SINCE 1963
ROHIT
CUTTING TOOLS ®

PRODUCT CATALOGUE

2025

www.rigpl.com

Core Competencies:

Industry Leadership

ROHIT has consistently positioned itself at the forefront of the HSS and Solid Carbide Cutting Tools industry since its inception in 1963 under the leadership of Mr. K.L. Duggal. The company has evolved from humble beginnings to a recognized brand synonymous with quality and reliability in cutting tools. The strategic direction of ROHIT is guided by our Chairman, whose vision has been instrumental in steering the company towards sustained growth and innovation in the cutting tools sector..

Manufacturing Expertise

With over six decades of experience in the production of HSS and Solid Carbide Cutting Tools, ROHIT has developed a robust manufacturing capability. Our facilities encompass two state-of-the-art manufacturing units, totaling over 40,000 square feet, equipped with advanced machinery to ensure precision and quality.

Research and Development Team

Our RD team comprises highly qualified engineers from India's premier engineering institutions, dedicated to advancing the design and functionality of Carbide Cutting Tools. This team focuses on enhancing productivity, improving repeatability, and minimizing CPC.

Heat Treatment Facility

Leveraging over 60 years of expertise in HSS heat treatment processes, ROHIT ensures the delivery of high-performance HSS tools that consistently meet rigorous industry standards.

Product Knowledge

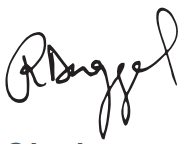
Our workforce, comprising experienced employees and engineers, possesses extensive knowledge accrued over six decades in the cutting tool industry. Concurrently, our RD center is committed to driving innovation and optimizing tool performance through rigorous testing and the application of cutting-edge technologies.

Innovations and New Designs

The RD center serves as the cornerstone of ROHIT's design initiatives. Our current portfolio of Milling and Drilling tools is engineered for machining Alloy Steels, Stainless Steel, Titanium, and other specialized alloys, leading the market with the lowest CPC guaranteed for our customers.

Regrinding Services

At ROHIT, we recognize our responsibility towards environmental sustainability. Our regrinding services not only enable customers to reduce costs but also promote recycling efforts. We provide refurbished tools that maintain original designs and coatings, ensuring performance akin to new ROHIT tools while contributing positively to the environment.



Chairman

Why Choose RIGPL?

- Quality down to last detail
- Expert advice on optimal tool application
- Hightest Productivity, Excellent Economic Efficiency
- Specialized solutions to improve your Bottom Line
- Think Tank to make your Cutting Tools Last that bit Longer

Industry We Support

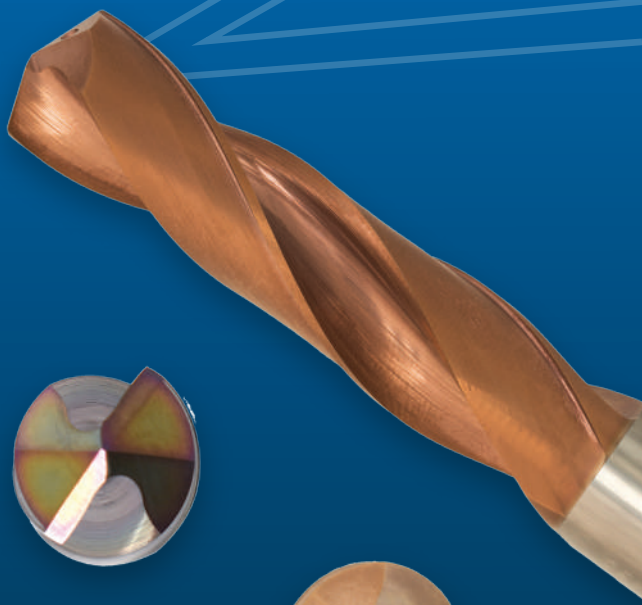
- Aerospace & Automotive
- Power Generation
- General Engineering
- Die & Mold Industry
- Medical Implants
- Ordnance Manufacturing
- Furniture Manufacturing

Table of Content

Contents Pages

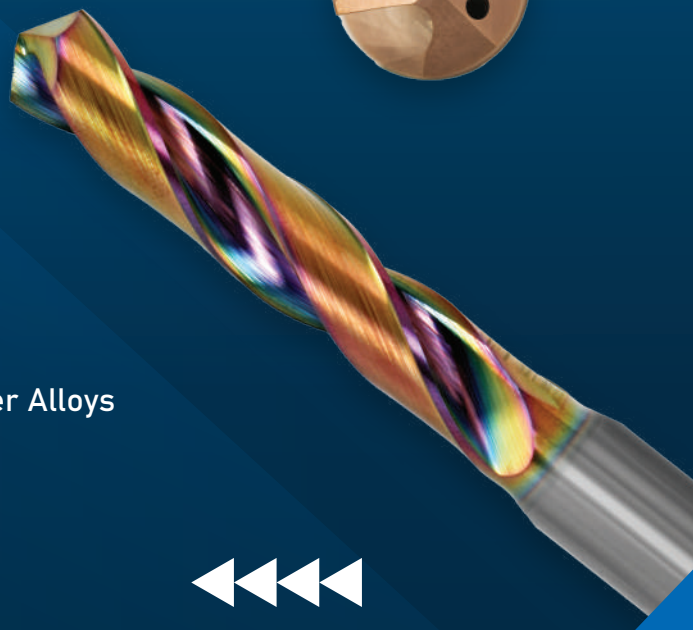
Carbide High Performance Drills CTHS series

- High Wear Resitance NOVA coating
- Stable Low Thrust Point Form
- Edge Chamfer to provide longer cutting edge life
- Best suited for Drilling Alloy Steel, SS, Titanium & Ni alloys



Carbide High Performance Drills C3AS Series

- Newly Developed High Wear Resistant ALU-IRIS Coated drills for ALU machining
- Edge Honing to provide sturdy drill point



C3HS Series

- C3HS drills comes with Edge Chamfer to provide longer cutting edge life
- C3HS & C3HL are Best suited for Drilling AS, SUS & Super Alloys

High Performance Endmills
401 & 402 Series

- Developed with Nano-fine grain along with newly Developed Tisinova Coating
- Best Suited for machining upto 65HRc

301 & 302 Series

- Developed with Ultra-fine grain along with Nova Coating
- Best Suited for machining upto 55HRc

Variable Helix Endmills

430, 433 & 434 Series

- Designed for Chatter free machining
- Exceptional performance in machining of Super Alloys

330, 333 & 334 Series

- Variable Helix with Ultra-fine grain along with Al-Pro Coating
- Best Suited for machining Alloy Steel and SS

311 & 313 Series

- High Helix design with ALU-IRIS Coating for machining AL and AL-Alloys

CARBIDE DRILLS

Series Group	Series	Image	Diameter Range (in mm)	Stock	# of Flutes	Coating Type	Page Number	Internal coolant
GP-Drills	C1GS		2 ~ 20	Yes	2	TiALN	17	-
	C1GJ		2 ~ 20	Yes	2	None/TiALN	20	-
HP Drills	C3HS		1 ~ 20	Yes	2	NOVA	25	-
	C3HL		1 ~ 20	Yes	2	NOVA	29	-
	CTHS		3 ~ 20	Yes	2	NOVA	32	YES
	CTHL		3 ~ 20	Yes	2	NOVA	36	YES
	CTHM		3 ~ 20	++	2	NOVA	39	YES
Micro Drill	C3MS		0.2 ~ 0.9	Yes	2	NOVA	40	-
HP-Drills for Alu Alloys	C3AS		2 ~ 20	+++	2	ALU-IRIS	41	-
SHP-Drills	C4HT		2 ~ 20	+++	2	PEROX	43	-
Spot Drills	C1N1		6 ~ 20	++	2	-	46	-
	C1N2		6~ 20	++	2	-	46	-
Centre Drills	C1CB		BS1 ~ BS7	Yes	2	-	47	-
	C1CD		1.6 ~ 8	Yes	2	-	48	-

CARBIDE REAMERS

Series Group	Series	Image	Diameter Range (in mm)	Stock	# of Flutes	Coating Type	Page Number	Internal coolant
Reamers	C1RS		3 ~ 16	++	4/6	NONE/TiALN	69	-
	C1RL		3 ~ 16	++	4/6	NONE/TiALN	71	-
	C1RR		3 ~ 16	++	4/6	NONE/TiALN	73	-

Carbon Steels BHN 180 to 225	Alloy Steels BHN 225 to 355	Pre-hardened Steels HRc 40 to 45	Austenitic Stainless Steel	Precipitation Hardened Stainless Steel	Titanium	HighTemp. Alloy	Grey Cast Iron	Ductile Cast Iron	Hardened Steels HRc 45 to 55	High Hardened Steels HRc 55 to 70	Aluminum	Aluminum Alloys	Plastic	Wood / MDF	Plywood/Laminates	Copper / Brass
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GP - General Purpose	
HP - High Performance	

Delivery Time	
+	1 Week
++	2 Weeks
+++	3 Weeks

1st	1st Choice
2nd	2nd choice

Carbon Steels BHN 180 to 225	Alloy Steels BHN 225 to 355	Pre-hardened Steels HRc 40 to 45	Austenitic Stainless Steel	Precipitation Hardened Stainless Steel	Titanium	HighTemp. Alloy	Grey Cast Iron	Ductile Cast Iron	Hardened Steels HRc 45 to 55	High Hardened Steels HRc 55 to 70	Aluminum	Aluminum Alloys	Plastic	Wood / MDF	Plywood/Laminates	Copper / Brass
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CARBIDE END MILLS

Series Group	Series	Image	Dia Range	Stock	# of Flutes	Square End	Ball Nose	Corner Radius	Neck Relief	Coating	Page Number
HP-VHEM*	330		4-20	Yes	4	x		x		AL-PRO	81
	333		6-20	++	5	x		x		AL-PRO	83
	334		3-20	Yes	4	x				AL-PRO	85
HP-SUS*	222		3-20	Yes	4	x				NOVA	88
	321		3-20	Yes	4	x		x		NOVA	89
	322		4-20	Yes	4	x				NOVA	91
HP-VHEM*	430		3-20	Yes	4	x		x		TISINOVA	92
	433		6-16	+++	5	x		x		TISINOVA	94
	434		3-20	Yes	4	x				TISINOVA	95
HP-4X	401		1-20	Yes	4	x				TISINOVA	96
	402		1-12	Yes	2		x		x	TISINOVA	97
	406		2-12	+++	2		x			TISINOVA	98
	423		3-20	Yes	4		x			TISINOVA	99
HP-3X	301		1-20	Yes	4	x	x			NOVA	100
	302		3-16	Yes	4		x		x	NOVA	102
	304		1-12	Yes	2				x	NOVA	103
	305		1-4	Yes	2	x	x		x	NOVA	104
	306		1-4	Yes	2		x	x		NOVA	106
	307		2-12	Yes	2					NOVA	108
	308		6-20	++	6	x				AL-PRO	109
	311		2-20	+++	2	x				ALU-IRIS	110
	313		3-20	+++	3	x				ALU-IRIS	111

Carbon Steels BHN 180 to 225	Alloy Steels BHN 225 to 355	Pre-hardened Steels HRc 40 to 45	Austenitic Stainless Steel	Precipitation Hardened Stainless Steel	Titanium	HighTemp. Alloy	Grey Cast Iron	Ductile Cast Iron	Hardened Steels HRc 45 to 55	High Hardened Steels HRc 55 to 70	Aluminum	Aluminum Alloys	Plastic	Wood / MDF	Plywood/Laminates	Copper / Brass
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GP - General Purpose	
HP - High Performance	

Delivery Time	
+	1 Week
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CARBIDE END MILLS

