777-001114
STB-640	3/16	0.1875	1-1/4	6	777-001113A
STB-640L				12	777-001113
STB-648			1-1/2	6	777-010113
STB-88L			1/4	12	777-001450
STB-812A	1/4	0.2500	3/8	3	777-001190
STB-812				6	777-001188
STB-812L				12	777-001190A
STB-816C				2	777-001195C
STB-816A				3	777-001195A
STB-816B	1/4	0.2500	1/2	4	777-001195B
STB-816				6	777-001195
STB-816L				12	777-001195D
STB-820A				3	777-001210B
STB-820	1/4	0.2500	5/8	6	777-001210
STB-820L				12	777-001210A
STB-824A				3	777-001290A
STB-824	1/4	0.2500	3/4	6	777-001290
STB-824L				12	777-001290B
STB-832	1/4	0.2500	1	6	777-001350
STB-832L				12	777-001400
STB-840L	1/4	0.2500	1-1/4	12	777-001420
STB-1010L	5/16	0.3125	5/16	12	777-001427
STB-1212L	3/8	0.3750	3/8	12	777-001421
STB-1216L			1/2		777-001422
STB-1224L			3/4		777-001423
STB-1232L			1		777-001424
STB-1616L	1/2	0.5000	1/2	12	777-001425
STB-1624L			3/4		777-001426

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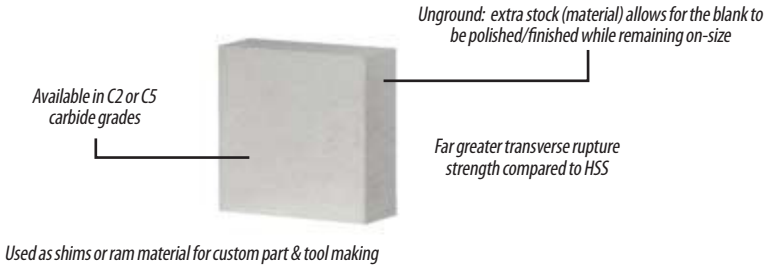
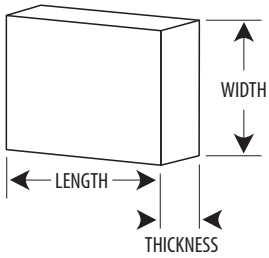
SERIES 1000
UNGROUND BLANKS

UNGRD + Grind Stock





MINIMUM GRIND STOCK;
THICKNESS FROM ≤ 5/16: +0.004 TO +0.015" THICKNESS ≥ 3/8: +0.006 TO +0.020

C-2 SM 10%

C-5 MED 8%

Style	Thickness	Dec In	Width	Length	C-2 Grade	C-5 Grade
1010	1/16	0.0625	1/8	5/8	700-007001	700-007001A
1020			3/16	1/4	700-007005	700-007005A
1030			1/4	5/16	700-007010	700-007010A
1040	3/32	0.0938	3/16	5/16	700-007012	700-007012A
1050				1/2	700-007012B	700-007012C
1060	3/32	0.0938	1/4	3/8	700-007011	700-007011A
1070				1/2	700-007013	700-007013A
1080	3/32	0.0938	5/16	3/8	700-007014	700-007014A
1090	3/32	0.0938	3/8	3/8	700-007016	700-007017
1100				1/2	700-007020	700-007020A
1105	3/32	0.0938	7/16	1/2	700-007030	700-007032
1110	1/8	0.1250	3/16	3/4	700-007035	700-007035A
1120	1/8	0.1250	1/4	1/2	700-007055	700-007056
1130				5/8	700-007057	700-007057A
1140				3/4	700-007049A	700-007049
1150	1/8	0.1250	5/16	7/16	700-007050	—
1160				1/2	700-007059	700-007060
1170				5/8	700-007070	—
1180	1/8	0.1250	3/8	1/2	700-007080	700-007081
1190				3/4	700-007082	700-007083
1200	1/8	0.1250	1/2	1/2	700-007084	700-007085
1210				3/4	700-007086	700-007087
1215	1/8	0.1250	3/4	3/4	700-007088	700-007088A
1220	5/32	0.1562	3/8	9/16	700-007089	—
1230				3/4	700-007098A	—
1240	5/32	0.1562	5/8	5/8	700-007099	—

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SERIES 1000 CONTINUED

MINIMUM GRIND STOCK;
THICKNESS FROM ≤ 5/16: +0.004 TO +0.015" THICKNESS ≥ 3/8: +0.006 TO +0.020

C-2 SM 10%

C-5 MED 8%

Style	Thickness	Dec In	Width	Length	C-2 Grade	C-5 Grade
1250	3/16	0.1875	5/16	7/16	700-007099A	700-007099D
1260				5/8	700-007099B	700-007099C
1270	3/16	0.1875	3/8	1/2	700-007091	700-007093
1280				5/8	700-007092	—
1290				3/4	700-007090	700-007100
1300	3/16	0.1875	7/16	5/8	700-007110	—
1310				13/16	700-007150	700-007150A
1320	3/16	0.1875	1/2	1/2	700-007160	700-007160A
1330				3/4	700-007180	700-007180A
1340	3/16	0.1875	3/4	3/4	700-007190	700-007190A
1350	1/4	0.2500	3/8	9/16	700-007200	—
1360				3/4	700-007200A	—
1370	1/4	0.2500	7/16	5/8	700-007311	—
1380	1/4	0.2500	1/2	3/4	700-007203	700-007204
1390	1/4	0.2500	9/16	1	700-007202	—
1400	1/4	0.2500	5/8	5/8	700-007208	—
1405	1/4	0.2500	3/4	3/4	700-007208B	—
1410				1	700-007201	700-007206
1430	5/16	0.3125	7/16	15/16	700-007312	—
1440	5/16	0.3125	1/2	3/4	700-007209	—
1450				1	700-007313	—
1460	5/16	0.3125	5/8	1	700-007314	—
1470	5/16	0.3125	3/4	3/4	700-007315	—
1475				1	700-007317	—
1480				1-1/4	700-007316	—
1490	3/8	0.3750	1/2	3/4	700-007209B	—
1500				1	700-007209C	—
1510	3/8	0.3750	5/8	1	700-007318	—
1520	3/8	0.3750	3/4	1-1/4	700-007319	—
1525				1-1/2	700-007320	—
1530	1/2	0.5000	3/4	1	700-007321	—
1540				1-1/4	700-007322	—
1550				1-1/2	700-007323	—

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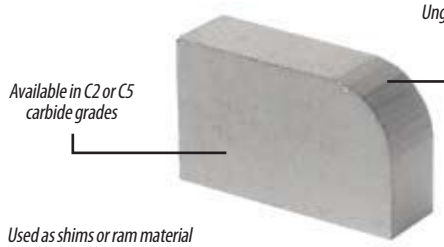
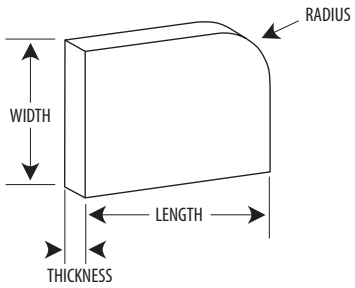
SERIES 2000
UNGROUND BLANKS

