



From Standard to Custom
Excellence in Every Tool

*Discover our newest
lineup of end mills!*



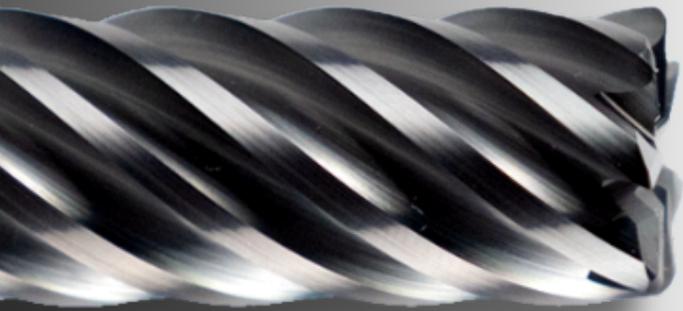
HX Series



**Custom
Tooling**



**HIGH
PERFORMANCE
END MILL SOLUTIONS**



PX Series



Unleash Power and Precision
Discover the Ferocious speed
and Hi-Velocity strength of
CGS Tool's flagship lineups.



Power. Precision. Innovation.

TERMS & CONDITIONS

PRICING INFORMATION

PRICING IS NOT INCLUDED IN THIS CATALOG. HOWEVER, PRICE BOOKS ARE AVAILABLE TO DISTRIBUTORS AND END-USERS. END-USERS WITH LOCAL DISTRIBUTORS MAY CONTACT THEM FOR THE MOST CURRENT PRICE BOOK FROM CGS. IF AN END-USER DOES NOT HAVE A DISTRIBUTOR, CONTACT THE CGS SALES DEPARTMENT FOR REFERRAL TO A LOCAL DISTRIBUTOR, OR, IN THE EVENT A DISTRIBUTOR IS NOT AVAILABLE IN THE AREA, CGS WILL SEND A PRICE BOOK DIRECT. DISTRIBUTORS MAY CONTACT CGS DIRECTLY FOR THE MOST CURRENT PRICE BOOKS.

CGS RESERVES THE RIGHT TO INCREASE PRICING WITHOUT NOTIFICATION BASED UPON CURRENT INDUSTRY STANDARDS AND THE RISING COST OF RAW MATERIAL.

RETURNED GOODS POLICY

CGS REQUIRES A RETURNED GOODS AUTHORIZATION ("RGA") DULY AUTHORIZED BY A CGS REPRESENTATIVE TO ITS CUSTOMERS REGARDING TOOLS THAT ARE REJECTED OR RECEIVED AND/OR ORDERED IN ERROR. ALL TOOLS ARE SUBJECT TO INSPECTION UPON RECEIPT AND MUST BE ACCOMPANIED BY THE WRITTEN "RGA." RETURNS ON STOCK ITEMS MUST BE MADE WITHIN 6 MONTHS FROM THE DATE OF PURCHASE. CGS RESERVES THE RIGHT TO REFUSE ANY ITEMS PURCHASED BEYOND 6 MONTHS FROM THE ORIGINAL INVOICE DATE.

THIS INVOLVES CGS STANDARD TOOLING ONLY. ALL RETURNS ARE SUBJECT TO A 15% RESTOCKING CHARGE. ALL TOOLS MUST BE RECEIVED UNDAMAGED AND IN THEIR ORIGINAL PACKAGING.

SPECIAL TOOLING IS NON-RETURNABLE. THIS INCLUDES ANY AND ALL STANDARD TOOLING WHICH HAS BEEN MODIFIED OR ALTERED FROM ITS ORIGINAL SPECIFICATIONS (i.e., SPECIAL NON-STOCK COATINGS, FLATS, CORNER RADII).

DISCONTINUED ITEMS WILL NOT BE CONSIDERED FOR RETURN AND/OR ITEMS IN SUCH QUANTITIES THAT THEY MAY CAUSE CGS AN INVENTORY PROBLEM.

CGS IS NOT RESPONSIBLE FOR GOODS RETURNED AND/OR RECEIVED AT OUR FACILITY WITHOUT A PROPER "RGA".

SHIPPING & PAYMENT TERMS

THE PREFERRED METHOD OF SHIPMENT IS UPS, F.O.B. CLEVELAND, EITHER PREPAID OR FREIGHT COLLECT. SHIPPING BY ANOTHER CARRIER WILL REQUIRE CUSTOMER'S ACCOUNT NUMBER AND WILL BE SENT FREIGHT COLLECT BY THE SPECIFIED COURIER UPON APPROVAL BY CGS.

OUR PAYMENT POLICY INCLUDES C.O.D., VISA AND MASTERCARD OR, WITH CREDIT APPROVAL, A NET 30 BASIS PAYABLE BY CHECK. ALL PAYMENTS FOR INTERNATIONAL ORDERS MUST BE PAID IN U.S. DOLLARS AND DRAWN ON A U.S.-BASED BANK OR BY A CERTIFIED INTERNATIONAL MONEY ORDER.

BALANCES WHICH REMAIN UNPAID BEYOND 60 DAYS ARE SUBJECT TO A 1-1/2% SERVICE CHARGE PER MONTH AND WILL CONTINUE TO ACCRUE UNTIL SAID BALANCE(S) IS (ARE) PAID IN FULL. ANY ACCOUNT WHICH CARRIES A BALANCE THAT IS OVERDUE BY 60 DAYS OR MORE IS SUBJECT TO CREDIT HOLD AND CURRENT ACTIVE ORDERS WILL NOT SHIP UNTIL SUCH OVERDUE BALANCE IS PAID IN FULL, INCLUDING THE ABOVE-STATED SERVICE CHARGE.

SPECIAL TOOLING POLICY

NEW CUSTOMERS WITHOUT AN ESTABLISHED ACCOUNT MAY BE SUBJECT TO A 50% DEPOSIT TOWARD THE PAYMENT OF ALL SPECIAL TOOLING ORDERED IN LARGE QUANTITIES AND/OR DOLLAR VALUE AT THE TIME THE ORDER IS PLACED.

WHEN PLACING A PURCHASE ORDER FOR QUOTED SPECIALS, A COPY OF THE QUOTE AND/OR PRINT MUST ACCOMPANY THE P.O. IF A PARTICULAR TOLERANCE IS REQUIRED IT MUST BE SPECIFIED ON THE PURCHASE ORDER, OTHERWISE ALL TOLERANCES WILL BE MANUFACTURED IN ACCORDANCE WITH INDUSTRY STANDARDS.

SPECIAL TOOLING CANNOT BE RETURNED. THEREFORE, NO CREDITS AND/OR REFUNDS WILL BE ISSUED. CANCELLATION OF SPECIAL TOOLING IS NOT PERMITTED AND CUSTOMERS STILL ASSUME THE RESPONSIBILITY FOR PAYMENT OF TOOLS.

CLAIMS

ANY CLAIMS CONCERNING SHORTAGES, LOST OR DAMAGED TOOLS MUST BE MADE WITHIN [10] DAYS OF THE INVOICE DATE.

WARNING

ANY CUTTING TOOL MAY BREAK OR SHATTER. GOVERNMENT REGULATIONS REQUIRE THE USE OF SAFETY GLASSES AND OTHER APPROPRIATE SAFETY EQUIPMENT BE WORN AT ALL TIMES. WET OR DRY GRINDING OR MILLING PRODUCES POTENTIALLY HAZARDOUS DUST OR MIST. TO AVOID ADVERSE HEALTH EFFECTS, THE USE OF ADEQUATE VENTILATION AND READ THE MATERIAL 'SAFETY DATA SHEETS' FOR FURTHER INFORMATION BEFORE GRINDING.

ABOUT US



CGS Tool, Inc. is an American Company with over 45 years of industry leadership in high-performance, carbide end mill manufacturing. Dedicated to its craft, CGS manufactures solid carbide cutting tools that service its clients around the globe.

We continually strive to develop and implement industry-leading methods, using the latest CNC technology, to produce the highest quality end mills that are centered on high-performance and the needs of our customers.

Formed in 1974, CGS began as a niche manufacturer of high-quality, high-performance, solid carbide end mills in the Cleveland, Ohio area before moving to a new, Brunswick location in 2009. Today, moving to a new, larger facility in 2013 located in the heart Medina, Ohio, CGS has firmly established itself as a global leader in the carbide cutting tool industry, strongly dedicated and focused on customer service and support.

Our multiple lines of high-performance and general purpose solid carbide end mills are used across many industries across the world, some of which include the medical, aerospace, military and automotive industries.

CGS end mills are designed and manufactured in the United States of America and are backed by a sole commitment to serving the needs of its customers. The CGS line of high-performance solid carbide end mills and custom tool options are designed to reduce cycle times and add value to any precision machining operation.



PROUDLY MADE IN OHIO

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FEROCIOUS

**Aluminum Alloys, Copper, Brass
Non-Ferrous Materials and Plastics**



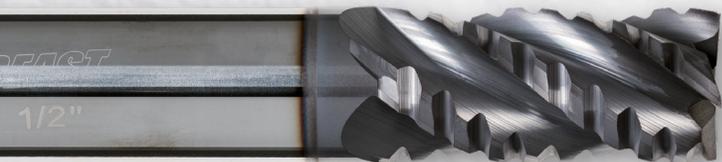
FEROCIOUS 3X

**Aluminum Alloys, Copper, Brass
Non-Ferrous Materials and Plastics**



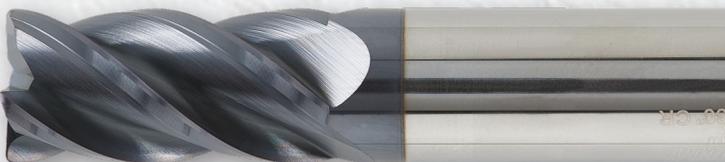
THE BEAST

**Stainless Steels, Titanium Alloys,
High Temp Alloys, Alloy Steels,
Grey Cast Iron, Die and Mold Steels**



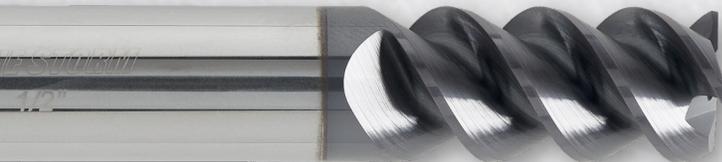
HI-VELOCITY

**Stainless Steels, Titanium Alloys,
High Temp Alloys, Alloy Steels,
Grey Cast Iron, Die and Mold Steels**



STORM

**Cast Iron, Brass, Copper, Titanium Alloys,
Inconel, Alloy Steels, Stainless Steels,
Die and Mold Steels**



EF-5 TORNADO

**Titanium Alloys, Inconel, Cast Iron,
Carbon Steels, Tool and Die Steels,
Stainless Steels**



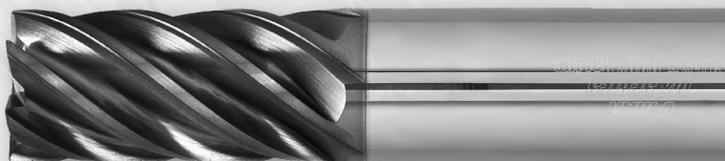
PX SERIES

**Titanium Alloys, Inconel, High Temp Alloys,
Alloy Steels, Grey Cast Iron, Tool Steels,
Stainless Steels, Die and Mold Steels**



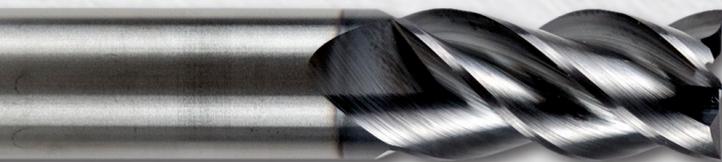
VMAX

**Titanium Alloys, Inconel, High Temp Alloys,
Alloy Steels, Grey Cast Iron, Tool Steels,
Stainless Steels, Die and Mold Steels**



HX SERIES

**Titanium Alloys, Inconel, Cast Iron,
Carbon Steels, Tool and Die Steels,
Stainless Steels**



Performance Matters

MATERIALS & APPLICATIONS

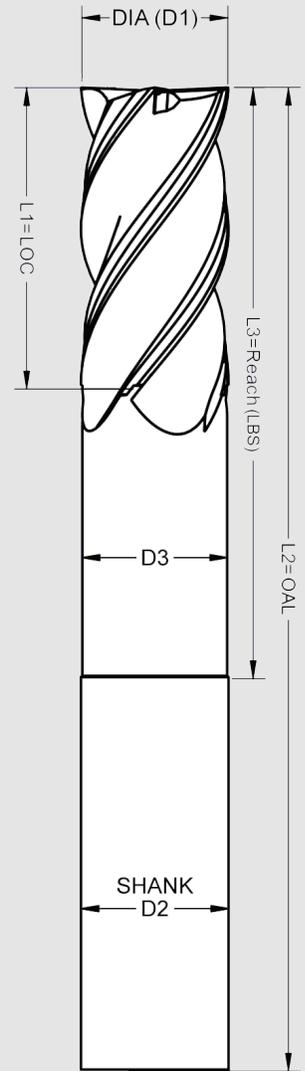
BY TOOL SERIES

See Pages 32-39 for Detailed
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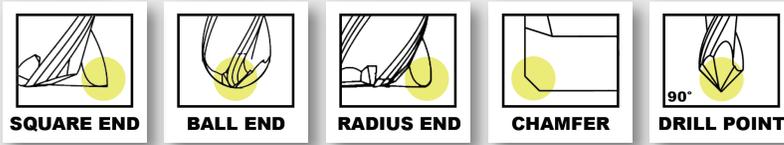
APPLICABLE MATERIALS

TOOL SERIES		High Temp Alloys	Titanium Alloys	Alloy Steels	Carbon Steels	Mold Steels	Stainless Steels	Die Steels	Soft Steels	Tool Steels	Grey Cast Iron	Inconel	Aluminum Alloys	Brass	Copper	Plastics	
FEROCIOUS 2000	 2 Flute 55° Helix	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Green	Green	Green	Green	
FEROCIOUS 3x	 3 & Flute Variable Helix	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Green	Green	Green	Green	
THE BEAST	 3 & 4 Flute Variable Helix	Yellow	Yellow	Yellow	Green	Green	Green	Green	Green	Green	Green	Yellow	Orange	Red	Red	Orange	
HI-VELOCITY	 4 Flute Variable Helix	Yellow	Yellow	Yellow	Green	Green	Green	Green	Green	Green	Green	Yellow	Orange	Orange	Orange	Red	
STORM	 3 Flute 60° Helix	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Green	Yellow	Orange	Yellow	Yellow	Red	
EF-5 TORNADO	 5 Flute 45° Helix	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Yellow	Green	Red	Orange	Orange	Red	
PX SERIES	 5 & 7 Flute Variable Helix	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Green	Green	Red	Red	Red	Red	
VMAX	 4 & 6 Flute Variable Helix	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Red	Red	Red	Red	
HX SERIES	 4 Flute Variable Helix	Yellow	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Red	Red	Red	Red	
		Green	⇨	Materials Most Suitable for Tool Series													
		Yellow	⇨	Materials Suitable for Tool Series													
		Orange	⇨	Materials Least Suitable for Tool Series													
		Red	⇨	Materials Not Applicable for Tool Series													

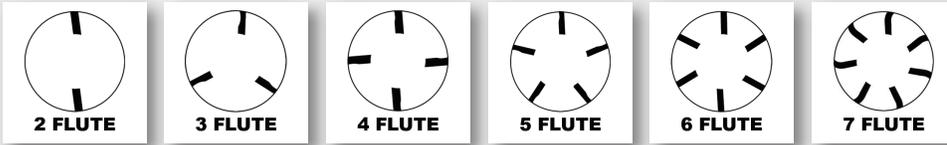
END MILL GLOSSARY



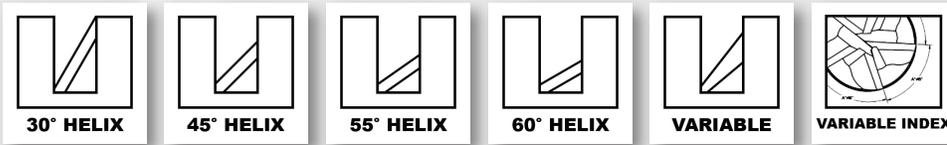
End Style for Each Tool Series



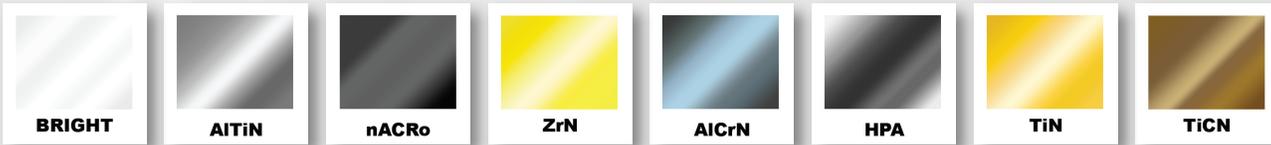
Number of Flutes for Each Tool Series



Helix Angle for Each Tool Series



Coating Types for Each Tool Series



Common Metalworking for Each Tool Series



COATING OVERVIEW

AlTiN

Abrasion resistant, cathodic arc deposited coating. Excellent for high metal removal rate machining. Recommended for the machining of cast iron, hardened die steels up to HRc 65 and other heat resistant alloys.

Strong General-Purpose Solution for Applications Including:

- Cast Iron
- High Temperature Alloys
- Hardened Die Steels
- Stainless Steels

nACrO

Outstanding in high-heat applications. Greater resistance to shock and chipping than nACo, for tough aggressive cutting applications. Dry and wet milling, hobbing, punching, fine blanking, injection forming.

A Hard High Performance Coating Recommended for Applications in:

- Titanium Alloys
- Stainless & Hardened Steels
- Superalloys

ZrN

ZrN PVD coating is especially suitable for machining aluminum alloys and is also a good choice for machining non-ferrous metals. The ZrN coating is also recommended for machining fiberglass, nylon and the majority of polymer materials.

A Low Friction Coating Recommended for Applications in:

- Aluminum Alloys
- Non-Ferrous Materials
- Plastics & Polymer Materials

AlCrN

Superior thermal properties and high wear resistance makes AlCrN an excellent choice for a variety of applications. Milling, sawing, and hobbing operations in particular benefit from the improved hot hardness and thermal shock resistance of this coating.

Versatile, High Performance Coating in a Range of Applications Including:

- Steels & Cast iron
- High Temperature Alloys
- Milling, Sawing, Hot Forging & Forming

HPA

Magnetron sputtering technology gives HPA a smooth surface. The hardness and oxidation temperature of this coating allows it to excel in the machining of low carbon and stainless steels.

Unmatched Performance for Applications in:

- Die Steels
- Stainless Steels
- Sticky/Gummy Materials

TiN

A general-purpose coating allowing higher metal removal rates and extended tool life compared to uncoated tools. A viable choice for tapping and decorative applications.

General Purpose Coating Recommended for Applications in:

- Medium Carbon Steels
- Alloyed Steels
- General Purpose Machining

TiCN

Lower coefficient of friction compared to TiN. A lubricious coating and with proper post treatment it is useful in stamping, forming and tapping operations, as well as the machining of non-ferrous materials.

Lubricious Coating Recommended for Applications in:

- Low Tensile Strength Stamped Metals
- Low Carbon Steels
- Non-Ferrous Materials

TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Chipping	<ul style="list-style-type: none"> Feed rate too high Up milling (conventional) Cutting edge too sharp Chattering Loose tool Work piece rigidity Tool rigidity Low cutting speed Loose tool holder 	<ul style="list-style-type: none"> Reduce feed rate Change to down milling (climb) Hone cutting edge or allow break-in Reduce RPM Remove, clean and retighten Tighten workpiece holding method Shorten LOC, place shank further up holder Increase RPM Remove from spindle, clean and replace
Wear	<ul style="list-style-type: none"> High cutting speed Low feed rate Up milling (conventional) Hard material Poor chip evacuation Improper cutter helix Poor coolant 	<ul style="list-style-type: none"> Reduce RPM Increase feed rate Change to down milling (climb) Use coated tool Reposition coolant lines, use air blasting Change to recommended helix angle Replace coolant or correct mixture
Breakage	<ul style="list-style-type: none"> Feed rate too high Depth of cut too large Poor tool rigidity Tool wear Poor chip evacuation 	<ul style="list-style-type: none"> Reduce feed rate Reduce depth of cut Shorten LOC, place shank further up holder Replace/regrind sooner Reposition coolant lines, use air blasting
Chattering	<ul style="list-style-type: none"> Speed and feed too high Poor toolholder rigidity Poor spindle rigidity Workpiece rigidity Relief angle too high Depth of cut too large Poor tool rigidity 	<ul style="list-style-type: none"> Reduce feed rate Replace with shorter, more rigid holder Use larger spindle or different machine tool Tighten workpiece holding method Regrind with smaller relief angle Reduce depth of cut Shorten LOC, place shank further up holder
Short Life	<ul style="list-style-type: none"> Cutter/workpiece friction Hard material Poor material condition Improper cutter angle Poor coolant 	<ul style="list-style-type: none"> Used coated tool, clean material surface Regrind with proper primary relief angle Replace coolant or correct mixture
Chip Packing	<ul style="list-style-type: none"> Feed rate too high Low cutting speed Insufficient chip room Insufficient coolant 	<ul style="list-style-type: none"> Reduce feed rate or increase speed Increase RPM or reduce feed rate Use tool with less flutes, increase helix Increase volume of coolant
Poor Surface Finish	<ul style="list-style-type: none"> Feed rate too high Low cutting speed Insufficient chip room Insufficient coolant 	<ul style="list-style-type: none"> Reduce feed rate Increase RPM Replace or regrind tool Switch to higher helix Reduce depth of cut Increase volume of coolant
Burring or Workpiece Chipping	<ul style="list-style-type: none"> Tool wear Improper helix angle Feed rate too high Depth of cut too large 	<ul style="list-style-type: none"> Replace or regrind tool Change to recommended helix Reduce feed rate Reduce depth of cut
Workpiece Inaccuracy	<ul style="list-style-type: none"> Loose/worn toolholder Poor toolholder rigidity Poor spindle rigidity Insufficient number of flutes Tool deflection 	<ul style="list-style-type: none"> Repair or replace Replace with shorter/more rigid toolholder Use larger spindle or different machine tool Use tool with higher flute quantity Shorten LOC, place shank further up holder

CUSTOM TOOLING

Looking for Something Special?

Whether you need three or three-hundred, CGS Tool can manufacture custom End Mills specifically for your application. Don't make your program fit the tool, make the tool fit your program! Contact our sales team to discuss the details of your custom tool as well as current pricing and lead time.

For Complex Designs Please Supply a Tool Print or Sample Tooling

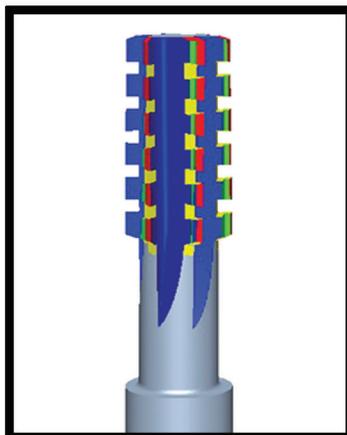
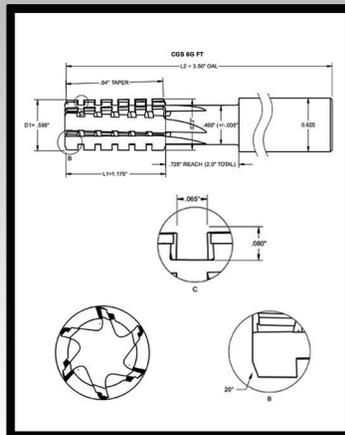
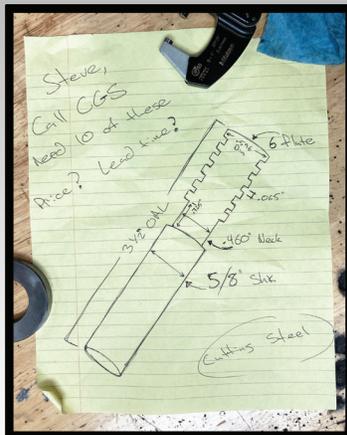
See Page 40 for Special Tooling Quotation Forms - *See Page 1 for Special Tooling Terms & Conditions*

Tool Customization

See a tool that almost fits your needs? CGS Tool can customize just about any in stock end mill from simply adding set screw flats, whistle notches, reduced necks or coolant grooves to custom lengths of cut, custom radii, corner chamfers, tapers, coolant holes and more!