Series Group	Series	Image	Dia Range	Stock	# of Flutes	Square End	Ball Nose	Corner Radius	Neck Relief	Coating	Page Number
GP-1X	201		3-25	Yes	4	x				TiALN	112
	202		3-20	Yes	4		x			TiALN	114
	205		2-16	Yes	4	x				HYPERLOX	115
	206		1-12	Yes	2		x			HYPERLOX	116
	207		2-10	++	2 & 4	x				TiALN	117
	208		2-10	++	2 & 4		x			TiALN	118
	211		2-20	Yes	2	x				-	119
	212		3-20	Yes	2		x			-	120
	213		3-20	Yes	3	x				-	121
	215		3-20	Yes	2,3,4					TiALN	122
GP-0X	102		3-20	Yes	4		x			TiALN	123
	110		3-20	Yes	4	x				TiALN	124
	121		3-20	Yes	4	x				NOVA	125
	122		1-20	Yes	4	x				NOVA	127
	123		1-20	Yes	2,4		x			NOVA	129
GP-0X (NON-Ferrous)	103		1-12	Yes	2	x				-	131
	104		1-12	Yes	2		x			-	132
	107		3-16	Yes	1	x				-	134
	108		1-4	+	2	x				-	135
	109		1-4	+	2		x			-	136
	112		6-16	+	2	x				-	137
	114		6-16	+	2	x				-	138
	118		3-12	+	2	x				-	139
	119		3-12	+	1	x				-	141

Carbon Steels BHN 180 to 225	Alloy Steels BHN 225 to 355	Pre-hardened Steels HRc 40 to 45	Austenitic Stainless Steel	Precipitation Hardened Stainless Steel	Titanium	HighTemp. Alloy	Grey Cast Iron	Ductile Cast Iron	Hardened Steels HRc 45 to 55	High Hardened Steels HRc 55 to 70	Aluminum	Aluminum Alloys	Plastic	Wood / MDF	Plywood/Laminates	Copper / Brass
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GP - General Purpose	
HP - High Performance	

Delivery Time	
+	1 Week
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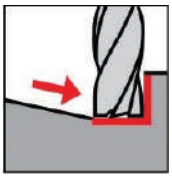
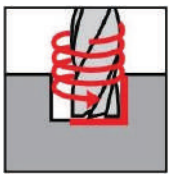
2nd	2nd Choice

Table Of Contents - HSS Tools

APPLICATION TYPE


Plunging


Ramping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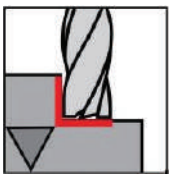
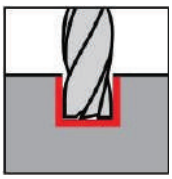
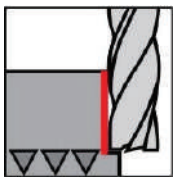

Roughing


Slotting


Copy Milling


Finishing

TOOL IDENTIFICATION


Solid Carbide


Coolant Fed

Cutting Edge Length

Drill Point Angle

Helix Angle

Din Specs

Chamfer

Variable Helix 5-Flute

Variable Helix 4-Flute

Number of Flutes

Right Hand Cutting

Shank Type

CARBIDE GRAIN SIZE

NG
Nano Fine Grain

UMG
Ultra Micro Fine Grain

SMG
Sub Micro Fine Grain

MG
Micro Fine Grain

COATING TYPES


TiALN


HYPERLOX


NOVA

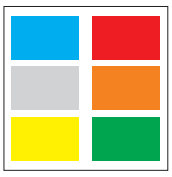

AL-PRO


PEROX


TISINOVA


ALU-IRIS

WORKPIECE MATERIAL GROUP



P
Steels

H
Hardend Steels (35-65 HRc)

M
Stainless Steels

K
Cast Iron

S
Special Alloys

N
Non-Ferrous

High Performance End Mills

- Included in our product line are high performance end mills developed for specific applications.
- Newly developed Variable Helix Endmills (VHEM-series) is suited for machining Stainless steel, Titanium and NICr Alloys and for High productivity in Alloy Steel machining.
- Our SUS-series is designed especially for Ortho manufacturers for machining stainless steel material like SS-316L.

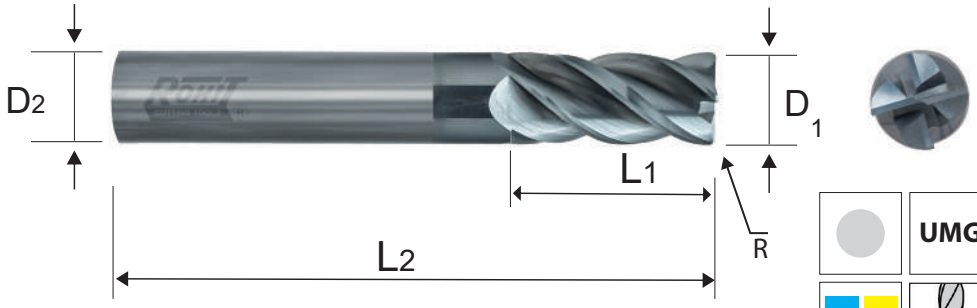
General Purpose End Mills

In addition to High Performance End Mills we have complete family of standard carbide end mills designed for efficient general purpose milling of all steels, cast iron, aluminium, softer metals, non-ferrous materials etc. these fall under GP-0X & GP-1X group of end mills.

Benefits of Rohit End Mills

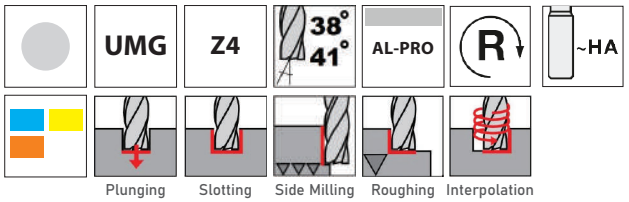
- Over 40 different variants of end mills available
- State of the art CNC 6-Axis machines for high precision manufacturing with Zero defects
- Standard, Long and Extended Reach Lengths are available
- Top of the notch Quality check Equipments (Zoller) to provide accurate tools with great quality
- Utilize our engineering experience to solve your milling trouble

Carbide HP 4-Flute Variable Helix End Mills AL-PRO Coated (Metric)



Corner Radius Tolerance	
R<=0.5	+/- 0.03
R>0.5	+/- 0.05

Tolerance	
D1	h10
D2	h6



Features:

- Variable Lead Geometery & Unequal Indexing design for Chatter free milling operations
- High DOC for effective material removal at very high Speeds and Feeds
- Highly Effective in Trochoidal milling
- Improved Surface quality of Work Piece
- Capable of machining wide range of material like Alloy Steel, Stainless Steel and Exotic Materials like Titanium
- AL-PRO is an advanced coating for achieving higher tool life on diffcult to machine material. It has remarkable wear resistance at lower speeds and feeds, as well as tremendous heat resistance at high speed

Item Code AL-PRO Coated	Flute Dia(D1)	Flute Len(L1)	Overall Len(L2)	Shank Dia(D2)	Corner Radius (R)
CR35HVH000B3	4	10	54	6	R0.3
CR35HVH00135	4.5	12	50	6	R0.3
CR35HVH00143	5.5	12	50	6	R0.3
CR35HVH00010	6	12	63	6	R0.3
CR35HVH00028	8	19	63	8	R0.5
CR35HVH00036	10	22	72	10	R0.5
CR35HVH00044	12	26	80	12	R0.75
CR35HVH00085	14	26	80	14	R0.75
CR35HVH00051	16	32	92	16	R0.30
CR35HVH00093	16	32	92	16	R0.75
CR35HVH000A5	20	38	100	20	R0.75

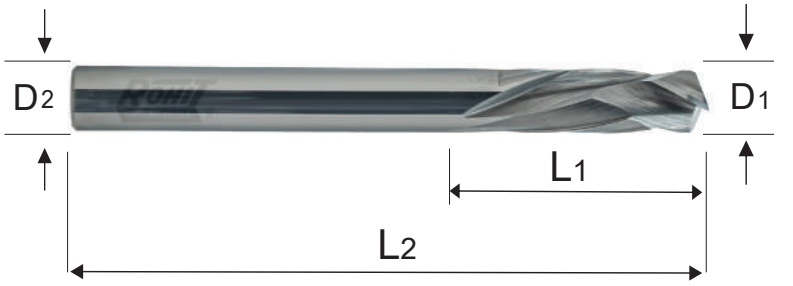
Carbide HP 4-Flute Variable Helix End Mills AL-PRO Coated (Inch)

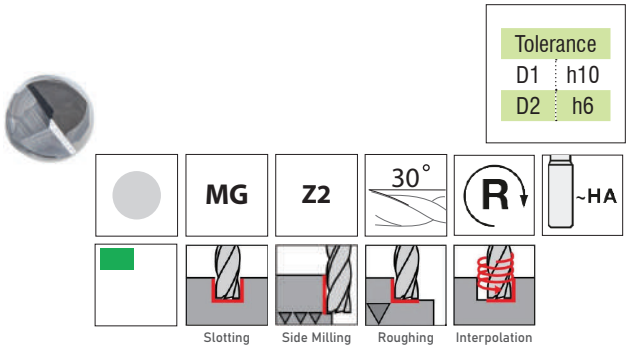
Item Code AL-PRO Coated	Flute Dia(D1)	Flute Len(L1)	Overall Len(L2)	Shank Dia(D2)	Corner Radius (R)
CX35HVH00071	1/4	1/2	2+1/2	1/4	R0.015
CX35HVH000C5	1/4	3/4	2+1/2	1/4	R0.015
CX35HVH000H4	5/16	13/16	2+1/2	5/16	R0.015
CX35HVH000E0	3/8	1	3	3/8	R0.015
CX35HVH000D2	1/2	1	3	1/2	R0.015
CX35HVH000J9	1/2	1+1/2	3+1/2	1/2	R0.015
CX35HVH00063	1/2	1	3	1/2	R0.03
CX35HVH000K7	1/2	1+1/2	3+1/2	1/2	R0.03
CX35HVH000L5	5/8	1+1/4	3+1/2	5/8	R0.015
CX35HVH000F8	5/8	1+1/4	3+1/2	5/8	R0.03
CX35HVH000M3	3/4	1+1/2	4	3/4	R0.015
CX35HVH000G6	3/4	1+1/2	4	3/4	R0.03

Carbon Steels BHN 180 to 225	Alloy Steels BHN 225 to 355	Prehardened Steels HRc 40 to 45	Austenitic Stainless Steel	Precipitation Hardened Stainless Steel	Titanium	HighTemp. Alloy	Grey Cast Iron	Ductile Cast Iron	Hardened Steels HRc 45 to 55	High Hardened Steels HRc 55 to 70	Aluminum	Aluminum Alloys	Plastic	Wood / MDF	Copper/Brass
1st	1st	1st	1st	1st	2nd	2nd		1st				2nd			

NOTE: FOR FEED & SPEED Rates, go to page no. PG-145

Carbide GP-0X 2-Flute Compression Bits for Plywood Laminates





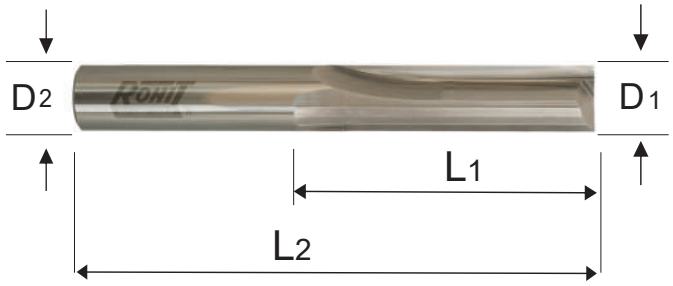
Features:

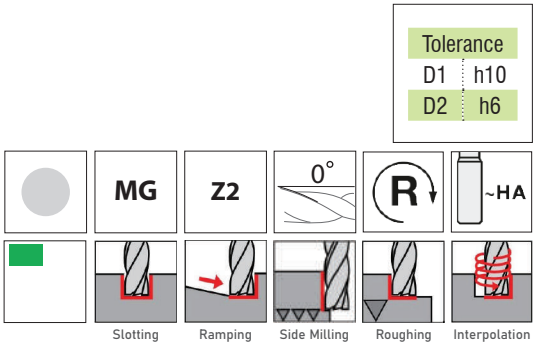
- Especially Designed to cut Laminated sheets at full depth in single pass

