

**2023 Tooling Matrix**



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ISO 9001:2015 Certified

# End Mill Matrix

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Preferred materials for each Series are designated below.		Coolant required in these materials Plunging not recommended in these materials														Preferred Cut Type for Series Best Better Good (blank) Not Recommended						Preferred Entry Method for Series			Preferred Tool Path for Series																							
<p>Cut depths (Ae &amp; Ap) are based on a percentage of the cutter diameter (DC)</p> <p>Material hardness and machinability affect speed, feed, and cut depths. Long flute or long reach tools require reduced rates and cut depths.</p>		Material														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.																							
		Low Carbon $\leq 20$ HRC		Medium Carbon, Alloy 20 to 35 HRC		High Carbon, Alloy 35 to 45 HRC		Ferritic & Martensitic $\leq 45$ HRC		Austenitic & Duplex $\leq 25$ HRC		Precipitation Hardened $\leq 45$ HRC		Low Alloy, Grey, Ductile $\leq 25$ HRC		Med-High Alloy, Nodular 25 to 35 HRC		High Alloy, Nodular $\geq 35$ HRC		Aluminum Alloys		Copper Alloys		Plastics, Composites		Titanium Alloys $\leq 45$ HRC		Iron, Nickel, Cobalt Alloys $\leq 45$ HRC		Refractory Alloys, Mo, Ta, W $\leq 35$ HRC		High Carbon, Med Alloy 45 to 50 HRC		Tool, Mold & Die 45 to 55 HRC		Tool, Mold & Die 55 to 65 HRC		Heavy	Moderate	Light	Fine	Finish-Wall	Finish - Floor	Plunge	Straight Ramp	Helical Ramp	Standard Path	HEM Path
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																	☆	○	★																									○	○	○	★