UNGRD + Grind Stock





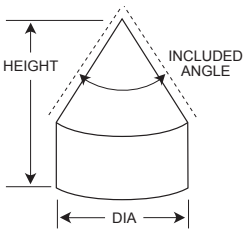
MINIMUM GRIND STOCK;
THICKNESS FROM ≤ 5/16: +0.004 TO +0.015" THICKNESS ≥ 3/8: +0.006 TO +0.020

C-2 SM 10%

C-5 MED 8%

Style	Thickness	Dec In	Width	Length	Radius	C-2 Grade	C-5 Grade
2010	1/16	0.0625	1/8	5/8	1/8	700-007208A	—
2020	1/16	0.0625	3/16	1/4	1/8	700-007209A	700-007209D
2030	1/16	0.0625	1/4	5/16	1/8	700-007210	700-007210A
2040	3/32	0.0938	3/16	5/16	1/8	700-007211	700-007211A
2050				1/2	1/8	700-007213	700-007214
2060	3/32	0.0938	1/4	3/8	1/8	700-007215	700-007216
2070				1/2	1/8	700-007218	700-007219
2080	3/32	0.0938	5/16	3/8	3/16	700-007220	—
2090	3/32	0.0938	3/8	3/8	3/16	700-007221	—
2100				1/2	3/16	700-007226	700-007226A
2105	3/32	0.0938	7/16	1/2	1/4	700-007228	700-007728.5
2110	1/8	0.1250	3/16	3/4	1/8	700-007230	700-007231
2120	1/8	0.1250	1/4	1/2	1/8	700-007232	700-007232A
2130				5/8	1/8	700-007233	700-007234
2140				3/4	1/8	700-007235	700-007235A
2150	1/8	0.1250	5/16	7/16	3/16	700-007236	—
2160				1/2	3/16	700-007237	—
2170				5/8	3/16	700-007241	700-007242
2180	1/8	0.1250	3/8	1/2	3/16	700-007243	700-007244
2190				3/4	3/16	700-007245B	700-007245A
2200	1/8	0.1250	1/2	1/2	1/4	700-007247	700-007247B
2210				3/4	1/4	700-007260	700-007265
2215	1/8	0.1250	3/4	3/4	1/4	700-007270	700-007275
2220	5/32	0.1562	3/8	9/16	3/16	700-007276	—
2230				3/4	3/16	700-007280	—
2240			5/8	5/8	1/4	700-007282	—
2250	3/16	0.1875	5/16	7/16	3/16	700-007284	—
2260				5/8	3/16	700-007290	—
2270	3/16	0.1875	3/8	1/2	3/16	700-007292	—
2280				5/8	3/16	700-007294	—
2290				3/4	3/16	700-007300	—
2300	3/16	0.1875	7/16	5/8	1/4	700-007302	—
2310				13/16	1/4	700-007304	700-007304A
2320	3/16	0.1875	1/2	1/2	1/4	700-007306	700-007306A
2330				3/4	1/4	700-007308	700-007308A
2340	3/16	0.1875	3/4	3/4	1/4	700-007310	—

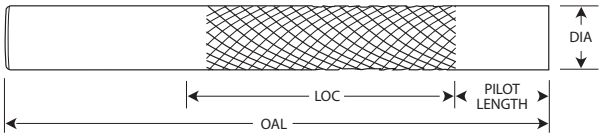
CENTER TIPS



DIAMETER TOLERANCE: +0.0000 / -0.0005" INCLUDE ANGLE ±1.0°

Style	DIA	Dec In	Height	Included Angle	C-2 Grade
CT-40	1/4	0.2500	7/16	60°	716-000001
CT-50	5/16	0.3125	9/16	60°	716-000002
CT-60	3/8	0.3750	11/16	60°	716-000003
CT-80	1/2	0.5000	7/8	60°	716-000004
CT-100	5/8	0.6250	1-1/16	60°	716-000005
CT-120	3/4	0.7500	1-1/4	60°	716-000006
CT-140	7/8	0.8750	1-3/8	60°	716-000007
CT-160	1	1.0000	1-1/2	60°	716-000008
CT-200	1-1/4	1.2500	1-3/4	60°	716-000009

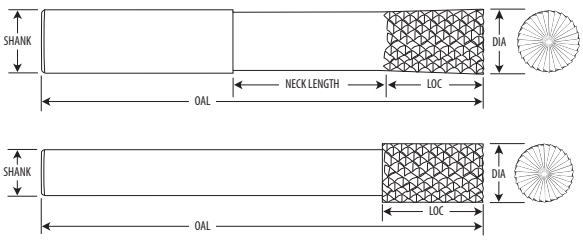
PILOTED DIE TRIMMERS



SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	Pilot Length	OAL	Bright
1/8	0.1250	1	1/8	1/2	2-1/2	310-006998
					3	310-006997
3/16	0.1875	1	3/16	1/2	2-1/2	310-006995
1/4	0.2500	1	1/4	1/2	2-1/2	310-006999
					3	310-006996
3/8	0.3750	1	3/8	1/2	2-1/2	310-007001
1/2	0.5000	1	1/2	1/2	3	310-007002

INTERNAL GRIND TOOLS



DIAMETER TOLERANCE: +0.002 / -0.000" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	Neck Length	OAL	Bright
.030	0.0300	3/32	1/8	1/8	1-1/2	312-708030
.040	0.0400	3/32	1/8	3/16	1-1/2	312-708040
.050	0.0500	1/8	1/8	1/4	1-1/2	312-708050
1/16	0.0625	1/8	1/8	3/8	1-1/2	312-708062
5/64	0.0781	5/32	1/8	3/8	1-1/2	312-708078
3/32	0.0938	5/32	1/8	3/8	1-1/2	312-708093
7/64	0.1094	3/16	1/8	1/2	1-1/2	312-708110
1/8	0.1250	3/16	1/8	1/2	1-1/2	312-708125
9/64	0.1406	7/32	3/16	5/8	2	312-708141
5/32	0.1562	7/32	3/16	5/8	2	312-708156
11/64	0.1719	1/4	3/16	5/8	2	312-708172
3/16	0.1875	1/4	3/16	5/8	2	312-708187
13/64	0.2031	9/32	1/4	3/4	2	312-708203
7/32	0.2188	9/32	1/4	3/4	2	312-708218
15/64	0.2344	5/16	1/4	3/4	2	312-708235
1/4	0.2500	5/16	1/4	3/4	2	312-708250
9/32	0.2812	11/32	1/4	—	2-1/2	312-708281
5/16	0.3125	11/32	1/4	—	2-1/2	312-708312
11/32	0.3438	3/8	1/4	—	2-1/2	312-708343
3/8	0.3750	3/8	1/4	—	2-1/2	312-708375
1/2	0.5000	3/8	3/8	—	3-1/2	312-708500