Item Code	Flute Dia(D1)	Flute Len(L1)	Reach Length (L3)	Overall Len(L2)	Shank Dia(D2)
CX0XGCP00018	6	25	-	75	6
1140635090-COMP-U	1/4"	7/8"	-	3"	1/4"
CX0XGCP00026	8	25	-	75	8
1140950090-COMP-U	3/8"	1"	-	3"	3/8"
CX0XGCP00059	10	25	-	75	10
CX0XGCP00034	10	25	-	100	10
CX0XGCP00067	12	25	-	75	12
CX0XGCP00042	12	25	-	100	12
114127100-COMP-U	1/2"	1-5/16"	-	3"	1/2"
114060100-COMP-L-U	6	25	40	75	6
1140635100-COMP-L-U	1/4"	7/8"	1-1/2"	3"	1/4"
114080100-COMP-L-U	8	25	40	75	8
114095100-COMP-L-U	3/8"	1"	1-5/16"	3"	3/8"
114100090-COMP-L-U	10	25	40	75	10
114120090-COMP-L-U	12	25	40	75	12
114127100-COMP-L-U	1/2	1-5/16"	2"	4"	1/2"

Carbon Steels BHN 180 to 225	Alloy Steels BHN 225 to 355	Prehardened Steels HRc 40 to 45	Austenitic Stainless Steel	Precipitation Hardened Stainless Steel	Titanium	HighTemp. Alloy	Grey Cast Iron	Ductile Cast Iron	Hardened Steels HRc 45 to 55	High Hardened Steels HRc 55 to 70	Aluminum	Hard Wood	Soft Wood	MDF	Plywood / Laminates
												1st	1st	1st	1st

Carbide GP-0X 2-Flute ST.Flute End Mills for HARD Wood





Features:

- For machining Hard Wood and MDF wood
- Specially designed for effective cutting in Hard wood.
- Straight Flute design with higher Flute Depth to ensure smooth flow of chips

Item Code	Flute Dia(D1)	Flute Len(L1)	Overall Len(L2)	Shank Dia(D2)
CX0XGSE00QH3	3	15	50	4
CX0XGSE00Q96	3	15	50	6
CX0XGSE00QA8	3	20	50	6
CX0XGSE00QB6	4	16	50	6
CX0XGSE00QJ8	4	20	50	4
CX0XGSE00QC4	4	22	50	6
CX0XGSE00QK6	5	22	50	5
CX0XGSE00QD1	5	22	50	6
CX0XGSE00QE9	6	22	50	6
CX0XGSE00QL4	6	25	60	6
CX0XGSE00QG5	6	30	60	8

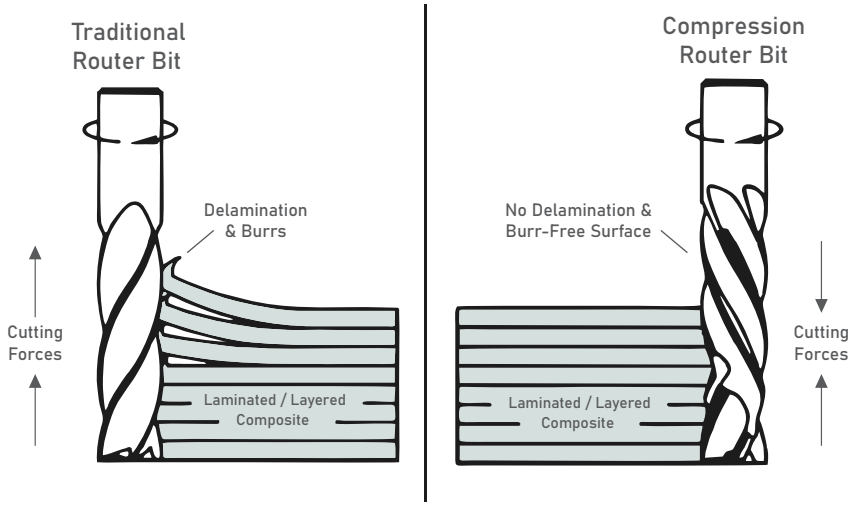
Item Code	Flute Dia(D1)	Flute Len(L1)	Overall Len(L2)	Shank Dia(D2)
CX0XGSE00QF7	6	35	75	6
CX0XGSE00QM2	8	30	60	8
CX0XGSE00QN9	8	35	75	8
CX0XGSE00QP5	8	50	100	8
CX0XGSE00QQ3	10	30	60	10
CX0XGSE00QR1	10	40	75	10
CX0XGSE00QS8	10	50	100	10
CX0XGSE00QT6	12	30	60	12
CX0XGSE00QU4	12	35	75	12
CX0XGSE00QV2	12	50	100	12

Carbon Steels BHN 180 to 225	Alloy Steels BHN 225 to 355	Prehardened Steels HRc 40 to 45	Austenitic Stainless Steel	Precipitation Hardened Stainless Steel	Titanium	HighTemp. Alloy	Grey Cast Iron	Ductile Cast Iron	Hardened Steels HRc 45 to 55	High Hardened Steels HRc 55 to 70	Aluminum	Hard Wood	Soft Wood	MDF	Plywood / Laminates
												1st	1st	1st	1st

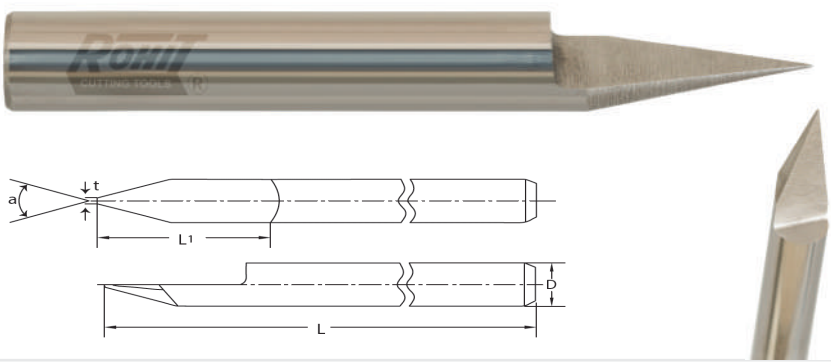
NOTE: For FEED & SPEED Rates, go to page no. PG-158

Benefits of Compression Router Bits

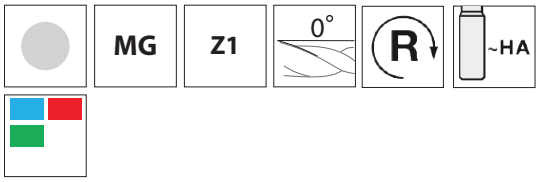
Straight Flute C118	UPCut C103	DownCut C112	Compression Bit C114
			
ADVANTAGES ▪ Good edge quality on most materials ▪ Moderate chip clear ability	▪ Clear chips from the kerf left good quality on bottom face when through-cutting ▪ Allow faster feed rates than Down cut sprial bit	▪ Clear chips down, good edge quality on top face ▪ Downwards force help with cutting thin sheets	▪ Designed to cut veneer or laminated materials at full depth in one pass ▪ Clean edge on both top and bottom face
DISADVANTAGES ▪ Lower processing efficiency than the spiral bit	▪ May chip or fray on top face ▪ Upwards force may cause part lifting via bit	▪ Downwards force help with cutting thin sheets ▪ Chip or fray bottom face when through-cutting ▪ Require slower feed rated than up cut	
SUITABLE MATERIAL ▪ Fit mostly material	▪ Plastics, Aluminum, or material of which heat buildup os the concerning	▪ Plywood, Laminates, MDF, Hard wood, Soft wood (Pocketing cutting)	▪ Plywood, Laminates, MDF, Hard wood, Soft wood (Pocketing cutting)



Carbide GP-0X Engraving Bit V-shape



Tolerance	
D1	h10
D2	h6

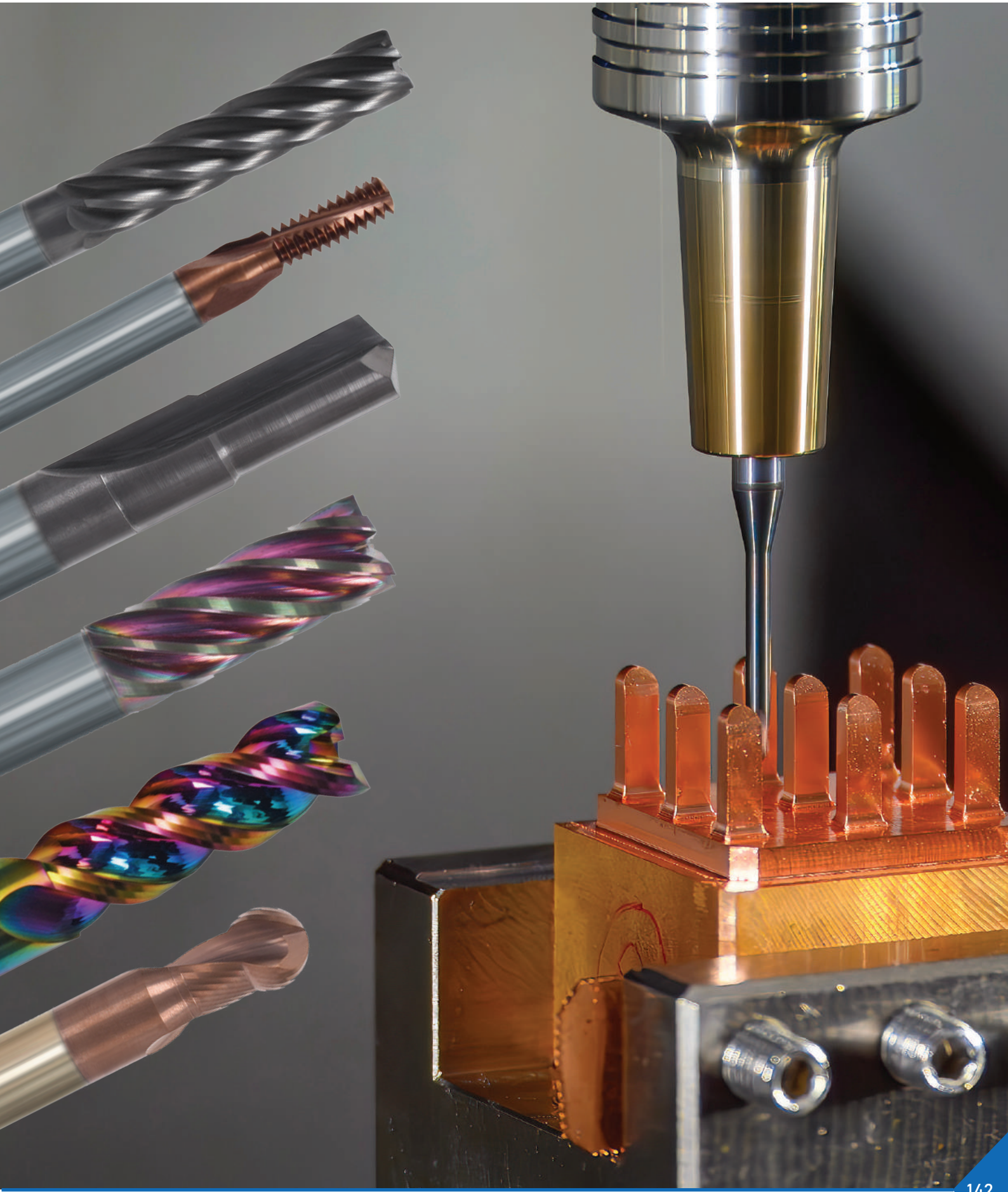


Features:

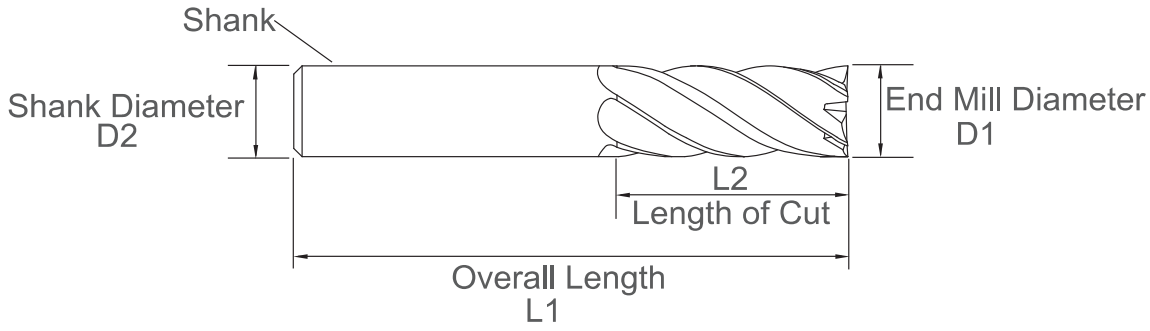
- For engraving in Soft Wood, Hard Wood, MDF, Plastics, Non-ferrous materials etc.
- Included Angle: 45, 60 and 90 deg. Can be made on special request. MOQ will apply
- Engraving bit tip diameters range from 0.10mm to 0.40mm ; so for your delicate Engraving work Opt for these Bits

