

2023 Tooling Matrix



End Mill Matrix

Preferred materials for each Series are designated below.		Coolant required in these materials ☑ Coolant required in these materials ☒ Plunging not recommended in these materials																	
Cut depths (Ae & Ap) are based on a percentage of the cutter diameter (DC)		Material																	
Material hardness and machinability affect speed, feed, and cut depths. Long flute or long reach tools require reduced rates and cut depths.		Low Carbon, Alloy 20 to 35 HRC	Medium Carbon, Alloy 20 to 35 HRC	High Carbon, Alloy 35 to 45 HRC	Ferritic & Martensitic ≤ 45 HRC	Austenitic & Duplex ≤ 25 HRC	Precipitation Hardened ≤ 45 HRC	Low Alloy, Grey, Ductile ≤ 25 HRC	Med-High Alloy, Nodular 25 to 35 HRC	High Alloy, Nodular ≥ 35 HRC	Aluminum Alloys	Copper Alloys	Plastics, Composites	Titanium Alloys ≤ 45 HRC	Iron, Nickel, Cobalt Alloys ≤ 45 HRC	Refractory Alloys, Mo, Ta, W ≤ 35 HRC	High Carbon, Med Alloy 45 to 50 HRC	Tool, Mold & Die 45 to 55 HRC	Tool, Mold & Die 55 to 65 HRC
Name	Series	Steel			Stainless Steel			Cast Iron			Non Ferrous			HRSA			Hard Steel		
Series 33	33	★	★	★	★	★	☆	★	★	☆				★	☆	☆	○	○	
Z-Carb-AP	Z1P	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Z-Carb-HTA	ZH1	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Series 7	7	★	★	★	★	★	★	★	★	★				★	★	☆	☆	○	
Z-Carb HPR	Z5	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
V-Carb	55	★	★	★	★	★	★	★	★	★				★	★	☆	○	○	
T-Carb®	51	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
H-Carb	77	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Multi Carb	66	★	★	★	★	☆	★	★	★	★				★	★	★	☆	○	
Multi Carb-B	67B	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Picatinny Groove F	PRT	★	★	★	★	★	★							★					
Picatinny Dovetail F	PRT	★	★	★	★	★	★							★					
Turbo Carb	56B	★	★	★				★	★	★							★	★	★
Z-Carb-MD	ZD1			☆					☆	★							★	★	★
Power-Carb®	57								☆								★	★	★
Ski-Carb	44										★	☆	○						
S-Carb® 2 Flute	47										★	★	○						
S-Carb® 3 Flute	43										★	★	○						
S-Carb® APR-3	43APR-3										★	★	○						
S-Carb® APR-4	43APR-4										★	★	○						
S-Carb® APF	43APF										★	★	○						
S-Carb® APF-B	43APF-B										★	★	☆						
Picatinny Groove NF	PRT										★								
Picatinny Dovetail NF	PRT										★								
Slow Helix	27											☆	★						
CCR	20-CCR												★						
CCR Coarse	31-CCR												★						
Compression Router	25												★						
Up Cut Router	21										☆	○	★						
Down Cut Router	22										☆	○	★						