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SA - CYLINDER SHAPE
NO END CUT

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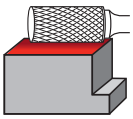
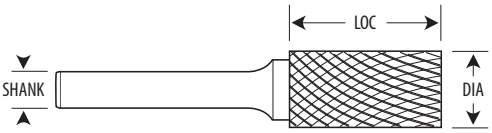


RHC RHS | C-2 SM 10% | SINGLE END TOOL | Bright



L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut	Aluma Cut
SA-41 †					310-001002	310-002002	
SA-41 L2 †	1/16	0.0625	1/4	1/8	310-001002B	310-002002B	
SA-41 L3 †					310-00100C	310-002002C	
SA-61	1/16	0.0625	1/4	3/32	310-001001	310-002001	
SA-42 †					310-001004	310-002004	
SA-42 L2 †	3/32	0.0938	7/16	1/8	310-001004B	310-002004B	
SA-42 L3 †					310-001004A	310-002004A	
SA-63	3/32	0.0938	3/8	3/32	310-001007	310-002007	
SA-11	1/8	0.1250	1/2	1/4	310-001005C	310-002005C	
SA-12	1/8	0.1250	5/8	1/4	310-001005D	310-002005D	
SA-43 †					310-001006	310-002006	
SA-43 L2 †	1/8	0.1250	9/16	1/8	310-006025	310-006050	
SA-43 L3 †					310-002631	310-002006A	
SA-13	5/32	0.1562	5/8	1/4	310-001009	310-002009C	
SA-52	5/32	0.1562	1/2	1/8	310-001008	310-002008	
SA-14	3/16	0.1875	5/8	1/4	310-001012C	310-002012C	
SA-53	3/16	0.1875	1/2	1/8	310-001010	310-002010	
SA-81	3/16	0.1875	5/8	3/16	310-001011	310-002011	
SA-1 L6 ‡			1/2	1/4	310-002601	310-002701	
SA-1	1/4	0.2500	5/8	1/4	310-001017C	310-002017C	
SA-1NF							310-002518
SA-1L			1	1/4	310-001936	310-002936	
SA-50	1/4	0.2500	3/16	1/8	310-001013	310-002013	
SA-51	1/4	0.2500	1/2	1/8	310-001015	310-002015	
SA-2	5/16	0.3125	3/4	1/4	310-001018	310-002018	
SA-3					310-001019	310-002019	
SA-3 L6 ‡			3/4	1/4	310-002602	310-002702A	
SA-3NF	3/8	0.3750					310-002500
SA-3L			1	1/4	310-001937	310-002937	
SA-3X			1-1/2	1/4	310-001702X	310-002702X	
SA-4	7/16	0.4375	1	1/4	310-001020	310-002020	
SA-5					310-001021	310-002021	
SA-5 L6 ‡	1/2	0.5000	1	1/4	310-002603	310-002703	
SA-5NF							310-002501
SA-6	5/8	0.6250	1	1/4	310-001022	310-002022	
SA-6NF							310-002502
SA-15	3/4	0.7500	1/2	1/4	310-001023	310-002023	
SA-16	3/4	0.7500	3/4	1/4	310-001024	310-002024	
SA-7	3/4	0.7500	1	1/4	310-001025	310-002025	
SA-7NF							310-002539
SA-8	7/8	0.8750	1	1/4	310-001025A	310-002025A	
SA-9	1	1.0000	1	1/4	310-001026	310-002026	

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SB - CYLINDER SHAPE WITH END CUT

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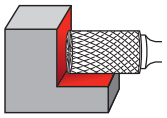

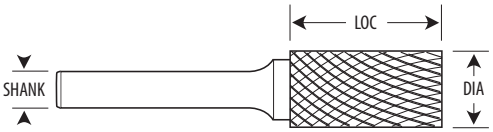

L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

DE = Double End Tool
ECO = End Cut Only

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut	Aluma Cut
SB-41 †					310-001031	310-002031	
SB-41 L2 †	1/16	0.0625	1/4	1/8	310-001056	310-002056	
SB-41 L3 †					310-001057	310-002057	
SB-ECO DE	3/32	0.0938	—	1/8	310-002390		
SB-42 †					310-001033	310-002033	
SB-42 L2 †	3/32	0.0938	7/16	1/8	310-001033A	310-002033A	
SB-42 L3 †					310-001033B	310-002033B	
SB-11	1/8	0.1250	1/2	1/4	310-001034C	310-002034C	
SB-43 †					310-001035	310-002035	
SB-43 L2 †	1/8	0.1250	9/16	1/8	310-001035E	310-002035A	
SB-43 L3 †					310-001036A	310-002036A	
SB-12	1/8	0.1250	5/8	1/4	310-001029	310-002029	
SB-13	5/32	0.1562	5/8	1/4	310-001038C	310-002038C	
SB-14	3/16	0.1875	5/8	1/4	310-001041C	310-002041	
SB-ECO DE	1/4	0.2500	—	1/4	310-002400		
SB-51	1/4	0.2500	3/16	1/8	310-001044	310-002044	
SB-51A			1/2	1/8	310-001044A	310-002044AA	
SB-1 L6 ‡	1/4	0.2500	1/2	1/4	310-001027	310-002027A	
SB-1					310-001046C	310-002046C	
SB-1NF	1/4	0.2500	5/8	1/4			310-002546
SB-1L					310-001968	310-002938	
SB-2	5/16	0.3125	3/4	1/4	310-001047	310-002048	
SB-3					310-001048	310-002047	
SB-3 L6 ‡			3/4	1/4	310-002941	310-002941A	
SB-3NF	3/8	0.3750					310-002588
SB-3L			1	1/4	310-001939	310-002939	
SB-3X			1-1/2	1/4	310-001048A	310-002047X	
SB-4	7/16	0.4375	1	1/4	310-001049	310-002049	
SB-5NF					310-001055	310-002055	
SB-5	1/2	0.5000	1	1/4	310-004299	310-004300	
SB-5 L6 ‡							310-002589
SB-6	5/8	0.6250	1	1/4	310-001050	310-002050	
SB-6NF							310-002590
SB-15	3/4	0.7500	1/2	1/4	310-001051	310-002051	
SB-16	3/4	0.7500	3/4	1/4	310-001052	310-002052	
SB-7	3/4	0.7500	1	1/4	310-001053	310-002053	
SB-7NF							310-002591
SB-8	7/8	0.8750	1	1/4	310-001053A	310-002053A	
SB-9	1	1.0000	1	1/4	310-001054	310-002054	

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SC - CYLINDER SHAPE RADIUS END

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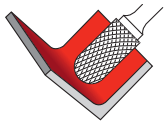
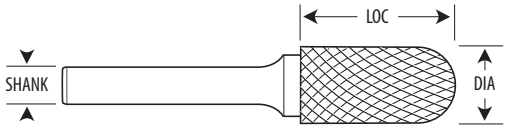