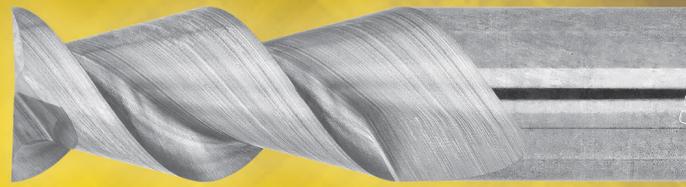
YOUR VISION IS OUR MISSION

- Extended Reach
- Custom Radii
- Tapered End Mills
- Dovetail Cutters
- Keyseat Cutters
- Coolant Through
- Up-Cut Routers
- Form Tools
- Chamfer Mills
- Drills
- Tight Tolerance
- Reamers



FEROCIOUS

2000 Series

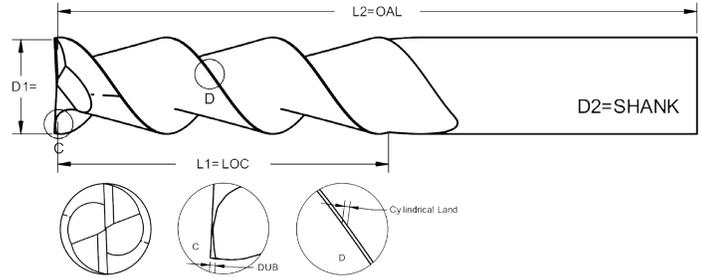


- **2 Flute, 55° Hi-Helix**
- **Manufactured from Premium Sub Micro Grain Carbide for High Transverse Rupture Strength**
- **Ground with Micro Polished Cylindrical Land for Improved Surface Finishes**
- **Stub, Standard, Long and Extra Long Lengths**
- **Extended Reach for Deep Pockets**
- **Reduced Neck & Weldon Flats Available Upon Request**

Standard Square End

2FL - Stub, Standard, & Long Length Sizes

EDP#	DIA	SHANK	LOC	OAL	FLUTE
2000	9/64"	3/16"	5/8"	2"	2 FL
2001	1/8"	1/8"	1/2"	1-1/2"	2 FL
2501	1/8"	1/8"	3/16"	1-1/2"	2 FL
2502	1/8"	1/8"	1/4"	2"	2 FL
2002	5/32"	5/32"	3/4"	2"	2 FL
2503	3/16"	3/16"	1/4"	2"	2 FL
2504	3/16"	3/16"	3/8"	3"	2 FL
2003	3/16"	3/16"	5/8"	2"	2 FL
2004	3/16"	3/16"	1"	3"	2 FL
2506	1/4"	1/4"	3/8"	2"	2 FL
2509	1/4"	1/4"	1/2"	3"	2 FL
2006	1/4"	1/4"	3/4"	2-1/2"	2 FL
2009	1/4"	1/4"	1-1/4"	3"	2 FL
2512	5/16"	5/16"	1/2"	2"	2 FL
2515	5/16"	5/16"	1/2"	3"	2 FL
2012	5/16"	5/16"	1"	2-1/2"	2 FL
2015	5/16"	5/16"	1-3/8"	3"	2 FL
2518	3/8"	3/8"	5/8"	2"	2 FL
2524	3/8"	3/8"	5/8"	4"	2 FL
2018	3/8"	3/8"	1"	2-1/2"	2 FL
2021	3/8"	3/8"	1-1/2"	3"	2 FL
2024	3/8"	3/8"	2-1/2"	4"	2 FL
2027	7/16"	7/16"	1"	3"	2 FL
2530	1/2"	1/2"	5/8"	2-1/2"	2 FL
2536	1/2"	1/2"	5/8"	4"	2 FL
2030	1/2"	1/2"	1"	3"	2 FL
2033	1/2"	1/2"	1-1/4"	3"	2 FL
2036	1/2"	1/2"	1-1/2"	3-1/2"	2 FL
2039	1/2"	1/2"	2"	4"	2 FL
2042	1/2"	1/2"	3"	5"	2 FL
2045	9/16"	9/16"	1-1/4"	3-1/2"	2 FL
2548	5/8"	5/8"	3/4"	3"	2 FL
2048	5/8"	5/8"	1-1/4"	3-1/2"	2 FL
2051	5/8"	5/8"	1-3/4"	4"	2 FL
2054	5/8"	5/8"	2-1/2"	5"	2 FL
2557	3/4"	3/4"	1"	3"	2 FL
2563	3/4"	3/4"	1"	6"	2 FL
2057	3/4"	3/4"	1-1/2"	4"	2 FL
2060	3/4"	3/4"	2-1/2"	5"	2 FL
2063	3/4"	3/4"	3-1/2"	6"	2 FL
2566	1"	1"	1"	3"	2 FL
2569	1"	1"	1"	7"	2 FL
2066	1"	1"	1-1/2"	4"	2 FL
2067	1"	1"	2-1/2"	5"	2 FL
2068	1"	1"	3"	6"	2 FL
2069	1"	1"	4"	7"	2 FL



Metric Square End

2FL - Stub, Standard, & Long Length Sizes

EDP#	DIA	SHANK	LOC	OAL	FLUTE
M2101-UC	3 mm	3 mm	10 mm	38 mm	2 FL
M2102-UC	4 mm	4 mm	16 mm	50 mm	2 FL
M2103-UC	5 mm	5 mm	16 mm	50 mm	2 FL
M2106-UC	6 mm	6 mm	19 mm	63 mm	2 FL
M2206-UC	6 mm	6 mm	32 mm	75 mm	2 FL
M2112-UC	8 mm	8 mm	22 mm	63 mm	2 FL
M2212-UC	8 mm	8 mm	35 mm	75 mm	2 FL
M2118-UC	10 mm	10 mm	25 mm	63 mm	2 FL
M2218-UC	10 mm	10 mm	38 mm	75 mm	2 FL
M2220-UC	10 mm	10 mm	63 mm	100 mm	2 FL
M2130-UC	12 mm	12 mm	25 mm	75 mm	2 FL
M2230-UC	12 mm	12 mm	38 mm	90 mm	2 FL
M2232-UC	12 mm	12 mm	50 mm	100 mm	2 FL
M2234-UC	12 mm	12 mm	75 mm	125 mm	2 FL
M2145-UC	14 mm	14 mm	32 mm	88 mm	2 FL
M2148-UC	16 mm	16 mm	32 mm	88 mm	2 FL
M2248-UC	16 mm	16 mm	44 mm	100 mm	2 FL
M2250-UC	16 mm	16 mm	63 mm	125 mm	2 FL
M2155-UC	18 mm	18 mm	38 mm	100 mm	2 FL
M2157-UC	20 mm	20 mm	38 mm	100 mm	2 FL
M2257-UC	20 mm	20 mm	63 mm	125 mm	2 FL
M2259-UC	20 mm	20 mm	90 mm	150 mm	2 FL
M2166-UC	25 mm	25 mm	38 mm	100 mm	2 FL
M2266-UC	25 mm	25 mm	63 mm	125 mm	2 FL
M2268-UC	25 mm	25 mm	102 mm	165 mm	2 FL

Cutting Diameter Tolerances +.000"/-.0005"

Shank Diameter Tolerances +.000"/-.0005"

Cutting Diameter Tolerances +.0"/-.0125mm"

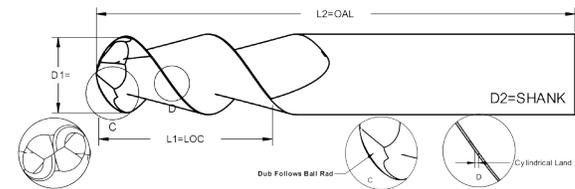
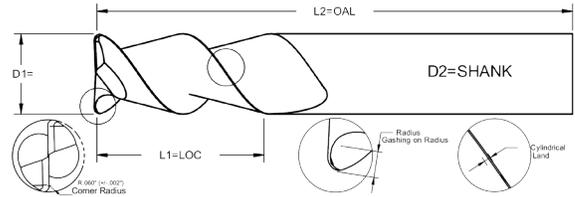
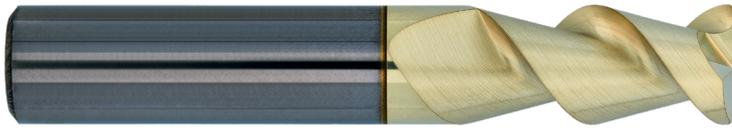
Shank Diameter Tolerances +.0"/-.0125mm"

FEROCIOUS

2000 Series

- Available with Corner Radius (CR) and Ball Nose (BN)
- High Performance in Roughing, Slotting, Contour, Peripheral and Finish Milling
- High Helix for Vertical Shear Action and Chip Evacuation
- Industry's Highest Attainable Speeds & Feeds when Milling Aluminum, Non-Ferrous Materials and Plastics
- Reduced Neck & Weldon Flats Available Upon Request

ZrN Coated tools: Add "S" After the Part Number



Corner Radius - CR

Cutting Diameter Tolerances +.000"/-.0005"

Shank Diameter Tolerances +.000"/-.0005"

2FL - Stub, Standard, & Long Length Sizes

Corner Radius Part Numbers

DIA	SHK	LOC	OAL	FLUTE	SQUARE	.015"	.030"	.060"	.090"	.125"
1/8"	1/8"	1/2"	1-1/2"	2 FL	2001	CR2001.015	CR2001.030	-	-	-
3/16"	3/16"	5/8"	2"	2 FL	2003	CR2003.015	CR2003.030	-	-	-
1/4"	1/4"	3/4"	2-1/2"	2 FL	2006	CR2006.015	CR2006.030	CR2006.060	-	-
3/8"	3/8"	1"	2-1/2"	2 FL	2018	CR2018.015	CR2018.030	CR2018.060	-	-
1/2"	1/2"	1"	3"	2 FL	2030	CR2030.015	CR2030.030	CR2030.060	CR2030.090	CR2030.125
1/2"	1/2"	1-1/4"	3"	2 FL	2033	CR2033.015	CR2033.030	CR2033.060	CR2033.090	CR2033.125
1/2"	1/2"	1-1/2"	3-1/2"	2 FL	2036	CR2036.015	CR2036.030	CR2036.060	CR2036.090	CR2036.125
1/2"	1/2"	2"	4"	2 FL	2039	CR2039.015	CR2039.030	CR2039.060	CR2039.090	CR2039.125
5/8"	5/8"	1-1/4"	3-1/2"	2 FL	2048	CR2048.015	CR2048.030	CR2048.060	CR2048.090	CR2048.125
3/4"	3/4"	1-1/2"	4"	2 FL	2057	CR2057.015	CR2057.030	CR2057.060	CR2057.090	CR2057.125
3/4"	3/4"	2-1/2"	5"	2 FL	2060	CR2060.015	CR2060.030	CR2060.060	CR2060.090	CR2060.125
1"	1"	1-1/2"	4"	2 FL	2066	CR2066.015	CR2066.030	CR2066.060	CR2066.090	CR2066.125
1"	1"	2-1/2"	5"	2 FL	2067	CR2067.015	CR2067.030	CR2067.060	CR2067.090	CR2067.125
1"	1"	4"	7"	2 FL	2069	CR2069.015	CR2069.030	CR2069.060	CR2069.090	CR2069.125

Ballnose - BN

Cutting Diameter Tolerances +.000"/-.0005"

Shank Diameter Tolerances +.000"/-.0005"

2FL - Stub, Standard, & Long Length Sizes

EDP#	DIA	SHANK	LOC	OAL	FLUTE
BN2001	1/8"	1/8"	1/2"	1-1/2"	2 FL
BN2003	3/16"	3/16"	5/8"	2"	2 FL
BN2006	1/4"	1/4"	3/4"	2-1/2"	2 FL
BN2009	1/4"	1/4"	1-1/4"	3"	2 FL
BN2012	5/16"	5/16"	1"	2-1/2"	2 FL
BN2018	3/8"	3/8"	1"	2-1/2"	2 FL
BN2021	3/8"	3/8"	1-1/2"	3"	2 FL
BN2030	1/2"	1/2"	1"	3"	2 FL
BN2033	1/2"	1/2"	1-1/4"	3"	2 FL
BN2036	1/2"	1/2"	1-1/2"	3-1/2"	2 FL
BN2039	1/2"	1/2"	2"	4"	2 FL
BN2048	5/8"	5/8"	1-1/4"	3-1/2"	2 FL
BN2057	3/4"	3/4"	1-1/2"	4"	2 FL
BN2060	3/4"	3/4"	2-1/2"	5"	2 FL
BN2066	1"	1"	1-1/2"	4"	2 FL
BN2067	1"	1"	2-1/2"	5"	2 FL
BN2069	1"	1"	4"	7"	2 FL

Special Sizes, Lengths and Radii Available Upon Quote Request

ZrN Coated tools: Add "S" After Each Part Number

Other Coatings Available Upon Request

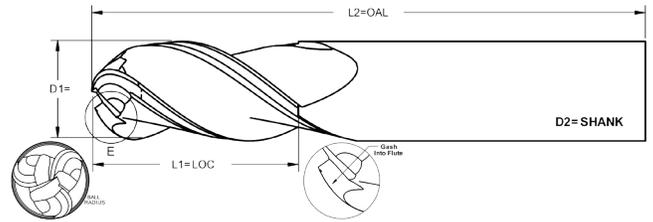
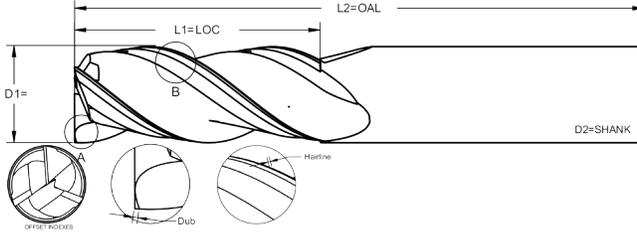


FEROCIOUS 3x

5300 & 5400 Series



- Aluminum Alloys, Non-Ferrous Materials & Plastics
 - Better Tool Performance at Higher RPM
 - Variable Helix and Variable Index
 - Improved Surface Finishes - Rough & Finish
 - Bright and ZrN Coating
 - Special Sizes, Lengths and Radii Available upon Request
 - Reduced Neck & Weldon Flats Available upon Request
- ZrN Coated tools: Add "S" After the Part Number**



Standard Square End

3FL - Square - Stub, Standard, & Long Length

EDP#	DIA	SHANK	LOC	OAL
5301	1/8"	1/8"	1/2"	1-1/2"
5303	3/16"	3/16"	5/8"	2"
5304	3/16"	3/16"	1"	3"
5306	1/4"	1/4"	3/4"	2-1/2"
5309	1/4"	1/4"	1-1/4"	3"
5312	5/16"	5/16"	1"	2-1/2"
5315	5/16"	5/16"	1-3/8"	3"
5318	3/8"	3/8"	1"	2-1/2"
5321	3/8"	3/8"	1-1/2"	3"
5327	7/16"	7/16"	1"	3"
5330	1/2"	1/2"	1"	3"
5333	1/2"	1/2"	1-1/4"	3"
5336	1/2"	1/2"	1-1/2"	3-1/2"
5339	1/2"	1/2"	2"	4"
5348	5/8"	5/8"	1-1/4"	3-1/2"
5351	5/8"	5/8"	1-3/4"	4"
5357	3/4"	3/4"	1-1/2"	4"
5360	3/4"	3/4"	2-1/2"	5"
5363	3/4"	3/4"	3-1/2"	6"
5366	1"	1"	1-1/2"	4"
5367	1"	1"	2-1/2"	5"
5368	1"	1"	3"	6"
5369	1"	1"	4"	7"

Cutting Diameter Tolerances +.0007/-.0005" Shank Diameter Tolerances +.0007/-.0005"

Standard Corner Radius

3FL - CR - Standard Sizes

EDP#	DIA	SHANK	LOC	OAL	RADIUS
CR5301.015	1/8"	1/8"	1/2"	1-1/2"	.015"
CR5303.020	3/16"	3/16"	5/8"	2"	.020"
CR5306.020	1/4"	1/4"	3/4"	2-1/2"	.020"
CR5312.020	5/16"	5/16"	1"	2-1/2"	.020"
CR5318.020	3/8"	3/8"	1"	2-1/2"	.020"
CR5330.015	1/2"	1/2"	1"	3"	.015"
CR5330.030	1/2"	1/2"	1"	3"	.030"
CR5348.030	5/8"	5/8"	1-1/4"	3-1/2"	.030"
CR5357.030	3/4"	3/4"	1-1/2"	4"	.030"
CR5366.030	1"	1"	1-1/2"	4"	.030"

Standard Ball End

3FL - BN - Standard Sizes

EDP#	DIA	SHANK	LOC	OAL	RADIUS
BN5301	1/8"	1/8"	1/2"	1-1/2"	BALL
BN5303	3/16"	3/16"	5/8"	2"	BALL
BN5306	1/4"	1/4"	3/4"	2-1/2"	BALL
BN5312	5/16"	5/16"	1"	2-1/2"	BALL
BN5318	3/8"	3/8"	1"	2-1/2"	BALL
BN5330	1/2"	1/2"	1"	3"	BALL
BN5348	5/8"	5/8"	1-1/4"	3-1/2"	BALL
BN5357	3/4"	3/4"	1-1/2"	4"	BALL
BN5366	1"	1"	1-1/2"	4"	BALL

Cutting Diameter Tolerances +.0"/-.0125mm

Shank Diameter Tolerances +.0"/-.0125mm

Metric Square End

3FL - Square - Metric Sizes - 5400 Series

EDP#	DIA	SHANK	LOC	OAL	RADIUS
5401	3 mm	3 mm	12 mm	38 mm	NO
5402	4 mm	4 mm	14 mm	50 mm	NO
5403	5 mm	5 mm	16 mm	50 mm	NO
5406	6 mm	6 mm	20 mm	63 mm	NO
5412	8 mm	8 mm	20 mm	63 mm	NO
5418	10 mm	10 mm	25 mm	75 mm	NO
5430	12 mm	12 mm	25 mm	75 mm	NO
5448	16 mm	16 mm	32 mm	88 mm	NO
5457	20 mm	20 mm	38 mm	100 mm	NO
5466	25 mm	25 mm	38 mm	100 mm	NO



THE BEAST

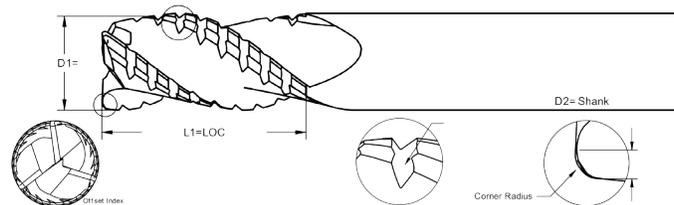
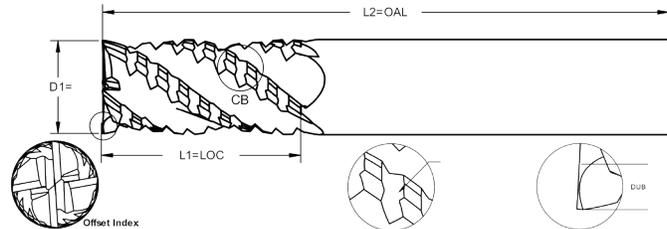
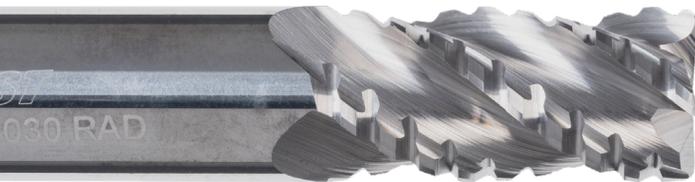
1000 Series

- Available with 3 or 4 Flutes & Corner Radius for Stronger Corners
- Advanced Chip Breaker Technology
- Available with ALTiN and other High Performance Coatings
- Free Cutting Geometry, Roughing and Finishing
- Variable Helix and Variable Index
- Smooth Wall Finish
- Reduced Neck & Weldon Flats Available Upon Request

Special Sizes, Lengths and Radii Available Upon Quote Request

ALTiN Coated tools:
Add "ALTiN" After Each Part #

AICrN & Other Coatings Available Upon Request



Beast Standard Square & Radius End

3FL & 4FL - Square & Corner Radius Sizes

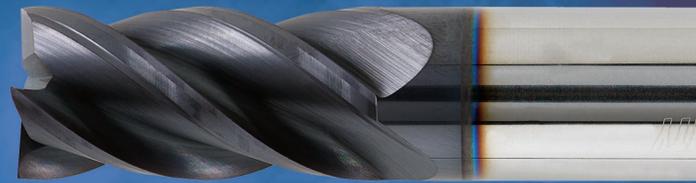
Cutting Diameter Tolerances +.000"/-.002"

Shank Diameter Tolerances +.000"/-.0005"

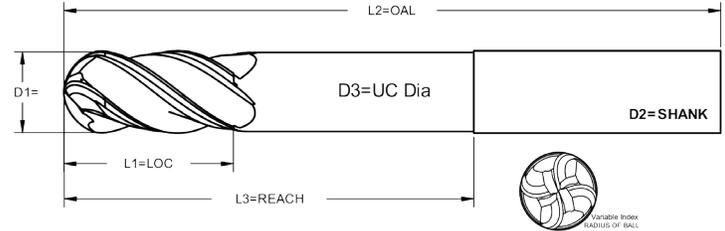
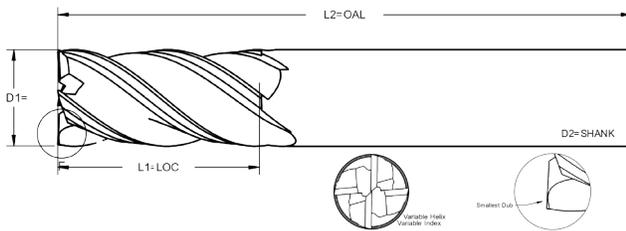
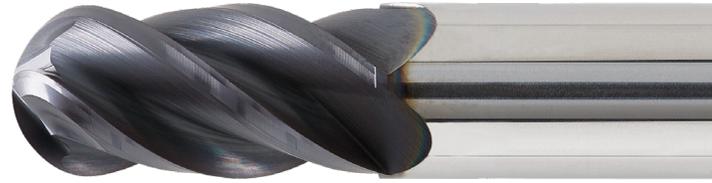
EDP#	DIA	SHANK	LOC	OAL	RADIUS	FLUTE
1001	1/8"	1/8"	1/2"	1-1/2"	-	4 FL
CR1001	1/8"	1/8"	1/2"	1-1/2"	.015"	4 FL
CR1301	1/8"	1/8"	1/2"	1-1/2"	.015"	3 FL
1003	3/16"	3/16"	5/8"	2"	-	4 FL
CR1003	3/16"	3/16"	5/8"	2"	.020"	4 FL
CR1303	3/16"	3/16"	5/8"	2"	.020"	3 FL
1006	1/4"	1/4"	3/4"	2-1/2"	-	4 FL
CR1006	1/4"	1/4"	3/4"	2-1/2"	.020"	4 FL
CR1306	1/4"	1/4"	3/4"	2-1/2"	.020"	3 FL
1009	5/16"	5/16"	13/16"	2-1/2"	-	4 FL
CR1009	5/16"	5/16"	13/16"	2-1/2"	.020"	4 FL
CR1309	5/16"	5/16"	13/16"	2-1/2"	.020"	3 FL
1012	3/8"	3/8"	1"	2-1/2"	-	4 FL
CR1012	3/8"	3/8"	1"	2-1/2"	.020"	4 FL
CR1312	3/8"	3/8"	1"	2-1/2"	.025"	3 FL
1015	7/16"	7/16"	1"	2-3/4"	-	4 FL
1018	1/2"	1/2"	1"	3"	-	4 FL
1020	1/2"	1/2"	1-1/4"	3"	-	4 FL
CR1018	1/2"	1/2"	1"	3"	.030"	4 FL
CR1020	1/2"	1/2"	1-1/4"	3"	.030"	4 FL
CR1318	1/2"	1/2"	1"	3"	.030"	3 FL
1021	9/16"	9/16"	1-1/4"	3-1/2"	-	4 FL
1024	5/8"	5/8"	1-1/4"	3-1/2"	-	4 FL
CR1024	5/8"	5/8"	1-1/4"	3-1/2"	.035"	4 FL
CR1324	5/8"	5/8"	1-1/4"	3-1/2"	.060"	3 FL
1030	3/4"	3/4"	1-1/2"	4"	-	4 FL
CR1030	3/4"	3/4"	1-1/2"	4"	.040"	4 FL
CR1330	3/4"	3/4"	1-1/2"	4"	.060"	3 FL
1033	1"	1"	1-1/2"	4"	-	4 FL