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Name	Series	Flute Count	Cut Diameter Range inch mm	Cut Length Availability ( x DC ) **	Reach Option ( x DC ) **	End Styles Square Radius Ball	Chipbreaker Option	Shank Option Solid Round Weldon Flat Jet Stream Coolant Hole	Center Cutting	Helix Angle	Flute Index	Coating	Maximum Recommended Ramp Angle ***
Series 33	33	3	0.125 to 1 3 to 20	2.25 to 3	–	R	By Request	SR, WF	Yes	32 / 48	Unequal	Ti-NAMITE®-A	90
Z-Carb-AP	Z1P	4	0.0156 to 1 1 to 25	1 to 3.25	2.5 to 8.5	S, R, B	By Request	SR, WF, JS	Yes	35 / 38	Unequal	Ti-NAMITE®-X	90
Z-Carb-HTA	ZH1	4	0.250 to 1 6 to 20	1.25 to 3	–	R	By Request	SR, WF	Yes	38 / 41	Unequal	Ti-NAMITE®-A	20
Series 7	7	4	0.125 to 1 3 to 25	2.25 to 8.25	–	S, B	By Request	SR	Yes	38	Unequal	Ti-NAMITE®-A	1
Z-Carb HPR	Z5	5	0.125 – 1 6 – 25	1 to 3	–	S, R	By Request	SR, WF, CH	No	37	Unequal	Ti-NAMITE®-M Ti-NAMITE®-A	7
V-Carb	55	5	0.125 to 1 6 to 20	1.25 to 5	–	S, R, B	By Request	SR, WF	Yes	45	Unequal	Ti-NAMITE®-A	5
T-Carb®	51	6	0.250 to 1 6 to 20	1.25 to 3	3.25 to 5.5	S, R	By Request	SR	Yes	41	Unequal	Ti-NAMITE®-X	3
H-Carb	77	7	0.250 to 1 6 to 25	2.5 to 4	–	S, R	In Stock Available	SR	No	37	Unequal	Ti-NAMITE®-M Ti-NAMITE®-A	1
Multi Carb	66	7, 9, 11	0.188 to 1 6 to 25	1.5 to 3.25	–	S, R	By Request	SR	No	35	Equal	Ti-NAMITE®-X	1
Multi Carb-B	67	4, 6, 8	– 6 to 16	1.2 to 1.9	–	B	By Request	SR	Yes	varies	Equal	Ti-NAMITE®-H	1
Picatinny Groove F	PRT	3	0.2100 –	0.56	–	S	Not Available	SR	Yes	35	Unequal	Ti-NAMITE®-M	–
Picatinny Dovetail F	PRT	5	0.6050 –	0.68	–	S	Not Available	SR	No	37	Unequal	Ti-NAMITE®-M	–
Turbo Carb	56B	2	0.031 to 0.750 1 to 20	1	2 to 2.25	B	By Request	SR	Yes	30	Equal	Ti-NAMITE®-X	25
Z-Carb-MD	ZD1	4	0.118 to 0.750 5 to 20	1 to 1.25	2.25 to 5	R	By Request	SR	Yes	42 / 45	Unequal	Ti-NAMITE®-X	2
Power-Carb®	57	6	0.250 to 0.500 6 to 20	2 to 2.25	–	S	By Request	SR	Yes	45	Equal	Ti-NAMITE®-X	1
Ski-Carb	44	2	0.250 to 1 3 to 20	1.25 to 7	–	S, R	By Request	SR, WF	Yes	45	Equal	uncoated or Ti-NAMITE®-B	90
S-Carb® 2 Flute	47	2	0.125 to 1 3 to 25	1 to 3	3 to 9	S, B	By Request	SR	Yes	35	Equal	uncoated or Ti-NAMITE®-B	90
S-Carb® 3 Flute	43	3	0.125 to 1 3 to 25	1 to 7	2.25 to 8.5	S, R, B	In Stock Available	SR	Yes	38	Equal	uncoated or Ti-NAMITE®-B	90
S-Carb® APR-3	43APR-3	3	0.750 to 1 12 to 26	1.25 to 1.75	3 to 4	S, R	Standard	CH	Yes	38	Unequal	Ti-NAMITE®-B	90
S-Carb® APR-4	43APR-4	4	20 to 25	1.25 to 1.75	2.25 to 3.5	S, R	Standard	CH	Yes	38 / 41	Unequal	Ti-NAMITE®-B	90
S-Carb® APF	43APF	4	0.500 to 0.750 6 to 25	2.5 to 4	3 to 5	S, R	By Request	CH	Yes	38 / 41	Unequal	Ti-NAMITE®-B	25
S-Carb® APF-B	43APF-B	3, 4	– 6 to 16	1.2 to 1.9	–	B	By Request	SR	Yes	varies	Equal	Ti-NAMITE®-B	1
Picatinny Groove NF	PRT	3	0.2100 –	0.56	–	S	Not Available	SR	Yes	38	Equal	Ti-NAMITE®-B	–
Picatinny Dovetail NF	PRT	3	0.6050 –	0.68	–	S	Not Available	SR	No	38	Equal	Ti-NAMITE®-B	–
Slow Helix	27	4	0.250 to 0.750 6 to 16	1.75 to 4	–	S	By Request	SR	Yes	10, 12	Unequal	uncoated or Di-NAMITE®	5
CCR	20-CCR	5, 8, 10, 12	0.250 to 0.500 2 to 12	2.75 to 4	–	S	Standard	SR	Based upon end style	15	Equal	uncoated or Di-NAMITE®	5 (for end cut styles)
CCR Coarse	31-CCR	5, 7, 8, 10	0.250 to 0.500 6 to 12	2.75 to 4	–	S	Standard	SR	Based upon end style	15	Equal	uncoated or Di-NAMITE®	5 (for end cut styles)
Compression Router	25	4, 6, 8	0.250 to 0.500 6 to 12	2.75 to 4	–	S	By Request	SR	Yes	30	Equal	uncoated or Di-NAMITE®	5
Up Cut Router	21	2	0.125 to 0.750 3 to 12	2.5 to 4.25	–	S	By Request	SR	Yes	35	Equal	various optional	90