RHC RHS | C-2 SM 10% | SINGLE END TOOL | Bright



L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut	Aluma Cut
SC-61	3/32	0.0938	3/8	3/32	310-001060	310-002060	
SC-41 †	3/32	0.0938	7/16	1/8	310-001061	310-002061	
SC-11	1/8	0.1250	1/2	1/4	310-001062C	310-002062C	
SC-42 †					310-001063	310-002063	
SC-42 L2 †	1/8	0.1250	9/16	1/8	310-006075	310-006100	
SC-42 L3 †					310-001063A	310-002732	
SC-12	1/8	0.1250	5/8	1/4	310-001062D	310-002062D	
SC-52	5/32	0.1562	1/2	1/8	310-001070	310-002070	
SC-13	5/32	0.1562	5/8	1/4	310-001065C	310-002065C	
SC-53	3/16	0.1875	1/2	1/8	310-001066	310-002066	
SC-14	3/16	0.1875	5/8	1/4	310-001068C	310-002068C	
SC-81	3/16	0.1875	5/8	3/16	310-001067	310-002067	
SC-51	1/4	0.2500	1/2	1/8	310-001069	310-002069	
SC-1 L6 ‡			1/2	1/4	310-002605	310-002705	
SC-1	1/4	0.2500	5/8	1/4	310-001071C	310-002072C	
SC-1NF							310-002519
SC-1L			1	1/4	310-001250	310-002250	
SC-2	5/16	0.3125	3/4	1/4	310-001072	310-002071	
SC-3					310-001073	310-002073	
SC-3NF			3/4	1/4			310-002503
SC-3 L6 ‡	3/8	0.3750			310-002606	310-002706	
SC-3L			1	1/4	310-001940	310-002940	
SC-3X			1-1/2	1/4	310-001706X	310-002706X	
SC-4	7/16	0.4375	1	1/4	310-001074	310-002074	
SC-5					310-001075	310-002075	
SC-5NF	1/2	0.5000	1	1/4			310-002504
SC-5 L6 ‡					310-002607	310-002707	
SC-6	5/8	0.6250	1	1/4	310-001076	310-002076	
SC-6NF							310-002505
SC-15	3/4	0.7500	1/2	1/4	310-001068A	310-002068A	
SC-16	3/4	0.7500	3/4	1/4	310-001078A	310-002078A	
SC-7	3/4	0.7500	1	1/4	310-001077	310-002077	
SC-7NF							310-002525
SC-9	1	1.0000	1	1/4	310-001079	310-002078	

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SD - BALL SHAPE

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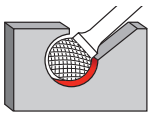

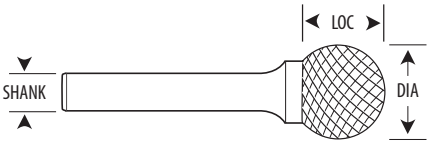

L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut	Aluma Cut
SD-40	1/16	0.0625	1/16	1/8	310-001079A	310-002079	
SD-61	3/32	0.0938	3/32	3/32	310-001080	310-002080	
SD-41 †	3/32	0.0938	3/32	1/8	310-001081	310-002081	
SD-11	1/8	0.1250	3/32	1/4	310-001083C	310-002083C	
SD-42 †					310-001082	310-002082	
SD-42 L2 †	1/8	0.1250	1/8	1/8	310-006125	310-006150	
SD-42 L3 †					310-001082A	310-002733	
SD-52	5/32	0.1562	5/32	1/8	310-001088	310-002088	
SD-14	3/16	0.1875	1/8	1/4	310-001086C	310-002086C	
SD-53	3/16	0.1875	5/32	1/8	310-001084	310-002084	
SD-81	3/16	0.1875	5/32	3/16	310-001085	310-002085	
SD-51	1/4	0.2500	7/32	1/8	310-001087	310-002087	
SD-1					310-001089C	310-002089C	
SD-1 L6 ‡	1/4	0.2500	7/32	1/4	310-002609	310-002709	
SD-1NF							310-002520
SD-2	5/16	0.3125	1/4	1/4	310-001090	310-002090	
SD-3					310-001091	310-002091	
SD-3 L6 ‡	3/8	0.3750	5/16	1/4	310-002610	310-002710	
SD-3NF							310-002506
SD-4	7/16	0.4375	3/8	1/4	310-001092	310-002092	
SD-5					310-001093	310-002093	
SD-5 L6 ‡	1/2	0.5000	7/16	1/4	310-002611	310-002711	
SD-5NF							310-002507
SD-6	5/8	0.6250	9/16	1/4	310-001094	310-002094	
SD-6NF							310-002508
SD-7	3/4	0.7500	11/16	1/4	310-001095	310-002095	
SD-7NF							310-003005
SD-9	1	1.0000	15/16	1/4	310-001096	310-002096	

SE - OVAL / EGG SHAPE

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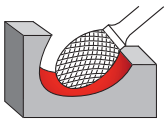

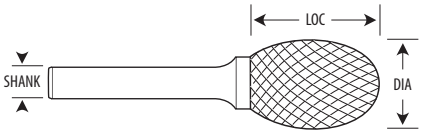

L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut	Aluma Cut
SE-61	3/32	0.0938	1/8	3/32	310-001108A	310-002108A	
SE-41 †					310-001100	310-002100	
SE-41 L3 †	1/8	0.1250	7/32	1/8	310-001100B	310-002100A	
SE-41 L2 †					310-006175	310-006200	
SE-53	3/16	0.1875	9/32	1/8	310-001101	310-002101	
SE-81	3/16	0.1875	9/32	3/16	310-001102	310-002102	
SE-11	3/16	0.1875	5/16	1/4	310-004127	310-004128	
SE-51	1/4	0.2500	3/8	1/8	310-001103	310-002103	

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SE BURRS OVAL/EGG SHAPE CONTINUED

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut	Aluma Cut
SE-1	1/4	0.2500	3/8	1/4	310-001105C	310-002105C	
SE-1 L6 ‡					310-002613	310-002713	
SE-3	3/8	0.3750	5/8	1/4	310-001106	310-002106	
SE-3 L6 ‡					310-002614	310-002714	
SE-3NF							310-002509
SE-5	1/2	0.5000	7/8	1/4	310-001107	310-002107	
SE-5 L6 ‡					310-005020	310-002715	
SE-5NF							310-002510
SE-6	5/8	0.6250	1	1/4	310-001108	310-002108	
SE-6NF							310-002511
SE-7	3/4	0.7500	1	1/4	310-001109	310-002109	
SE-7NF							310-004302

SF - TREE SHAPE RADIUS

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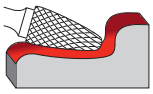