End Mill Matrix

Preferred Cut Type for Series ★ Best ☆ Better ○ Good (blank) Not Recommended						Preferred Entry Method for Series			Preferred Tool Path for Series	
Unless blank, a high quality wall or floor finish can be achieved with any Series with adjusted speed & feed.						Speed & Feed are based on ramp angle.			For rough milling, HEM tool paths are usually preferred in most situations, however, Standard paths may be more efficient using suitable tools with moderate to heavy cut types.	
Heavy	Moderate	Light	Fine	Finish-Wall	Finish - Floor	Plunge	Straight Ramp	Helical Ramp	Standard Path	HEM Path
Ae = 1 to .4 x DC Ap ≤ 1 x DC	Ae = .4 to .25 x DC Ap ≤ 1.5 x DC	Ae = .25 to .1 x DC Ap ≤ 2.5 x DC	Ae = .1 to .02 x DC Ap ≤ 4.5 x DC	Ae ≤ .02 x DC any Ap	Ae ≥ .5 x DC Ap ≤ .02 x DC	Ap ≤ 1 x DC lower feed rates	Ap ≤ 2 x DC medium feed rates	Ap ≤ 4 x DC higher feed rates		
★	★	☆	☆	○	☆	☆	★	★	★	☆
★	★	☆	☆	○	☆	☆	★	★	★	☆
★	★	☆	☆	○	☆	☆	★	★	★	☆
○	○	○	★	★	☆		○	☆	○	☆
☆	★	★	☆	☆	★		★	★	★	★
○	☆	★	★	★	★		○	☆	☆	★
○	○	☆	★	★	★		○	★	○	★
○	○	○	☆	★	★		○	★	○	★
			★	★			○	○	★	
★	★	★	★	★	★				★	
★	★	★	★	★	★				★	
○	○	☆	★	★		○	○	★	★	★
★	★	☆	☆	☆	☆		☆	★	☆	★
☆	☆	☆	★	★	☆	☆	★	★	★	☆
★	★	☆	☆	○	☆	☆	★	★	★	☆
★	★	☆	☆		★	☆	★	★	★	☆
○	○	☆	★	★	★	○	☆	★	☆	★
			★	★	☆		○	○	★	
★	★	★	★	★	★				★	
★	★	★	★	★	★				★	
○	○	☆	★	★	☆	○	☆	★	★	☆
★	★	☆	☆		☆	○	☆	★	★	☆
○	○	☆	☆	★	☆	○	☆	★	★	☆
○	○	☆	☆	☆	☆				★	☆

End Mill Matrix

Name	Series	Flute Count	Cut Dia. Range inch mm	Cut Length Availability (x DC)	Reach Option (x DC)	End Styles Square (S) Radius (R) Ball (B)
Series 33	33	3	0.125 to 1 3 to 20	2.25 to 3	-	R
Z-Carb-AP	Z1P	4	0.0156 to 1 1 to 25	1 to 3.25	2.5 to 8.5	S, R, B
Z-Carb-HTA	ZH1	4	0.250 to 1 6 to 20	1.25 to 3	-	R
Series 7	7	4	0.125 to 1 3 to 25	2.25 to 8.25	-	S, B
Z-Carb HPR	Z5	5	0.125 - 1 6 - 25	1 to 3	-	S, R
V-Carb	55	5	0.125 to 1 6 to 20	1.25 to 5	-	S, R, B
T-Carb®	51	6	0.250 to 1 6 to 20	1.25 to 3	3.25 to 5.5	S, R
H-Carb	77	7	0.250 to 1 6 to 25	2.5 to 4	-	S, R
Multi Carb	66	7, 9, 11	0.188 to 1 6 to 25	1.5 to 3.25	-	S, R
Multi Carb-B	67	4, 6, 8	- 6 to 16	1.2 to 1.9	-	B
Picatinny Groove F	PRT	3	0.2100 -	0.56	-	S
Picatinny Dovetail F	PRT	5	0.6050 -	0.68	-	S
Turbo Carb	56B	2	0.031 to 0.750 1 to 20	1	2 to 2.25	B
Z-Carb-MD	ZD1	4	0.118 to 0.750 5 to 20	1 to 1.25	2.25 to 5	R
Power-Carb®	57	6	0.250 to 0.500 6 to 20	2 to 2.25	-	S
Ski-Carb	44	2	0.250 to 1 3 to 20	1.25 to 7	-	S, R
S-Carb® 2 Flute	47	2	0.125 to 1 3 to 25	1 to 3	3 to 9	S, B
S-Carb® 3 Flute	43	3	0.125 to 1 3 to 25	1 to 7	2.25 to 8.5	S, R, B
S-Carb® APR-3	43APR-3	3	0.750 to 1 12 to 26	1.25 to 1.75	3 to 4	S, R
S-Carb® APR-4	43APR-4	4	20 to 25	1.25 to 1.75	2.25 to 3.5	S, R
S-Carb® APF	43APF	4	0.500 to 0.750 6 to 25	2.5 to 4	3 to 5	S, R
S-Carb® APF-B	43APF-B	3, 4	- 6 to 16	1.2 to 1.9	-	B
Picatinny Groove NF	PRT	3	0.2100 -	0.56	-	S
Picatinny Dovetail NF	PRT	3	0.6050 -	0.68	-	S
Slow Helix	27	4	0.250 to 0.750 6 to 16	1.75 to 4	-	S
CCR	20-CCR	5, 8, 10, 12	0.250 to 0.500 2 to 12	2.75 to 4	-	S
CCR Coarse	31-CCR	5, 7, 8, 10	0.250 to 0.500 6 to 12	2.75 to 4	-	S
Compression Router	25	4, 6, 8	0.250 to 0.500 6 to 12	2.75 to 4	-	S
Up Cut Router	21	2	0.125 to 0.750 3 to 12	2.5 to 4.25	-	S
Down Cut Router	22	2	0.125 to 0.750 3 to 12	2.5 to 4.25	-	S