Ordering Code	TIP (t)	Included Angle (a0)	Cutting Length (L1)	Overall Length(L)	Shank Dia(D)
CX0XEB00013	0.2-0.5	30°	12	50	3
CX0XEB00021	0.2-0.5	30°	12	50	4
CX0XEB00039	0.2-0.5	30°	15	50	5
CX0XEB00047	0.2-0.5	30°	15	50	6
CX0XEB00054	0.4-0.8	30°	25	60	8
119100075-U	0.4-0.8	30°	25	75	10
119120075-U	0.4-0.8	30°	25	75	12
119127075-U	0.4-0.8	30°	25	75	12.7

Carbon Steels BHN 180 to 225	Alloy Steels BHN 225 to 355	Prehardened Steels HRc 40 to 45	Austenitic Stainless Steel	Precipitation Hardened Stainless Steel	Titanium	HighTemp. Alloy	Grey Cast Iron	Ductile Cast Iron	Hardened Steels HRc 45 to 55	High Hardened Steels HRc 55 to 70	Aluminum	Aluminum Alloys	Plastic	Wood / MDF	Copper/Brass
1st	1st	2nd	1st	2nd							1st	2nd	1st	1st	1st

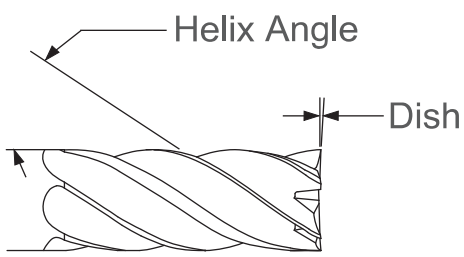


End Mill Terminology



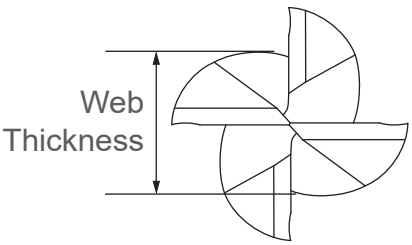
Length of Cut (Flute Length) – Always select the shortest Flute Length possible for your application. By selecting the shortest Flute Length, you can increase rigidity and allow for higher feed rates.

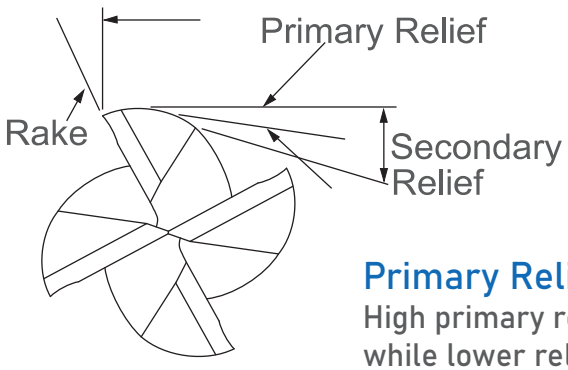
End Mill Diameter – Always select the largest diameter possible for your milling operation. Increasing your diameter by just 10%, can increase your rigidity by 25%.



Helix Angle – Varies from 0 to 60 degrees. Higher helix angles can increase the number of teeth in a cut, and help in redirecting cutting forces. This is beneficial in harder to machine materials in particular. Changes in helix angle can also greatly affect the flute form of an end mill, and affect chip evacuation.

Web Thickness – The cross section of the fluting of the end mill. Larger webs allow for more rigidity, while smaller webs allow for better chip evacuation. This feature is highly dependent on the material being machined.





Rake Angle – The measurement of the curvature of the cutting edge in the face of the flute. A high rake angle will cut more aggressively, while a lower rake angle will increase the strength of the cutting edge.

Primary Relief – The clearance directly behind the cutting edge. High primary relief angles will allow for more aggressive milling, while lower relief angles will increase the strength of the cutting edge. The primary relief will also affect the wear on a cutting edge. Lower primary relief angles can tend to develop larger wear lands.

Conversion charts

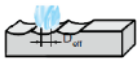
English to Metric

MULTIPLY	BY	TO OBTAIN
Inches	25.4	Millimetres
Inches	2.54	Centimetres
Feet	.3048	Metres
Inches per minute	25.4	Millimetres per minute
Cubic Inches per minute	16.387	Cubic Centimetres per minute
Surface Feet per minute	.3048	Surface Metres per minute

Metric to English

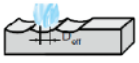
MULTIPLY	BY	TO OBTAIN
Millimetres	.0394	Inches
Centimetres	.3937	Inches
Metres	3.2808	Feet
Millimetres per minute	.0394	Inches per minute
Cubic Centimetres per minute	.0610	Cubic Inches per minute
Surface Metres per minute	3.2808	Surface Feet per minute

Milling Formulas - METRIC Values

Symbol	Description		Formula
Vc	Surface Meters / Minute		$Vc = \frac{\pi \times D \times n}{1000}$
n	Revolutions / Minute		$n = \frac{Vc \times 1000}{\pi \times D}$
fz	Feed / Tooth		$Fz = \frac{vf}{n \times z}$
Vf	Millimeters / Minute		$vf = (n) \times (z) \times (fz)$
D(eff)	Effective Diameter		$D(eff) = 2 \times \sqrt{D \times ap - ap2}$

symbol key : π = 3.1416 D = tool diameter (mm) z = no. of flutes ap = depth of cut

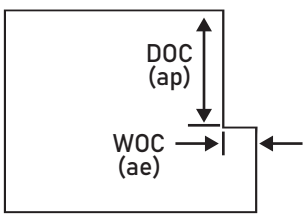
Milling Formulas - INCH Values

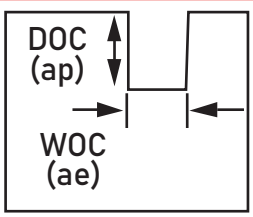
Symbol	Description		Formula
SFM	Surface Meters / Minute		$SFM = \frac{RPM \times D}{3.82}$
RPM	Revolutions / Minute		$RPM = \frac{SFM \times 3.82}{D}$
IPT	Feed / Tooth		$IPT = \frac{IPM}{z \times RPM}$
IPM	Inches / Minute		$IPM = IPT \times RPM \times z$
$D_{(eff)}$	Effective Diameter		$D(eff) = 2 \times \sqrt{R^2 - (R - D_1)^2}$

symbol key : D = tool diameter (in.) z = no. of flutes R = Radius D_1 = DOC (ap)

Feed & Speed Parameters for Alloy Steel, SS, Cast Iron & Super Alloy Machining

	Material	Hardness
Alloy Steel	Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	BHN 180 to 225
	Medium Carbon & High Carbon Steels,Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6,S2, W1 to W310Alloy Steels	BHN 225 to 355
	Alloyed heat-treatable, Tool and High Speed Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3,D4, D5, D7	40-45 HRc
Stainless Steel	Austenitic SS: Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	<28 HRc
	Austenitic SS Moderately Difficult: 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	<28 HRc
	Precip. Hardened SS Difficult to Machine: 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	>28 HRc
Super Alloys	TitaniumAlloys 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Ai-8V-6Cr4Mo-4Zr, 10V-2Fe-3Ai, 13V-11Cr-3Ai	<42 HRc
	High-TemperatureAlloys Inconel, Nimonic, Monel, Hastelloy, Waspalloy, A286, Rene41, Udimet, Stellite	<42 HRc
CAST IRON	Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	<240 HB
	Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350	>240 HB





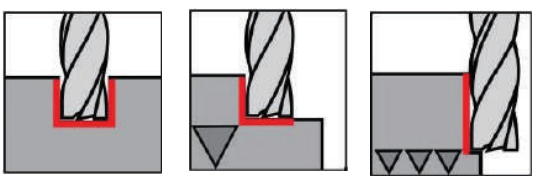
ADOC / DOC (Ap)
Axial Depth of Cut

RDOC / WOC (Ae)
Radial Depth of Cut

NOTE: 1. These are just the Starting Parameters, you may vary the Speed and Feed depending upon other machining condition.
2. Always select shortest possible flute length to prevent breakage & vibration rising due to over hang.
3. Always wear protective gear as high speed tools may break & cause harm

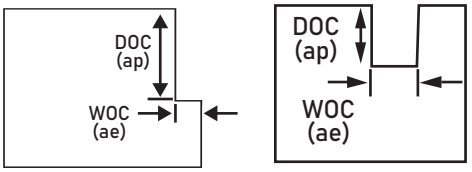
Feed & Speed Parameters for Alloy Steel, SS, Cast Iron & Super Alloy Machining

Application	DOC (Ap) max	WOC (Ae) max	Cutting speed (Vc)	FEED per TOOTH								
				4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	14 mm	16 mm	20 mm
			m/min	mm / Z								
SLT	0.04 x D	1.00 x D	110-130	0.011	0.014	0.016	0.026	0.033	0.04	0.048	0.053	0.066
RGH	1.00 x D	0.15 x D	110-130	0.02	0.023	0.031	0.05	0.063	0.075	0.088	0.1	0.125
FIN	2.00 x D	0.02 x D	130-150	0.015	0.018	0.023	0.037	0.046	0.055	0.064	0.074	0.092
SLT	0.04 x D	1.00 x D	90-100	0.011	0.014	0.016	0.024	0.03	0.036	0.044	0.048	0.06
RGH	1.00 x D	0.15 x D	90-100	0.02	0.023	0.031	0.046	0.057	0.068	0.078	0.091	0.114
FIN	2.00 x D	0.02 x D	100-120	0.015	0.018	0.023	0.034	0.042	0.05	0.059	0.067	0.084
SLT	0.03 x D	1.00 x D	60-70	0.011	0.014	0.016	0.024	0.03	0.036	0.044	0.048	0.06
RGH	0.5 x D	0.1 x D	70-80	0.02	0.023	0.031	0.046	0.057	0.068	0.078	0.091	0.114
FIN	1.00 x D	0.01 x D	90-100	0.015	0.018	0.023	0.034	0.042	0.05	0.059	0.067	0.084
SLT	0.03 x D	1.00 x D	60-70	0.008	0.011	0.013	0.017	0.021	0.025	0.031	0.034	0.042
RGH	0.5 x D	0.10 x D	80-90	0.019	0.022	0.029	0.038	0.049	0.058	0.065	0.077	0.097
FIN	1.00 x D	0.02 x D	80-90	0.012	0.015	0.017	0.023	0.029	0.035	0.041	0.047	0.059
SLT	0.03 x D	1.00 x D	50-60	0.008	0.011	0.013	0.017	0.021	0.025	0.031	0.034	0.042
RGH	0.5 x D	0.10 x D	60-70	0.019	0.022	0.029	0.038	0.049	0.058	0.065	0.077	0.097
FIN	1.00 x D	0.02 x D	65-75	0.012	0.015	0.017	0.023	0.029	0.035	0.041	0.047	0.059
SLT	0.02 x D	1.00 x D	30-40	0.008	0.011	0.013	0.017	0.021	0.025	0.031	0.034	0.042
RGH	0.5 x D	0.07 x D	45-55	0.021	0.024	0.032	0.042	0.053	0.063	0.075	0.084	0.105
FIN	1.00 x D	0.01 x D	50-60	0.015	0.018	0.023	0.03	0.038	0.046	0.055	0.061	0.076
SLT	0.02 x D	1.00 x D	30-40	0.008	0.011	0.013	0.017	0.021	0.025	0.031	0.034	0.042
RGH	0.3 x D	0.05 x D	45-55	0.021	0.024	0.032	0.042	0.053	0.063	0.075	0.084	0.105
FIN	0.5 x D	0.01 x D	50-60	0.015	0.018	0.023	0.03	0.038	0.046	0.055	0.061	0.076
SLT	0.01 x D	1.00 x D	20-30	0.007	0.01	0.011	0.014	0.018	0.022	0.025	0.029	0.036
RGH	0.2 x D	0.05 x D	30-40	0.018	0.021	0.027	0.036	0.045	0.054	0.065	0.072	0.09
FIN	0.2 x D	0.01 x D	40-50	0.013	0.016	0.019	0.026	0.032	0.039	0.045	0.052	0.065
SLT	0.04 x D	1.00 x D	110-130	0.011	0.014	0.016	0.026	0.033	0.04	0.048	0.053	0.066
RGH	1.00 x D	0.15 x D	110-130	0.02	0.023	0.031	0.05	0.063	0.075	0.088	0.1	0.125
FIN	2.00 x D	0.02 x D	130-150	0.015	0.018	0.023	0.037	0.046	0.055	0.064	0.074	0.092
SLT	0.04 x D	1.00 x D	90-100	0.011	0.014	0.016	0.024	0.03	0.036	0.044	0.048	0.06
RGH	1.00 x D	0.15 x D	90-100	0.02	0.023	0.031	0.046	0.057	0.068	0.078	0.091	0.114
FIN	2.00 x D	0.02 x D	100-120	0.015	0.018	0.023	0.034	0.042	0.05	0.059	0.067	0.084