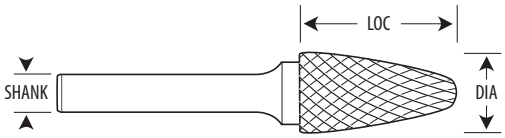

L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut	Aluma Cut
SF-61	3/32	0.0938	1/4	3/32	310-003702A	310-003702	
SF-41 †	1/8	0.1250	1/4	1/8	310-001110	310-002110	
SF-42 †	1/8	0.1250	1/2	1/8	310-001111	310-002111	
SF-42 L2 †					310-006225	310-006250	
SF-42 L3 †					310-001146	310-002735	
SF-11	1/8	0.1250	1/2	1/4	310-001112C	310-002112C	
SF-53	3/16	0.1875	1/2	1/8	310-001113	310-002113	
SF-81	3/16	0.1875	1/2	3/16	310-001114	310-002114	
SF-51	1/4	0.2500	1/2	1/8	310-001115	310-002115	
SF-1 L6 ‡	1/4	0.2500	1/2	1/4	310-002617	310-002717	
SF-1			5/8	1/4	310-001117C	310-002117C	
SF-1NF							310-002521
SF-3	3/8	0.3750	3/4	1/4	310-001118	310-002118	
SF-3 L6 ‡					310-002618	310-002718	
SF-3NF							310-002512
SF-4	7/16	0.4375	1	1/4	310-001119	310-002119	
SF-13	1/2	0.5000	3/4	1/4	310-001120	310-002120	
SF-5	1/2	0.5000	1	1/4	310-001121	310-002121	
SF-5 L6 ‡					310-002619	310-002719	
SF-5NF							310-002513
SF-6	5/8	0.6250	1	1/4	310-001122	310-002122	
SF-6NF							310-002514
SF-7	3/4	0.7500	1	1/4	310-001123	310-002123	
SF-7NF							310-002544
SF-14	3/4	0.7500	1-1/4	1/4	310-001124	310-002124C	
SF-14NF							310-003006
SF-15	3/4	0.7500	1-1/2	1/4	310-001125	310-002125	

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SG - TREE SHAPE POINTED

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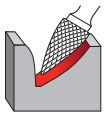
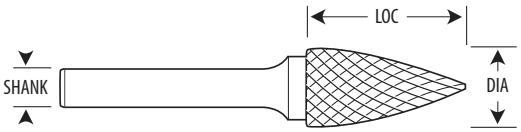


RHC RHS | C-2 SM 10% | SINGLE END TOOL | Bright



L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut
SG-61	3/32	0.0938	1/4	3/32	310-002148	310-002147
SG-41 †	1/8	0.1250	1/4	1/8	310-001130	310-002130
SG-42 †	1/8	0.1250	5/16	1/8	310-001131	310-002131
SG-43 †	1/8	0.1250	3/8	1/8	310-001132	310-002132
SG-44 †	1/8	0.1250	1/2	1/8	310-001145	310-002145
SG-44 L2 †					310-006275	310-006300
SG-44 L3 †					310-006875	310-006900
SG-53	3/16	0.1875	1/2	1/8	310-001133	310-002133
SG-81	3/16	0.1875	1/2	3/16	310-001134	310-002134
SG-51	1/4	0.2500	1/2	1/8	310-001135	310-002135
SG-1 L6 ‡	1/4	0.2500	1/2	1/4	310-002621	310-002721
SG-1			5/8	1/4	310-001137C	310-002137C
SG-2	5/16	0.3125	3/4	1/4	310-001138	310-002138
SG-3	3/8	0.3750	3/4	1/4	310-001139	310-002139
SG-3 L6 ‡					310-002622	310-002722
SG-13	1/2	0.5000	3/4	1/4	310-001140	310-002140
SG-5	1/2	0.5000	1	1/4	310-001141	310-002141
SG-5 L6 ‡					310-002623	310-002723
SG-6	5/8	0.6250	1	1/4	310-001142	310-002142
SG-7	3/4	0.7500	1	1/4	310-001143	310-002143
SG-15	3/4	0.7500	1-1/2	1/4	310-001144	310-002144

SH - FLAME SHAPE

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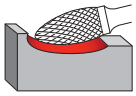
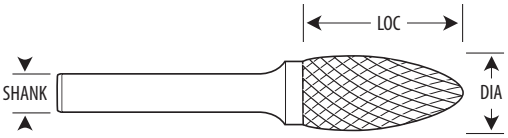


RHC RHS | C-2 SM 10% | SINGLE END TOOL | Bright



L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut
SH-41 †	1/8	0.1250	1/4	1/8	310-001150	310-002150
SH-41 L2 †					310-006325	310-006350
SH-41 L3 †					310-002637	310-002737
SH-53	3/16	0.1875	3/8	1/8	310-001151	310-002151
SH-1	1/4	0.2500	5/8	1/4	310-001157C	310-002157C
SH-2	5/16	0.3125	3/4	1/4	310-001153	310-002153
SH-2 L6 ‡					310-002629	310-002729
SH-5	1/2	0.5000	1-1/4	1/4	310-001154	310-002154
SH-5 L6 ‡					310-002630	310-002730
SH-6	5/8	0.6250	1-7/16	1/4	310-001155	310-002155
SH-7	3/4	0.7500	1-5/8	1/4	310-001156	310-002156

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SJ - CONE SHAPE 60°

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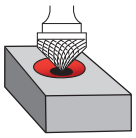

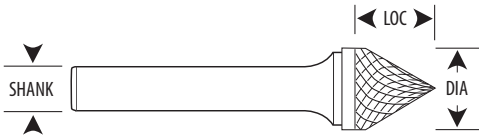

DE = Doubled End Tool † Mold, Tool & Die

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut
SJ-42 †	1/8	0.1250	3/32	1/8	310-001160	310-002160
SJ-42 DE †					310-001160D	310-002160D
SJ-81	3/16	0.1875	9/64	3/16	310-001168	310-002161
SJ-81 DE					310-001168D	—
SJ-1	1/4	0.2500	3/16	1/4	310-001162	310-002162
SJ-1 DE					310-001162D	310-002162D
SJ-3	3/8	0.3750	5/16	1/4	310-001163	310-002163
SJ-5	1/2	0.5000	7/16	1/4	310-001164	310-002164
SJ-6	5/8	0.6250	9/16	1/4	310-001165	310-002165
SJ-7	3/4	0.7500	11/16	1/4	310-001166	310-002166
SJ-9	1	1.0000	15/16	1/4	310-001167	310-002167

SK - CONE SHAPE 90°

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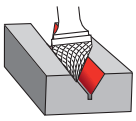