HI-VELOCITY

HV Series - Square & Ball End



- Variable Helix and Variable Index
- **AlTiN Coating**
- Better Tool Performance at Higher RPM
- Less Tool Wear at High Speeds in Alloys and Steels
- Improved Surface Finishes - Rough & Finish
- Eliminate Multiple Tooling
- Reduced Neck & Weldon Flats Available Upon Request



HV Standard Square & Ball End

Cutting Diameter Tolerances $+0.000/-0.002$ Shank Diameter Tolerances $+0.000/-0.0005$

4FL - Square & Ball End - Stub, Standard, Long Length & Extended Reach Sizes

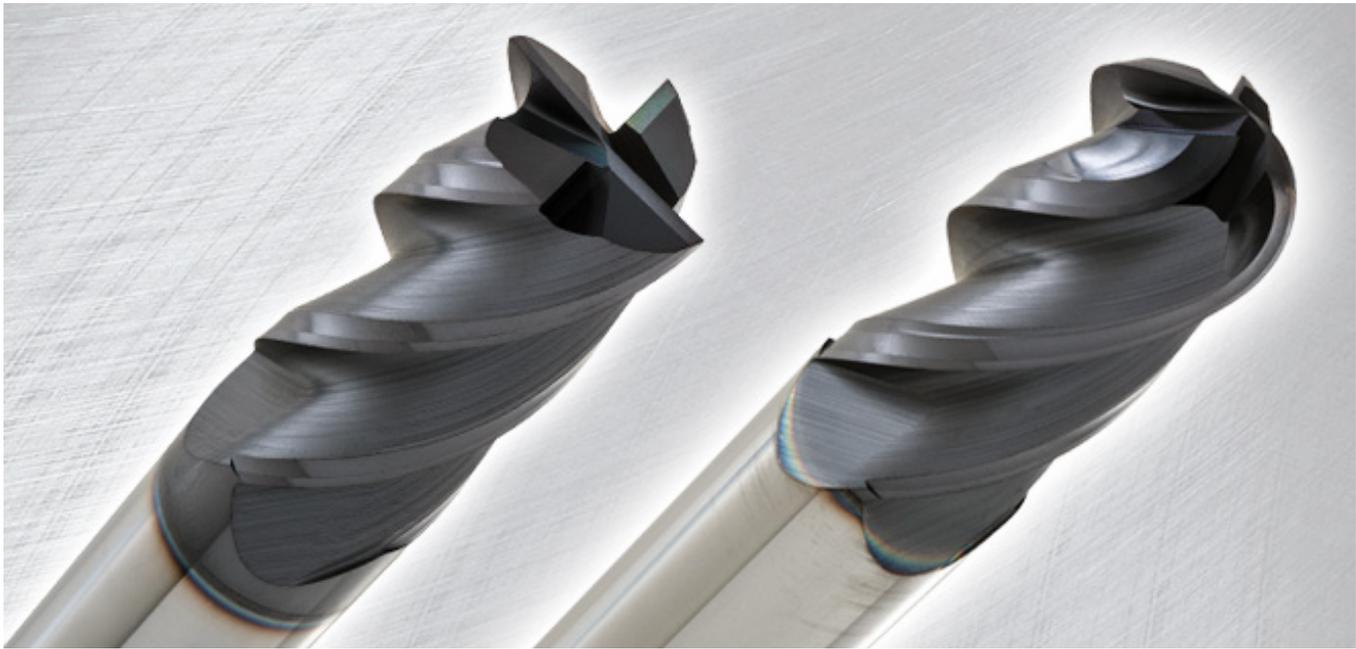
DIA	SHANK	LOC	NECK (D3)	REACH (L3)	OAL	SQUARE END	BALL END
1/8"	1/8"	3/16"	-	-	1-1/2"	HV240-1250	HV242-1250
1/8"	1/8"	1/4"	-	-	2"	HV240-1252	HV242-1252
1/8"	1/8"	1/2"	-	-	1-1/2"	HV140-1250	HV142-1250
1/8"	1/8"	1/2"	-	-	3"	HV140-1252	HV142-1252
1/8"	1/8"	1/2"	-	-	2"	HV140-1253	HV142-1253
3/16"	3/16"	1/4"	-	-	2"	HV240-1872	-
3/16"	3/16"	3/8"	-	-	2"	HV240-1875	HV242-1875
3/16"	3/16"	3/8"	-	-	3"	HV240-1873	-
3/16"	3/16"	5/8"	-	-	2"	HV140-1875	HV142-1875
3/16"	3/16"	5/8"	-	-	3"	HV140-1876	HV142-1876
1/4"	1/4"	1/2"	-	-	2"	HV240-2500	HV242-2500
1/4"	1/4"	1/2"	-	-	3"	HV240-2503	-
1/4"	1/4"	3/4"	-	-	2-1/2"	HV140-2500	HV142-2500
1/4"	1/4"	3/4"	-	-	3"	HV140-2503	-
1/4"	1/4"	3/4"	0.2350"	2-1/2"	4"	HV140-2501	HV142-2501
1/4"	1/4"	1-1/8"	-	-	3"	HV740-2500	-
5/16"	5/16"	1/2"	-	-	2"	HV240-3125	HV242-3125
5/16"	5/16"	1/2"	-	-	3"	HV240-3123	-
5/16"	5/16"	13/16"	-	-	2-1/2"	HV140-3125	HV142-3125
5/16"	5/16"	13/16"	-	-	3"	HV140-3123	-
5/16"	5/16"	13/16"	0.3000"	2-1/2"	4"	HV140-3126	HV142-3126
5/16"	5/16"	1-1/8"	-	-	3"	HV740-3125	-
3/8"	3/8"	1/2"	-	-	3"	HV240-3753	-
3/8"	3/8"	1/2"	-	-	4"	HV240-3754	-
3/8"	3/8"	1/2"	-	-	6"	HV240-3756	-
3/8"	3/8"	5/8"	-	-	2"	HV240-3750	HV242-3750
3/8"	3/8"	1"	-	-	2-1/2"	HV140-3750	HV142-3750
3/8"	3/8"	1"	0.3600"	2-1/2"	4"	HV140-3751	HV142-3751
3/8"	3/8"	1"	0.3600"	4"	6"	HV140-3752	HV142-3752
3/8"	3/8"	1"	-	-	3"	HV140-3753	-
3/8"	3/8"	1"	-	-	4"	HV140-3754	-
3/8"	3/8"	1"	-	-	6"	HV140-3756	-
3/8"	3/8"	1-1/2"	-	-	3"	HV740-3750	-
7/16"	7/16"	5/8"	-	-	2-1/2"	HV240-4375	-
7/16"	7/16"	1"	-	-	2-3/4"	HV140-4375	HV142-4375

Special Sizes, Lengths and Radii Available Upon Request - AlCrN Coating Available Upon Request

- 4 FLUTE
- VARIABLE
- VARIABLE INDEX
- SQUARE END
- BALL END
- AlTiN
- AlCrN
- PROFILE
- ROUGHING
- SLOTTING
- CONTOUR
- HEM

HI-VELOCITY

HV Series - Square & Ball End



HV Standard Square & Ball End

Cutting Diameter Tolerances $\pm 0.007/-0.002$ Shank Diameter Tolerances $\pm 0.0007/-0.0005$

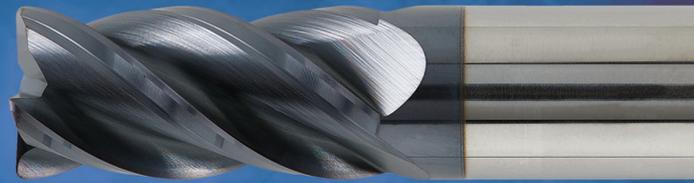
4FL - Square & Ball End - Stub, Standard, Long Length & Extended Reach Sizes

DIA	SHANK	LOC	NECK (D3)	REACH (L3)	OAL	SQUARE END	BALL END
1/2"	1/2"	5/8"	-	-	2-1/2"	HV240-5000	HV242-5000
1/2"	1/2"	5/8"	-	-	3"	HV240-5003	-
1/2"	1/2"	5/8"	-	-	4"	HV240-5004	-
1/2"	1/2"	5/8"	-	-	6"	HV240-5006	-
1/2"	1/2"	1"	-	-	3"	HV140-5000	HV142-5000
1/2"	1/2"	1"	-	-	4"	HV140-5004	-
1/2"	1/2"	1"	0.4850"	2-1/2"	4"	HV140-5001	HV142-5001
1/2"	1/2"	1"	-	-	6"	HV140-5006	-
1/2"	1/2"	1"	0.4850"	4"	6"	HV140-5002	HV142-5002
1/2"	1/2"	1-1/4"	-	-	3"	HV140-5025	HV142-5025
1/2"	1/2"	2"	-	-	4"	HV740-5000	-
5/8"	5/8"	3/4"	-	-	3"	HV240-6250	HV242-6250
5/8"	5/8"	3/4"	-	-	5"	HV240-6255	-
5/8"	5/8"	1-1/4"	-	-	3-1/2"	HV140-6250	HV142-6250
5/8"	5/8"	1-1/4"	0.6100"	4"	6"	HV140-6251	HV142-6251
5/8"	5/8"	2-1/4"	-	-	5"	HV740-6250	-
3/4"	3/4"	1"	-	-	3"	HV240-7500	HV242-7500
3/4"	3/4"	1"	-	-	5"	HV240-7505	-
3/4"	3/4"	1-1/2"	-	-	4"	HV140-7500	HV142-7500
3/4"	3/4"	1-1/2"	0.7300"	3"	5"	HV140-7501	HV142-7501
3/4"	3/4"	1-1/2"	0.7300"	5"	6"	HV140-7502	HV142-7502
3/4"	3/4"	2-1/4"	-	-	5"	HV740-7500	-
3/4"	3/4"	3"	-	-	6"	HV840-7500	-
1"	1"	1-1/2"	-	-	4"	HV140-1000	HV142-1000
1"	1"	1-1/2"	0.9800"	3"	5"	HV140-1001	HV142-1001
1"	1"	1-1/2"	0.9800"	4"	6"	HV140-1002	HV142-1002
1"	1"	2-1/4"	-	-	5"	HV740-1000	-
1"	1"	3"	-	-	6"	HV840-1000	-

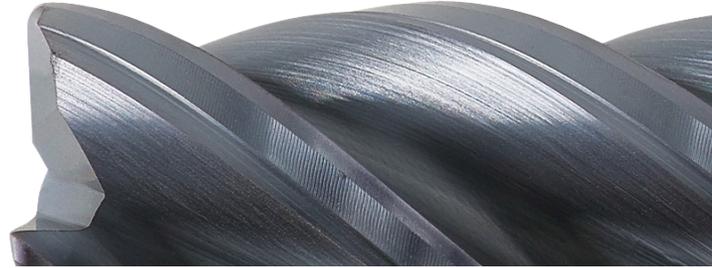
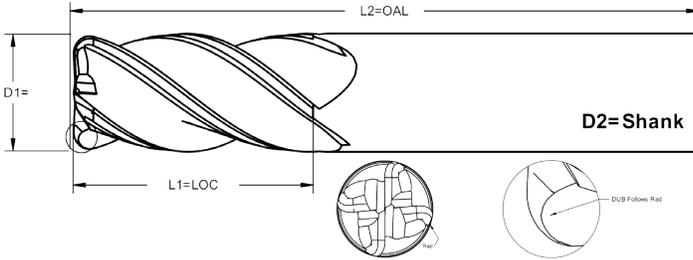
Special Sizes, Lengths and Radii Available Upon Request - AICrN Coating Available Upon Request

HI-VELOCITY

HV Series - Corner Radius



- Variable Helix and Variable Index
- **AlTiN Coating**
- Better Tool Performance at Higher RPM
- Less Tool Wear at High Speeds in Alloys and Steels
- Improved Surface Finishes - Rough & Finish
- Eliminate Multiple Tooling
- Reduced Neck & Weldon Flats Available Upon Request



HV Standard Corner Radius

Cutting Diameter Tolerances +.000"/-.002" Shank Diameter Tolerances +.000"/-.0005"

4 FL - Corner Radius - Stub, Standard, Long Length & Extended Reach Sizes

DIA	SHK	LOC	D3	L3	OAL	.010"	.015"	.030"	.060"	.090"	.125"
1/8"	1/8"	3/16"	-	-	1-1/2"	HV243-1250.010	HV243-1250.015	-	-	-	-
1/8"	1/8"	1/4"	-	-	2"	HV243-1252.010	HV243-1252.015	-	-	-	-
1/8"	1/8"	1/2"	-	-	1-1/2"	HV143-1250.010	HV143-1250.015	HV143-1250.030	-	-	-
1/8"	1/8"	1/2"	-	-	3"	-	HV143-1252.015	-	-	-	-
1/8"	1/8"	1/2"	-	-	2"	-	HV143-1253.015	-	-	-	-
3/16"	3/16"	1/4"	-	-	2"	-	HV243-1872.015	-	-	-	-
3/16"	3/16"	3/8"	-	-	2"	-	HV243-1875.015	HV243-1875.030	-	-	-
3/16"	3/16"	3/8"	-	-	3"	-	HV243-1873.015	-	-	-	-
3/16"	3/16"	5/8"	-	-	2"	-	HV143-1875.015	HV143-1875.030	-	-	-
3/16"	3/16"	5/8"	-	-	3"	-	HV143-1876.015	-	-	-	-
1/4"	1/4"	1/2"	-	-	2"	HV243-2500.010	HV243-2500.015	HV243-2500.030	-	-	-
1/4"	1/4"	1/2"	-	-	3"	-	HV243-2503.015	HV243-2503.030	-	-	-
1/4"	1/4"	3/4"	-	-	2-1/2"	HV143-2500.010	HV143-2500.015	HV143-2500.030	-	-	-
1/4"	1/4"	3/4"	-	-	3"	-	HV143-2503.015	HV143-2503.030	-	-	-
1/4"	1/4"	3/4"	0.2350"	2-1/2"	4"	-	HV143-2501.015	-	-	-	-
1/4"	1/4"	1-1/8"	-	-	3"	-	HV743-2500.015	HV743-2500.030	-	-	-
5/16"	5/16"	1/2"	-	-	2"	-	HV243-3125.015	HV243-3125.030	-	-	-
5/16"	5/16"	1/2"	-	-	3"	-	HV243-3123.015	HV243-3123.030	-	-	-
5/16"	5/16"	13/16"	-	-	2-1/2"	HV143-3125.010	HV143-3125.015	HV143-3125.030	-	-	-
5/16"	5/16"	13/16"	-	-	3"	-	HV143-3123.015	HV143-3123.030	-	-	-
5/16"	5/16"	13/16"	0.3000"	2-1/2"	4"	-	HV143-3126.015	-	-	-	-
5/16"	5/16"	1-1/8"	-	-	3"	-	HV743-3125.015	HV743-3125.030	-	-	-
3/8"	3/8"	1/2"	-	-	3"	-	HV243-3753.015	-	-	-	-
3/8"	3/8"	1/2"	-	-	4"	-	HV243-3754.015	-	-	-	-
3/8"	3/8"	1/2"	-	-	6"	-	HV243-3756.015	-	-	-	-
3/8"	3/8"	5/8"	-	-	2"	HV243-3750.010	HV243-3750.015	HV243-3750.030	-	-	-
3/8"	3/8"	1"	-	-	2-1/2"	HV143-3750.010	HV143-3750.015	HV143-3750.030	HV143-3750.060	-	-
3/8"	3/8"	1"	0.3600"	2-1/2"	4"	-	HV143-3751.015	-	-	-	-
3/8"	3/8"	1"	0.3600"	4"	6"	-	HV143-3752.015	-	-	-	-
3/8"	3/8"	1"	-	-	3"	HV143-3753.010	HV143-3753.015	-	-	-	-
3/8"	3/8"	1"	-	-	4"	-	HV143-3754.015	-	-	-	-
3/8"	3/8"	1"	-	-	6"	-	HV143-3756.015	-	-	-	-
3/8"	3/8"	1-1/2"	-	-	3"	-	HV743-3750.015	HV743-3750.030	-	-	-
7/16"	7/16"	5/8"	-	-	2-1/2"	-	HV243-4375.015	-	-	-	-
7/16"	7/16"	1"	-	-	2-3/4"	-	HV143-4375.015	-	-	-	-

Special Sizes, Lengths and Radii Available Upon Request - AlCrN Coating Available Upon Request

HV Standard Corner Radius

Cutting Diameter Tolerances $\pm .000^+/- .002^*$

Shank Diameter Tolerances $\pm .000^+/- .0005^*$

4FL - Corner Radius - Stub, Standard, Long Length & Extended Reach Sizes

DIA	SHK	LOC	D3	L3	OAL	.010"	.015"	.030"	.060"	.090"	.125"
1/2"	1/2"	5/8"	-	-	2-1/2"	HV243-5000.010	HV243-5000.015	HV243-5000.030	HV243-5000.060	HV243-5000.090	HV243-5000.125
1/2"	1/2"	5/8"	-	-	3"	-	HV243-5003.015	HV243-5003.030	HV243-5003.060	-	-
1/2"	1/2"	5/8"	-	-	4"	-	HV243-5004.015	HV243-5004.030	HV243-5004.060	-	-
1/2"	1/2"	5/8"	-	-	6"	-	HV243-5006.015	HV243-5006.030	HV243-5006.060	-	-
1/2"	1/2"	1"	-	-	3"	-	HV143-5000.015	HV143-5000.030	HV143-5000.060	HV143-5000.090	HV143-5000.125
1/2"	1/2"	1"	-	-	4"	-	HV143-5004.015	HV143-5004.030	HV143-5004.060	-	-
1/2"	1/2"	1"	0.4850"	2-1/2"	4"	-	-	HV143-5001.030	-	-	-
1/2"	1/2"	1"	-	-	6"	-	HV143-5006.015	HV143-5006.030	HV143-5006.060	-	-
1/2"	1/2"	1"	0.4850"	4"	6"	-	-	HV143-5002.030	-	-	-
1/2"	1/2"	1-1/4"	-	-	3"	-	HV143-5025.015	HV143-5025.030	-	-	-
1/2"	1/2"	2"	-	-	4"	-	HV743-5000.015	HV743-5000.030	-	-	-
5/8"	5/8"	3/4"	-	-	3"	-	HV243-6250.015	HV243-6250.030	HV243-6250.060	-	-
5/8"	5/8"	3/4"	-	-	5"	-	-	HV243-6255.030	-	-	-
5/8"	5/8"	1-1/4"	-	-	3-1/2"	-	HV143-6250.015	HV143-6250.030	HV143-6250.060	HV143-6250.090	-
5/8"	5/8"	1-1/4"	0.6100"	4"	6"	-	-	HV143-6251.030	-	-	-
5/8"	5/8"	2-1/4"	-	-	5"	-	-	HV743-6250.030	-	-	-
3/4"	3/4"	1"	-	-	3"	-	-	HV243-7500.030	HV243-7500.060	HV243-7500.090	-
3/4"	3/4"	1"	-	-	5"	-	-	HV243-7505.030	-	-	-
3/4"	3/4"	1-1/2"	-	-	4"	-	-	HV143-7500.030	HV143-7500.060	HV143-7500.090	HV143-7500.125
3/4"	3/4"	1-1/2"	0.7300"	3"	5"	-	-	HV143-7501.030	-	-	-
3/4"	3/4"	1-1/2"	0.7300"	5"	6"	-	-	HV143-7502.030	-	-	-
3/4"	3/4"	2-1/4"	-	-	5"	-	-	HV743-7500.030	HV743-7500.060	HV743-7500.090	-
3/4"	3/4"	3"	-	-	6"	-	-	HV843-7500.030	-	-	-
1"	1"	1-1/2"	-	-	4"	-	-	HV143-1000.030	HV143-1000.060	HV143-1000.090	HV143-1000.125
1"	1"	1-1/2"	0.9800"	3"	5"	-	-	HV143-1001.030	-	-	-
1"	1"	1-1/2"	0.9800"	4"	6"	-	-	HV143-1002.030	-	-	-
1"	1"	2-1/4"	-	-	5"	-	-	HV743-1000.030	-	-	-
1"	1"	3"	-	-	6"	-	-	HV843-1000.030	-	-	-

Special Sizes, Lengths and Radii Available: Request a Quote!

AlCrN Coating Available Upon Request

HV Metric Corner Radius

4FL - Corner Radius - Metric Sizes

Cutting Diameter Tolerances 1mm-2.9mm = $\pm 0/- .025$ mm 3mm-25mm = $\pm 0/- .050$ mm

Shank Diameter Tolerances $\pm 0^+/- .0125$ mm

EDP#	DIA	SHANK	LOC	OAL	RADIUS
HVM143-030	3 mm	3 mm	12 mm	38 mm	.25 mm
HVM143-040	4 mm	4 mm	14 mm	50 mm	.25 mm
HVM143-050	5 mm	5 mm	16 mm	50 mm	.25 mm
HVM143-060	6 mm	6 mm	20 mm	63 mm	.38 mm
HVM143-080	8 mm	8 mm	20 mm	63 mm	.38 mm
HVM143-100	10 mm	10 mm	25 mm	75 mm	.51 mm
HVM143-120	12 mm	12 mm	25 mm	75 mm	.51 mm
HVM143-160	16 mm	16 mm	32 mm	88 mm	.63 mm
HVM143-200	20 mm	20 mm	38 mm	100 mm	.89 mm
HVM143-250	25 mm	25 mm	38 mm	100 mm	.89 mm

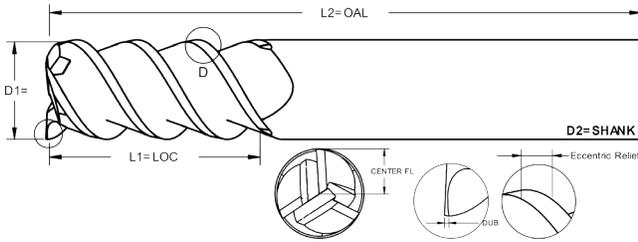


STORM

3000 Series



- **3 Flute, 60° Hi-Helix**
- **Free Cutting Geometry**
- **Ground with HD Eccentric Relief for Extra Strength and Stability to the Cutting Edge**
- **High Performance End Mill Used in the Milling of Stainless Steels, Titanium, Inconel & Nickel Based Alloys**
- **Reduced Neck & Weldon Flats Available Upon Request**

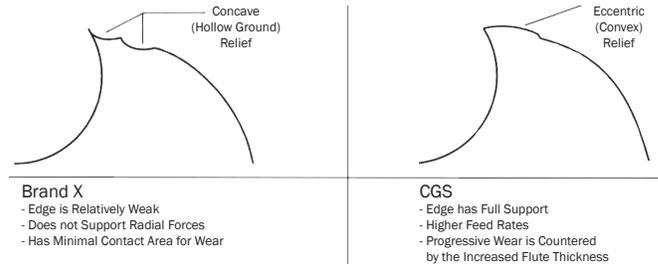


Special Sizes, Lengths and Radii Available Upon Quote Request

ALTiN Coated tools: Add "ALTiN" After Each Part #

Other Coatings Available Upon Request

ECCENTRIC RELIEF is a Positive Arched Cutting Edge: A Convex Surface vs. a Concave (hollow ground) Surface. Eccentric Relief Increases the Strength of an End Mills Cutting Edges.