Item			Preferred Cut Type for Series													Attributes																
			Material													<p>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.</p> <p>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.</p>																
			Low Carbon $\leq 20$ HRC	Medium Carbon, Alloy 20 to 35 HRC	High Carbon, Alloy 35 to 45 HRC	Ferritic & Martensitic $\leq 45$ HRC	Austenitic & Duplex $\leq 25$ HRC	Precipitation Hardened $\leq 45$ HRC	Low Alloy Grey, Ductile $\leq 25$ HRC	Med-High Alloy, Nodular 25 to 35 HRC	High Alloy, Nodular $\geq 35$ HRC	Aluminum Alloys	Copper Alloys	Plastics, Composites	Titanium Alloys $\leq 45$ HRC											Iron, Nickel, Cobalt Alloys $\leq 45$ HRC	Refractory Alloys, Mo, Ta, W $\leq 35$ 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	Tool Type	Coolant Delivery	Steel	Stainless Steel	Cast Iron	Non Ferrous	HRSA	Hard Steel	Diameter Range	Diameter Range	Tolerance	Length	Point Angle °	Self Centering	Flute Count	Margins	Helix Angle °	Shank	Coating													
Hi-PerCarb® 142P	High Performance Drill	Internal	★	★	★	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x, 8x, 12x	137	yes	2	4	30	Common	Ti-NAMITE®-X		
Hi-PerCarb® 143M-S	High Performance Drill	Internal	☆			★	★	★	☆	☆	☆	○	★	★	★					0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x	136	yes	2	2	30	Common	Ti-NAMITE®-A		
Hi-PerCarb® 141K	High Performance Drill	Internal	☆	☆	☆	○			★	★	★	☆	☆		○					0.1250 0.7500	3,00 16,00	DC + / +	5x	124	yes	3	3	30	Common	Ti-NAMITE®-X		
Hi-PerCarb® 131N	High Performance Drill	External							○			★	★	☆	○					0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x	124	yes	3	3	30	Common	Ti-NAMITE®-B		
Series 120	High Performance Drill	External										★								0.0980 0.5000	2,70 12,00	DC 0 / -	3x	145, 90	yes	2	4	20	Common	Di-NAMITE®		
Hi-PerCarb® 135	High Performance Drill	External	★	★	★	★	☆	★	☆	☆	☆	○	○	☆	☆	☆	★	☆	☆	0.0156 0.9219	1,25 22,00	DC + / +	3x, 5x	145	yes	2	4	32	Common	Ti-NAMITE®-A		
Hi-PerCarb® 146U	High Performance Drill	Internal	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	0.1250 0.8125	3,00 20,50	DC + / +	3x, 5x	180	yes	2	4	15	Common	Ti-NAMITE®-X		
Hi-PerCarb® 136U	High Performance Drill	External	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	0.0625 0.8125	1,50 20,50	DC + / +	2x	180	yes	2	4	15	Common	Ti-NAMITE®-X		
Series 120	High Performance Drill	External										★								0.0980 0.5000	2,70 12,00	DC + / -	3x	145, 90	yes	2	4	20	Common	Di-Namite®		
Series 106	General Application Drill	External	○	○	○				☆										★	★	☆	0.0400 0.5000	1,00 12,00	DC 0 / -	3x	140	yes	2	2	0	Straight	Ti-NAMITE®-A or uncoated
Series 101	General Application Drill	External	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			0.0135 0.5000	0,70 12,00	DC 0 / -	5x	118	no	2	2	20	Straight	Ti-NAMITE®-A or uncoated
Series 103	General Application Drill	External	○	○	○	○	○	○	☆	☆	○				○	○	○					0.1065 0.7500	3,00 20,00	DC 0 / -	3x	150	yes	3	3	30	Straight	Ti-NAMITE®-A or uncoated
Series 108	General Application Drill	External	★	☆	☆	☆	☆	☆	☆	☆	○	○	☆	☆	☆							-	0,50 16,00	DC 0 / -	3x	118	yes	2	2	20	Straight	Ti-NAMITE®-A or uncoated
Series 301, 301M	Drill & Countersink	External	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	○	☆	○	○				0.0250 0.2188	0,50 5,00	DC + / 0	spot	118, 60	yes	2	2	0	Straight	Ti-NAMITE®-A or uncoated
Series 601	Countersink	External	○	○	○	○	★	○	☆	☆	☆	★	☆	○	○	○						0.1250 1.0000	-	DC + / -	spot	60, 82, or 90	yes	1	-	0	Common	uncoated
Series 603	Countersink	External	☆	☆	☆	☆	★	☆	★	☆	☆	★	★	☆	☆	☆	○					0.1250 1.0000	-	DC + / -	spot	60, 82, or 90	yes	3	-	0	Common	uncoated
Series 606	Countersink	External	★	★	★	★	★	★	★	★	○	★	★	★	★	★	☆	☆	○			0.1250 1.0000	-	DC + / -	spot	60, 82, or 90	yes	6	6	0	Common	uncoated
Series 200	Reamer	External	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	○				0.0469 0.5000	-	DC + / 0	varies	-	-	4 or 6	4 or 6	0	Straight	uncoated
Series 201M	Reamer	External	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	○				-	1,00 10,00	DC + / 0	varies	-	-	4 or 6	4 or 6	0	Straight	uncoated



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