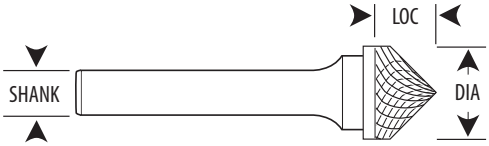

DE = Doubled End Tool † Mold, Tool & Die

Tool	DIA	Dec In	LOC	Shank	Single Cut	Double Cut
SK-42 †	1/8	0.1250	1/16	1/8	310-001169	310-002169
SK-42 DE †					310-001169D	310-002169D
SK-81	3/16	0.1875	3/32	3/16	310-001171	310-002171
SK-81 DE					310-001171D	310-002171D
SK-1	1/4	0.2500	1/8	1/4	310-001172	310-002172C
SK-3	3/8	0.3750	3/16	1/4	310-001173	310-002173
SK-5	1/2	0.5000	1/4	1/4	310-001174	310-002174
SK-6	5/8	0.6250	5/16	1/4	310-001175	310-002175
SK-7	3/4	0.7500	3/8	1/4	310-001176	310-002176
SK-9	1	1.0000	1/2	1/4	310-001177C	310-002177

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SL - TAPER SHAPE RADIUS

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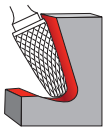
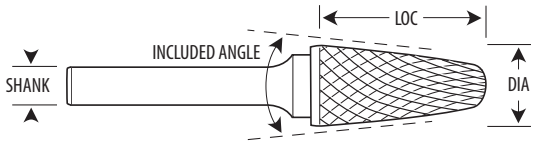


RHC RHS | C-2 SM 10% | SINGLE END TOOL | Bright



L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Included Angle	Single Cut	Double Cut	Aluma Cut
SL-41 †	1/8	0.1250	3/8	1/8	14°	310-001180	310-002180	
SL-42 †						310-001181	310-002181	
SL-42 L2 †	1/8	0.1250	1/2	1/8	14°	310-001181A	310-002181A	
SL-42 L3 †						310-002640	310-002740	
SL-53	3/16	0.1875	1/2	1/8	14°	310-001182	310-002182	
SL-81	3/16	0.1875	1/2	3/16	14°	310-001183	310-002183	
SL-51	1/4	0.2500	1/2	1/8	14°	310-001178	310-002178	
SL-1						310-001184	310-002184	
SL-1 L6 ‡	1/4	0.2500	5/8	1/4	14°	310-002625	310-002725	
SL-1NF								310-002547
SL-2	5/16	0.3125	7/8	1/4	14°	310-001185	310-002185	
SL-3						310-001186	310-002186	
SL-3 L6 ‡	3/8	0.3750	1-1/16	1/4	14°	310-002626	310-002726	
SL-3NF								310-002515
SL-4						310-001187	310-002187	
SL-4 L6 ‡	1/2	0.5000	1-1/8	1/4	14°	310-001187B	310-002187B	
SL-4NF								310-002516
SL-5	5/8	0.6250	1-3/16	1/4	14°	310-001188	310-002188	
SL-5NF								310-003007
SL-6	5/8	0.6250	1-5/16	1/4	14°	310-001179	310-002179	
SL-6NF								310-002517
SL-7	3/4	0.7500	1-1/2	1/4	14°	310-001189	310-002189	
SL-7NF								310-004303

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SM - CONE SHAPE POINTED

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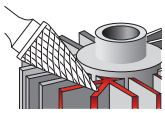
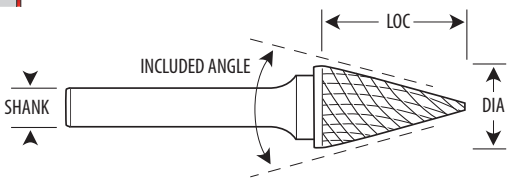


RHC RHS | C-2 SM 10% | SINGLE END TOOL | Bright



L2 = 2" Overall Length
L3 = 3" Overall Length
L6 = 6" Length of Shank

† Mold, Tool & Die

‡ Long Shank Burrs

Tool	DIA	Dec In	LOC	Shank	Included Angle	Single Cut	Double Cut
SM-61	3/32	0.0938	1/4	3/32	10°	310-001190	310-002190
SM-41 †	1/8	0.1250	11/32	1/8	12°	310-001191	310-002191
SM-42 L3 †	1/8	0.1250	7/16	1/8	14°	310-001192B	310-002192B
SM-42 L2 †	1/8	0.1250	7/16	1/8	14°	310-001192A	310-002192A
SM-42 †	1/8	0.1250	7/16	1/8	14°	310-001192	310-002192
SM-43 †	1/8	0.1250	5/8	1/8	7°	310-001193	310-002193
SM-53	3/16	0.1875	1/2	1/8	16°	310-001194	310-002194
SM-51	1/4	0.2500	1/2	1/8	22°	310-001196	310-002196
SM-1 L6 ‡	1/4	0.2500	1/2	1/4	22°	310-002753	310-002754
SM-1	1/4	0.2500	1/2	1/4	22°	310-001198C	310-002198C
SM-2	1/4	0.2500	3/4	1/4	14°	310-001199	310-002199
SM-3 L6 ‡	1/4	0.2500	1	1/4	10°	310-002850	310-002851A
SM-3	1/4	0.2500	1	1/4	10°	310-001200	310-002200
SM-4 L6 ‡	3/8	0.3750	5/8	1/4	28°	310-002632	310-002849
SM-4	3/8	0.3750	5/8	1/4	28°	310-001201	310-002201
SM-5 L6 ‡	1/2	0.5000	7/8	1/4	28°	310-002636	310-002204
SM-5	1/2	0.5000	7/8	1/4	28°	310-001202	310-002202
SM-6	5/8	0.6250	1	1/4	31°	310-001203	310-002203

SN - CONE SHAPE INVERTED

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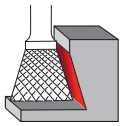
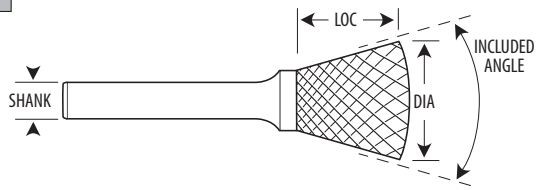


RHC RHS | C-2 SM 10% | SINGLE END TOOL | Bright



† Mold, Tool & Die

Tool	DIA	Dec In	LOC	Shank	Included Angle	Single Cut	Double Cut
SN-61	3/32	0.0938	1/8	3/32	10°	310-001220	310-002220
SN-41 †	3/32	0.0938	1/8	1/8	10°	310-001221	310-002221
SN-42 †	1/8	0.1250	3/16	1/8	10°	310-001222	310-002222
SN-53	3/16	0.1875	1/4	1/8	10°	310-001223	310-002223
SN-81	3/16	0.1875	1/4	3/16	10°	310-001224	310-002224
SN-51	1/4	0.2500	1/4	1/8	10°	310-001225	310-002225
SN-1	1/4	0.2500	5/16	1/4	10°	310-001227	310-002227
SN-2	3/8	0.3750	3/8	1/4	13°	310-001231	310-002231
SN-4	1/2	0.5000	1/2	1/4	28°	310-001228	310-002228
SN-6	5/8	0.6250	3/4	1/4	18°	310-001229	310-002229
SN-7	3/4	0.7500	5/8	1/4	30°	310-001230	310-002230