Storm Standard Square End

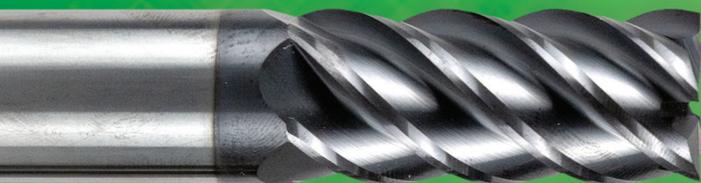
Cutting Diameter Tolerances +.000"/-.002"

Shank Diameter Tolerances +.000"/-.0005"

3FL - Stub, Standard, & Long Length Sizes

EDP#	DIA	SHANK	LOC	OAL	FLUTE
3001	1/8"	1/8"	1/2"	1-1/2"	3 FL
3002	5/32"	3/16"	1/2"	2"	3 FL
3003	3/16"	3/16"	5/8"	2"	3 FL
3103	3/16"	3/16"	1"	2-1/2"	3 FL
3004	7/32"	1/4"	3/4"	2-1/2"	3 FL
3006	1/4"	1/4"	3/4"	2-1/2"	3 FL
3106	1/4"	1/4"	1"	2-1/2"	3 FL
3107	1/4"	1/4"	1-1/4"	2-1/2"	3 FL
3009	5/16"	5/16"	13/16"	2-1/2"	3 FL
3012	3/8"	3/8"	1"	2-1/2"	3 FL
3108	3/8"	3/8"	1-1/8"	2-1/2"	3 FL
3109	3/8"	3/8"	1-1/2"	3"	3 FL
3015	7/16"	7/16"	1"	3"	3 FL
3018	1/2"	1/2"	1"	3"	3 FL
3112	1/2"	1/2"	1-1/4"	3"	3 FL
3113	1/2"	1/2"	1-1/2"	3-1/2"	3 FL
3115	1/2"	1/2"	2"	4"	3 FL
3021	9/16"	9/16"	1-1/4"	3-1/2"	3 FL
3024	5/8"	5/8"	1-1/4"	3-1/2"	3 FL
3116	5/8"	5/8"	1-3/4"	4"	3 FL
3030	3/4"	3/4"	1-1/2"	4"	3 FL
3121	3/4"	3/4"	2"	4"	3 FL
3124	3/4"	3/4"	2-1/2"	5"	3 FL
3127	3/4"	3/4"	3-1/2"	6"	3 FL
3033	1"	1"	1-1/2"	4"	3 FL
3136	1"	1"	4"	7"	3 FL
3137	1"	1"	6"	9"	3 FL



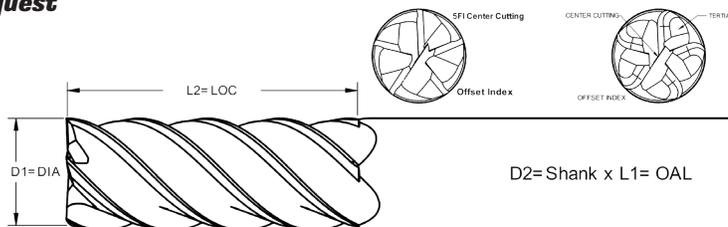


EF-5 TORNADO



45000 Series

- 5 Flute, 45° Helix with Variable Index
- High Performance when Peripheral and Finish Milling
- High Helix for Vertical Shear Action and Chip Evacuation
- Ground with Flat Clearance for Extreme Cutting Edge Strength and Improved Surface Finishes
- Heavy Core for Increased Stability and Minimum Tool Deflection
- Reduced Neck & Weldon Flats Available Upon Request



EF-5 Square & Radius End

5FL - Square End & Corner Radius - Stub, Standard, Long Length Sizes

DIA	SHK	LOC	OAL	SQUARE	.015"	.030"	.060"	.090"
1/8"	1/8"	1/4"	1-1/2"	45001	CR45001.015	CR45001.030	-	-
1/8"	1/8"	1/2"	1-1/2"	45002	CR45002.015	CR45002.030	-	-
5/32"	3/16"	5/16"	2"	45003	-	-	-	-
5/32"	3/16"	9/16"	2"	45004	-	-	-	-
3/16"	3/16"	5/16"	2"	45005	CR45005.015	CR45005.030	-	-
3/16"	3/16"	9/16"	2"	45006	CR45006.015	CR45006.030	-	-
7/32"	1/4"	3/8"	2"	45007	-	-	-	-
7/32"	1/4"	3/4"	2-1/2"	45008	-	-	-	-
1/4"	1/4"	3/8"	2"	45009	CR45009.015	CR45009.030	-	-
1/4"	1/4"	3/4"	2-1/2"	45010	CR45010.015	CR45010.030	-	-
1/4"	1/4"	1-1/4"	4"	45011	CR45011.015	CR45011.030	-	-
9/32"	5/16"	7/16"	2"	45012	-	-	-	-
9/32"	5/16"	13/16"	2-1/2"	45013	-	-	-	-
5/16"	5/16"	7/16"	2"	45014	CR45014.015	CR45014.030	CR45014.060	-
5/16"	5/16"	13/16"	2-1/2"	45015	CR45015.015	CR45015.030	CR45015.060	-
5/16"	5/16"	1-1/4"	4"	45016	CR45016.015	CR45016.030	CR45016.060	-
5/16"	5/16"	2-1/8"	4"	45017	CR45017.015	CR45017.030	-	-
11/32"	3/8"	1/2"	2"	45018	-	-	-	-
11/32"	3/8"	1"	2-1/2"	45019	-	-	-	-
3/8"	3/8"	1/2"	2"	45020	CR45020.015	CR45020.030	CR45020.060	CR45020.090
3/8"	3/8"	1"	2-1/2"	45021	CR45021.015	CR45021.030	CR45021.060	CR45021.090
3/8"	3/8"	1-1/2"	4"	45022	CR45022.015	CR45022.030	CR45022.060	-
3/8"	3/8"	2-1/2"	6"	45023	CR45023.015	CR45023.030	CR45023.060	-
13/32"	7/16"	9/16"	2-1/2"	45024	-	-	-	-
13/32"	7/16"	1"	3"	45025	-	-	-	-
7/16"	7/16"	9/16"	2-1/2"	45026	-	-	-	-
7/16"	7/16"	1"	3"	45027	CR45027.015	CR45027.030	CR45027.060	-
7/16"	7/16"	2"	4"	45028	-	-	-	-
15/32"	1/2"	5/8"	2-1/2"	45029	-	-	-	-
15/32"	1/2"	1-1/4"	3"	45030	-	-	-	-
1/2"	1/2"	5/8"	2-1/2"	45031	CR45031.015	CR45031.030	CR45031.060	CR45031.090
1/2"	1/2"	1-1/4"	3"	45032	CR45032.015	CR45032.030	CR45032.060	CR45032.090
1/2"	1/2"	2"	4"	45033	CR45033.015	CR45033.030	CR45033.060	CR45033.090
1/2"	1/2"	3-1/8"	6"	45034	CR45034.015	CR45034.030	CR45034.060	CR45034.090
9/16"	9/16"	1-1/2"	3-1/2"	45035	-	-	-	-
5/8"	5/8"	3/4"	3"	45036	CR45036.015	CR45036.030	CR45036.060	CR45036.090
5/8"	5/8"	1-5/8"	3-1/2"	45037	CR45037.015	CR45037.030	CR45037.060	CR45037.090
5/8"	5/8"	2-1/2"	5"	45038	CR45038.015	CR45038.030	CR45038.060	CR45038.090
5/8"	5/8"	4"	6"	45039	CR45039.015	CR45039.030	CR45039.060	CR45039.090
3/4"	3/4"	1"	3"	45040	CR45040.015	CR45040.030	CR45040.060	CR45040.090
3/4"	3/4"	1-5/8"	4"	45041	CR45041.015	CR45041.030	CR45041.060	CR45041.090
3/4"	3/4"	2-1/4"	5"	45042	CR45042.015	CR45042.030	CR45042.060	CR45042.090
3/4"	3/4"	3-1/4"	6"	45043	CR45043.015	CR45043.030	CR45043.060	CR45043.090
3/4"	3/4"	4"	6"	45044	CR45044.015	CR45044.030	CR45044.060	CR45044.090
1"	1"	1-1/4"	3"	45045	CR45045.015	CR45045.030	CR45045.060	CR45045.090
1"	1"	2"	4"	45046	CR45046.015	CR45046.030	CR45046.060	CR45046.090
1"	1"	2-5/8"	6"	45047	CR45047.015	CR45047.030	CR45047.060	CR45047.090
1"	1"	3-1/4"	6"	45048	CR45048.015	CR45048.030	CR45048.060	CR45048.090
1"	1"	4-1/8"	7"	45049	CR45049.015	CR45049.030	CR45049.060	CR45049.090

Special Sizes, Lengths and Radii Available Upon Quote Request

ALTiN Coated tools: Add "ALTiN" After Each Part #

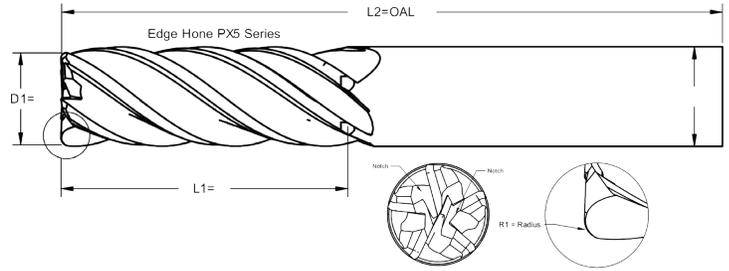
AICrN & Other Coatings Available Upon Request

Cutting Diameter Tolerances +.000"/-.002" Shank Diameter Tolerances +.000"/-.0005"

PX SERIES



- **High Efficiency Tool Path Optimized**
- **High Performance Nano Grain Carbide**
- **HD Eccentric Cutting Edge Prep**
- **AlCrN High Performance Tool Coating**
- **Variable Helix and Variable Index**
- **Reduced Neck & Weldon Flats Available Upon Request**



PX 5 Flute Radius End

Cutting Diameter Tolerances $\pm .0007$ / $-.002$ Shank Diameter Tolerances $\pm .0007$ / $-.0005$

5FL - Corner Radius - Stub, Standard, Long Length Sizes

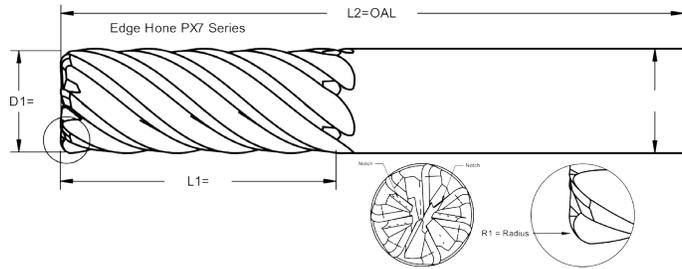
DIA	SHK	LOC	OAL	.010"	.015"	.030"	.060"	.090"	.120"
1/8"	1/8"	1/4"	1-1/2"	PX253-1250.010	PX253-1250.015	PX253-1250.030	-	-	-
1/8"	1/8"	1/2"	1-1/2"	PX153-1250.010	PX153-1250.015	PX153-1250.030	-	-	-
3/16"	3/16"	3/8"	2"	PX253-1875.010	PX253-1875.015	PX253-1875.030	-	-	-
3/16"	3/16"	5/8"	2"	PX153-1875.010	PX153-1875.015	PX153-1875.030	-	-	-
1/4"	1/4"	1/2"	2"	PX253-2500.010	PX253-2500.015	PX253-2500.030	-	-	-
1/4"	1/4"	3/4"	2-1/2"	PX153-2500.010	PX153-2500.015	PX153-2500.030	PX153-2500.060	-	-
1/4"	1/4"	1-1/8"	3"	PX753-2500.010	PX753-2500.015	PX753-2500.030	-	-	-
5/16"	5/16"	1/2"	2"	-	PX253-3125.015	PX253-3125.030	-	-	-
5/16"	5/16"	1"	2-1/2"	-	PX153-3125.015	PX153-3125.030	PX153-3125.060	-	-
3/8"	3/8"	5/8"	2"	-	PX253-3750.015	PX253-3750.030	-	-	-
3/8"	3/8"	1"	2-1/2"	-	PX153-3750.015	PX153-3750.030	PX153-3750.060	-	-
3/8"	3/8"	1-1/2"	3"	-	PX753-3750.015	PX753-3750.030	-	-	-
7/16"	7/16"	1"	2-3/4"	-	-	PX153-4375.030	-	-	-
1/2"	1/2"	5/8"	2-1/2"	-	PX253-5000.015	PX253-5000.030	PX253-5000.060	PX253-5000.090	PX253-5000.120
1/2"	1/2"	1"	3"	-	PX153-5000.015	PX153-5000.030	PX153-5000.060	PX153-5000.090	PX153-5000.120
1/2"	1/2"	1-1/4"	3"	-	PX153-5001.015	PX153-5001.030	PX153-5001.060	PX153-5001.090	PX153-5001.120
1/2"	1/2"	2"	4"	-	PX753-5000.015	PX753-5000.030	PX753-5000.060	PX753-5000.090	PX753-5000.120
5/8"	5/8"	1-3/8"	3-1/2"	-	PX153-6250.015	PX153-6250.030	PX153-6250.060	PX153-6250.090	PX153-6250.120
3/4"	3/4"	1"	3"	-	-	PX253-7500.030	PX253-7500.060	PX253-7500.090	PX253-7500.120
3/4"	3/4"	1-1/2"	4"	-	PX153-7500.015	PX153-7500.030	PX153-7500.060	PX153-7500.090	PX153-7500.120
3/4"	3/4"	2-1/2"	5"	-	PX753-7500.015	PX753-7500.030	PX753-7500.060	PX753-7500.090	PX753-7500.120
1"	1"	1"	3"	-	-	PX253-1000.030	-	-	-
1"	1"	1-5/8"	4"	-	-	PX153-1000.030	PX153-1000.060	PX153-1000.090	PX153-1000.120
1"	1"	2-1/2"	5"	-	-	PX753-1000.030	PX753-1000.060	PX753-1000.090	PX753-1000.120

Special Sizes, Lengths and Radii Available, Request Quote



PX SERIES

- **High Efficiency Tool Path Optimized**
- **High Performance Nano Grain Carbide**
- **HD Eccentric Cutting Edge Prep**
- **AlCrN High Performance Tool Coating**
- **Variable Helix and Variable Index**
- **Reduced Neck & Weldon Flats Available Upon Request**



PX 7 Flute Radius End

Cutting Diameter Tolerances +.000/-0.002" Shank Diameter Tolerances +.000/-0.0005"

7FL - Corner Radius - Stub, Standard, Long Length Sizes

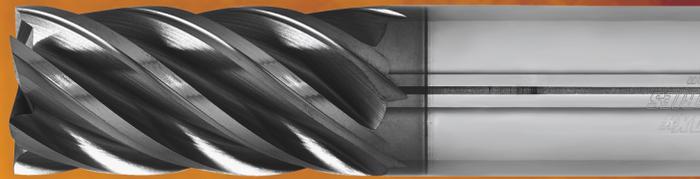
DIA	SHK	LOC	OAL	.010"	.015"	.030"	.060"	.090"	.120"
1/8"	1/8"	1/4"	1-1/2"	PX273-1250.010	PX273-1250.015	PX273-1250.030	-	-	-
1/8"	1/8"	1/2"	1-1/2"	PX173-1250.010	PX173-1250.015	PX173-1250.030	-	-	-
3/16"	3/16"	3/8"	2"	PX273-1875.010	PX273-1875.015	PX273-1875.030	-	-	-
3/16"	3/16"	5/8"	2"	PX173-1875.010	PX173-1875.015	PX173-1875.030	-	-	-
1/4"	1/4"	1/2"	2"	PX273-2500.010	PX273-2500.015	PX273-2500.030	-	-	-
1/4"	1/4"	3/4"	2-1/2"	PX173-2500.010	PX173-2500.015	PX173-2500.030	PX173-2500.060	-	-
1/4"	1/4"	1-1/8"	3"	PX773-2500.010	PX773-2500.015	PX773-2500.030	-	-	-
5/16"	5/16"	1/2"	2"	-	PX273-3125.015	PX273-3125.030	-	-	-
5/16"	5/16"	1"	2-1/2"	-	PX173-3125.015	PX173-3125.030	PX173-3125.060	-	-
3/8"	3/8"	5/8"	2"	-	PX273-3750.015	PX273-3750.030	-	-	-
3/8"	3/8"	1"	2-1/2"	-	PX173-3750.015	PX173-3750.030	PX173-3750.060	-	-
3/8"	3/8"	1-1/2"	3"	-	PX773-3750.015	PX773-3750.030	-	-	-
7/16"	7/16"	1"	2-3/4"	-	-	PX173-4375.030	-	-	-
1/2"	1/2"	5/8"	2-1/2"	-	PX273-5000.015	PX273-5000.030	PX273-5000.060	PX273-5000.090	PX273-5000.120
1/2"	1/2"	1"	3"	-	PX173-5000.015	PX173-5000.030	PX173-5000.060	PX173-5000.090	PX173-5000.120
1/2"	1/2"	1-1/4"	3"	-	PX173-5001.015	PX173-5001.030	PX173-5001.060	PX173-5001.090	PX173-5001.120
1/2"	1/2"	2"	4"	-	PX773-5000.015	PX773-5000.030	PX773-5000.060	PX773-5000.090	PX773-5000.120
5/8"	5/8"	1-3/8"	3-1/2"	-	PX173-6250.015	PX173-6250.030	PX173-6250.060	PX173-6250.090	PX173-6250.120
3/4"	3/4"	1"	3"	-	-	PX273-7500.030	PX273-7500.060	PX273-7500.090	PX273-7500.120
3/4"	3/4"	1-1/2"	4"	-	-	PX173-7500.030	PX173-7500.060	PX173-7500.090	PX173-7500.120
3/4"	3/4"	2-1/2"	5"	-	-	PX773-7500.030	PX773-7500.060	PX773-7500.090	PX773-7500.120
1"	1"	1"	3"	-	-	PX273-1000.030	-	-	-
1"	1"	1-5/8"	4"	-	-	PX173-1000.030	PX173-1000.060	PX173-1000.090	PX173-1000.120
1"	1"	2-1/2"	5"	-	-	PX773-1000.030	PX773-1000.060	PX773-1000.090	PX773-1000.120

Special Sizes, Lengths and Radii Available, Request Quote

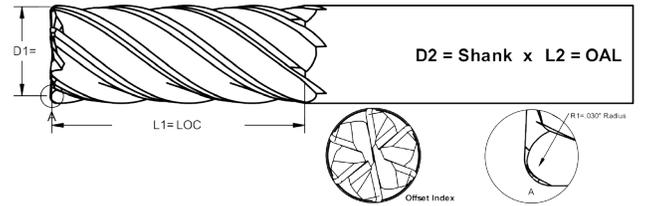
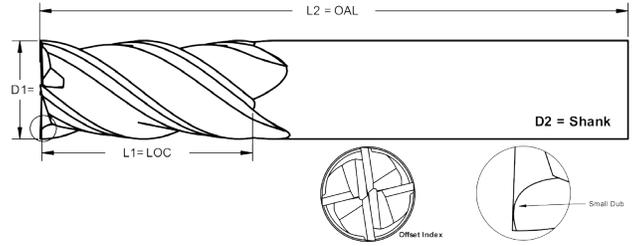


VMAX

MX Series



- **Heavy Core for Stability and Minimum Tool Deflection**
- **Ideal for Titanium and High Temp Alloys**
- **HD Eccentric Cutting Edge Prep**
- **nACRo High Performance Tool Coating**
- **Variable Helix and Variable Index**
- **Reduced Neck & Weldon Flats Available Upon Request**



6 Flute Square & Radius End

6FL - Square End & Corner Radius - Stub & Standard Length Sizes

DIA	SHK	LOC	OAL	RAD	SQUARE #	CR PART #
1/8"	1/8"	1/4"	1-1/2"	.010"	MX260-1250	MX263-1250.010
1/8"	1/8"	1/2"	1-1/2"	.010"	MX160-1250	MX163-1250.010
3/16"	3/16"	3/8"	2"	.015"	MX260-1875	MX263-1875.015
3/16"	3/16"	5/8"	2"	.015"	MX160-1875	MX163-1875.015
1/4"	1/4"	1/2"	2"	.015"	MX260-2500	MX263-2500.015
1/4"	1/4"	3/4"	2-1/2"	.015"	MX160-2500	MX163-2500.015
5/16"	5/16"	1"	2-1/2"	.015"	MX160-3125	MX163-3125.015
3/8"	3/8"	5/8"	2"	.020"	MX260-3750	MX263-3750.020
3/8"	3/8"	1"	2-1/2"	.020"	MX160-3750	MX163-3750.020
1/2"	1/2"	5/8"	2-1/2"	.030"	MX260-5000	MX263-5000.030
1/2"	1/2"	1"	3"	.030"	MX160-5000	MX163-5000.030
1/2"	1/2"	1-1/4"	3"	.030"	MX160-5001	MX163-5001.030
5/8"	5/8"	3/4"	3"	.030"	MX260-6250	MX263-6250.030
5/8"	5/8"	1-3/8"	3-1/2"	.030"	MX160-6250	MX163-6250.030
3/4"	3/4"	1"	3"	.030"	MX260-7500	MX263-7500.030
3/4"	3/4"	1-1/2"	4"	.030"	MX160-7500	MX163-7500.030
1"	1"	1-5/8"	4"	.060"	MX160-1000	MX163-1000.060

ALCrN Coating Available Upon Request

Special Sizes, Lengths and Radii Available, Request Quote

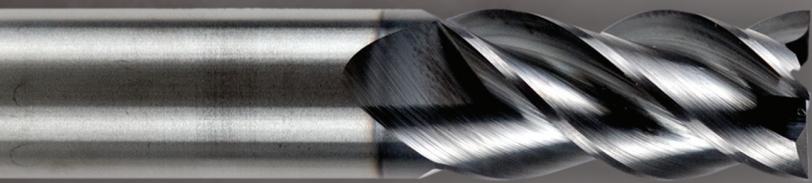
4 Flute Square & Radius End

Cutting Diameter Tolerances +.000"/-.002" Shank Diameter Tolerances +.000"/-.0005"

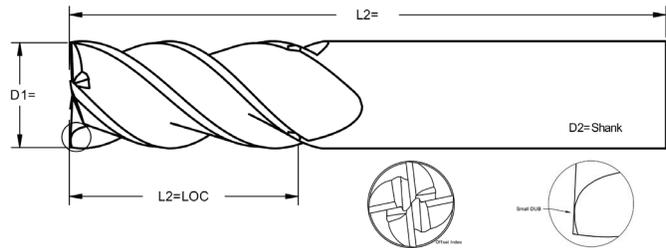
4FL - Square End & Corner Radius - Stub, Standard, Long Length Sizes

DIA	SHK	LOC	OAL	SQUARE	.010"	.015"	.030"	.060"	.090"
1/8"	1/8"	1/4"	1-1/2"	MX240-1250	MX243-1250.010	MX243-1250.015	MX243-1250.030	-	-
1/8"	1/8"	1/2"	1-1/2"	MX140-1250	MX143-1250.010	MX143-1250.015	MX143-1250.030	-	-
3/16"	3/16"	3/8"	2"	MX240-1875	MX243-1875.010	MX243-1875.015	MX243-1875.030	-	-
3/16"	3/16"	5/8"	2"	MX140-1875	MX143-1875.010	MX143-1875.015	MX143-1875.030	-	-
1/4"	1/4"	1/2"	2"	MX240-2500	MX243-2500.010	MX243-2500.015	MX243-2500.030	MX243-2500.060	-
1/4"	1/4"	3/4"	2-1/2"	MX140-2500	MX143-2500.010	MX143-2500.015	MX143-2500.030	MX143-2500.060	-
1/4"	1/4"	1-1/8"	3"	MX740-2500	MX743-2500.010	MX743-2500.015	MX743-2500.030	-	-
5/16"	5/16"	1/2"	2"	MX240-3125	-	MX243-3125.015	MX243-3125.030	MX243-3125.060	-
5/16"	5/16"	1"	2-1/2"	MX140-3125	-	MX143-3125.015	MX143-3125.030	MX143-3125.060	-
3/8"	3/8"	5/8"	2"	MX240-3750	-	MX243-3750.015	MX243-3750.030	MX243-3750.060	-
3/8"	3/8"	1"	2-1/2"	MX140-3750	-	MX143-3750.015	MX143-3750.030	MX143-3750.060	-
3/8"	3/8"	1-1/2"	3"	MX740-3750	-	MX743-3750.015	MX743-3750.030	-	-
7/16"	7/16"	1"	2-3/4"	MX140-4375	-	-	MX143-4375.030	-	-
1/2"	1/2"	5/8"	2-1/2"	MX240-5000	-	MX243-5000.015	MX243-5000.030	MX243-5000.060	MX243-5000.090
1/2"	1/2"	1"	3"	MX140-5000	-	MX143-5000.015	MX143-5000.030	MX143-5000.060	MX143-5000.090
1/2"	1/2"	1-1/4"	3"	MX140-5001	-	MX143-5001.015	MX143-5001.030	MX143-5001.060	MX143-5001.090
1/2"	1/2"	2"	4"	MX740-5000	-	MX743-5000.015	MX743-5000.030	-	-
5/8"	5/8"	3/4"	3"	MX240-6250	-	-	MX243-6250.030	MX243-6250.060	MX243-6250.090
5/8"	5/8"	1-3/8"	3-1/2"	MX140-6250	-	MX143-6250.015	MX143-6250.030	MX143-6250.060	MX143-6250.090
5/8"	5/8"	2-1/4"	5"	MX740-6250	-	-	MX743-6250.030	-	-
3/4"	3/4"	1"	3"	MX240-7500	-	-	MX243-7500.030	MX243-7500.060	MX243-7500.090
3/4"	3/4"	1-1/2"	4"	MX140-7500	-	MX143-7500.015	MX143-7500.030	MX143-7500.060	MX143-7500.090
3/4"	3/4"	2-1/2"	5"	MX740-7500	-	-	MX743-7500.030	MX743-7500.060	-
1"	1"	1"	3"	MX240-1000	-	-	MX243-1000.030	-	-
1"	1"	1-5/8"	4"	MX140-1000	-	-	MX143-1000.030	MX143-1000.060	MX143-1000.090
1"	1"	2-1/2"	5"	MX740-1000	-	-	MX743-1000.030	-	-