Slotting (SLT) | Roughing (RGH) | Finishing (FIN)

	Material	Hardness
Alloy Steel	Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	BHN 180 to 225
	Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels: 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310Alloy Steels	BHN 225 to 355
	Alloyed heat-treatable, Tool and High Speed Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3,D4, D5, D7	40-45 HRc
Hardened Steel	Hardened Steel Carbon and Alloy Steels, Tool &Die Steels L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3,D4, D5, D7	<55 HRc
	High Hardened Steel, Die Steels, High Speed Steel	55-65 HRc
Stainless Steel	Austenitic SS: Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	<28 HRc
	Austenitic SS Moderately Difficult: 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	<28 HRc
	Precip. Hardened SS Difficult to Machine: 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	>28 HRc
Super Alloys	Titanium Alloys: 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Ai-8V-6Cr4Mo-4Zr	<42 HRc
CAST IRON	Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	<240 HB
	CCast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350	>240 HB
Non Ferous	Aluminium-Cast alloys, Al-Alloys: High Silicon - A380, A390, Castings, 3.2131 G-AlSi-5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9, 3.2581 G-AlSi12, 3.2583 G-AlSi12Cu.	above 3% Si



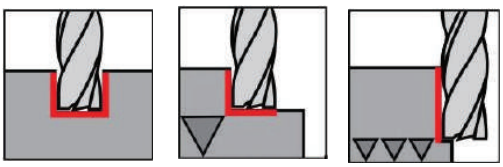
ADOC / DOC (Ap)
Axial Depth of Cut

RDOC / WOC (Ae)
Radial Depth of Cut

NOTE: 1. These are just the Starting Parameters, you may vary the Speed and Feed depending upon other machining condition.
2. Always select shortest possible flute length to prevent breakage & vibration rising due to over hang.
3. Always wear protective gear as high speed tools may break & cause harm

Feed & Speed Parameters for Alloy Steel, SS, Cast Iron & Aluminium Alloys Machining

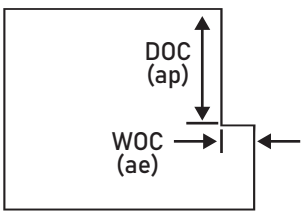
Application	Ap max	Ae max	Cutting speed (Vc)	FEED per TOOTH								
				3 mm	4 mm	6 mm	8 mm	10 mm	12 mm	14 mm	16 mm	20 mm
			m/min	mm / Z								
SLT	0.02 x D	1.00 x D	80-90	0.006	0.009	0.013	0.021	0.026	0.032	0.038	0.042	0.053
RGH	-	-	-	-	-	-	-	-	-	-	-	-
FIN	1.00 x D	0.02 x D	110-120	0.008	0.012	0.018	0.030	0.037	0.044	0.051	0.059	0.074
SLT	0.02 x D	1.00 x D	60-70	0.006	0.009	0.013	0.019	0.024	0.029	0.035	0.038	0.048
RGH	-	-	-	-	-	-	-	-	-	-	-	-
FIN	1.00 x D	0.02 x D	90-100	0.008	0.012	0.018	0.027	0.034	0.040	0.047	0.054	0.067
SLT	-	-	-	-	-	-	-	-	-	-	-	-
RGH	-	-	-	-	-	-	-	-	-	-	-	-
FIN	1.00 x D	0.02 x D	90-100	0.007	0.012	0.018	0.027	0.034	0.040	0.047	0.054	0.067
SLT	-	-	-		-	-	-	-	-	-	-	-
RGH	-	-	-		-	-	-	-	-	-	-	-
FIN	0.01 x D	0.1 x D	60-70	0.007	0.012	0.018	0.027	0.034	0.04	0.047	0.054	0.067
SLT	-	-	-		-	-	-	-	-		-	-
RGH	-	-	-		-	-	-	-	-		-	-
FIN	0.01 x D	0.1 x D	40-50	0.005	0.01	0.015	0.024	0.031	0.038	0.044	0.051	0.062
SLT	0.03 x D	1.00 x D	50-60	0.005	0.006	0.01	0.014	0.017	0.02	0.025	0.027	0.034
RGH	0.5 x D	0.10 x D	60-70	0.008	0.015	0.023	0.03	0.039	0.046	0.052	0.062	0.078
FIN	1.00 x D	0.02 x D	60-70	0.007	0.01	0.014	0.018	0.023	0.028	0.033	0.038	0.047
SLT	0.03 x D	1.00 x D	50-60	0.005	0.006	0.01	0.014	0.017	0.02	0.025	0.027	0.034
RGH	-	-	-	-	-	-	-	-	-	-	-	-
FIN	1.00 x D	0.02 x D	65-75	0.007	0.01	0.014	0.018	0.023	0.028	0.033	0.038	0.047
SLT	0.02 x D	1.00 x D	30-40	0.005	0.006	0.01	0.014	0.017	0.02	0.025	0.027	0.034
RGH	-	-	-	-	-	-	-	-	-	-	-	-
FIN	1.00 x D	0.01 x D	50-60	0.007	0.012	0.018	0.024	0.03	0.037	0.044	0.049	0.061
SLT	-	-	-	-	-	-	-	-	-	-	-	-
RGH	-	-	-	-	-	-	-	-	-	-	-	-
FIN	0.01 x D	0.01 x D	30-40	0.006	0.011	0.016	0.021	0.027	0.032	0.039	0.043	0.053
SLT	0.04 x D	1.00 x D	80-90	0.006	0.009	0.013	0.021	0.026	0.032	0.038	0.042	0.053
RGH	1.00 x D	0.15 x D	90-100	-	0.016	0.025	0.04	0.05	0.06	0.07	0.08	0.1
FIN	2.00 x D	0.02 x D	100-110	0.008	0.012	0.018	0.03	0.037	0.044	0.051	0.059	0.074
SLT	0.04 x D	1.00 x D	70-80	0.005	0.008	0.012	0.019	0.024	0.029	0.035	0.038	0.048
RGH	1.00 x D	0.15 x D	70-80	-	-	-	-	-	-	-	-	-
FIN	2.00 x D	0.02 x D	80-90	0.007	0.012	0.018	0.027	0.034	0.04	0.047	0.054	0.067
SLT	1.00 x D	1.00 x D	140-160	0.02	0.025	0.035	0.045	0.053	0.062	0.075	0.092	0.135
RGH	2.00 x D	1.00 x D	140-160	0.024	0.03	0.04	0.05	0.06	0.07	0.082	0.102	0.15
FIN	2.00 x D	0.5 x D	160-180	0.026	0.03	0.04	0.05	0.06	0.07	0.082	0.102	0.15

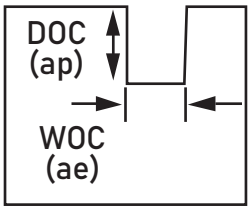


Slotting (SLT) | Roughing (RGH) | Finishing (FIN)

Feed & Speed Parameters for Alloy Steel, SS & Super Alloy Machining

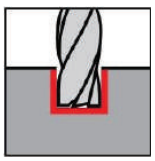
	Material	Hardness	Application	DOC (Ap) max	WOC (Ae) max	Cutting speed (Vc)	FEED per TOOTH					
							4 mm	6 mm	8 mm	10 mm	12 mm	16 mm
						m/min	mm / Z					
Alloy Steel	Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels: 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 085, 1095, 1541, 1551, 9255, 2515, 3135,3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310Alloy Steels	BHN 225 TO 355	SLT	0.06 x D	1.00 x D	130-140	0.014	0.022	0.032	0.04	0.048	0.064
			RGH	1.00 x D	0.15 x D	150-160	0.027	0.041	0.061	0.076	0.091	0.122
			FIN	2.00 x D	0.02 x D	180-190	0.02	0.03	0.045	0.056	0.067	0.09
	Alloyed heat-treatable, Tool and High Speed Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 2100, A 128, D2, D3,D4, D5, D7	40-45 HRc	SLT	0.05 x D	1.00 x D	90-100	0.013	0.020	0.029	0.036	0.043	0.058
			RGH	1.00 x D	0.1 x D	130-140	0.024	0.037	0.055	0.068	0.082	0.110
			FIN	2.00 x D	0.01 x D	150-160	0.018	0.027	0.041	0.050	0.060	0.081
Stainless Steel	Austenitic Stainless Steel Moderately Difficult: 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	<28 HRc	SLT	0.05 x D	1.00 x D	60-70	0.011	0.017	0.022	0.028	0.034	0.045
			RGH	1.00 x D	0.10 x D	90-100	0.026	0.038	0.051	0.065	0.078	0.103
			FIN	2.00 x D	0.02 x D	110-130	0.016	0.023	0.031	0.039	0.047	0.062
	Precip. Hardened Stainless Steel Difficult to Machine: 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	>28 HRc	SLT	0.05 x D	1.00 x D	45-55	0.011	0.017	0.022	0.028	0.034	0.045
			RGH	0.5 x D	0.07 x D	70-80	0.028	0.042	0.056	0.07	0.084	0.112
			FIN	1.00 x D	0.01 x D	90-100	0.02	0.03	0.04	0.05	0.061	0.081
Super Alloys	Titanium Alloys: 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Ai-8V-6Cr4Mo-4Zr,	<42 HRc	SLT	0.05 x D	1.00 x D	45-55	0.011	0.017	0.022	0.028	0.034	0.045
			RGH	0.5 x D	0.05 x D	50-70	0.028	0.042	0.056	0.07	0.084	0.112
			FIN	1.00 x D	0.01 x D	70-80	0.02	0.03	0.04	0.05	0.061	0.081
	High-TemperatureAlloys Inconel, Nimonic, Waspalloy, Stellite	>42 HRc	SLT	0.03 x D	1.00 x D	30-40	0.01	0.014	0.019	0.024	0.029	0.038
			RGH	0.5 x D	0.03 x D	40-50	0.024	0.036	0.048	0.06	0.072	0.096
			FIN	0.5 x D	0.01 x D	50-60	0.018	0.026	0.034	0.043	0.052	0.069



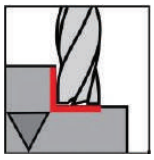


ADOC / DOC (Ap)
Axial Depth of Cut

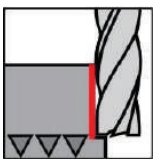
RDOC / WOC (Ae)
Radial Depth of Cut



Slotting (SLT)



Roughing (RGH)



Finishing (FIN)

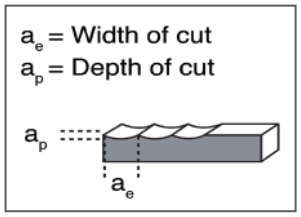
NOTE: 1. These are just the Starting Parameters, you may vary the Speed and Feed depending upon other machining condition.
2. Always select shortest possible flute length to prevent breakage & vibration rising due to overhang.
3. Always wear protective gear as high speed tools may break & cause harm