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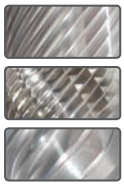
DEBURRING RECOMMENDATIONS

Burr Diameter	Minimum RPM	Medium RPM	Maximum RPM (Stainless)
1/16	50000	75000	100000
1/8	30000	60000	90000
3/16	25000	50000	75000
1/4	20000	40000	65000
5/16	15000	35000	60000
3/8	15000	35000	60000
7/16	15000	35000	60000
1/2	10000	30000	50000
5/8	10000	30000	50000
3/4	10000	20000	35000
1	5000	15000	30000



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DOUBLE CUT — IDEAL FOR MATERIAL REMOVAL

ALUMA CUT — IDEAL FOR NON-FERROUS MATERIALS

Industry Designation	Shape	Application
SA	Cylinder	Universal Surface Grinding
SB	Cylinder with End Cut	Blind holes & Inner Contours
SC	Cylinder with Radius	Contouring & Bore holes
SD	Ball	Contouring & Bore holes
SE	Oval / Egg	Molds & Fillet Welds
SF	Radius Tree	Molds & Contouring
SG	Pointed Tree	Chamfering & Bore Holes
SH	Flame	Molds & Contouring
SJ	60° Cone	Chamfering & Beveling & Countersinking
SK	90° Cone	Chamfering & Beveling & Countersinking
SL	Taper with Radius	Contouring & Difficult to Access Areas
SM	Pointed Cone	Conical Holes & Grooves & Model Building
SN	Inverted Cone	Inner Edges & Conical Profiles

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HIGH PERFORMANCE ENDMILL SETS

- *Five Piece Sets - 1/8, 3/16, 1/4, 3/8, & 1/2 sizes*
- *Regular/standard flute and overall lengths*
- *Engineered nano-foam cushioning for ultimate tool protection*
- *Rugged plastic index can be reused to house future tooling*
- *Uncoated and coated options offered*

AVALANCHE

FLUTES	END STYLE	Bright	ZrN
2	Corner Radius	282-888881	282-888882
3	Square	273-888881	273-888882
3	Corner Radius	283-888881	283-888882

FUSION

FLUTES	END STYLE	Bright	AlTiCrN
4	Square	284-888881	284-888882

ALPHA

FLUTES	END STYLE	nACRo®
4	Corner Radius	294-888881
5	Corner Radius	295-888881

ATTACKER

FLUTES	END STYLE	Bright	AlTiN
3	Corner Radius	267-888881	267-888882
4	Corner Radius	257-888881	257-888882

AGGRESSOR

FLUTES	PROFILE	Bright	ZrN	AlTiCrN
4	Fine Pitch	255-888811	—	255-888812
4	Medium Pitch	256-888881	—	256-888882
3	Coarse Pitch	255-888801	255-888802	—

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- *Five Piece Sets - 1/8, 3/16, 1/4, 3/8, & 1/2 sizes*
- *Regular/standard flute and overall lengths*
- *Engineered nano-foam cushioning for ultimate tool protection*
- *Rugged plastic index can be reused to house future tooling*
- *Uncoated and coated options offered*

FLUTES	END STYLE	Bright	TiCN	AlTiN
2	Square	204-888881	204-888882	—
3		205-888881	—	205-888882
4		206-888881	—	206-888882
2	Ballnose	221-888881	221-888882	
3		222-888881	—	222-888882
4		223-888881	—	223-888882

Drill Mill Sets

- *Five Piece Sets - 1/8, 3/16, 1/4, 3/8, & 1/2 sizes*
- *Regular/standard flute and overall lengths*
- *Engineered nano-foam cushioning for ultimate tool protection*
- *Rugged plastic index can be reused to house future tooling*
- *Uncoated and coated options offered*

FLUTES	INCLUDED ANGLE	Bright	AlTiN
2	90°	208-888821	208-888822
4	90°	208-888841	208-888842

5 Piece Spade Drill Set

INCLUDED ANGLE	DIAMETERS INCLUDED	Bright
118°	1/8, 3/16, 1/4, 3/8 & 1/2"	400-888881

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5 Piece N/C Spot Drill Sets

INCLUDED ANGLE	DIAMETERS INCLUDED	Bright	AlTiN
90°	1/8, 3/16, 1/4, 3/8 & 1/2"	402-888801	402-888802
120°	1/8, 3/16, 1/4, 3/8 & 1/2"	402-888811	402-888812
140°	1/8, 3/16, 1/4, 3/8 & 1/2"	402-888821	402-888822

15 Piece Drill Sets

DRILL STYLE	DIAMETERS INCLUDED	Bright	AlTiN
TWIST	1/16" - 1/2" x 32nds	450-000015	450-000015B
SCREW MACHINE		460-000015	460-000015B
STRAIGHT FLUTE		470-000015	470-000015B

21 Piece Drill Sets

DRILL STYLE	DIAMETERS INCLUDED	Bright	AlTiN
TWIST	1/16" - 3/8" x 64ths	450-000021	450-000021B
SCREW MACHINE		460-000021	460-000021B
STRAIGHT FLUTE		470-000021	470-000021B

24 Piece Drill Sets

DRILL STYLE	DIAMETERS INCLUDED	Bright	AlTiN
TWIST	1.0.mm - 12.5mm x 0.5mm	450-000024	450-000024B
SCREW MACHINE		460-000024	460-000024B
STRAIGHT FLUTE		470-000024	470-000024B

29 Piece Drill Sets

DRILL STYLE	DIAMETERS INCLUDED	Bright	AlTiN
TWIST	1/16" - 1/2" x 64ths	450-000029	450-000029B
SCREW MACHINE		460-000029	460-000029B
STRAIGHT FLUTE		470-000029	470-000029B

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4 Piece Countersink Sets

FLUTES	DIAMETERS INCLUDED	INCLUDED ANGLE	Bright
1	1/4", 1/2, 3/4 & 1"	60°	331-100060
		82°	331-100082
		90°	331-100090
		100°	331-100100
		120°	331-100120
3	1/4", 1/2, 3/4 & 1"	60°	333-100060
		82°	333-100082
		90°	333-100090
		100°	333-100100
		120°	333-100120
6	1/4", 1/2, 3/4 & 1"	60°	336-100060
		82°	336-100082
		90°	336-100090
		100°	336-100100
		120°	336-100120