- 4 FLUTE
- 6 FLUTE
- VARIABLE
- VARIABLE INDEX
- SQUARE END
- RADIUS END
- nACRo
- ALCrN
- PROFILE
- ROUGHING
- SLOTTING
- HEM



- **Featuring Premium AP Coating - An Ultra Smooth ALTiN Based Performance Coating**
- **Variable Index / Variable Helix**
- **Designed for High Efficiency Tool Paths**
- **Eccentric OD for Improved Cutting Edge Performance**
- **Free Cutting Geometry**
- **Other Sizes, Lengths, and End Styles Available Upon Quotation**
- **Reduced Neck & Weldon Flats Available Upon Request**



HX Square End

Cutting Diameter Tolerances $+0.000/-0.0005$ " Shank Diameter Tolerances $+0.000/-0.0005$ "

4FL - Square End - Standard Sizes

EDP#	DIA	SHANK	LOC	OAL
HX140-1250	1/8"	1/8"	1/2"	1-1/2"
HX140-1875	3/16"	3/16"	5/8"	2"
HX140-2500	1/4"	1/4"	3/4"	2-1/2"
HX140-3125	5/16"	5/16"	13/16"	2-1/2"
HX140-3750	3/8"	3/8"	1"	2-1/2"
HX140-5000	1/2"	1/2"	1"	3"
HX140-6250	5/8"	5/8"	1-1/4"	3-1/2"
HX140-7500	3/4"	3/4"	1-1/2"	4"
HX140-1000	1"	1"	1-1/2"	4"



HX Corner Radius

Cutting Diameter Tolerances $+0.000/-0.0005$ " Shank Diameter Tolerances $+0.000/-0.0005$ "

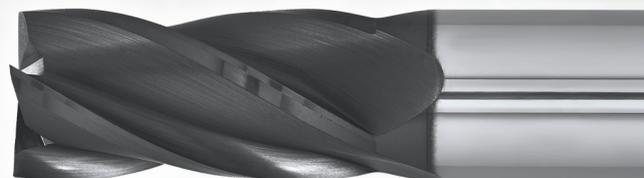
4FL - CR - Standard Sizes

EDP#	DIA	SHANK	LOC	OAL	RADIUS
HX143-1250.015	1/8"	1/8"	1/2"	1-1/2"	.015"
HX143-1875.015	3/16"	3/16"	5/8"	2"	.015"
HX143-2500.015	1/4"	1/4"	3/4"	2-1/2"	.015"
HX143-3125.015	5/16"	5/16"	13/16"	2-1/2"	.015"
HX143-3750.015	3/8"	3/8"	1"	2-1/2"	.015"
HX143-3750.030	3/8"	3/8"	1"	2-1/2"	.030"
HX143-5000.015	1/2"	1/2"	1"	3"	.015"
HX143-5000.030	1/2"	1/2"	1"	3"	.030"
HX143-5000.060	1/2"	1/2"	1"	3"	.060"
HX143-5000.090	1/2"	1/2"	1"	3"	.090"
HX143-5000.125	1/2"	1/2"	1"	3"	.125"
HX143-6250.030	5/8"	5/8"	1-1/4"	3-1/2"	.030"
HX143-7500.030	3/4"	3/4"	1-1/2"	4"	.030"
HX143-7500.060	3/4"	3/4"	1-1/2"	4"	.060"
HX143-7500.090	3/4"	3/4"	1-1/2"	4"	.090"
HX143-7500.125	3/4"	3/4"	1-1/2"	4"	.125"
HX143-1000.030	1"	1"	1-1/2"	4"	.030"
HX143-1000.060	1"	1"	1-1/2"	4"	.060"
HX143-1000.090	1"	1"	1-1/2"	4"	.090"
HX143-1000.125	1"	1"	1-1/2"	4"	.125"

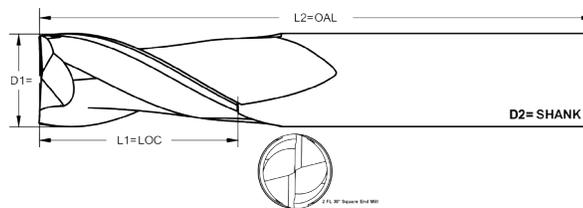
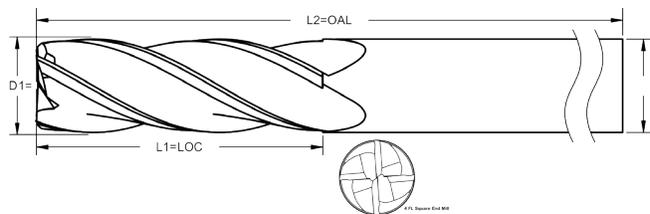


GENERAL PURPOSE

Square End



- Available with 2, 3, and 4 Flutes
- Square End, 30° Helix
- Premium Micro Grain Carbide
- General Purpose Milling
- Bright (Uncoated) and ALTiN Coating
- Special Sizes and Lengths Available Upon Request



General Purpose Standard Square End

2FL, 3FL & 4FL - Stub, Standard, Long & Extra Long Sizes

2 FL	3 FL	4 FL	DIA	SHK	LOC	OAL
220-0312	230-0312	240-0312	1/32"	1/8"	1/16"	1-1/2"
120-0312	130-0312	140-0312	1/32"	1/8"	3/32"	1-1/2"
220-0469	-	240-0469	3/64"	1/8"	3/32"	1-1/2"
120-0469	-	140-0469	3/64"	1/8"	1/8"	1-1/2"
220-0625	230-0625	240-0625	1/16"	1/8"	1/8"	1-1/2"
120-0625	130-0625	140-0625	1/16"	1/8"	3/16"	1-1/2"
120-0781	-	140-0781	5/64"	1/8"	1/4"	1-1/2"
220-0938	230-0938	240-0938	3/32"	1/8"	3/16"	1-1/2"
120-0938	130-0938	140-0938	3/32"	1/8"	3/8"	1-1/2"
120-1094	-	140-1094	7/64"	1/8"	3/8"	1-1/2"
220-1250	230-1250	240-1250	1/8"	1/8"	1/4"	1-1/2"
120-1250	130-1250	140-1250	1/8"	1/8"	1/2"	1-1/2"
720-1250	-	740-1250	1/8"	1/8"	3/4"	2-1/4"
820-1250	-	840-1250	1/8"	1/8"	1"	3"
120-1406	-	140-1406	9/64"	3/16"	1/2"	2"
220-1562	-	240-1562	5/32"	3/16"	5/16"	2"
120-1562	-	140-1562	5/32"	3/16"	1/2"	2"
120-1719	-	140-1719	11/64"	3/16"	5/8"	2"
220-1875	230-1875	240-1875	3/16"	3/16"	3/8"	2"
120-1875	130-1875	140-1875	3/16"	3/16"	5/8"	2"
720-1875	-	740-1875	3/16"	3/16"	3/4"	2-1/2"
820-1875	-	840-1875	3/16"	3/16"	1-1/8"	3"
120-2031	-	140-2031	13/64"	1/4"	5/8"	2-1/2"
220-2188	-	240-2188	7/32"	1/4"	1/2"	2"
120-2188	-	140-2188	7/32"	1/4"	5/8"	2-1/2"
120-2344	-	140-2344	15/64"	1/4"	3/4"	2-1/2"
220-2500	230-2500	240-2500	1/4"	1/4"	1/2"	2"
120-2500	130-2500	140-2500	1/4"	1/4"	3/4"	2-1/2"
720-2500	-	740-2500	1/4"	1/4"	1-1/4"	3"
820-2500	-	840-2500	1/4"	1/4"	1-1/2"	4"
120-2656	-	140-2656	17/64"	5/16"	3/4"	2-1/2"
120-2812	-	140-2812	9/32"	5/16"	3/4"	2-1/2"
120-2969	-	140-2969	19/64"	5/16"	13/16"	2-1/2"
220-3125	230-3125	240-3125	5/16"	5/16"	1/2"	2"
120-3125	130-3125	140-3125	5/16"	5/16"	13/16"	2-1/2"
720-3125	-	740-3125	5/16"	5/16"	1-3/8"	3"
820-3125	-	840-3125	5/16"	5/16"	1-3/4"	4"
120-3281	-	140-3281	21/64"	3/8"	7/8"	2-1/2"
120-3438	-	140-3438	11/32"	3/8"	7/8"	2-1/2"

2 FL	3 FL	4 FL	DIA	SHK	LOC	OAL
120-3594	-	140-3594	23/64"	3/8"	7/8"	2-1/2"
220-3750	230-3750	240-3750	3/8"	3/8"	5/8"	2"
120-3750	130-3750	140-3750	3/8"	3/8"	1"	2-1/2"
720-3750	-	740-3750	3/8"	3/8"	1-1/2"	3"
820-3750	-	840-3750	3/8"	3/8"	2"	4"
120-3905	-	140-3905	25/64"	7/16"	1"	2-3/4"
120-4062	-	140-4062	13/32"	7/16"	1"	2-3/4"
120-4219	-	140-4219	27/64"	7/16"	1"	2-3/4"
220-4375	-	240-4375	7/16"	7/16"	5/8"	2-1/2"
120-4375	-	140-4375	7/16"	7/16"	1"	2-3/4"
720-4375	-	740-4375	7/16"	7/16"	2"	4"
820-4375	-	840-4375	7/16"	7/16"	3"	6"
120-4531	-	140-4531	29/64"	1/2"	1"	3"
120-4688	-	140-4688	15/32"	1/2"	1"	3"
120-4844	-	140-4844	31/64"	1/2"	1"	3"
220-5000	230-5000	240-5000	1/2"	1/2"	5/8"	2-1/2"
120-5000	130-5000	140-5000	1/2"	1/2"	1"	3"
120-5001	130-5001	140-5001	1/2"	1/2"	1-1/4"	3"
720-5000	-	740-5000	1/2"	1/2"	2"	4"
820-5000	-	840-5000	1/2"	1/2"	3"	6"
120-5625	-	140-5625	9/16"	9/16"	1-1/4"	3-1/2"
220-6250	-	240-6250	5/8"	5/8"	3/4"	3"
120-6250	130-6250	140-6250	5/8"	5/8"	1-1/4"	3-1/2"
720-6250	-	740-6250	5/8"	5/8"	2-1/4"	5"
820-6250	-	840-6250	5/8"	5/8"	3"	6"
120-6875	-	140-6875	11/16"	3/4"	1-1/2"	4"
220-7500	-	240-7500	3/4"	3/4"	1"	3"
120-7500	130-7500	140-7500	3/4"	3/4"	1-1/2"	4"
720-7500	-	740-7500	3/4"	3/4"	2-1/4"	5"
820-7500	-	840-7500	3/4"	3/4"	3"	6"
820-7501	-	840-7501	3/4"	3/4"	4"	7"
120-8750	-	140-8750	7/8"	7/8"	1-1/2"	4"
120-1000	130-1000	140-1000	1"	1"	1-1/2"	4"
720-1000	-	740-1000	1"	1"	2-1/2"	5"
820-1000	-	840-1000	1"	1"	3"	6"
820-1001	-	840-1001	1"	1"	4"	7"
820-1002	-	840-1002	1"	1"	5"	8"
820-1003	-	840-1003	1"	1"	6"	9"

Cutting Diameter Tolerances .0312" thru .123" = (+.000)/-.001" .125" thru 1.0" = (+.000)/-.002"
Shank Diameter Tolerances +.000"/-.0005"





GENERAL PURPOSE

Metric Square End



- Available with 2 and 4 Flutes
- Square End, 30° Helix
- Premium Micro Grain Carbide

- General Purpose Milling
- Bright (Uncoated) and ALTiN Coating
- Special Sizes and Lengths Available Upon Request

General Purpose Metric Square End

2FL & 4FL - Stub, Standard, Long & Extra Long Sizes

2 FL	4 FL	DIA	SHK	LOC	OAL
M120-010	M140-010	1 mm	3 mm	3 mm	38 mm
M120-015	M140-015	1.5 mm	3 mm	4.5 mm	38 mm
M120-020	M140-020	2 mm	3 mm	6 mm	38 mm
M120-025	M140-025	2.5 mm	3 mm	7.5 mm	38 mm
-	M240-030	3 mm	3 mm	6 mm	38 mm
M120-030	M140-030	3 mm	3 mm	12 mm	38 mm
M720-030	M740-030	3 mm	3 mm	20 mm	63 mm
M820-030	M840-030	3 mm	3 mm	25 mm	75 mm
-	M240-040	4 mm	4 mm	8 mm	50 mm
M120-040	M140-040	4 mm	4 mm	14 mm	50 mm
M720-040	M740-040	4 mm	4 mm	20 mm	63 mm
M820-040	M840-040	4 mm	4 mm	28 mm	75 mm
-	M240-050	5 mm	5 mm	10 mm	50 mm
M120-050	M140-050	5 mm	5 mm	16 mm	50 mm
M720-050	M740-050	5 mm	5 mm	25 mm	75 mm
M820-050	M840-050	5 mm	5 mm	38 mm	75 mm
-	M240-060	6 mm	6 mm	12 mm	50 mm
M120-060	M140-060	6 mm	6 mm	20 mm	63 mm
M720-060	M740-060	6 mm	6 mm	28 mm	75 mm
M820-060	M840-060	6 mm	6 mm	38 mm	100 mm
-	M240-080	8 mm	8 mm	12 mm	50 mm
M120-080	M140-080	8 mm	8 mm	20 mm	63 mm
M720-080	M740-080	8 mm	8 mm	28 mm	75 mm
M820-080	M840-080	8 mm	8 mm	50 mm	100 mm
M220-100	-	10 mm	10 mm	16 mm	50 mm
M120-100	M140-100	10 mm	10 mm	25 mm	63 mm
M720-100	M740-100	10 mm	10 mm	28 mm	75 mm
M820-100	M840-100	10 mm	10 mm	50 mm	100 mm
M220-120	-	12 mm	12 mm	19 mm	63 mm
M120-120	M140-120	12 mm	12 mm	25 mm	75 mm
M720-120	M740-120	12 mm	12 mm	50 mm	100 mm
M820-120	M840-120	12 mm	12 mm	80 mm	150 mm
M120-140	M140-140	14 mm	14 mm	32 mm	88 mm
M720-140	M740-140	14 mm	14 mm	60 mm	125 mm
-	M840-140	14 mm	14 mm	80 mm	150 mm
M120-160	M140-160	16 mm	16 mm	38 mm	88 mm
-	M740-160	16 mm	16 mm	60 mm	125 mm
-	M840-160	16 mm	16 mm	85 mm	150 mm
M120-180	M140-180	18 mm	18 mm	38 mm	100 mm
-	M740-180	18 mm	18 mm	60 mm	125 mm
-	M840-180	18 mm	18 mm	85 mm	150 mm
M120-200	M140-200	20 mm	20 mm	38 mm	100 mm
-	M740-200	20 mm	20 mm	60 mm	125 mm
-	M840-200	20 mm	20 mm	85 mm	150 mm
M120-250	M140-250	25 mm	25 mm	38 mm	100 mm

Special Sizes, Lengths and Radii Available Upon Quote Request

ALTiN Coated tools: Add "ALTiN" After Each Part #

Other Coatings Available Upon Request

Cutting Diameter Tolerances 1mm thru 2.9mm = (+0/-0.025mm) 3mm thru 25mm = (+0/-0.050mm) Shank Diameter Tolerances +0/-0.0125mm

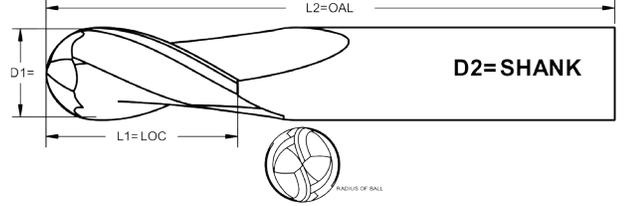
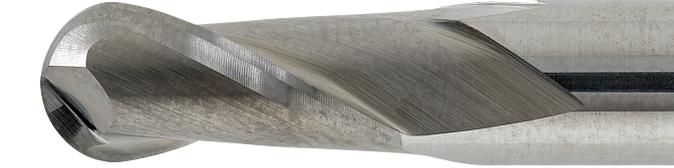
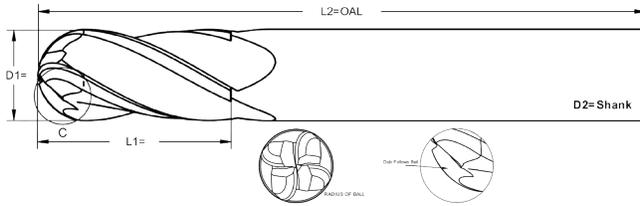


GENERAL PURPOSE

Ball End



- Available with 2 and 4 Flutes
- Ball End, 30° Helix
- Premium Micro Grain Carbide
- General Purpose Milling
- Bright (Uncoated) and AlTiN Coating
- Special Sizes and Lengths Available Upon Request



General Purpose Standard Ball End

2FL, 3FL & 4FL - Stub, Standard, Long & Extra Long Sizes

2 FL	4 FL	DIA	SHK	LOC	OAL
222-0312	242-0312	1/32"	1/8"	1/16"	1-1/2"
122-0312	142-0312	1/32"	1/8"	3/32"	1-1/2"
222-0469	242-0469	3/64"	1/8"	3/32"	1-1/2"
122-0469	142-0469	3/64"	1/8"	1/8"	1-1/2"
222-0625	242-0625	1/16"	1/8"	1/8"	1-1/2"
122-0625	142-0625	1/16"	1/8"	3/16"	1-1/2"
122-0781	142-0781	5/64"	1/8"	1/4"	1-1/2"
222-0938	242-0938	3/32"	1/8"	3/16"	1-1/2"
122-0938	142-0938	3/32"	1/8"	3/8"	1-1/2"
122-1094	142-1094	7/64"	1/8"	3/8"	1-1/2"
222-1250	242-1250	1/8"	1/8"	1/4"	1-1/2"
122-1250	142-1250	1/8"	1/8"	1/2"	1-1/2"
722-1250	742-1250	1/8"	1/8"	3/4"	2-1/4"
822-1250	842-1250	1/8"	1/8"	1"	3"
122-1406	142-1406	9/64"	3/16"	1/2"	2"
222-1562	242-1562	5/32"	3/16"	5/16"	2"
122-1562	142-1562	5/32"	3/16"	1/2"	2"
122-1719	142-1719	11/64"	3/16"	5/8"	2"
222-1875	242-1875	3/16"	3/16"	3/8"	2"
122-1875	142-1875	3/16"	3/16"	5/8"	2"
722-1875	742-1875	3/16"	3/16"	3/4"	2-1/2"
822-1875	842-1875	3/16"	3/16"	1-1/8"	3"
122-2031	142-2031	13/64"	1/4"	5/8"	2-1/2"
222-2188	242-2188	7/32"	1/4"	1/2"	2"
122-2188	142-2188	7/32"	1/4"	5/8"	2-1/2"
122-2344	142-2344	15/64"	1/4"	3/4"	2-1/2"
222-2500	242-2500	1/4"	1/4"	1/2"	2"
122-2500	142-2500	1/4"	1/4"	3/4"	2-1/2"
722-2500	742-2500	1/4"	1/4"	1-1/4"	3"
822-2500	842-2500	1/4"	1/4"	1-1/2"	4"
122-2656	142-2656	17/64"	5/16"	3/4"	2-1/2"
122-2812	142-2812	9/32"	5/16"	3/4"	2-1/2"
122-2969	142-2969	19/64"	5/16"	13/16"	2-1/2"
222-3125	242-3125	5/16"	5/16"	1/2"	2"
122-3125	142-3125	5/16"	5/16"	13/16"	2-1/2"
722-3125	742-3125	5/16"	5/16"	1-3/8"	3"
822-3125	842-3125	5/16"	5/16"	1-3/4"	4"
122-3281	142-3281	21/64"	3/8"	7/8"	2-1/2"
122-3438	142-3438	11/32"	3/8"	7/8"	2-1/2"

2 FL	4 FL	DIA	SHK	LOC	OAL
122-3594	142-3594	23/64"	3/8"	7/8"	2-1/2"
222-3750	242-3750	3/8"	3/8"	5/8"	2"
122-3750	142-3750	3/8"	3/8"	1"	2-1/2"
722-3750	742-3750	3/8"	3/8"	1-1/2"	3"
822-3750	842-3750	3/8"	3/8"	2"	4"
122-3905	142-3905	25/64"	7/16"	1"	2-3/4"
122-4062	142-4062	13/32"	7/16"	1"	2-3/4"
122-4219	142-4219	27/64"	7/16"	1"	2-3/4"
222-4375	242-4375	7/16"	7/16"	5/8"	2-1/2"
122-4375	142-4375	7/16"	7/16"	1"	2-3/4"
722-4375	742-4375	7/16"	7/16"	2"	4"
822-4375	842-4375	7/16"	7/16"	3"	6"
122-4531	142-4531	29/64"	1/2"	1"	3"
122-4688	142-4688	15/32"	1/2"	1"	3"
122-4844	142-4844	31/64"	1/2"	1"	3"
222-5000	242-5000	1/2"	1/2"	5/8"	2-1/2"
122-5000	142-5000	1/2"	1/2"	1"	3"
122-5001	142-5001	1/2"	1/2"	1-1/4"	3"
722-5000	742-5000	1/2"	1/2"	2"	4"
822-5000	842-5000	1/2"	1/2"	3"	6"
122-5625	142-5625	9/16"	9/16"	1-1/4"	3-1/2"
222-6250	242-6250	5/8"	5/8"	3/4"	3"
122-6250	142-6250	5/8"	5/8"	1-1/4"	3-1/2"
722-6250	742-6250	5/8"	5/8"	2-1/4"	5"
822-6250	842-6250	5/8"	5/8"	3"	6"
122-6875	142-6875	11/16"	3/4"	1-1/2"	4"
222-7500	242-7500	3/4"	3/4"	1"	3"
122-7500	142-7500	3/4"	3/4"	1-1/2"	4"
722-7500	742-7500	3/4"	3/4"	2-1/4"	5"
822-7500	842-7500	3/4"	3/4"	3"	6"
822-7501	842-7501	3/4"	3/4"	4"	7"
122-8750	142-8750	7/8"	7/8"	1-1/2"	4"
122-1000	142-1000	1"	1"	1-1/2"	4"
722-1000	742-1000	1"	1"	2-1/2"	5"
822-1000	842-1000	1"	1"	3"	6"
822-1001	842-1001	1"	1"	4"	7"
822-1002	842-1002	1"	1"	5"	8"
822-1003	842-1003	1"	1"	6"	9"

Cutting Diameter Tolerances .0312" thru .125" = (+.000"/-.001") .125" thru 1.0" = (+.000"/-.002")
Shank Diameter Tolerances +.000"/-.0005"



GENERAL PURPOSE

Metric Ball End



- Available with 2 and 4 Flutes
- Ball End, 30° Helix
- Premium Micro Grain Carbide
- General Purpose Milling
- Bright (Uncoated) and ALTiN Coating
- Special Sizes and Lengths Available Upon Request