Feed and Speed Parameters for Die & Mould Machining

	Material	Hardness	Application	Ap max	Ae max	Cutting speed (Vc)	FEED per TOOTH					
							1 to 3 mm	4 mm	6 mm	8 mm	10 mm	12 mm
						m/min	mm / Z					
Hardened Steel	Hardened Steel Carbon and Alloy Steels	50-55 HRc	SLT	-	-	-	-	-	-	-	-	-
			RGH	-	-	-	-	-	-	-	-	-
			FIN	0.01 x D	1 x D	80-100	0.009	0.015	0.025	0.038	0.045	0.051
	High Hardened Steels Tool &Die Steels P2, P20, S1, S5, S7, 52100, A 128, D2, D3,D4, D5, D7	55-60 HRc	SLT	-	-	-	-	-	-	-	-	-
			RGH	-	-	-	-	-	-	-	-	-
			FIN	0.01 x D	1 x D	60-70	0.007	0.012	0.02	0.032	0.041	0.045
	High Hardened Steels Die Steels & High Speed Steel: M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	> 60 HRc	RGH	-	-	-	-	-	-	-	-	-
			FIN	0.01 x D	1 x D	25-50	0.005	0.01	0.017	0.027	0.034	0.038

Feed and Speed Parameters for Die & Mould Machining

	Material	Hardness	Application	Ap max	Ae max	Cutting speed (Vc)	FEED per TOOTH					
							1 to 3 mm	4 mm	6 mm	8 mm	10 mm	12 mm
						m/min	mm / Z					
Hardened Steel	Hardened Steel Carbon and Alloy Steels	50-55 HRc	SLT	-	-	-	-	-	-	-	-	-
			RGH	-	-	-	-	-	-	-	-	-
			FIN	0.1-0.3	0.02 x D	130-150	0.01	0.015	0.022	0.03	0.041	0.052
	High Hardened Steels Tool &Die Steels P2, P20, S1, S5, S7, 52100, A 128, D2, D3,D4, D5, D7	55-60 HRc	SLT	-	-	-	-	-	-	-	-	-
			RGH	-	-	-	-	-	-	-	-	-
			FIN	0.1-0.2	0.01 x D	110-120	0.007	0.009	0.011	0.014	0.021	0.028
	High Hardened Steels Die Steels & High Speed Steel: M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	> 60 HRc	RGH	-	-	-	-	-	-	-	-	-
			FIN	0.05-0.1	0.01 x D	70-100	0.005	0.007	0.009	0.011	0.018	0.023

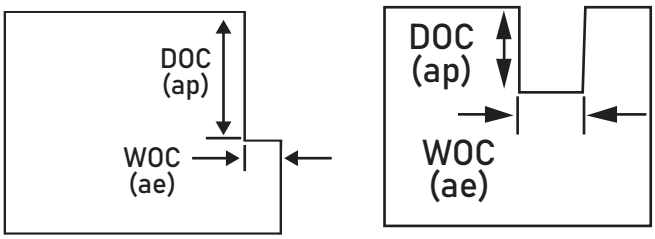


NOTE: Coolant Prefernce: Mist Spray

These are just the Starting Parameters, you may vary the Speed and Feed depending upon other machining condition.

Feed and Speed Parameters for Die & Mould & Alloy Steel Machining

	Material	Hardness
Alloy Steel	Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	BHN 180 to 225
	Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels: 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620,9262, 9840, 52100, O1, O2, O6, S2, W1 to W310Alloy Steels	BHN 225 to 355
	Alloyed heat-treatable, Tool and High Speed Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3,D4, D5, D7	40-45 HRc
Stainless Steel	Hardened Steel Carbon and Alloy Steels, Tool &Die Steels	<55 HRc
	High Hardened Steel, Die Steels, High Speed Steel	55-65 HRc
Super Alloys	Austenitic SS: Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	<28 HRc
	Austenitic SS Moderately Difficult: 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	< 28 HRc
	Precip. Hardened SS Difficult to Machine: 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	>28 HRc



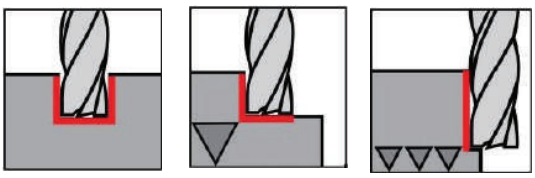
ADOC / DOC (Ap)
Axial Depth of Cut

RDOC / WOC (Ae)
Radial Depth of Cut

NOTE: 1. These are just the Starting Parameters, you may vary the Speed and Feed depending upon other machining condition.
2. Always select shortest possible flute length to prevent breakage & vibration rising due to over hang.
3. Always wear protective gear as high speed tools may break & cause harm

Feed and Speed Parameters for Die & Mould & Alloy Steel Machining

Application	DOC (Ap) max	WOC (Ae) max	Cutting speed (Vc)	FEED per TOOTH									
				1-3 mm	4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	14 mm	16 mm	20 mm
			m/min	mm / Z									
SLT	0.05 x D	1.00 x D	60-80	0.008	0.011	0.016	0.021	0.032	0.038	0.045	0.054	0.061	0.07
RGH	-	-	-	-	-	-	-	-	-	-	-	-	-
FIN	-	-	-	-	-	-	-	-	-	-	-	-	-
SLT	0.03 x D	1.00 x D	50-70	0.007	0.01	0.015	0.02	0.03	0.036	0.043	0.052	0.059	0.068
RGH	-	-	-	-	-	-	-	-	-	-	-	-	-
FIN	-	-	-	-	-	-	-	-	-	-	-	-	-
SLT	0.01 x D	1.00 x D	40-60	0.005	0.08	0.013	0.018	0.029	0.035	0.041	0.05	0.057	0.065
RGH	-	-	-	-	-	-	-	-	-	-	-	-	-
FIN	2.00 x D	0.02 x D	70-90	0.006	0.009	0.012	0.016	0.027	0.034	0.040	0.047	0.054	0.062
SLT	-	-	-		-	-	-	-	-	-	-	-	-
RGH	-	-	-		-	-	-	-	-	-	-	-	-
FIN	0.01 x D	0.1 x D	40-50	0.006	0.009	0.015	0.018	0.027	0.034	0.04	0.047	0.054	0.062
SLT	-	-	-		-	-	-	-	-	-	-	-	-
RGH	-	-	-		-	-	-	-	-	-	-	-	-
FIN	0.01 x D	0.01 x D	20-40	0.004	0.007	0.012	0.015	0.024	0.03	0.035	0.042	0.05	0.057
SLT	0.02 x D	1.00 x D	50-70	0.008	0.011	0.019	0.021	0.032	0.038	0.045	0.054	0.061	0.07
RGH	-	-	-	-	-	-	-	-	-	-	-	-	-
FIN	1.00 x D	0.02 x D	70-90	0.006	0.009	0.015	0.018	0.027	0.034	0.04	0.047	0.054	0.062
SLT	-	-	-	-	-	-	-	-	-	-	-	-	-
RGH	-	-	-	-	-	-	-	-	-	-	-	-	-
FIN	0.03 x D	0.01 x D	20-40	0.004	0.007	0.012	0.015	0.024	0.031	0.036	0.043	0.05	0.057
SLT	-	-	-	-	-	-	-	-	-	-	-	-	-
RGH	-	-	-	-	-	-	-	-	-	-	-	-	-
FIN	0.01 x D	0.01 x D	20-40	0.003	0.004	0.008	0.01	0.02	0.027	0.032	0.039	0.046	0.054



Slotting (SLT) | Roughing (RGH) | Finishing (FIN)

NOTE: For 308-Series parameters of Finishing application only to be applied.
Reduce WOC by 40% and increase FEED by 30%

Feed & Speed Parameters for Profile & Copy Milling Applications

Series: 423, 302, 304, 306, 307 & 202, 206, 208, 212 & 102, 123, 104, 109

Material	
Alloy Steel	Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330
	Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels : 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310Alloy Steels
	Alloyed heat-treatable, Tool and High Speed Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3,D4, D5, D7
Hardened Steel	Hardened Steel Carbon and Alloy Steels, Tool &Die Steels
	High Hardened Steel, Die Steels, High Speed Steel
Stainless Steel	Austenitic SS: Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F
	Austenitic SS Moderately Difficult: 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH
	Precip. Hardened SS Difficult to Machine: 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic
Super Alloys	Titanium Alloys: 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Ai-8V-6Cr4Mo-4Zr
	High-TemperatureAlloys Inconel, Nimonic, Waspalloy, Stellite

Feed & Speed Parameters for Profile & Copy Milling Applications

Series: 423, 302, 304, 306, 307 & 202, 206, 208, 212 & 102, 123, 104, 109

Hardness	Ballnose Series	Ae max	Cutting speed (Vc)	FEED per TOOTH								
				3 mm	4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	16 mm	20 mm
			m/min	mm / Z								
BHN 180 to 225	C-202, 206, 208, 123	0.1 x D	60-70	0.015	0.018	0.020	0.023	0.030	0.045	0.060	0.075	0.090
	C-202, 206, 208, 123	0.03 x D	90-100	0.011	0.013	0.015	0.016	0.021	0.032	0.042	0.055	0.065
	C-202, 206, 208, 123	0.01 x D	100-120	0.009	0.01	0.012	0.014	0.018	0.027	0.036	0.051	0.055
BHN 225 to 355	C-202, 206, 208, 123	0.1 x D	60-70	0.015	0.018	0.020	0.023	0.030	0.045	0.060	0.075	0.090
	C-202, 206, 208, 123	0.03 x D	90-100	0.011	0.013	0.015	0.016	0.021	0.032	0.042	0.055	0.065
	C-202, 206, 208, 123	0.01 x D	100-120	0.01	0.011	0.013	0.015	0.020	0.030	0.039	0.055	0.060
40-45 HRc	C-302, 306, 307	0.1 x D	50-60	0.007	0.009	0.01	0.011	0.014	0.022	0.029	0.036	0.042
	C-302, 306, 307	0.03 x D	80-90	0.005	0.007	0.007	0.008	0.01	0.015	0.02	0.024	0.03
	C-302, 306, 307	0.01 x D	90-100	0.005	0.007	0.007	0.007	0.009	0.014	0.019	0.024	0.027
< 55 HRc	C-206, 302, 306	0.1 x D	40-50	0.01	0.011	0.013	0.014	0.019	0.029	0.038	0.048	0.056
	C-206, 302, 306	0.02 x D	50-60	0.007	0.009	0.01	0.01	0.014	0.02	0.027	0.032	0.04
	C-206, 302, 306	0.01 x D	60-70	0.006	0.007	0.007	0.009	0.012	0.017	0.023	0.028	0.036
55-65 HRC	C-302, 304, 306, 307	0.02 x D	40-50	0.006	0.007	0.007	0.008	0.011	0.017	0.022	0.028	0.032
	C-302, 304, 306, 307	0.01 x D	50-60	0.005	0.006	0.007	0.007	0.01	0.014	0.019	0.024	0.028
<28 HRc	C-302, 423, 306, 307	0.1 x D	80-90	0.01	0.012	0.014	0.016	0.021	0.031	0.042	0.052	0.064
	C-302, 423, 306, 307	0.03 x D	100-115	0.007	0.008	0.009	0.011	0.014	0.022	0.029	0.036	0.044
	C-302, 423, 306, 307	0.01 x D	100-120	0.006	0.007	0.009	0.01	0.012	0.019	0.025	0.032	0.036
<28 HRc	C-302, 423, 306, 307	0.1 x D	50-60	0.01	0.011	0.012	0.014	0.019	0.029	0.038	0.048	0.056
	C-302, 423, 306, 307	0.03 x D	80-90	0.007	0.008	0.009	0.01	0.014	0.02	0.027	0.032	0.04
	C-302, 423, 306, 307	0.01 x D	60-70	0.006	0.007	0.008	0.009	0.012	0.017	0.023	0.028	0.036
>28 HRc	C-302, 423, 306, 307	0.1 x D	30-40	0.008	0.009	0.011	0.012	0.016	0.024	0.032	0.04	0.048
	C-302, 423, 306, 307	0.02 x D	40-50	0.006	0.007	0.008	0.008	0.011	0.017	0.022	0.028	0.032
	C-302, 423, 306, 307	0.01 x D	30-40	0.005	0.007	0.012	0.007	0.01	0.014	0.019	0.024	0.028
<42 HRc	C-423, 406	0.1 x D	40-50	0.01	0.011	0.012	0.014	0.019	0.029	0.038	0.048	0.056
	C-423, 406	0.02 x D	60-70	0.007	0.008	0.009	0.01	0.014	0.02	0.027	0.032	0.04
	C-423, 406	0.01 x D	60-70	0.006	0.007	0.008	0.009	0.012	0.017	0.023	0.028	0.036
<42 HRc	C-423, 406	0.1 x D	20-30	0.008	0.009	0.011	0.012	0.016	0.024	0.032	0.04	0.048
	C-423, 406	0.02 x D	30-40	0.006	0.007	0.008	0.008	0.011	0.017	0.022	0.028	0.032
	C-423, 406	0.01 x D	30-40	0.005	0.007	0.012	0.007	0.01	0.014	0.019	0.024	0.028