End Mill Matrix

Chipbreaker Option	Shank Option Solid Round (SR) Weldon Flat (WF) Jet Stream (JS) Coolant Hole (CH)	Center Cutting	Helix Angle	Flute Index	Coating	Maximum Recommended Ramp Angle °
By Request	SR, WF	Yes	32 / 48	Unequal	Ti-NAMITE®-A	90
By Request	SR, WF, JS	Yes	35 / 38	Unequal	Ti-NAMITE®-X	90
By Request	SR, WF	Yes	38 / 41	Unequal	Ti-NAMITE®-A	20
By Request	SR	Yes	38	Unequal	Ti-NAMITE®-A	1
By Request	SR, WF, CH	No	37	Unequal	Ti-NAMITE®-M Ti-NAMITE®-A	7
By Request	SR, WF	Yes	45	Unequal	Ti-NAMITE®-A	5
By Request	SR	Yes	41	Unequal	Ti-NAMITE®-X	3
In Stock Available	SR	No	37	Unequal	Ti-NAMITE®-M Ti-NAMITE®-A	1
By Request	SR	No	35	Equal	Ti-NAMITE®-X	1
By Request	SR	Yes	varies	Equal	Ti-NAMITE®-H	1
Not Available	SR	Yes	35	Unequal	Ti-NAMITE®-M	-
Not Available	SR	No	37	Unequal	Ti-NAMITE®-M	-
By Request	SR	Yes	30	Equal	Ti-NAMITE®-X	25
By Request	SR	Yes	42 / 45	Unequal	Ti-NAMITE®-X	2
By Request	SR	Yes	45	Equal	Ti-NAMITE®-X	1
By Request	SR, WF	Yes	45	Equal	uncoated or Ti-NAMITE®-B	90
By Request	SR	Yes	35	Equal	uncoated or Ti-NAMITE®-B	90
In Stock Available	SR	Yes	38	Equal	uncoated or Ti-NAMITE®-B	90
Standard	CH	Yes	38	Unequal	Ti-NAMITE®-B	90
Standard	CH	Yes	38 / 41	Unequal	Ti-NAMITE®-B	90
By Request	CH	Yes	38 / 41	Unequal	Ti-NAMITE®-B	25
By Request	SR	Yes	varies	Equal	Ti-NAMITE®-B	1
Not Available	SR	Yes	38	Equal	Ti-NAMITE®-B	-
Not Available	SR	No	38	Equal	Ti-NAMITE®-B	-
By Request	SR	Yes	10, 12	Unequal	uncoated or Di-NAMITE®	5
Standard	SR	Based upon end style	15	Equal	uncoated or Di-NAMITE®	5 (for end cut styles)
Standard	SR	Based upon end style	15	Equal	uncoated or Di-NAMITE®	5 (for end cut styles)
By Request	SR	Yes	30	Equal	uncoated or Di-NAMITE®	5
By Request	SR	Yes	35	Equal	various optional	90
By Request	SR	Yes	35	Equal	various optional	-