General Purpose Metric Ball End

2FL & 4FL - Standard, Long & Extra Long Sizes

2 FL	4 FL	DIA	SHK	LOC	OAL
M122-010	M142-010	1 mm	3 mm	3 mm	38 mm
M122-015	M142-015	1.5 mm	3 mm	4.5 mm	38 mm
M122-020	M142-020	2 mm	3 mm	6 mm	38 mm
M122-025	M142-025	2.5 mm	3 mm	7.5 mm	38 mm
M122-030	M142-030	3 mm	3 mm	12 mm	38 mm
M722-030	M742-030	3 mm	3 mm	20 mm	63 mm
M822-030	M842-030	3 mm	3 mm	25 mm	75 mm
M122-040	M142-040	4 mm	4 mm	14 mm	50 mm
M722-040	M742-040	4 mm	4 mm	20 mm	63 mm
M822-040	M842-040	4 mm	4 mm	28 mm	75 mm
M122-050	M142-050	5 mm	5 mm	16 mm	50 mm
M722-050	M742-050	5 mm	5 mm	25 mm	75 mm
M822-050	M842-050	5 mm	5 mm	38 mm	75 mm
M122-060	M142-060	6 mm	6 mm	20 mm	63 mm
M722-060	M742-060	6 mm	6 mm	28 mm	75 mm
M822-060	M842-060	6 mm	6 mm	38 mm	100 mm
M122-080	M142-080	8 mm	8 mm	20 mm	63 mm
M722-080	M742-080	8 mm	8 mm	28 mm	75 mm
M822-080	M842-080	8 mm	8 mm	50 mm	100 mm
M122-090	M142-090	9 mm	10 mm	22 mm	63 mm
M122-100	M142-100	10 mm	10 mm	25 mm	63 mm
M722-100	M742-100	10 mm	10 mm	28 mm	75 mm
M822-100	M842-100	10 mm	10 mm	50 mm	100 mm
M122-120	M142-120	12 mm	12 mm	25 mm	75 mm
M722-120	M742-120	12 mm	12 mm	50 mm	100 mm
M822-120	M842-120	12 mm	12 mm	80 mm	150 mm
M122-140	M142-140	14 mm	14 mm	32 mm	88 mm
-	M742-140	14 mm	14 mm	60 mm	125 mm
-	M842-140	14 mm	14 mm	80 mm	150 mm
M122-160	M142-160	16 mm	16 mm	38 mm	88 mm
-	M742-160	16 mm	16 mm	60 mm	125 mm
-	M842-160	16 mm	16 mm	85 mm	150 mm
M122-180	M142-180	18 mm	18 mm	38 mm	100 mm
-	M742-180	18 mm	18 mm	60 mm	125 mm
-	M842-180	18 mm	18 mm	85 mm	150 mm
M122-200	M142-200	20 mm	20 mm	38 mm	100 mm
-	M742-200	20 mm	20 mm	60 mm	125 mm
M122-220	M142-220	22 mm	25 mm	38 mm	100 mm
M122-250	M142-250	25 mm	25 mm	38 mm	100 mm

Special Sizes, Lengths and Radii Available Upon Quote Request

ALTiN Coated tools: Add "ALTiN" After Each Part #

Other Coatings Available Upon Request

Cutting Diameter Tolerances 1mm thru 2.9mm = (+0/-0.025mm) 3mm thru 25mm = (+0/-0.050mm) Shank Diameter Tolerances +0/-0.0125mm



GENERAL PURPOSE

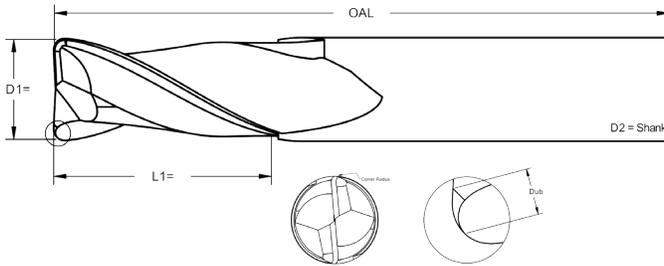
Corner Radius



- Available with 2 and 4 Flutes
- Corner Radius, 30° Helix
- Premium Micro Grain Carbide

- General Purpose Milling
- Bright (Uncoated) and ALTiN Coating
- Special Sizes and Lengths Available Upon Request

ALTiN Coated Tools: Add "ALTiN" After Each Part Number



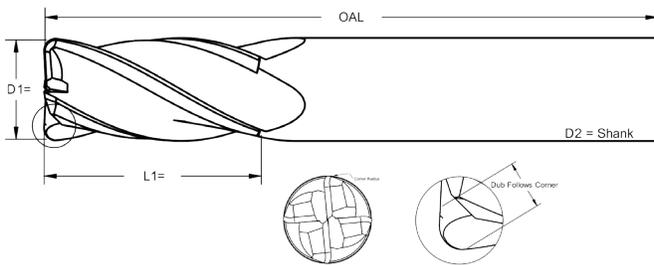
2 Flute General Purpose Corner Radius

2FL - Corner Radius - Standard Sizes

Cutting Diameter Tolerances $+0.000/-0.002$ "

Shank Diameter Tolerances $+0.000/-0.0005$ "

DIA	SHK	LOC	OAL	.010"	.015"	.020"	.030"	.060"	.125"
1/8"	1/8"	1/2"	1-1/2"	CR123-1250.010	-	-	-	-	-
3/16"	3/16"	5/8"	2"	-	CR123-1875.015	-	-	-	-
1/4"	1/4"	3/4"	2-1/2"	-	CR123-2500.015	-	CR123-2500.030	-	-
3/8"	3/8"	1"	2-1/2"	-	CR123-3750.015	-	CR123-3750.030	-	-
1/2"	1/2"	1"	3"	-	CR123-5000.015	-	CR123-5000.030	CR123-5000.060	CR123-5000.125
5/8"	5/8"	1-1/4"	3-1/2"	-	-	CR123-6250.020	-	CR123-6250.060	-
3/4"	3/4"	1-1/2"	4"	-	-	CR123-7500.020	-	CR123-7500.060	CR123-7500.125
1"	1"	1-1/2"	4"	-	-	CR123-1000.020	-	CR123-1000.060	CR123-1000.125



4 Flute General Purpose Corner Radius

4FL - Corner Radius - Standard Sizes

Cutting Diameter Tolerances $+0.000/-0.002$ "

Shank Diameter Tolerances $+0.000/-0.0005$ "

DIA	SHK	LOC	OAL	.010"	.015"	.020"	.030"	.060"	.125"
1/8"	1/8"	1/2"	1-1/2"	CR143-1250.010	CR143-1250.015	-	CR143-1250.030	-	-
3/16"	3/16"	5/8"	2"	-	CR143-1875.015	-	CR143-1875.030	-	-
1/4"	1/4"	3/4"	2-1/2"	-	CR143-2500.015	-	CR143-2500.030	CR143-2500.060	-
3/8"	3/8"	1"	2-1/2"	-	CR143-3750.015	CR143-3750.020	CR143-3750.030	CR143-3750.060	CR143-3750.125
1/2"	1/2"	1"	3"	-	CR143-5000.015	CR143-5000.020	CR143-5000.030	CR143-5000.060	CR143-5000.125
5/8"	5/8"	1-1/4"	3-1/2"	-	-	CR143-6250.020	CR143-6250.030	CR143-6250.060	-
3/4"	3/4"	1-1/2"	4"	-	-	CR143-7500.020	-	CR143-7500.060	CR143-7500.125
1"	1"	1-1/2"	4"	-	-	CR143-1000.020	-	CR143-1000.060	CR143-1000.125

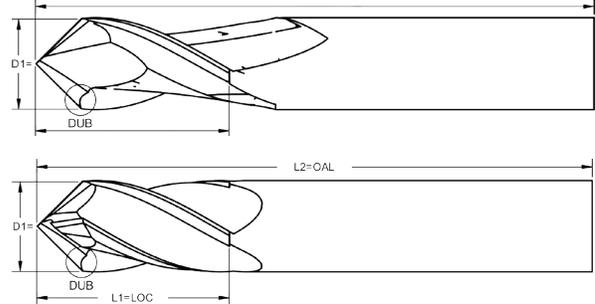
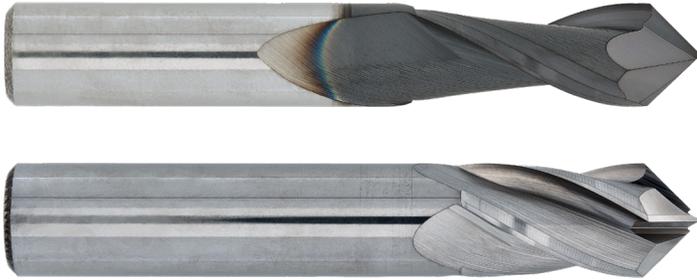


GENERAL PURPOSE

Drill Mills & Profile Mills

- 2 and 4 Flute, 90° Point
- For Spotting, Countersinking, Drilling, Chamfering and Side Milling

- Bright (Uncoated) and ALTiN Coating
- Available in other Point Angles Upon Request for Quote



Drill Mills

2FL & 4FL - 290 & 490 Series

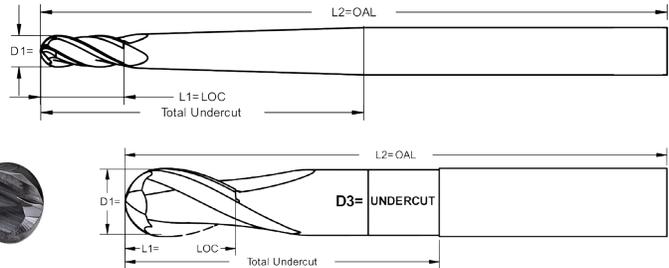
Cutting Diameter Tolerances $+0.000/-0.002$ "

Shank Diameter Tolerances $+0.000/-0.0005$ "

2 FLUTE	4 FLUTE	DIAMETER	SHANK	LOC	OAL
290-1250	490-1250	1/8"	1/8"	1/2"	1-1/2"
290-1875	490-1875	3/16"	3/16"	5/8"	2"
290-2500	490-2500	1/4"	1/4"	3/4"	2-1/2"
290-3125	490-3125	5/16"	5/16"	13/16"	2-1/2"
290-3750	490-3750	3/8"	3/8"	1"	2-1/2"
290-5000	490-5000	1/2"	1/2"	1"	3"
290-6250	490-6250	5/8"	5/8"	1-1/4"	3-1/2"
290-7500	490-7500	3/4"	3/4"	1-1/2"	4"

- 2 and 4 Flute, 30° Helix
- Profile, Deep Pocket and Contour Milling

- Bright (Uncoated) and ALTiN Coating
- Special Sizes and Lengths Available Upon Request



Profile Mills

2FL & 4FL - 7000 & 8000 Series

Cutting Diameter Tolerances $+0.000/-0.002$ "

Shank Diameter Tolerances $+0.000/-0.0005$ "

EDP #	FLUTES	DIA (D1)	SHK (D2)	UNDERCUT (D3)	LOC (L1)	OAL (L2)	REACH (L3)	TAPER (T1)
7002	2	1/8"	3/16"	.115"	1/4"	2-1/2"	1-5/8"	2°
8002	4	1/8"	3/16"	.115"	1/4"	2-1/2"	1-5/8"	2°
7003	2	3/16"	1/4"	.117"	1/4"	3"	1-3/4"	2°
8003	4	3/16"	1/4"	.117"	1/4"	3"	1-3/4"	2°
7004	2	1/4"	3/8"	.240"	3/8"	4"	2-1/2"	2°
8004	4	1/4"	3/8"	.240"	3/8"	4"	2-1/2"	2°
7005	2	1/4"	3/8"	.240"	3/8"	6"	2-1/2"	2°
8005	4	1/4"	3/8"	.240"	3/8"	6"	2-1/2"	2°
7006	2	5/16"	3/8"	.300"	1/2"	4"	2-1/2"	2°
8006	4	5/16"	3/8"	.300"	1/2"	4"	2-1/2"	2°
7007	2	3/8"	3/8"	.365"	5/8"	4"	2-1/2"	0°
8007	4	3/8"	3/8"	.365"	5/8"	4"	2-1/2"	0°
7008	2	3/8"	3/8"	.365"	5/8"	6"	2-1/2"	0°
8008	4	3/8"	3/8"	.365"	5/8"	6"	2-1/2"	0°
7009	2	1/2"	1/2"	.490"	13/16"	4"	2-1/2"	0°
8009	4	1/2"	1/2"	.490"	13/16"	4"	2-1/2"	0°
7010	2	1/2"	1/2"	.490"	13/16"	6"	2-1/2"	0°
8010	4	1/2"	1/2"	.490"	13/16"	6"	2-1/2"	0°



GENERAL PURPOSE

Double End



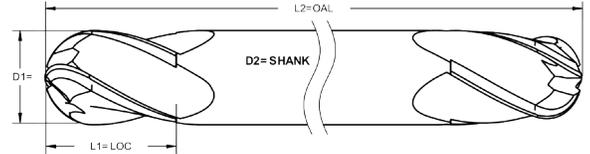
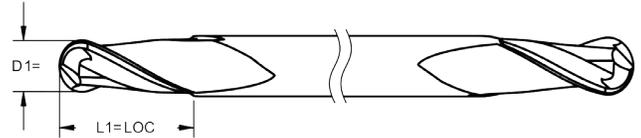
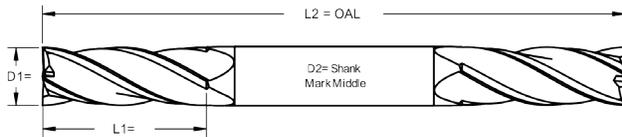
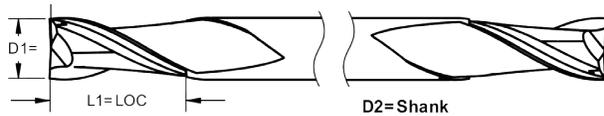
- Double End - 2 and 4 Flutes, 30° Helix
- Square End and Ball End
- Premium Micro Grain Carbide

- General Purpose Milling
- Bright (Uncoated) and ALTiN Coating
- Standard and Long Lengths

Special Sizes, Lengths
and Radii Available
Upon Quote Request

ALTiN Coated tools:
Add "ALTiN"
After Each Part #

Other Coatings
Available
Upon Request



Double End - Square

2FL & 4FL - Square Double End Sizes

2 FL	4 FL	DIA	SHK	LOC	OAL
420-0312	440-0312	1/32"	1/8"	1/16"	1-1/2"
420-0625	440-0625	1/16"	1/8"	1/8"	1-1/2"
420-0938	440-0938	3/32"	1/8"	3/16"	1-1/2"
420-1250	440-1250	1/8"	1/8"	1/4"	1-1/2"
420-1562	440-1562	5/32"	3/16"	5/16"	2"
420-1875	440-1875	3/16"	3/16"	3/8"	2"
420-2188	440-2188	7/32"	1/4"	1/2"	2-1/2"
420-2500	440-2500	1/4"	1/4"	1/2"	2-1/2"
420-3125	440-3125	5/16"	5/16"	1/2"	2-1/2"
420-3750	440-3750	3/8"	3/8"	5/8"	2-1/2"
420-4375	440-4375	7/16"	7/16"	5/8"	3"
420-5000	440-5000	1/2"	1/2"	5/8"	3"
420-6250	440-6250	5/8"	5/8"	3/4"	4"
420-7500	440-7500	3/4"	3/4"	1"	4"

Double End - Ball

2FL & 4FL - Ball Double End Sizes

2 FL	4 FL	DIA	SHK	LOC	OAL
422-0312	442-0312	1/32"	1/8"	1/16"	1-1/2"
422-0625	442-0625	1/16"	1/8"	1/8"	1-1/2"
422-0938	442-0938	3/32"	1/8"	3/16"	1-1/2"
422-1250	442-1250	1/8"	1/8"	1/4"	1-1/2"
422-1562	442-1562	5/32"	3/16"	5/16"	2"
422-1875	442-1875	3/16"	3/16"	3/8"	2"
422-2188	442-2188	7/32"	1/4"	1/2"	2-1/2"
422-2500	442-2500	1/4"	1/4"	1/2"	2-1/2"
422-3125	442-3125	5/16"	5/16"	1/2"	2-1/2"
422-3750	442-3750	3/8"	3/8"	5/8"	2-1/2"
422-4375	442-4375	7/16"	7/16"	5/8"	3"
422-5000	442-5000	1/2"	1/2"	5/8"	3"
422-6250	442-6250	5/8"	5/8"	3/4"	4"
422-7500	442-7500	3/4"	3/4"	1"	4"

Cutting Diameter Tolerances +.000"/-.002"

Shank Diameter Tolerances +.000"/-.0005"



SPEEDS & FEEDS

GENERAL PURPOSE

- Plunge Operations: Reduce feed per tooth 50-65%
- Slotting Applications: Surface speeds (sfm) should be reduced approximately 20% of the lowest value
- Light radial depths of cut, the higher of the recommended surface speeds (sfm) should be used
- Greater Radial depths of cut (more than 0.5 X diameter), the lower range of surface speeds (sfm) should be used
- Axial Depth of Cut: Recommendations are not to exceed 1.5 times the diameter. If this condition exists, Conventional Milling should be used and feed per tooth should be reduced by 50%

MATERIAL	SPEED (SFM)	END MILL DIAMETER FEED PER TOOTH (inches)		
		UP TO 1/4"	UP TO 1/2"	UP TO 1"
Aluminum/Aluminum Alloys	600-1300	.0002-.002	.002-.004	.004-.008
Brass/Soft Bronze	400-700	.0005-.002	.002-.003	.003-.005
Bronze/High Tensile	250-400	.001-.002	.002-.003	.004-.006
Copper/Copper Alloys	350-900	.005-.002	0.002	.002-.006
Iron-Cast (soft)	200-500	.0005-.002	.002-.003	.003-.008
Iron-Cast (hard)	100-450	.0003-.001	.0008-.002	.003-.005
Iron-Ductile	80-400	.0002-.001	.001-.002	.002-.006
Iron-Malleable	250-600	.001-.002	.001-.003	.003-.008
Magnesium/Magnesium Alloys	800-1400	.0005-.002	.002-.004	.004-.010
Monel/High Nickel Steel	150-300	.0002-.001	.001-.002	.002-.004
Nickel Base Hi-Temp Alloys	20-100	.0003-.0008	.0008-.001	.001-.002
Plastics	600-1200	.0006-.003	.003-.006	.006-.015
Plastics-Glass Filled	300-800	.0006-.003	.003-.004	.004-.012
Refractory Alloys	80-400	.0002-.001	0.001	.001-.002
Steel-Low Carbon	250-550	.0002-.001	.001-.003	.003-.007
Steel-Medium Carbon	100-250	.0004-.0015	.0015-.002	.002-.005
Steel-Up to Rc35	150-250	.0005-.001	.001-.002	.002-.003
Steel-Rc35 - Rc50	80-150	.0002-.0007	.0007-.001	.002-.003
Steel: Rc50- Rc60	25-120	.0002-.0005	.0005-.001	.002-.003
Steel-Mold	200-350	.0002-.001	.001-.002	.002-.006
Steel-Tool	100-300	.0002-.001	.001-.002	.002-.006
Stainless Steel-Soft	250-400	.0002-.001	.001-.002	.002-.006
Stainless Steel-Hard	50-250	.0002-.001	.001-.002	.001-.005
Titanium-Soft	120-350	.0002-.001	.001-.002	.002-.006
Titanium-Hard	30-150	.0002-.0005	.0005-.001	.001-.004

*** PLEASE NOTE: The above recommendations should be considered ONLY as a starting point; "fine tuning" may be required in order to maximize performance ***

SPEEDS & FEEDS

FEROCIOUS & FEROCIOUS 3x

- **Max Spindle Speeds Possible**
- **Dramatic Feed Rate Increase**
- **Vertical Chip Ejection**
- **Quiet Operation**
- **Longer Tool Life**

- THE IPT VALUES BELOW ARE MINIMUM STARTING POINTS - REDUCING IPT VALUES CAN CAUSE THE TOOL TO DEFLECT
- IF SFM CANNOT BE ACHIEVED DUE TO RPM LIMITS, PLEASE RUN AT MAXIMUM SAFE RPM AND MAINTAIN IPT RECOMMENDATION

SPEEDS AND FEEDS		
TOOL DIAMETER	I.P.T (INCH PER TOOTH)	STARTING RPM
1/8	.001	12,000
3/16	.002	10,000
1/4	.003	10,000
5/16	.004	8,000
3/8	.005	8,000
1/2	.006	8,000
5/8	.007	6,000
3/4	.008	4,000
1	.010	4,000

MATERIAL	CUT TYPE		Starting SFM Range	Target SFM	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
					ipt								
Aluminum Alloys	≥ 0.5xD to 1xD	Full Slot	395-786	590-1572	0.0009	0.0016	0.0024	0.0038	0.0046	0.0062	0.0070	0.0077	0.0088
	≤ 0.5xD	Profile			0.0012	0.0021	0.0031	0.0049	0.0059	0.0079	0.0090	0.0099	0.0113
	≤ 0.05xD	Finish Pass			0.0016	0.0028	0.0043	0.0068	0.0082	0.0110	0.0125	0.0137	0.0157
					ipt								
Cast Aluminum (High Silicon)	≥ 0.5xD to 1xD	Full Slot	395-786	590-1572	0.0008	0.0014	0.0022	0.0034	0.0041	0.0056	0.0063	0.0069	0.0079
	≤ 0.5xD	Profile			0.0010	0.0018	0.0028	0.0044	0.0053	0.0072	0.0081	0.0089	0.0102
	≤ 0.05xD	Finish Pass			0.0014	0.0026	0.0038	0.0061	0.0074	0.0099	0.0112	0.0123	0.0141
					ipt								
Copper Alloys / Brass	≥ 0.5xD to 1xD	Full Slot	395-786	590-1572	0.0008	0.0014	0.0022	0.0034	0.0041	0.0056	0.0063	0.0069	0.0079
	≤ 0.5xD	Profile			0.0010	0.0018	0.0028	0.0044	0.0053	0.0072	0.0081	0.0089	0.0102
	≤ 0.05xD	Finish Pass			0.0014	0.0026	0.0038	0.0061	0.0074	0.0099	0.0112	0.0123	0.0141
					ipt								
Plastics	≥ 0.5xD to 1xD	Full Slot	395-786	590-1572	0.0017	0.0031	0.0046	0.0073	0.0088	0.0119	0.0135	0.0148	0.0169
	≤ 0.5xD	Profile			0.0022	0.0039	0.0059	0.0094	0.0113	0.0153	0.0173	0.0190	0.0217
	≤ 0.05xD	Finish Pass			0.0031	0.0055	0.0082	0.0130	0.0158	0.0212	0.0240	0.0264	0.0301
					ipt								

WARNING: TOO LOW OF AN RPM COUPLED WITH TOO MUCH FEED MIGHT CAUSE THE TOOL TO SHATTER

FOR BEST RESULTS:

- DIRECT MULTIPLE COOLANT NOZZLES AT THE END MILL TO ASSURE CONSTANT COOLING OF THE TOOL AND TO FLUSH CHIPS.
- THESE TOOLS ARE SPECIALLY DESIGNED FOR HI-SPEED MILLING OF ALUMINUM.
- THE FEEDS LISTED ARE STARTING POINTS. VARIATIONS OF THESE WILL DEPEND ON THE RADIAL & AXIAL DEPTH-OF-CUT & WORK PIECE CONDITIONS
- REDUCE FEED BY 50% ON LONG AND LONG REACH TOOLS OR WHEN AXIAL DEPTH OF CUT EXCEEDS 1.5XD
- RADIAL RUNOUT OF TOOL TIP UNDER (.0005") WHEN RUNNING TO ACHIEVE OPTIMUM FEEDS
- CGS RECOMMENDS STARTING AT LOWER END OF SFM VALUES AND INCREASING AT CONTROLLED LEVELS TO ACHIEVE OPTIMUM FEEDS & SURFACE FINISHES