Feed & Speed Parameters for Profile & Copy Milling Applications

Series: 423, 302, 304, 306, 307 & 202, 206, 208, 212 & 102, 123, 104, 109

Material	
CAST IRON	Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40
CAST IRON	Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350
Non Ferous	Aluminum, Al-wrought alloys 2024, 6061, 7075, 1050, 6351, 5005, 2017, 7075
Non Ferous	Aluminium-Cast alloys, Al-Alloys: High Silicon - A380, A390, Castings, 3.2131 G-AlSi-5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9, 3.2581 G-AlSi12, 3.2583 G-AlSi12Cu.
Non Ferous	Magnesium-alloys MgMn2, G-MgAl8Zn1, G-MgAl6Zn3
Non Ferous	Wood, Hard Wood, MDF, Plyboards, Plastics
Non Ferous	Non-ferrous metals (copper, short- or long-chippingbrass or bronze)

Application	Width/ Depth		Ballnose Diameter (mm)									
			1	2	3	4	6	8	10	12	16	20
Roughing A < 15°	Ae	(mm)	0.2	0.5	0.8	1.2	1.6	2.2	2.8	3.4	4.6	5.8
	Ap	(mm)	0.07	0.12	0.19	0.26	0.58	0.78	1	1.2	1.6	2
Finishing A > 15°	Ae	(mm)	0.01	0.02	0.04	0.06	0.1	0.14	0.18	0.22	0.28	0.32
	Ap	(mm)	0.04	0.08	0.13	0.18	0.27	0.37	0.5	0.6	0.8	0.9

1 - Roughing = surface milling, machined surface angle A less than 15°.

2 - Finishing = contour milling, machined surface angle A between 15° and 90°.

3 - Reduce feeds and speeds 20% for tool projection greater than 5xD.

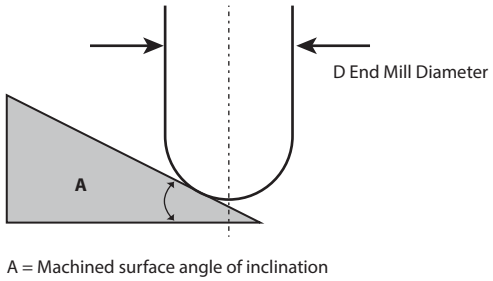
4 - Use Endmill dia. (D1) to calculate RPM (do not use effective diameter).

5 - ALL VALUES IN METRIC.

Feed & Speed Parameters for Profile & Copy Milling Applications

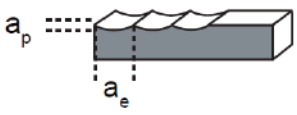
Series: 423, 302, 304, 306, 307 & 202, 206, 208, 212 & 102, 123, 104, 109

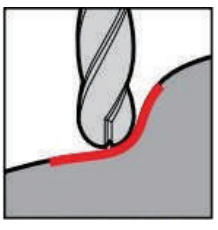
Hardness	Ballnose Series	Ae max	Cutting speed (Vc)	FEED per TOOTH								
				3 mm	4 mm	5 mm	6 mm	8 mm	10 mm	12 mm	16 mm	20 mm
			m/min	mm / Z								
<240 HB	C-202, 208, 123	0.1 x D	90-100	0.012	0.014	0.016	0.018	0.024	0.036	0.048	0.06	0.072
	C-202, 208, 123	0.03 x D	110-130	0.008	0.01	0.012	0.013	0.017	0.025	0.034	0.044	0.052
	C-202, 208, 123	0.01 x D	130-150	0.007	0.008	0.01	0.011	0.014	0.022	0.029	0.036	0.044
>240 HB	C-206, 302, 306	0.1 x D	70-80	0.01	0.012	0.014	0.016	0.021	0.031	0.042	0.052	0.064
	C-206, 302, 306	0.02 x D	90-100	0.007	0.009	0.01	0.011	0.014	0.022	0.029	0.036	0.042
	C-206, 302, 306	0.01 x D	100-120	0.006	0.007	0.009	0.01	0.012	0.019	0.025	0.032	0.036
up to 3% Si	C-202, 212, 208	0.1 x D	240-250	0.016	0.019	0.02	0.024	0.032	0.048	0.064	0.08	0.095
	C-202, 212, 208	0.03 x D	300-320	0.011	0.013	0.015	0.017	0.023	0.034	0.045	0.055	0.065
	C-202, 212, 208	0.01 x D	340-360	0.01	0.012	0.014	0.015	0.019	0.029	0.039	0.05	0.06
above 3% Si	C-202, 212, 208	0.1 x D	110-120	0.015	0.018	0.02	0.023	0.03	0.045	0.06	0.075	0.09
	C-202, 212, 208	0.03 x D	150-160	0.011	0.013	0.014	0.016	0.021	0.032	0.042	0.055	0.065
	C-202, 212, 208	0.01 x D	180-200	0.009	0.011	0.013	0.014	0.018	0.027	0.036	0.045	0.055
-	C-202, 212, 208	0.1 x D	70-80	0.013	0.015	0.017	0.02	0.026	0.039	0.052	0.065	0.08
	C-202, 212, 208	0.03 x D	90-110	0.009	0.011	0.013	0.014	0.018	0.028	0.037	0.045	0.055
	C-202, 212, 208	0.01 x D	100-120	0.008	0.01	0.011	0.012	0.016	0.024	0.031	0.04	0.045
-	C-102, 104, 109	0.1 x D	200-250	0.016	0.019	0.02	0.024	0.032	0.048	0.064	0.08	0.095
	C-102, 104, 109	0.03 x D	270-320	0.011	0.013	0.015	0.017	0.023	0.034	0.045	0.055	0.065
	C-102, 104, 109	0.01 x D	300-360	0.01	0.012	0.014	0.015	0.019	0.029	0.039	0.05	0.06
-	C-202, 208, 102, 123	0.1 x D	100-120	0.015	0.018	0.02	0.023	0.03	0.045	0.06	0.075	0.09
	C-202, 208, 102, 123	0.03 x D	140-160	0.011	0.013	0.014	0.016	0.021	0.032	0.042	0.055	0.065
	C-202, 208, 102, 123	0.01 x D	140-160	0.009	0.011	0.013	0.014	0.018	0.027	0.036	0.045	0.055



A = Machined surface angle of inclination

a_e = Width of cut
a_p = Depth of cut





Copy Milling

NOTE: These are just the Starting Parameters, you may vary the Speed and Feed depending upon other machining condition.

311, 313, 211, 213

Feed & Speed Parameters for Aluminium, Al-alloy, Magnesium & Copper machining

	Material	Hardness	Application	Ap max	Ae max	Cutting speed (Vc)	FEED per TOOTH						
							4 mm	6 mm	8 mm	10 mm	12 mm	16 mm	20 mm
						m/min	mm / Z						
Non Ferous	Aluminum, Al-wrought alloys 2024, 6061, 7075, 1050, 6351, 5005, 2017, 7075	<3% Si	SLT	1.00 x D	1.00 x D	Max.	0.02	0.045	0.06	0.07	0.085	0.1	0.12
			RGH	3.00 x D	0.8 x D	Max.	0.02	0.045	0.06	0.07	0.085	0.1	0.12
			FIN	1.00 x D	0.3 x D	Max.	0.025	0.05	0.07	0.08	0.095	0.12	0.15
	Aluminium-Cast alloys, Al-Alloys: High Silicon - A380, A390, Castings, 3.2131 G-AlSi-5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9, 3.2581 G-AlSi12, 3.2583 G-AlSi12Cu.	>3% Si	SLT	0.5 x D	1.00 x D	150-300	0.016	0.036	0.048	0.056	0.068	0.08	0.096
			RGH	2.00 x D	0.6 x D	150-300	0.016	0.036	0.048	0.056	0.068	0.08	0.096
			FIN	1.00 x D	0.2 x D	250-300	0.02	0.04	0.056	0.064	0.076	0.096	0.12
	Magnesium-alloys MgMn2, G-MgAl8Zn1, G-MgAl6Zn3	-	SLT	0.5 x D	1.00 x D	150-300	0.016	0.036	0.048	0.056	0.068	0.08	0.096
			RGH	2.00 x D	0.5 x D	150-300	0.016	0.036	0.048	0.056	0.068	0.08	0.096
			FIN	1.00 x D	0.1 x D	250-300	0.02	0.04	0.056	0.064	0.076	0.096	0.12
	Non-ferrous metals (copper, short- or long-chippingbrass or bronze)	-	SLT	0.5 x D	1.00 x D	120-150	0.016	0.036	0.048	0.056	0.068	0.08	0.096
			RGH	1.00 x D	0.3 x D	120-150	0.016	0.036	0.048	0.056	0.068	0.08	0.096
			FIN	1.00 x D	0.1 x D	160-180	0.02	0.04	0.056	0.064	0.076	0.096	0.12

201, 110, 121, 122

Feed & Speed Parameters for General Purpose machining

	Material	Hardness	Application	Ap max	Ae max	Cutting speed (Vc)	FEED per TOOTH						
							4 mm	6 mm	8 mm	10 mm	12 mm	16 mm	20 mm
						m/min	mm / Z						
Alloy Steel	Free Machining & Low Carbon Steels	BHN 180-225		1.00 x D	0.02 x D	80-100	0.012	0.018	0.027	0.034	0.040	0.054	0.067
	Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels	BHN 25-355		0.50 x D	0.01 x D	65-85	0.009	0.013	0.019	0.024	0.029	0.038	0.048
CAST IRON	Cast Iron - Gray CG	up to 240HB)		1.00 x D	0.02 x D	80-100	0.012	0.018	0.027	0.034	0.04	0.054	0.067
Non Ferous	Aluminum, Al-wrought alloys	<3% Si		1.00 x D	0.05 x D	120-140	0.025	0.035	0.045	0.053	0.062	0.092	0.135
	Aluminium-Cast alloys, Al-Alloys: High Silicon	>3% Si		0.50 x D	0.03 x D	100-110	0.025	0.035	0.045	0.053	0.062	0.092	0.135
	Wood, Hard Wood, MDF, Plyboards, Plastics	-		1.00 x D	0.05 x D	100-120	0.035	0.053	0.062	0.075	0.092	0.092	0.135
	Non-ferrous metals (copper, short- or long-chippingbrass or bronze)	-		1.00 x D	0.05 x D	90-100	0.025	0.035	0.045	0.053	0.062	0.092	0.135

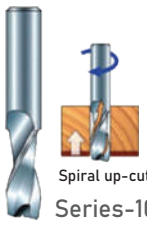
NOTE: For 110-series Lower the Feed and Speed rates by 30%
These are just the Starting Parameters, you may vary the Speed and Feed depending upon other machining condition.