Drill Matrix

Item			Preferred Cut Type for Series ★ Best ☆ Better ○ Good (blank) Not Recommended																	
Material			Material																	
Name / Series	Tool Type	Coolant Delivery	Steel		Stainless Steel			Cast Iron			Non Ferrous			HRSA			Hard Steel			
Hi-PerCarb® 142P	High Performance Drill	Internal	★	★	★	☆	☆	☆	☆	☆	☆	☆	★		☆	☆	☆	★	☆	☆
Hi-PerCarb® 143M-S	High Performance Drill	Internal	☆			★	★	★	☆	☆	☆	○	★		★	★	★			
Hi-PerCarb® 141K	High Performance Drill	Internal	☆	☆	☆	○		○	★	★	★	☆	☆		○		○			
Hi-PerCarb® 131N	High Performance Drill	External							○			★	★	☆	○					
Series 120	High Performance Drill	External												★						
Hi-PerCarb® 135	High Performance Drill	External	★	★	★	★	☆	★	☆	☆	☆	○	○		☆	☆	☆	★	☆	☆
Hi-PerCarb® 146U	High Performance Drill	Internal	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★
Hi-PerCarb® 136U	High Performance Drill	External	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★
Series 106	General Application Drill	External	○	○	○					☆								★	★	☆
Series 101	General Application Drill	External	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
Series 103	General Application Drill	External	○	○	○	○	○	○	☆	☆	○				○	○	○			
Series 108	General Application Drill	External	★	☆	☆	☆	☆	☆	☆	☆		○	○	☆	☆	☆				
Series 301, 301M	Drill & Countersink	External	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	○	○	☆	○	○	
Series 601	Countersink	External	○	○	○	○	★	○	☆	☆	☆	★	☆	○	○	○				
Series 603	Countersink	External	☆	☆	☆	☆	★	☆	★	☆	☆	★	★	☆	☆	☆	○			
Series 606	Countersink	External	★	★	★	★	★	★	★	★	★	○	★	★	★	★	★	☆	☆	○
Series 200	Reamer	External	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	○
Series 201M	Reamer	External	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	○

Drill Matrix

Attributes										
Diameter Range inch	Diameter Range mm	Tolerance	Length	Point Angle °	Self Centering	Flute Count	Margins	Helix Angle °	Shank	Coating
0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x, 8x, 12x	137	Yes	2	4	30	Common	Ti-NAMITE®-X
0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x	136	Yes	2	2	30	Common	Ti-NAMITE®-A
0.1250 0.7500	3,00 16,00	DC + / +	5x	124	Yes	3	3	30	Common	Ti-NAMITE®-X
0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x	124	Yes	3	3	30	Common	Ti-NAMITE®-B
0.0980 0.5000	2,70 12,00	DC 0 / -	3x	145, 90	Yes	2	4	20	Common	Di-NAMITE®
0.0156 0.9219	1,25 22,00	DC + / +	3x, 5x	145	Yes	2	4	32	Common	Ti-NAMITE®-A
0.1250 0.8125	3,00 20,50	DC + / +	3x, 5x	180	Yes	2	4	15	Common	Ti-NAMITE®-X
0.0625 0.8125	1,50 20,50	DC + / +	2x	180	Yes	2	4	15	Common	Ti-NAMITE®-X
0.0400 0.5000	1,00 12,00	DC 0 / -	3x	140	Yes	2	2	0	Straight	Ti-NAMITE®-A or uncoated
0.0135 0.5000	0,70 12,00	DC 0 / -	5x	118	Yes	2	2	20	Straight	Ti-NAMITE®-A or uncoated
0.1065 0.7500	3,00 20,00	DC 0 / -	3x	150	Yes	3	3	30	Straight	Ti-NAMITE®-A or uncoated
-	0,50 16,00	DC 0 / -	3x	118	Yes	2	2	20	Straight	Ti-NAMITE®-A or uncoated
0.0250 0.2188	0,50 5,00	DC + / 0	spot	118, 60	Yes	2	2	0	Straight	Ti-NAMITE®-A or uncoated
0.1250 1.0000	-	DC + / -	spot	60, 82, or 90	Yes	1	-	0	Common	uncoated
0.1250 1.0000	-	DC + / -	spot	60, 82, or 90	Yes	3	-	0	Common	uncoated
0.1250 1.0000	-	DC + / -	spot	60, 82, or 90	Yes	6	6	0	Common	uncoated
0.0469 0.5000	-	DC + / 0	varies	-	-	4 or 6	4 or 6	0	Straight	uncoated
-	1,00 10,00	DC + / 0	varies	-	-	4 or 6	4 or 6	0	Straight	uncoated

Material hardness and machinability affect speed, feed, and cut depths.

For dimensional and finish quality, a low TIR of the tool-holder assembly in the machine is critical: less than 0.1% drill diameter is preferred.

Spot drilling is not necessary in most situations if the drilling surface is machined flat ; spot drill point angle should be greater than drill point angle.

Liquid coolant (internal or external) such as oil based or synthetic is highly recommended for all drilling applications.

For proper cooling, lubrication and chip evacuation, ensure the coolant is supplied throughout the entire depth of the hole.

When liquid coolant cannot be applied for applications such as plastics or composites, clear the swarf with air or vacuum.

Depending on material machinability, a peck cycle may be necessary for external coolant drills beyond 2x or 3x depths.

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