SPEEDS & FEEDS

HV & THE BEAST

		1/8"	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	
Work Material	SFM	RPM - IPM	RPM - IPM	RPM - IPM	RPM - IPM	RPM - IPM	RPM - IPM	RPM - IPM	RPM - IPM	RPM - IPM	
Titanium Alloys											
	HIGH	250	7640 - 15.3	5093 - 10.2	3820 - 9.2	3056 - 11.0	2547 - 11.2	1910 - 10.7	1528 - 9.2	1273 - 11.2	955 - 9.9
	LOW	212	6479 - 13.0	4319 - 8.6	3239 - 7.7	2591 - 9.3	2160 - 9.5	1620 - 9.0	1296 - 7.7	1080 - 9.5	810 - 8.4
	<i>IPT</i>		0.0005	0.0005	0.0006	0.0009	0.0011	0.0014	0.0015	0.0022	0.0026
High Temp Alloys											
	HIGH	125	3820 - 6.1	2547 - 4.1	1910 - 5.4	1528 - 6.8	1273 - 5.6	955 - 6.5	764 - 5.8	637 - 6.1	478 - 4.6
	LOW	106	3239 - 5.2	2160 - 3.4	1620 - 4.5	1296 - 5.7	1080 - 4.7	810 - 5.5	648 - 4.9	540 - 5.2	405 - 3.9
	<i>IPT</i>		0.0004	0.0004	0.0007	0.0011	0.0011	0.0017	0.0019	0.0024	0.0024
Alloy Steels											
4140-4340	HIGH	575	17572 - 42.2	11715 - 46.8	8786 - 56.2	7029 - 56.2	5857 - 58.5	4393 - 54.5	3514 - 49.2	2929 - 43.3	2197 - 35.15
Below 36Rc	LOW	450	13752 - 33.0	9168 - 36.7	6876 - 44.0	5501 - 44.0	4584 - 45.8	3438 - 42.6	2750 - 38.5	2292 - 33.9	1719 - 27.5
	<i>IPT</i>		0.0006	0.001	0.0016	0.002	0.0025	0.0031	0.0035	0.0037	0.004
4140-4340	HIGH	387	11827 - 28.4	7884 - 31.5	5913 - 37.8	4731 - 37.8	3942 - 39.4	2957 - 36.7	2365 - 33.1	1971 - 29.2	1478 - 23.6
Above 36Rc	LOW	325	9932 - 23.8	6621 - 26.5	4966 - 31.8	3937 - 31.8	3311 - 33.1	2483 - 30.8	1986 - 27.8	1655 - 24.5	1242 - 19.9
	<i>IPT</i>		0.0006	0.001	0.0016	0.002	0.0025	0.0031	0.0035	0.0037	0.004
Grey Cast Iron											
	HIGH	700	21392 - 68.5	14242 - 45.8	10696 - 34.2	8557 - 41.1	7131 - 34.2	5348 - 38.5	4278 - 34.2	3565 - 34.2	2674 - 30.0
	LOW	575	17572 - 56.2	11715 - 37.5	8786 - 28.1	7029 - 33.7	5857 - 28.1	4393 - 31.6	3514 - 28.1	2929 - 28.1	2197 - 24.6
	<i>IPT</i>		0.0008	0.0008	0.0008	0.0012	0.0012	0.0018	0.002	0.0024	0.0028
Tool Steels											
Below 36Rc	HIGH	575	17572 - 35.1	11715 - 32.8	8786 - 49.2	7029 - 53.4	5857 - 46.9	4393 - 46.9	3514 - 43.6	2929 - 37.5	2197 - 30.8
	LOW	450	13752 - 27.5	9168 - 25.7	6876 - 38.5	5501 - 41.8	4584 - 36.7	3438 - 34.4	2750 - 34.1	2292 - 29.3	1719 - 24.1
	<i>IPT</i>		0.0005	0.0007	0.0014	0.0019	0.002	0.0025	0.0031	0.0032	0.0035
Above 36Rc	HIGH	262	8007 - 16.	5338 - 15.0	4003 - 22.4	3203 - 24.3	2669 - 21.4	2002 - 20.0	1601 - 19.9	1334 - 17.1	1001 - 14.0
	LOW	211	6448 - 12.9	4299 - 12.0	3224 - 18.0	2579 - 19.6	2149 - 17.2	1612 - 16.1	1290 - 16.0	1075 - 13.8	806 - 11.3
	<i>IPT</i>		0.0005	0.0007	0.0014	0.0019	0.002	0.0025	0.0031	0.0032	0.0035
Stainless Steels											
Hard to Machine	HIGH	362	11063 - 17.7	7375 - 11.8	5531 - 13.3	4425 - 17.7	3688 - 14.8	2766 - 17.7	2213 - 15.9	1844 - 16.2	1383 - 12.2
	LOW	325	9932 - 15.9	6621 - 10.6	4966 - 11.9	3973 - 15.9	3311 - 13.2	2483 - 15.9	1986 - 14.3	1655 - 14.6	1242 - 10.9
	<i>IPT</i>		0.0004	0.0004	0.0006	0.001	0.001	0.0016	0.0018	0.0022	0.0022
Mild to Machine	HIGH	375	11460 - 22.9	7640 - 15.3	5730 - 16.0	4584 - 20.2	3820 - 16.8	2865 - 19.5	2292 - 17.4	1910 - 17.6	1433 - 13.2
	LOW	337	10299 - 20.6	6866 - 13.7	5149 - 14.4	4119 - 18.1	3433 - 15.1	2575 - 17.5	2060 - 15.7	1716 - 15.8	1287 - 11.8
	<i>IPT</i>		0.0005	0.0005	0.0007	0.0011	0.0011	0.0017	0.0019	0.0023	0.0023
Easy to Machine			14883 - 35.7	9922 - 23.8	7441 - 23.8	5953 - 28.6	4961 - 23.8	3721 - 26.8	2977 - 23.8	2480 - 23.8	1860 - 17.9
			11827 - 28.4	7884 - 18.9	5913 - 18.9	4731 - 22.7	3942 - 18.9	2957 - 21.3	2365 - 18.9	1971 - 18.9	1478 - 14.2
	<i>IPT</i>		0.0006	0.0006	0.0008	0.0012	0.0012	0.0018	0.002	0.0024	0.0024
Soft Steels	HIGH	762	23287 - 55.9	15524 - 49.7	11643 - 37.3	9315 - 44.7	7762 - 37.3	5822 - 41.9	4657 - 37.3	3881 - 37.3	2911 - 32.6
	LOW	637	19467 - 46.7	12978 - 41.5	9733 - 31.2	7787 - 37.4	6489 - 31.2	4867 - 35.0	3893 - 31.1	3244 - 31.1	2433 - 27.3
	<i>IPT</i>		0.0006	0.0008	0.0008	0.0012	0.0012	0.0018	0.002	0.0024	0.0028
Die Steels											
Below 37Rc	HIGH	387	11827 - 28.4	7884 - 31.5	5913 - 37.8	4731 - 37.8	3942 - 39.4	2957 - 36.7	2365 - 33.1	1971 - 29.2	1478 - 23.6
	LOW	325	9932 - 23.8	6621 - 26.5	4966 - 31.8	3937 - 31.8	3311 - 33.1	2483 - 30.8	1986 - 27.8	1655 - 24.5	1242 - 19.9
	<i>IPT</i>		0.0006	0.001	0.0016	0.002	0.0025	0.0031	0.0035	0.0037	0.004

- Speed and feed recommendations are for **profile milling** (side cut) operations up to 20% of the cutter diameter
- Decrease values by 20% for **slotting operations**
- Rates based on **HIGH** values are for optimum working conditions

SPEEDS & FEEDS

STORM

Storm Series Application Guide - Speeds & Feeds (Inch)

Material Information			Feed (Inches per tooth)								
Work Material	HRC	SFM	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
COBALT BASE ALLOYS											
Haynes 25/188, Stellite 21,	< 40	70 - 110	.0008" - .0020"	.0004" - .0010"	.0007" - .0012"	.0010" - .0018"	.0010" - .0020"	.0018" - .0028"	.0023" - .0031"	.0027" - .0034	.0029" - .0036"
Cobalt Chrome	> 40	50 - 90	.0005" - .0015"	.0004" - .0007"	.0005" - .0011"	.0008" - .0014"	.0010" - .0017"	.0015" - .0025"	.0021" - .0028"	.0024" - .0030"	.0025" - .0031"
NICKEL BASE ALLOYS											
Inconel-625/718, Waspaloy, Invar	< 40	65 - 110	.0005" - .0009"	.0005" - .0009"	.0007" - .0013"	.0010" - .0017"	.0010" - .0020"	.0020" - .0028"	.0025" - .0032"	.0029" - .0036"	.0030" - .0038"
Rene, Hastelloy, Monel	> 40	55 - 90	.0003" - .0008"	.0004" - .0007"	.0007" - .0012"	.0009" - .0015"	.0010" - .0018"	.0015" - .0025"	.0022" - .0030"	.0026" - .0033"	.0029" - .0035"
IRON BASE ALLOYS											
A286, Discaloy, Haynes 556,	< 40	65 - 110	.0005" - .0010"	.0008" - .0010"	.0006" - .0012"	.0007" - .0015"	.0011" - .0016"	.0018" - .0026"	.0025" - .0030"	.0026" - .0034"	.0032" - .0038"
Carpenter 22, Greek Ascology	> 40	55 - 90	.0003" - .0008"	.0004" - .0008"	.0005" - .0010"	.0006" - .0013"	.0008" - .0014"	.0013" - .0023"	.0022" - .0028"	.0025" - .0031"	.0030" - .0035"
TITANIUM ALLOYS											
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si	-	125 - 175	.0005" - .0010"	.0005" - .0012"	.0008" - .0015"	.0010" - .0022"	.0018" - .0027"	.0023" - .0032"	.0025" - .0033"	.0027" - .0035"	.0028" - .0037"
5553 / Beta Titanium	-	100 - 150	.0004" - .0010"	.0004" - .0010"	.0006" - .0014"	.0008" - .0017"	.0015" - .0025"	.0022" - .0028"	.0024" - .0030"	.0026" - .0032"	.0028" - .0035"
STAINLESS STEELS											
13/8, 15/5, 17-4, PH Types	< 40	175 - 225	.0005" - .0007"	.0004" - .0008"	.0007" - .0010"	.0008" - .0012"	.0013" - .0018"	.0010" - .0020"	.0012" - .0025"	.0012" - .0020"	.0020" - .0028"
-	> 40	135 - 175	.0002" - .0004"	.0002" - .0006"	.0003" - .0007"	.0004" - .0008"	.0007" - .0012"	.0008" - .0015"	.0010" - .0016"	.0013" - .0017"	.0015" - .0020"
300 Series, 304L, Nitronic 50,	< 40	200 - 225	.0003" - .0007"	.0005" - .0010"	.0008" - .0015"	.0009" - .0013"	.0010" - .0018"	.0015" - .0020"	.0018" - .0022"	.0018" - .0035"	.0023" - .0036"
Duplex, Super-Austenitic	> 40	155 - 200	.0002" - .0005"	.0004" - .0007"	.0005" - .0010"	.0005" - .0010"	.0007" - .0010"	.0009" - .0015"	.0012" - .0018"	.0015" - .0025"	.0020" - .0030"
400 Series - 403, 405, 420, 455	< 40	200 - 225	.0007" - .0010"	.0009" - .0015"	.0009" - .0014"	.0011" - .0015"	.0013" - .0018"	.0015" - .0025"	.0020" - .0035"	.0022" - .0040"	.0030" - .0046"
-	> 40	150 - 200	.0004" - .0008"	.0006" - .0010"	.0007" - .0011"	.0008" - .0012"	.0009" - .0015"	.0012" - .0020"	.0018" - .0030"	.0020" - .0035"	.0024" - .0042"
MEDIUM ALLOY TOOL STEEL HIGH STRENGTH TOOL STEEL											
4140, 4340, 52100, 6150, 8620	< 40	225 - 325	.0005" - .0008"	.0008" - .0015"	.0015" - .0020"	.0015" - .0023"	.0015" - .0025"	.0020" - .0030"	.0020" - .0030"	.0025" - .0035"	.0030" - .0040"
A2, D2, P20, H13, S2, O1	> 40	150 - 225	.0003" - .0005"	.0005" - .0010"	.0008" - .0012"	.0010" - .0015"	.0010" - .0018"	.0015" - .0020"	.0015" - .0020"	.0018" - .0025"	.0020" - .0030"
CARBON STEELS											
1000's - 1018, 1020, 12L14	< 40	225 - 325	.0005" - .0008"	.0008" - .0015"	.0015" - .0020"	.0015" - .0023"	.0015" - .0025"	.0020" - .0030"	.0020" - .0030"	.0025" - .0035"	.0030" - .0040"
CAST MATERIAL											
Ductile Iron	-	225 - 325	.0010" - .0015"	.0015" - .0020"	.0020" - .0030"	.0025" - .0035"	.0025" - .0035"	.0030" - .0045"	.0040" - .0050"	.0040" - .0050"	.0050" - .0060"
Gray Iron	-	300 - 400	.0015" - .0025"	.0020" - .0030"	.0025" - .0035"	.0030" - .0040"	.0030" - .0040"	.0040" - .0050"	.0050" - .0060"	.0060" - .0070"	.0060" - .0070"

- Speed and feed recommendations are for **profile milling** (side cut) operations up to 20% of the cutter diameter
- Decrease values by 20% for **slotting operations**
- Rates based on **HIGH** values are for optimum working conditions

SPEEDS & FEEDS

EF-5 TORNADO

EF-5 Tornado Application Guide - Speeds and Feeds (Inch)

Material Information						Feed (Inches Per Tooth)									
Work Material	Type of Cut	Axial DOC	Radial DOC	Flutes	Speed (SFM)	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	1
Cast Iron	Slotting	0.5 x D	1 x D	5	300	0.0006	0.0009	0.0012	0.0015	0.0018	0.0021	0.0024	0.003	0.0036	0.0048
Gray	Peripheral - Rough	1.25 x D	.3 x D	5	375	0.0008	0.0012	0.0016	0.002	0.0025	0.0029	0.0033	0.0041	0.0049	0.0065
ASTM-A48 Class 20, 25, 30, 35 & 40	Finish	2 x D	.015 x D	5	375	0.0008	0.0012	0.0017	0.0021	0.0025	0.0029	0.0033	0.0042	0.005	0.0067
	Slotting	.5 x D	1 x D	5	275	0.0005	0.0008	0.001	0.0013	0.0015	0.0018	0.002	0.0025	0.003	0.004
	Peripheral - Rough	1.25 x D	.3 x D	5	350	0.0007	0.001	0.0014	0.0017	0.002	0.0024	0.0027	0.0034	0.0041	0.0055
Cast Iron	Peripheral - HEM*	3 x D	.05 x D	5	390	0.002	0.003	0.004	0.005	0.006	0.007	0.0081	0.0101	0.0121	0.0161
	Finish	2 x D	.015 x D	5	350	0.0007	0.001	0.0014	0.0017	0.0021	0.0024	0.0028	0.0035	0.0042	0.0056
	Slotting	.5 x D	1 x D	5	325	0.0007	0.0011	0.0014	0.0018	0.0021	0.0025	0.0028	0.0035	0.0042	0.0056
Low Carbon Steels ≤ 38 Rc	Peripheral - Rough	1.25 x D	.3 x D	5	400	0.001	0.0014	0.0019	0.0024	0.0029	0.0033	0.0038	0.0048	0.0057	0.0076
	Peripheral - HEM*	3 x D	.07 x D	5	450	0.0028	0.0042	0.0056	0.007	0.0084	0.0098	0.0112	0.014	0.0168	0.0224
	Finish	2 x D	.015 x D	5	400	0.001	0.0015	0.0019	0.0024	0.0029	0.0034	0.0039	0.0049	0.0058	0.0078
Medium Carbon Steels ≤ 48 HRC	Slotting	.5 x D	1 x D	5	300	0.0006	0.001	0.0013	0.0016	0.0019	0.0022	0.0026	0.0032	0.0038	0.0051
	Peripheral - Rough	1.25 x D	.3 x D	5	375	0.0009	0.0013	0.0017	0.0022	0.0026	0.0031	0.0035	0.0044	0.0052	0.007
	Peripheral - HEM*	3 x D	.05 x D	5	415	0.0026	0.0039	0.0052	0.0065	0.0077	0.009	0.0103	0.0129	0.0155	0.0207
1045, 4140, 4340, 5140	Finish	2 x D	.015 x D	5	375	0.0009	0.0013	0.0018	0.0022	0.0027	0.0031	0.0036	0.0044	0.0053	0.0071
	Slotting	.5 x D	1 x D	5	275	0.0005	0.0008	0.0011	0.0014	0.0016	0.0019	0.0022	0.0027	0.0032	0.0043
	Peripheral - Rough	1.25 x D	.3 x D	5	350	0.0007	0.0011	0.0015	0.0018	0.0022	0.0026	0.0029	0.0037	0.0044	0.0059
Tool and Die Steels ≤ 48 Rc	Peripheral - HEM*	3 x D	.05 x D	5	390	0.0022	0.0032	0.0043	0.0054	0.0065	0.0076	0.0087	0.0108	0.013	0.0173
	Finish	2 x D	.015 x D	5	350	0.0007	0.0011	0.0015	0.0019	0.0022	0.0026	0.003	0.0037	0.0045	0.006
	Slotting	.5 x D	1 x D	5	300	0.0006	0.001	0.0013	0.0016	0.0019	0.0022	0.0026	0.0032	0.0038	0.0051
Martensitic & Ferritic Stainless Steels	Peripheral - Rough	1.25 x D	.3 x D	5	375	0.0009	0.0013	0.0017	0.0022	0.0026	0.0031	0.0035	0.0044	0.0052	0.007
	Peripheral - HEM*	3 x D	.05 x D	5	415	0.0026	0.0039	0.0052	0.0065	0.0077	0.009	0.0103	0.0129	0.0155	0.0207
	Finish	2 x D	.015 x D	5	375	0.0009	0.0013	0.0018	0.0022	0.0027	0.0031	0.0036	0.0044	0.0053	0.0071
410, 416, 440	Slotting	.5 x D	1 x D	5	275	0.0006	0.0009	0.0012	0.0015	0.0018	0.0021	0.0024	0.003	0.0036	0.0048
	Peripheral - Rough	1.25 x D	.3 x D	5	350	0.0008	0.0012	0.0016	0.002	0.0025	0.0029	0.0033	0.0041	0.0049	0.0065
	Peripheral - HEM*	3 x D	.05 x D	5	390	0.0025	0.0037	0.0049	0.0062	0.0074	0.0086	0.0099	0.0123	0.0148	0.0198
Austenitic Stainless Steels, FeNi Alloys	Finish	2 x D	.015 x D	5	350	0.0008	0.0012	0.0017	0.0021	0.0025	0.0029	0.0033	0.0042	0.005	0.0067
	Slotting	.5 x D	1 x D	5	250	0.0005	0.0008	0.001	0.0013	0.0015	0.0018	0.002	0.0025	0.003	0.004
	Peripheral - Rough	1.25 x D	.3 x D	5	325	0.0007	0.001	0.0014	0.0017	0.002	0.0024	0.0027	0.0034	0.0041	0.0055
Precipitation Hardening Stainless Steels	Peripheral - HEM*	3 x D	.05 x D	5	360	0.002	0.003	0.004	0.0049	0.0059	0.0069	0.0079	0.0099	0.0119	0.0158
	Finish	1.5 x D	.015 x D	5	325	0.0007	0.001	0.0014	0.0017	0.0021	0.0024	0.0028	0.0035	0.0042	0.0056
	Slotting	.5 x D	1 x D	5	250	0.0005	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0023	0.0028	0.0037
Titanium Alloys	Peripheral - Rough	1 x D	.3 x D	5	300	0.0006	0.0009	0.0013	0.0016	0.0019	0.0022	0.0025	0.0031	0.0038	0.005
	Peripheral - HEM*	3 x D	.05 x D	5	330	0.0018	0.0027	0.0036	0.0046	0.0055	0.0064	0.0073	0.0091	0.0109	0.0146
	Finish	1.5 x D	.015 x D	5	300	0.0006	0.001	0.0013	0.0016	0.0019	0.0022	0.0026	0.0032	0.0038	0.0051
Difficult-to-Machine Titanium Alloys	Slotting	.25 x D	1 x D	5	200	0.0003	0.0005	0.0007	0.0009	0.001	0.0012	0.0014	0.0017	0.002	0.0027
	Peripheral - Rough	1 x D	.25 x D	5	250	0.0005	0.0007	0.001	0.0012	0.0015	0.0017	0.002	0.0025	0.0029	0.0039
	Peripheral - HEM*	3 x D	.05 x D	5	275	0.0015	0.0022	0.003	0.0037	0.0045	0.0052	0.0059	0.0074	0.0089	0.0119
10-2-3	Finish	1.5 x D	.01 x D	5	250	0.0006	0.0009	0.0012	0.0014	0.0017	0.002	0.0023	0.0029	0.0035	0.0046

- Speed and feed recommendations are for **profile milling** (side cut) operations up to 20% of the cutter diameter
- Decrease values by 20% for **slotting operations**
- Rates based on **HIGH** values are for optimum working conditions

SPEEDS & FEEDS

PX SERIES

PX Series Application Guide - Speeds & Feeds (Inch)

Material Information					Feed (Inches per tooth)									
Work Material	Type of Cut	Axial DOC	Radial DOC	Speed SPM	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	1"
Cast Iron	Slotting	0.5 x D	1 x D	300	.0006	.0009	.0012	.0015	.0018	.0021	.0024	.0030	.0036	.0048
ASTM-A48 Class 20, 25, 30, 35 & 40	Peripheral - Rough	1.25 x D	.3 x D	375	.0008	.0012	.0016	.0025	0.0026	.0029	.0033	.0041	.0049	.0065
	Finish	2 x D	.015 x D	375	.0008	.0012	.0017	.0025	0.0027	.0029	.0033	.0042	.0050	.0067
	Slotting	0.5 x D	1 x D	275	.0005	.0008	.0010	.0013	.0015	.0018	.0020	.0025	.0030	.0040
Cast Iron	Peripheral - Rough	1.25 x D	.3 x D	350	.0007	.0010	.0014	.0017	.0020	.0024	.0027	.0034	.0034	.0055
Malleable	Peripheral - HEM*	3 x D	.05 x D	390	.0020	.0030	.0040	.0050	.0060	.0070	.0081	.0101	.0121	.0161
	Slotting	2 x D	.015 x D	350	.0007	.0010	.0014	.0017	.0021	.0024	.0028	.0035	.0042	.0056
	Slotting	0.5 x D	1 x D	325	.0007	.0011	.0014	.0018	.0021	.0025	.0028	.0035	.0042	.0056
Low Carbon Steels ≤ 38 Rc	Peripheral - Rough	1.25 x D	.3 x D	400	.0010	.0014	.0019	.0024	.0029	.0033	.0038	.0048	.0057	.0076
1018, 1020, 12L14, 5120, 8620	Peripheral - HEM*	3 x D	.07 x D	450	.0028	.0042	.0056	.0070	.0084	.0098	.0112	.0140	.0168	.0224
	Finish	2 x D	.015 x D	400	.0010	.0015	.0019	.0024	.0029	.0034	.0039	.0049	.0058	.0078
	Slotting	0.5 x D	1 x D	300	.0006	.0010	.0013	.0016	.0019	.0022	.0026	.0032	.0038	.0051
Medium Carbon Steels ≤ 48 HRC	Peripheral - Rough	1 x D	.3 x D	375	.0009	.0013	.0017	.0022	.0026	.0031	.0035	.0044	.0052	.0070
1045, 4140, 4340, 5140	Peripheral - HEM*	3 x D	.05 x D	415	.0026	.0039	.0052	.0065	.0077	.0090	.0103	.0129	.0155	.0207
	Finish	2 x D	.015 x D	375	.0009	.0013	.0018	.0022	.0027	.0031	.0036	.0044	.0053	.0071
	Slotting	0.5 x D	1 x D	275	.0005	.0008	.0011	.0014	.0016	.0019	.0022	.0027	.0032	.0043
Tool and Die Steels ≤ 48 Rc	Peripheral - Rough	1.25 x D	.3 x D	350	.0007	.0011	.0015	.0018	.0022	.0026	.0029	.0037	.0044	.0059
A2, D2, O1, S7, P20, H13	Peripheral - HEM*	3 x D	.05 x D	390	.0022	.0032	.0043	.0054	.0065	.0076	.0087	.0108	.0130	.0173
	Finish	2 x D	.015 x D	350	.0007	.0011	.0015	.0019	.0022	.0026	.0030	.0037	.0045	.0060
	Slotting	0.5 x D	1 x D	300	.0006	.0010	.0013	.0016	.0019	.0022	.0026	.0032	.0038	.0051
Martensitic & Ferritic Stainless Steels	Peripheral - Rough	1.25 x D	.3 x D	375	.0009	.0013	.0017	.0022	.0026	.0031	.0035	.0044	.0052	.0070
410, 416, 440	Peripheral - HEM*	3 x D	.05 x D	415	.0026	.0039	.0052	.0065	.0077	.0090	.0103	.0129	.0155	.0207
	Slotting	2 x D	.015 x D	375	.0009	.0013	.0018	.0022	.0027	.0031	.0036	.0044	.0053	.0071
	Slotting	0.5 x D	1 x D	275	.0006	.0009	.0012	.0015	.0018	.0021	.0024	.0030	.0036	.0048
Austenitic Stainless Steels, FeNi Alloys	Peripheral - Rough	1.25 x D	.3 x D	350	.0008	.0012	.0016	.0020	.0025	.0029	.0033	.0041	.0049	.0065
303, 304, 316, Invar, Kovar	Peripheral - HEM*	3 x D	.05 x D	390	.0025	.0037	.0049	.0062	.0074	.0086	.0099	.0123	.0148	.0198
	Finish	2 x D	.015 x D	350	.0008	.0012	.0017	.0021	.0025	.0029	.0033	.0042	.0050	.0067
	Slotting	0.5 x D	1 x D	250	.0005	.0008	.0010	.0013	.0015	.0018	.0020	.0025	.0030	.0040
Precipitation Hardening Stainless Steels	Peripheral - Rough	1.25 x D	.3 x D	325	.0007	.0010	.0014	.0017	.0020	.0024	.0027	.0034	.0041	.0055
17-4, 15-5	Peripheral - HEM*	3 x D	.05 x D	360	.0020	.0030	.0040	.0049	.0059	.0069	.0079	.0099	.0119	.0158
	Slotting	1.5 x D	.015 x D	325	.0007	.0010	.0014	.0017	.0021	.0024	.0028	.0035	.0042	.0056
	Slotting	0.5 x D	1 x D	250	.0005	.0007	.0009	.0012	.0014	.0016	.0018	.0023	.0028	.0037
Titanium Alloys	Peripheral - Rough	1 x D	.3 x D	300	.0006	.0009	.0013	.0016	.0019	.0022	.0025	.0031	.0038	.0050
6Al-4V, 6-2-4	Peripheral - HEM*	3 x D	.05 x D	330	.0018	.0027	.0036	.0046	.0055	.0064	.0073	.0091	.0109	.0146
	Finish	1.5 x D	.015 x D	300	.0006	.0010	.0013	.0016	.0019	.0022	.0026	.0032	.0038	.0051
	Slotting	0.25 x D	1 x D	200	.0003	.0005	.0007	.0009	.0010	.0012	.0014	.0017	.0020	.0027
Difficult-to-Machine Titanium Alloys	Peripheral - Rough	1 x D	.25 x D	250	.0005	.0007	.0010	.0012	.0015	.0017	.0020	.0025	.0029	.0039
10-2-3	Peripheral - Rough	1 x D	.25 x D	250	.0005	.0007	.0010	.0012	.0015	.0017	.0020	.0025	.0029	.0039
Precipitation Hardening Stainless Steels	Peripheral - HEM*	3 x D	.05 x D	275	.0015	.0022	.0030	.0037	.0045	.0052	.0059	.0074	.0089	.0119
13-8	Slotting	1.5 x D	.01 x D	250	.0006	.0009	.0012	.0014	.0017	.0020	.0023	.0029	.0035	.0046