Feed & Speed Parameters for Wood & Plastic machining

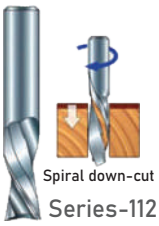
Series: 103, 107, 108, 112, 114 & 118

	Material	Cutting speed (Vc) m/min	Ap max	Ae max	FEED per TOOTH mm / Z					
					3 mm	4 mm	6 mm	8 mm	10 mm	12 mm
WOOD / PLASTIC	HARD WOOD: maple, oak, teak, and walnut.	Max. Available	2 X D	0.5 X D	0.08 - 0.13	0.13 - 0.19	0.23 - 0.28	0.32 - 0.38	0.38 - 0.46	0.48 - 0.53
	SOFTWOOD / PLYWOOD: cedar, Douglas fir, juniper, pine, redwood, spruce, and yew.	250-400	3 X D	1 X D	0.1 - 0.15	0.17 - 0.22	0.28 - 0.33	0.35 - 0.4	0.43 - 0.51	0.53 - 0.58
	Medium Density Fiberboard (MDF) / Laminated Plywood	250-400	2 X D	1 X D	0.1 - 0.18	0.2 - 0.31	0.33 - 0.41	0.42 - 0.48	0.51 - 0.58	0.64 - 0.69
	SOFT PLASTIC	150-180	3 X D	1 X D	0.1 - 0.15	0.18 - 0.24	0.2 - 0.3	0.2 - 0.3	0.2 - 0.3	0.25 - 0.36
	HARD PLASTIC	120-150	2 X D	0.5 X D	0.15 - 0.2	0.2 - 0.28	0.25 - 0.3	0.25 - 0.3	0.25 - 0.3	0.3 - 0.4

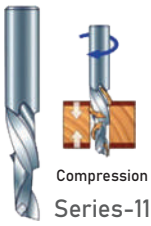
Straight flute
Series-118



Spiral up-cut
Series-103



Spiral down-cut
Series-112

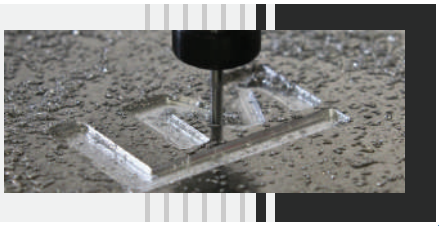


Compression
Series-114

Good edge quality on most materials	May chip or fray top face, good quality on bottom face when through-cutting	Best edge quality on top face, may chip or fray bottom face when through-cutting	Clean edge on both top and bottom face
Moderate chip clearing abilities	Excels at clearing chips and dissipating heat, especially with “o-flute” bits	May compact chips in a groove	Designed to cut veneered or laminated materials at full depth in one pass
	Upwards force may cause part lifting concern	Downwards force may help with cutting thin sheets	
Ideal for : general- purpose cutting	Ideal for: plastics, aluminum, or any material where heat buildup is a concern	Ideal for : plywood and laminates (pocketing)	Ideal for: plywood and laminates (profile cutting)

Types of CNC Router Bits and there use

CNC Router machines & Handheld routers are being used increasingly in industries like construction, wood furniture, stone carving, aluminium door industry and many more. Hence the right use of the Router Bits & knowledge of the same is must. Read more on rigpl.com/blog



Best Machining with High Efficiency Milling (HEM)

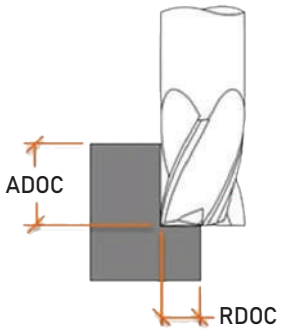
Radial Depth of Cut (RDOC): The distance a tool is stepping over into a workpiece. Also referred to as Stepover, Cut Width

Axial Depth of Cut (ADOC): The distance a tool engages a workpiece along its centerline. Also referred to as Stepdown, or Cut Depth.

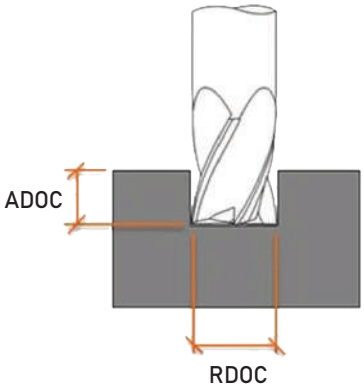
Peripheral Milling: An application in which only a percentage of the tool's cutter diameter is engaging a part.

Slotting: An application in which the tool's entire cutter diameter is engaging a part.

High Efficiency Milling (HEM): A newer machining strategy in which a light RDOC and heavy ADOC is paired with increased feed rates to achieve higher material removal rates and decreased tool wear.



Peripheral Milling



Slotting

Depth of Cut Strategy for High Efficiency Milling (HEM)

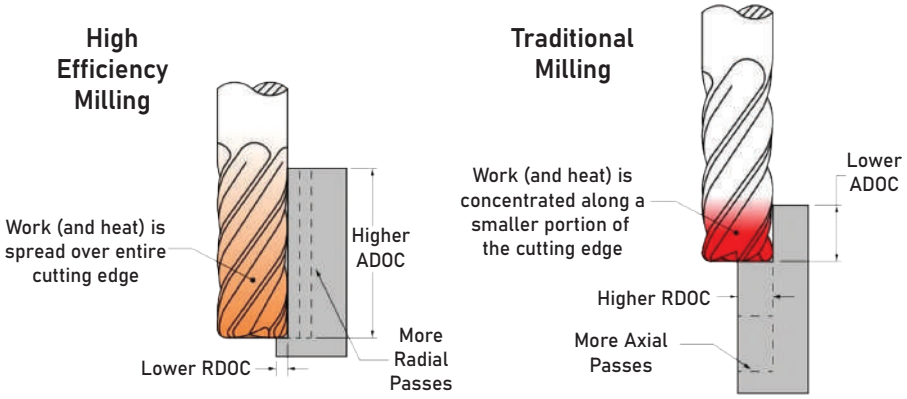
Pairing a light RDOC and heavy ADOC with high performance toolpaths is a machining strategy known as High Efficiency Milling or HEM. With this machining style, feed rates can be increased and cuts are kept uniform to evenly distribute stresses across the cutting portion of the tool, prolonging tool life.

Traditional Strategy

- Heavy RDOC
- Light ADOC
- Conservative Feed Rate

Newer Strategy – High Efficiency Milling (HEM)

- Light RDOC
- Heavy ADOC
- Increased Feed Rate



HEM involves using 7-30% of the tool diameter radially and up to twice the cutter diameter axially, paired with increased feed rates. Accounting for chip thinning, this combination of running parameters can result in noticeably higher metal removal rates (MRR). Modern CAM software often offers a complete high performance solution with built-in features for HEM toolpaths. These principals can also be applied to trochoidal toolpaths for slotting applications.

Best Tools for HEM:

- High flute count for increased MRR.
- Large core diameter for added strength.
- Tool coating optimized for the workpiece material for increased lubricity.
- Variable Pitch/Variable Helix design for reduced harmonics.

General notes:

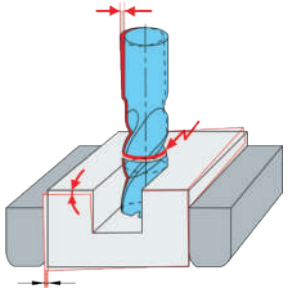
- All the cutting rate recommendations specified in this catalog are standard values valid exclusively for new tools or tools re-ground to RIGPL specifications.
- Pre-requisites are stable machines, optimal cooling, optimal tool clamping and maximum concentricity of the tool and the machine spindle.
- Our recommended cutting rates must be reduced if the conditions deviate.
- The values may also be adjusted to influence Surface finish quality, machining rate or tool life.

1. Workpiece Clamping

Loss of tool life or tool breakage through unstable clamping

Improve workpiece clamping

Alternative:
- reduce feed
- reduce cutting width or depth

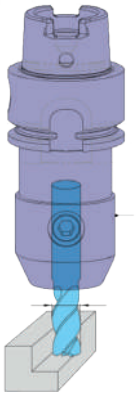


2. Tool Clamping

Loss of tool life or tool breakage through unstable, worn or too small/ long/thin tool holder

Apply new or larger tool holder or holder with increased clamping force and increased concentricity

Alternative:
- reduce cutting rates
- reduce clamping length
- apply tool with smaller diameter
- check clamping screws for wear

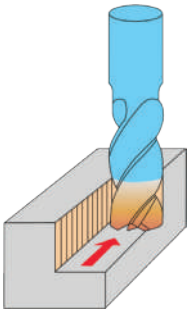


3. Surface Finish Quality

Excessive peak-to-valley height Ra/Rz at the tool Surface finish through excessive feed rates or vibrations

Improve workpiece clamping and tool clamping (see points 1 & 2)

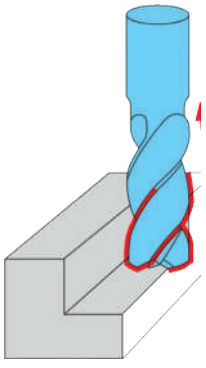
Alternative:
- reduce feed and feed rate
- increase cutting speed



4. Vibrations

High tool wear, insufficient workpiece Surface finish quality and insufficient dimensional accuracy through vibration

- Improve workpiece and tool clamping (see points 1 and 2)
- Increase tooth feed, because the chip centre thickness is too small
- Modify speed
- Modify milling strategy, i.e. select alternative cutting distribution
- Change tool selection, i.e. reduce no. of teeth or spiral



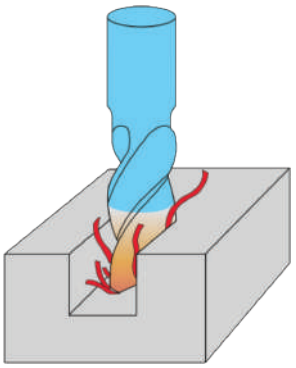
5. Chip Congestion / Cooling

Significant reduction in tool life, chipping on cutting edges, edge build-up of flutes through insufficient chip evacuation

Select milling cutters with internal cooling

Alternative:

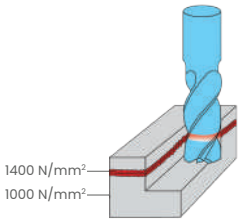
- increase volume flow
- adjust coolant flow
- apply compressed air cooling (according to tool and material)
- reduce feed rate
- modify cutting distribution
- select end mill with fewer flutes



6. Thermal Influence on Materials

Through welding or torch cutting, the material characteristics at the parting line do not correspond with the specified material class

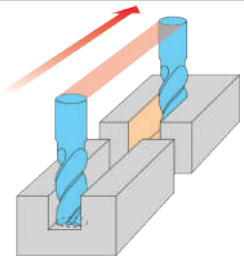
- Reduce cutting rates
- Select tool for materials with a higher tensile strength



7. Loss in Tool Life Due to Interrupted Cutting

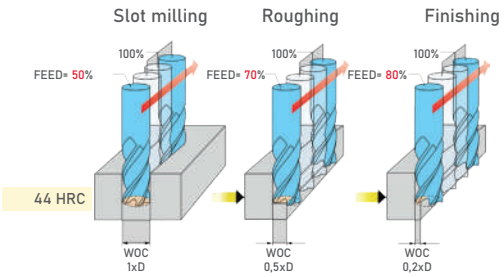
Significant loss in tool life through interrupted cutting (especially with milling angles of 90°)

- Modify cutting distribution
- Reduce feed rate for entry and exit
- Reduce approach angle



8. Entry in Hardened Materials

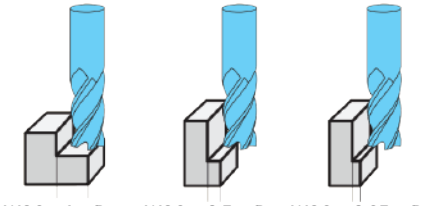
For entering materials over 45 HRc, reduce the feed rate in accordance with the image illustration on the right



9. Feed Rate Adjustment: Modifying the Cutting Width:

When modifying the cutting width WOC, the feed rate must be reduced in accordance with the illustration on the right

- Cutting speed or revolutions remain unchanged
- Double reduction applies when also modifying the cutting depth DOC!



10. Feed Rate Adjustment: Modifying the Cutting Depth:

When modifying the cutting depth DOC, the feed rate must be reduced in accordance with the illustration on the right

- Cutting speed or revolutions remain unchanged up to cutting depths of 3 x D, must only be adapted over 3 x D
- Double reduction applies when also modifying the cutting width WOC!