Aluma Burr Sets

SET LETTER	NUMBER OF PIECES	DIAMETERS INCLUDED	BURRS INCLUDED	ALUMA CUT
AL1	10	1/4 & 3/8	SA-1NF, SA-3NF, SB-3NF, SC-1NF, SC-3NF, SD-1NF, SD-3NF, SE-3NF, SF-3NF, SL-3NF	310-130001
AL2	12	1/4, 3/8 & 1/2	SA-1NF, SA-3NF, SA-5NF, SC-1NF, SC-3NF, SC-5NF, SD-1NF, SD-3NF, SD-5NF, SF-1NF, SF-3NF, SF-5NF	310-130002
AL3	12	1/4, 3/8 & 1/2	SA-1NF, SA-3NF, SA-5NF, SB-5NF, SD-1NF, SD-3NF, SD-5NF, SF-1NF, SF-3NF, SF-5NF, SL-3NF, SL-4NF	310-130003
AL4	11	1/4, 3/8 & 1/2	SA-1NF, SA-3NF, SA-5NF, SC-1NF, SC-3NF, SC-5NF, SF-1NF, SF-3NF, SF-5NF, SL-3NF, SL-4NF	310-130004
AL5	8	1/2 & 3/8	SA-5NF, SB-5NF, SC-5NF, SD-5NF, SE-5NF, SF-5NF, SL-3NF, SL-4NF	310-130005
AL6	10	3/8 & 1/2	SA-3NF, SA-5NF, SD-3NF, SD-5NF, SE-3NF, SE-5NF, SF-3NF, SF-5NF, SL-3NF, SL-4NF	310-130006

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Miniature Burr Sets

SET LETTER	NUMBER OF PIECES	DIAMETERS INCLUDED	BURRS INCLUDED	SINGLE CUT	DOUBLE CUT
A	12	3/32 & 1/8	SA-42, SA-43, SC-42, SD-42, SE-41, SF-41, SF-42, SG-41, SL-42, SM-43, SN-41, SN-42	310-110001	310-120001
B	12	1/16, 3/32 & 1/8	SA-41, SA-42, SC-41, SC-42, SD-42, SE-41, SF-41, SF-42, SH-41, SL-41, SL-42, SN-42	310-110002	310-120002
C	11	1/16, 3/32 & 1/8	SA-41, SB-41, SC-41, SD-41, SE-41, SF-41, SG-41, SH-41, SL-41, SM-41, SN-41	310-110003	310-120003
D	11	3/32 & 1/8	SA-42, SB-42, SC-42, SD-42, SF-42, SG-42, SJ-42, SK-42, SL-42, SM-42, SN-42	310-110004	310-120004

Standard Burr Sets

SET LETTER	NUMBER OF PIECES	DIAMETERS INCLUDED	BURRS INCLUDED	SINGLE CUT	DOUBLE CUT
K	12	1/8, 5/32, 3/16 & 1/4	SA-11, SB-14, SC-13, SD-14, SE-11, SF-11, SG-1, SH-1, SJ-1, SK-1, SM-1, SN-1	310-110011	310-120011
F	12	5/32 & 3/16	SA-52, SA-53, SC-52, SC-53, SD-52, SD-53, SE-53, SF-53, SG-53, SH-53, SM-53, SN-53	310-110006	310-120006
H	12	5/32 & 1/4	SA-51, SA-52, SB-51, SC-51, SC-52, SD-51, SD-52, SE-51, SF-51, SG-51, SM-51, SN-51	310-110008	310-120008
E	10	3/16	SA-53, SC-53, SD-53, SE-53, SF-53, SG-53, SH-53, SL-53, SM-53, SN-53	310-110005	310-120005
L	12	3/16 & 1/4	SA-1, SA-14, SC-1, SC-14, SD-1, SE-1, SF-1, SG-1, SJ-1, SL-1, SH-1, SN-1	310-110012	310-120012
AA	12	1/4	SA-1, SB-1, SC-1, SD-1, SE-1, SF-1, SG-1, SH-1, SJ-1, SK-1, SL-1, SM-1	310-110026	310-120026
G	9	1/4	SA-51, SB-51, SC-51, SD-51, SE-51, SF-51, SG-51, SM-51, SN-51	310-110007	310-120007
I	12	1/4	SA-1, SB-1, SC-1, SD-1, SE-1, SF-1, SG-1, SH-1, SJ-1, SK-1, SM-1, SN-1	310-110009	310-120009
J	12	1/4	SB-1, SC-1, SD-1, SE-1, SF-1, SG-1, SH-1, SJ-1, SK-1, SL-1, SM-1, SN-1	310-110010	310-120010
M	9	1/4 & 3/8	SA-3, SC-3, SD-3, SE-3, SF-3, SG-3, SJ-3, SM-3, SN-2	310-110013	310-120013
N	9	1/4 & 3/8	SB-3, SC-3, SD-3, SE-3, SF-3, SG-3, SK-3, SL-3, SM-3	310-110014	310-120014
O	12	1/4, 3/8 & 1/2	SA-1, SA-3, SA-5, SD-1, SD-3, SD-5, SF-1, SF-3, SF-5, SG-1, SG-3, SG-5	310-110021	310-120021
P	9	1/4, 3/8 & 1/2	SA-1, SA-3, SA-5, SC-1, SC-3, SC-5, SF-1, SF-3, SF-5	310-110015	310-120015
Q	9	1/4, 3/8 & 1/2	SB-1, SB-3, SB-5, SD-1, SD-3, SD-5, SE-1, SE-3, SE-5	310-110016	310-120016
R	9	1/4, 3/8 & 1/2	SA-1, SA-3, SA-5, SE-1, SE-3, SE-5, SN-1, SN-2, SN-4	310-110017	310-120017
S	9	1/4, 3/8 & 1/2	SB-1, SB-3, SB-5, SC-1, SC-3, SC-5, SF-1, SF-3, SF-5	310-110018	310-120018
V	12	1/4, 3/8 & 1/2	SA-1, SA-3, SA-5, SC-1, SC-3, SC-5, SE-1, SE-3, SE-5, SM-1, SM-3, SM-5	310-110022	310-120022
W	12	1/4, 3/8 & 1/2	SB-1, SB-3, SB-5, SD-1, SD-3, SD-5, SF-1, SF-3, SF-5, SN-1, SN-2, SN-4	310-110023	310-120023
X	12	1/4, 3/8 & 1/2	SA-1, SA-3, SA-5, SC-1, SC-3, SC-5, SG-1, SG-3, SG-5, SM-1, SM-3, SM-5	310-110024	310-120024
Y	12	1/4, 3/8 & 1/2	SF-1, SF-3, SF-5, SG-1, SG-3, SG-5, SL-1, SL-3, SL-4, SM-1, SM-3, SM-5	310-110025	310-120025
AB	12	3/8	SA-3, SB-3, SC-3, SD-3, SE-3, SF-3, SG-3, SJ-3, SK-3, SL-3, SM-4, SN-2	310-110027	310-120027
AC	12	1/2	SA-5, SB-5, SC-5, SD-5, SE-5, SF-5, SG-5, SH-5, SJ-5, SK-5, SL-4, SM-5	310-110028	310-120028
T	8	1/2	SA-5, SC-5, SD-5, SE-5, SG-5, SH-5, SK-5, SM-5	310-110019	310-120019
U	8	1/2	SB-5, SC-5, SD-5, SF-5, SG-5, SH-5, SJ-5, SK-5	310-110020	310-120020

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