*** For 5 & 7 Flute HEM applications, please refer to standard RDOC chip thinning practices ***

Recommended Speeds and Feeds For MX Series End Mills with 4 & 6 Flutes											
CUTTING SPEEDS		1/8"	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	
Work Material	SFM	ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt	
Titanium Alloys											
	HIGH	250	0.0004	0.0004	0.0005	0.0008	0.001	0.0013	0.0014	0.0021	0.0025
	LOW	212	0.0005	0.0005	0.0006	0.0009	0.0011	0.0014	0.0015	0.0022	0.0026
High Temp Alloys											
	HIGH	125	0.0003	0.0003	0.0006	0.001	0.001	0.0016	0.0018	0.0023	0.0023
	LOW	106	0.0004	0.0004	0.0007	0.0011	0.0011	0.0017	0.0019	0.0024	0.0024
Alloy Steels											
4140-4340	HIGH	575	0.0005	0.0009	0.0015	0.0019	0.0024	0.003	0.0034	0.0036	0.0039
Below 36Rc	LOW	450	0.0006	0.001	0.0016	0.002	0.0025	0.0031	0.0035	0.0037	0.004
4140-4340	HIGH	387	0.0005	0.0009	0.0015	0.0019	0.0024	0.003	0.0034	0.0036	0.0039
Above 36Rc	LOW	325	0.0006	0.001	0.0016	0.002	0.0025	0.0031	0.0035	0.0037	0.004
Grey Cast Iron											
	HIGH	700	0.0007	0.0007	0.0007	0.0011	0.0011	0.0017	0.0019	0.0023	0.0027
	LOW	575	0.0008	0.0008	0.0008	0.0012	0.0012	0.0018	0.002	0.0024	0.0028
Tool Steels											
Below 36Rc	HIGH	575	0.0004	0.0006	0.0013	0.0018	0.0019	0.0024	0.003	0.0031	0.0034
	LOW	450	0.0005	0.0007	0.0014	0.0019	0.002	0.0025	0.0031	0.0032	0.0035
Above 36Rc	HIGH	262	0.0004	0.0006	0.0013	0.0018	0.0019	0.0024	0.003	0.0031	0.0034
	LOW	211	0.0005	0.0007	0.0014	0.0019	0.002	0.0025	0.0031	0.0032	0.0035
Stainless Steels											
Hard to Machine	HIGH	362	0.0003	0.0003	0.0005	0.0009	0.0009	0.0015	0.0017	0.0021	0.0021
	LOW	325	0.0004	0.0004	0.0006	0.001	0.001	0.0016	0.0018	0.0022	0.0022
Mild to Machine	HIGH	375	0.0004	0.0004	0.0006	0.001	0.001	0.0016	0.0018	0.0022	0.0022
	LOW	337	0.0005	0.0005	0.0007	0.0011	0.0011	0.0017	0.0019	0.0023	0.0023
Easy to Machine	HIGH	487	0.0005	0.0005	0.0007	0.0011	0.0011	0.0017	0.0019	0.0023	0.0023
	LOW	387	0.0006	0.0006	0.0008	0.0012	0.0012	0.0018	0.002	0.0024	0.0024
Soft Steels											
	HIGH	762	0.0005	0.0007	0.0007	0.0011	0.0011	0.0017	0.0019	0.0023	0.0027
	LOW	637	0.0006	0.0008	0.0008	0.0012	0.0012	0.0018	0.002	0.0024	0.0028
Die Steels											
Below 37Rc	HIGH	387	0.0005	0.0009	0.0015	0.0019	0.0024	0.003	0.0034	0.0036	0.0039
	LOW	325	0.0006	0.001	0.0016	0.002	0.0025	0.0031	0.0035	0.0037	0.004

- Speed and feed recommendations are for *profile milling* (side cut) operations up to 20% of the cutter diameter
- Decrease values by 20% for *slotting operations*
- Rates based on **HIGH** values are for optimum working conditions

SPEEDS & FEEDS

HX SERIES

HX Series Application Guide - Speeds & Feeds (Inch)

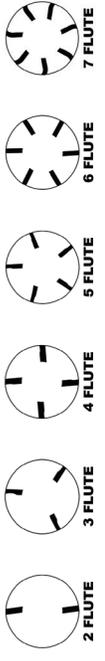
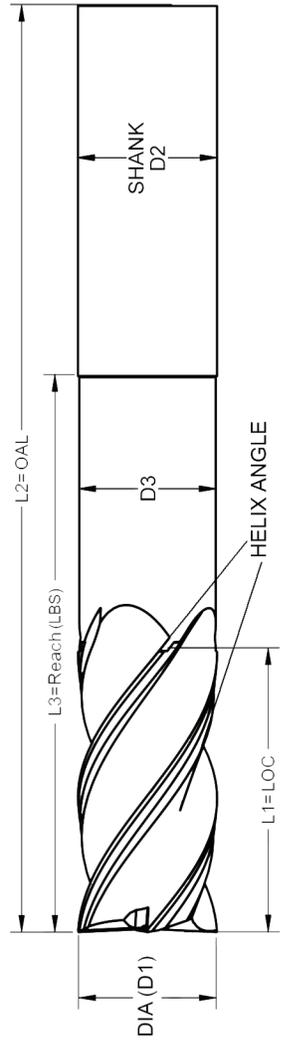
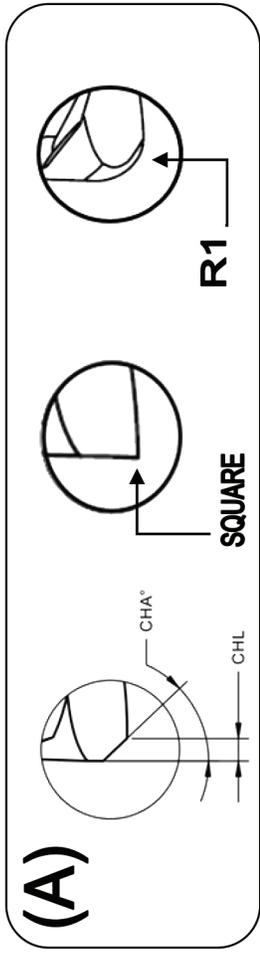
Material Information					Feed (Inches per tooth)									
Work Material	Type of Cut	Axial DOC	Radial DOC	Speed SPM	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	1"
	Slotting	0.5 x D	1 x D	300	0.0006	0.001	0.0013	0.0016	0.0019	0.0022	0.0026	0.0032	0.0038	0.0051
Martensitic & Ferritic Stainless Steels	Peripheral - Rough	1.25 x D	.3 x D	375	0.0009	0.0013	0.0017	0.0022	0.0026	0.0031	0.0035	0.0044	0.0052	0.007
410, 416, 440	Peripheral - HEM*	3 x D	.05 x D	415	0.0026	0.0039	0.0052	0.0065	0.0077	0.009	0.0103	0.0129	0.0155	0.0207
	Finish	2 x D	.015 x D	375	0.0009	0.0013	0.0018	0.0022	0.0027	0.0031	0.0036	0.0044	0.0053	0.0071
	Slotting	0.5 x D	1 x D	275	0.0006	0.0009	0.0012	0.0015	0.0018	0.0021	0.0024	0.003	0.0036	0.0048
Austenitic Stainless Steels, FeNi Alloys	Peripheral - Rough	1.25 x D	.3 x D	350	0.0008	0.0012	0.0016	0.002	0.0025	0.0029	0.0033	0.0041	0.0049	0.0065
303, 304, 316, Invar, Kovar	Peripheral - HEM*	3 x D	.05 x D	390	0.0025	0.0037	0.0049	0.0062	0.0074	0.086	0.0099	0.0123	0.0148	0.0198
	Slotting	2 x D	.015 x D	350	0.0008	0.0012	0.0017	0.0021	0.0025	0.0029	0.0033	0.0042	0.005	0.0067
	Slotting	0.5 x D	1 x D	250	0.0005	0.0008	0.001	0.0013	0.0015	0.0018	0.002	0.0025	0.003	0.004
Precipitation Hardening Stainless Steels	Peripheral - Rough	1.25 x D	.3 x D	325	0.0007	0.001	0.0014	0.0017	0.002	0.0024	0.0027	0.0034	0.0041	0.0055
17-4, 15-5	Peripheral - HEM*	3 x D	.05 x D	360	0.002	0.003	0.004	0.0059	0.0055	0.0069	0.0079	0.0099	0.0119	0.0158
	Finish	1.5 x D	.015 x D	325	0.0007	0.001	0.0014	0.0021	0.0019	0.0024	0.0028	0.0035	0.0042	0.0056
	Slotting	0.5 x D	1 x D	250	0.0005	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0023	0.0028	0.0037
Titanium Alloys	Peripheral - Rough	1 x D	.3 x D	300	0.0006	0.0009	0.0013	0.0016	0.0019	0.0022	0.0025	0.0031	0.0038	0.005
6Al-4V, 6-2-4	Peripheral - HEM*	3 x D	.05 x D	330	0.0018	0.0027	0.0036	0.0046	0.0055	0.0064	0.0073	0.0091	0.0109	0.0146
	Finish	1.5 x D	.015 x D	300	0.0006	0.001	0.0013	0.0016	0.0019	0.0022	0.0026	0.0032	0.0038	0.0051
Difficult to Machine Titanium Alloys	Slotting	0.25 x D	1 x D	200	0.0003	0.0005	0.0007	0.0009	0.001	0.0012	0.0014	0.0017	0.002	0.0027
10-2-3	Peripheral - Rough	1 x D	.25 x D	250	0.0005	0.0007	0.001	0.0012	0.0015	0.0017	0.002	0.0025	0.0029	0.0039
Precipitation Hardening Stainless Steels	Peripheral - HEM*	3 x D	.05 x D	275	0.0015	0.0022	0.003	0.0037	0.0045	0.0052	0.0059	0.0074	0.0089	0.0119
13-8	Finish	1.5 x D	.01 x D	250	0.0006	0.009	0.0012	0.0014	0.0017	0.002	0.0023	0.0029	0.0035	0.0046
	Slotting	0.5 x D	1 x D	275	0.0005	0.0008	0.0011	0.0014	0.0016	0.0019	0.0022	0.0027	0.0032	0.0043
Tool & Die Steels < 48 Rc	Peripheral - Rough	1.25 x D	.3 x D	350	0.0007	0.0011	0.0015	0.0018	0.0022	0.0026	0.0029	0.0037	0.0044	0.0059
c A2, D2, O1, S7, P20, H13	Peripheral - HEM*	3 x D	.05 x D	390	0.0022	0.0032	0.0043	0.0054	0.0065	0.0076	0.0087	0.0108	0.013	0.0173
	Slotting	2 x D	.015 x D	350	0.0007	0.0011	0.0015	0.0019	0.0022	0.0026	0.003	0.0037	0.0045	0.006
	Slotting	0.5 x D	1 x D	325	0.0007	0.0011	0.0018	0.0021	0.001	0.0025	0.0028	0.0035	0.0042	0.0056
Low Carbon Steels < 38 Rc	Peripheral - Rough	1.25 x D	.3 x D	400	0.001	0.0019	0.0024	0.0029	0.0015	0.0033	0.0038	0.0048	0.0057	0.0076
1018, 1020, 12L14, 5120, 8620	Peripheral - HEM*	3 x D	.07 x D	450	0.0028	0.0056	0.007	0.0084	0.0045	0.0098	0.0112	0.014	0.0168	0.0224
	Finish	2 x D	.015 x D	400	0.001	0.0019	0.0024	0.0029	0.0017	0.0034	0.0039	0.0049	0.0058	0.0078
	Slotting	0.5 x D	1 x D	300	0.0006	0.001	0.0013	0.0016	0.0019	0.0022	0.0026	0.0032	0.0038	0.0051
Medium Carbon Steels < 48 Rc	Peripheral - Rough	1.25 x D	.3 x D	375	0.0009	0.0013	0.0017	0.0022	0.0026	0.0031	0.0035	0.0044	0.0052	0.007
1045, 4140, 4340, 5140	Peripheral - HEM*	3 x D	.05 x D	415	0.0026	0.0039	0.0052	0.0065	0.0077	0.009	0.0103	0.0129	0.0155	0.0207
	Slotting	2 x D	.015 x D	375	0.0009	0.0013	0.0018	0.0022	0.0027	0.0031	0.0036	0.0044	0.0053	0.0071

- Speed and feed recommendations are for **profile milling** (side cut) operations up to 20% of the cutter diameter
- Decrease values by 20% for **slotting operations**
- Rates based on **HIGH** values are for optimum working conditions

Quotation valid for 30 days – Special tooling is Non-Returnable
 We reserve the right to over or under ship special tooling by 10% unless otherwise specified
 For taper designs or more complex form tools please supply print or sample tooling.

D1 (DIA): _____ TOL: (+ / -) _____
 D2 (SHANK): _____ TOL: (+ / -) _____
 D3 (NECK): _____ TOL: (+ / -) _____
 L1 (LOC): _____
 L2 (OAL): _____
 L3 (LBS): _____
 END TYPE: _____
 R1 : _____
 CHA° _____ CHL: _____
 NO. FLUTES: _____
 HELIX ANGLE: _____
 SPIRAL (RH/LH/STR): _____

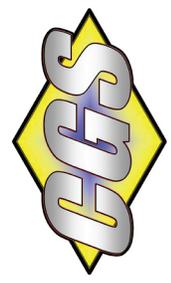
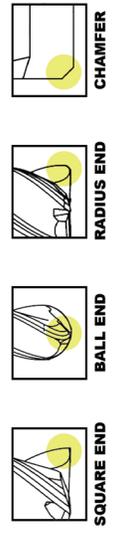
CUT (RH/LH): _____
 SINGLE END / DOUBLE END: _____
 COATING: _____
 MAT'L BEING CUT: _____



Material Family

P = Steel **K** = Cast Iron **M** = Stainless Steel
S = Special Alloys **H** = Hardened Steel **N** = Non-Ferrous

End Type



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Technical Data

Machine Type _____

Coolant _____

RMS Required _____

Spindle Taper _____

TYPE OF MATERIAL: _____

S.F.M: _____ R.P.M: _____

HARDNESS OF MATERIAL: _____

I.P.M: _____

Speed _____

A = Axial _____

Feed _____

R= Radial _____

Chip Per Tooth _____

Depth of Cut _____

HP _____



PROFILE
 Profile Cut

Check One



SLOTING
 Slot Cut

Tool Specification

Circle One: Climb Milling OR Conventional Milling

TYPE OF TOOL: _____

Shank DIA _____

TYPE OF COATING: _____

Helix _____

NUMBER OF FLUTES: _____

End Style Square

DIAMETER: _____

Ball End

Radius: _____

Contact _____

LOC _____

Comments _____

ADDITIONAL COMMENTS: _____

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CONVERSION CHART

(MM)	(INCH)	SIZE	(MM)	(INCH)	SIZE	(MM)	(INCH)	SIZE	(MM)	(INCH)	SIZE	(MM)	(INCH)	SIZE	(MM)	(INCH)	SIZE	(MM)	(INCH)	SIZE
.3429mm	.0135"	#80	1.9844mm	.078125"	5/64"	4.4958mm	.177"	#16	7.8mm	.3071"		14.6844mm	.578125"	37/64"						
.3683mm	.0145"	#79	1.9939mm	.0785"	#47	4.5mm	.1772"		7.9375mm	.3125"	5/16"	15mm	.5906"							
.3969mm	.015625"	1/64"	2mm	.0787"		4.572mm	.18"	#15	8mm	.315"		15.0813mm	.59375"	19/32"						
.4064mm	.016"	#78	2.05mm	.0807"		4.6228mm	.182"	#14	8.0264mm	.316"	O	15.4781mm	.609375"	39/64"						
.4572mm	.018"	#77	2.0574mm	.081"	#46	4.699mm	.185"	#13	8.2042mm	.323"	P	15.5mm	.6102"							
.5mm	.0197"	#76	2.0828mm	.082"	#45	4.7625mm	.1875"	3/16"	8.3344mm	.328125"	21/64"	15.875mm	.625"	5/8"						
.508mm	.02"	#75	2.1844mm	.086"	#44	4.8006mm	.189"	#12	8.4328mm	.332"	Q	16mm	.6299"							
.5334mm	.021"	#74	2.2606mm	.089"	#43	4.8514mm	.191"	#11	8.5mm	.3346"		16.2719mm	.640625"	41/64"						
.5715mm	.0225"	#73	2.3749mm	.0935"	#42	4.9149mm	.1935"	#10	8.6106mm	.339"	R	16.5mm	.6496"							
.6096mm	.024"	#72	2.3813mm	.09375"	3/32"	4.9784mm	.196"	#9	8.7313mm	.34375"	11/32"	16.6688mm	.65625"	21/32"						
.635mm	.025"	#71	2.4384mm	.096"	#41	5mm	.1969"		8.8mm	.3465"		17mm	.6693"							
.6604mm	.026"	#70	2.4892mm	.098"	#40	5.0546mm	.199"	#8	8.8392mm	.348"	S	17.0656mm	.671875"	43/64"						
.7112mm	.028"	#69	2.5mm	.0984"		5.1054mm	.201"	#7	9mm	.3543"		17.4625mm	.6875"	11/16"						
.74168mm	.0292"	#68	2.5273mm	.0995"	#39	5.1594mm	.203125"	13/64"	9.0932mm	.358"	T	17.5mm	.689"							
.75mm	.0295"	#67	2.5781mm	.1015"	#38	5.1816mm	.204"	#6	9.1281mm	.359375"	23/64"	17.8594mm	.703125"	45/64"						
.7874mm	.031"	#66	2.6416mm	.104"	#37	5.2197mm	.2055"	#5	9.25mm	.3642"		18mm	.7087"							
.7938mm	.03125"	1/32"	2.7051mm	.1065"	#36	5.25mm	.2067"		9.3472mm	.368"	U	18.2563mm	.71875"	23/32"						
.8128mm	.032"	#65	2.7781mm	.109375"	7/64"	5.3086mm	.209"	#4	9.5mm	.374"		18.5mm	.7283"							
.8382mm	.033"	#64	2.794mm	.11"	#35	5.4102mm	.213"	#3	9.525mm	.374"	3/8"	18.6531mm	.734375"	47/64"						
.85mm	.0335"	#63	2.8194mm	.111"	#34	5.5mm	.2165"		9.5758mm	.377"	V	19mm	.748"							
.899mm	.035"	#62	2.8702mm	.113"	#33	5.5563mm	.21875"	7/32"	9.8044mm	.386"	W	19.05mm	.75"	3/4"						
.9144mm	.036"	#61	2.9mm	.1142"	#32	5.6134mm	.221"	#2	9.8219mm	.390625"	25/64"	19.4469mm	.765625"	49/64"						
.9398mm	.037"	#60	2.9464mm	.116"	#31	5.7912mm	.228"	#1	10mm	.3937"		19.5mm	.7677"							
.95mm	.0374"	#59	3mm	.1181"	#30	5.8436mm	.234"	A	10.0838mm	.397"	X	19.8438mm	.78125"	25/32"						
.9652mm	.038"	#58	3.048mm	.12"	#29	5.9531mm	.234375"	15/64"	10.2mm	.4016"		20mm	.7874"							
.9906mm	.039"	#57	3.175mm	.125"	1/8"	6mm	.2362"		10.2616mm	.404"	Y	20.2406mm	.796875"	51/64"						
1mm	.0394"	#56	3.2639mm	.1285"	#28	6.0452mm	.238"	B	10.3188mm	.40625"	13/32"	20.5mm	.8071"							
1.016mm	.04"	#55	3.3mm	.1299"	#27	6.1468mm	.242"	C	10.4902mm	.413"	Z	20.6375mm	.8125"	13/16"						
1.0414mm	.041"	#54	3.4544mm	.136"	#26	6.2484mm	.246"	D	10.5mm	.4134"		21mm	.8268"							
1.0668mm	.042"	#53	3.5mm	.1378"	#25	6.25mm	.2461"		10.7156mm	.421875"	27/64"	21.0344mm	.828125"	53/64"						
1.0922mm	.043"	#52	3.5687mm	.1405"	#24	6.35mm	.25"	1/4"	11mm	.4331"		21.4313mm	.84375"	27/32"						
1.1mm	.0433"	#51	3.5719mm	.140625"	9/64"	6.35mm	.25"	E	11.1125mm	.4375"	7/16"	21.5mm	.8465"							
1.1811mm	.0465"	#50	3.6mm	.1417"	#23	6.5mm	.2559"		11.25mm	.4425"		21.8281mm	.859375"	55/64"						
1.1906mm	.046875"	3/64"	3.6576mm	.144"	#22	6.5278mm	.257"	F	11.5mm	.4528"		22mm	.8661"							
1.25mm	.0492"	#49	3.7mm	.1457"	#21	6.6294mm	.261"	G	11.5094mm	.453125"	29/64"	22.225mm	.875"	7/8"						
1.3mm	.0512"	#48	3.7338mm	.147"	#20	6.7469mm	.265625"	17/64"	11.9063mm	.46875"	15/32"	22.5mm	.8858"							
1.3208mm	.052"	#47	3.7973mm	.1495"	#19	6.7564mm	.266"	H	12mm	.4724"		22.6219mm	.890625"	57/64"						
1.397mm	.055"	#46	3.8608mm	.152"	#18	6.8mm	.2677"		12.3031mm	.484375"	31/64"	23mm	.9055"							
1.45mm	.0571"	#45	3.9116mm	.154"	#17	6.9088mm	.272"	I	12.5mm	.4921"		23.0188mm	.90625"	29/32"						
1.5mm	.0591"	#44	3.9688mm	.15625"	5/32"	7mm	.2756"		12.7mm	.5"	1/2"	23.4156mm	.921875"	59/64"						
1.5113mm	.0595"	#43	3.9878mm	.157"	#22	7.0358mm	.277"	J	12.8mm	.5039"		23.5mm	.9252"							
1.5875mm	.0625"	1/16"	4mm	.1575"	#21	7.1374mm	.281"	K	13mm	.5118"		23.8125mm	.9375"	15/16"						
1.6mm	.063"	#42	4.0386mm	.159"	#20	7.1438mm	.28125"	9/32"	13.0969mm	.515625"	33/64"	24mm	.9449"							
1.6129mm	.0635"	#41	4.0894mm	.161"	#19	7.25mm	.2854"		13.4938mm	.53125"	17/32"	24.2094mm	.953125"	61/64"						
1.7018mm	.067"	#40	4.2mm	.1654"	#18	7.366mm	.29"	L	13.5mm	.5315"		24.5mm	.9646"							
1.75mm	.0689"	#39	4.2164mm	.166"	#17	7.493mm	.295"	M	13.8906mm	.546875"	35/64"	24.6063mm	.96875"	31/32"						
1.778mm	.07"	#38	4.3053mm	.1695"	#16	7.5mm	.2953"		14mm	.5512"		25mm	.9843"							
1.8542mm	.073"	#37	4.3656mm	.171875"	11/64"	7.5406mm	.296875"	19/64"	14.2875mm	.5625"	9/16"	25.0031mm	.984375"	63/64"						
1.9304mm	.076"	#36	4.3942mm	.173"	#15	7.6708mm	.302"	N	14.5mm	.5709"		25.4mm	1.000"	1"						



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