Solid End Milling

End Mills									
Z = number of teeth		Fine Finishing	Finishing	Roughing	Slot Milling	Plunging	Contour Milling	Peel Milling	Trochoidal Milling
end mill Z = 1		○	○	●	●	●	○	○	○
end mill Z = 2		○	○	◑	●	●	○	○	○
end mill Z = 3		○	◑	◑	●	◑	○	○	○
end mill Z = 4/5		◑	●	●	●*	○	○	●	●
multi-flute cutter Z = 6-8		●	●	○	○	○	○	●	●
Ball Nose and Torus End Mills									
ball nose end mill Z = 2					●		●		
ball nose end mill Z = 4					◑		●		

**VariMill™/VariMill™ GP Only*

● first choice

◑ suitable with limitations

○ not recommended

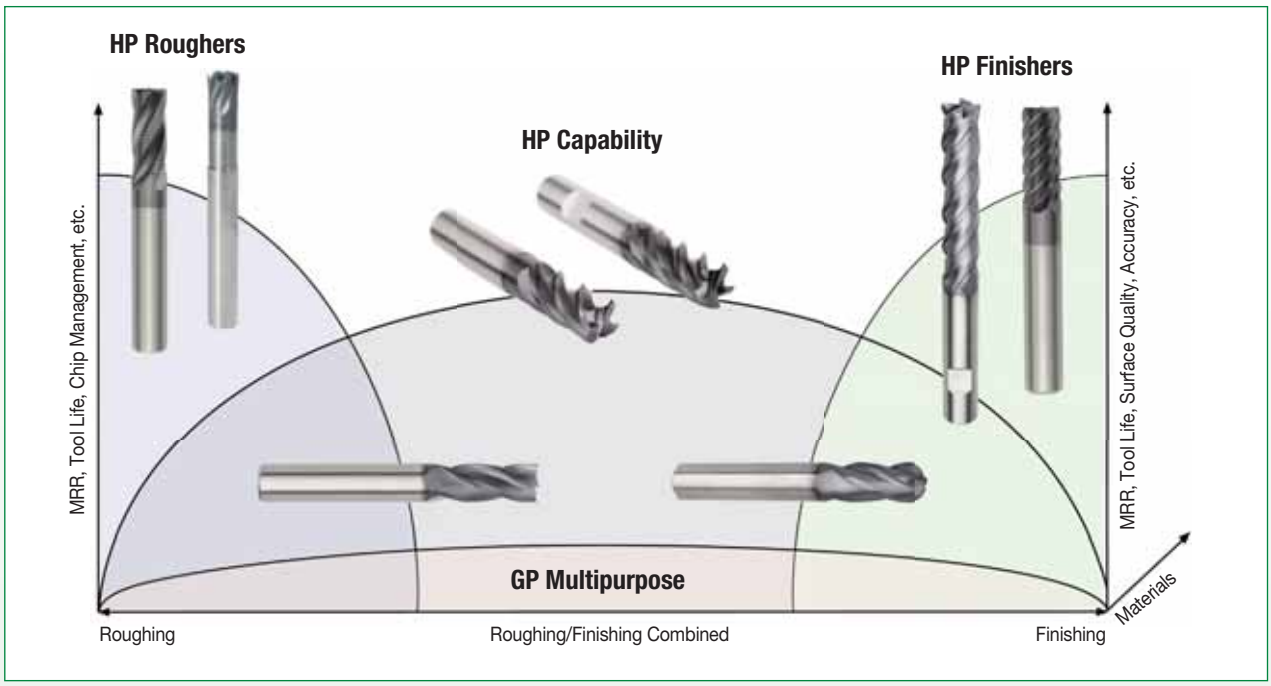
Always select a tool with the shortest possible flute length whenever possible. This will increase the stability of the tool and give the best results.

When selecting an end mill, the following machining factors will affect your selection of the correct end mill for your application:

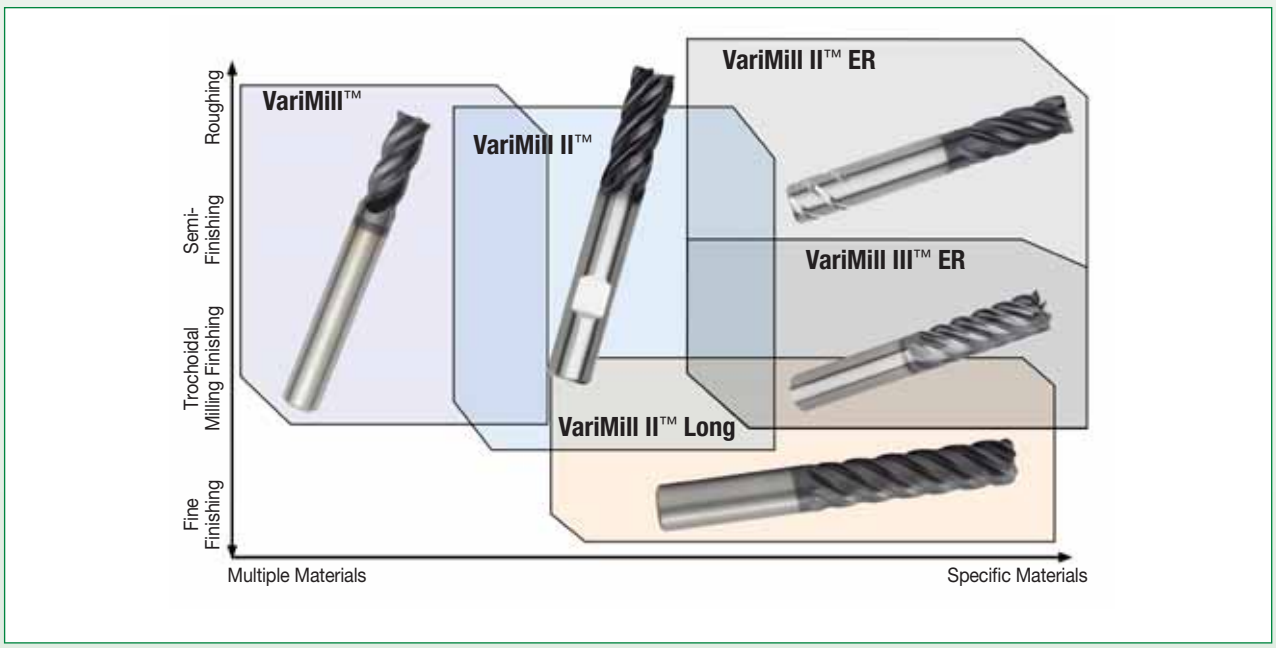
1. Tool overhang.
2. Coolant flow.
3. Machine and setup stability.
4. Machine power and torque.
5. Material to be machined.
6. Machine adapter size (CV40, CV50, HSK63, etc.).
7. See Tool Reference Guides on pages L6–L11.

Type of Cut	Materials	Recommended Series																									Page Reference
		P							M			K			N						S				H				
		Steels & Alloyed Steels							Stainless Steel			Cast Iron			Non-Ferrous						High-Temp Alloys & Titanium				Hardened Materials				
		0	1	2	3	4	5	6	1	2	3	1	2	3	1	2	3	4	5	6	1	2	3	4	1	2	3	4	
	Roughing																												
	4Q03 4Q05	■	■	■	■	■	■	■	■	■	■	■	■	■															M54
	4M0R, 4M4R						■	■	■	■	■										■	■	■	■	■	■	■	■	M56
	X-Feed™ 7FN6				■	■																			■	■			M120
	X-Feed 7FN7																										■	■	M121
	4A0R														■	■	■	■	■	■									M113
	Semi-Finishing																												
	VariMill I™ — 4V05	■	■	■	■	■			■	■	■	■	■	■															M4–M8
	VariMill II™ — 5V0C		■	■	■	■	■	■	■	■	■	■	■																M26–M27
	VariMill II ER — 5V0E						■	■	■	■	■										■	■	■	■	■				M34
	VariMill III™ ER — 7V1E, 7V2E						■	■	■	■	■										■	■	■	■	■				M47
	Vision Plus™ — 7S05				■	■																			■	■	■	■	M138
	AluSurf™ 5A02, 5A03														■	■	■	■	■	■									M82–M85
	Finishing																												
	4S07	■	■	■	■	■	■	■	■	■	■	■	■								■	■	■	■	■				M66
	VariMill III ER — 7VNX, 7V1E, 7V2E						■	■	■	■	■											■	■	■	■				M46–M47
	7S15, 7S25				■	■																			■	■	■	■	M138
	AluSurf 5A02, 5A03														■	■	■	■	■	■									M82–M85
	Finishing Pockets																												
	VariMill I — 4VN5, 4VPT	■	■	■	■	■			■	■	■	■	■	■							■	■	■	■	■				M12–M14
	VariMill II — 5VNC						■	■	■	■	■	■									■	■	■	■					M28
	VariMill II ER — 5VNE						■	■	■	■	■										■	■	■	■	■				M35
	VariMill III ER — 7VNX						■	■	■	■	■										■	■	■	■	■				M46
	AluSurf 5AN2, 5AN3														■	■	■	■	■	■									M86–M89
	Long Wall Milling																												
	VariMill II Long — 5W1S	■	■	■	■	■	■		■	■	■	■	■	■							■	■	■	■	■	■	■		M40–M41
	VariMill III ER — 7V2E						■	■	■	■	■										■	■	■	■	■				M47
	3D Ball Nose																												
	VariMill I — 4V00, 4VP0	■	■	■	■	■	■		■	■	■	■	■	■							■	■	■	■	■				M15–M16
	7S5F				■	■																			■	■	■	■	M139
	4A01/4AN1														■	■	■	■	■	■									M111–M112
	HPC/Peel Milling																												
	VariMill I — 4V05	■	■	■	■	■			■	■	■	■	■	■															M4–M8
	VariMill II — 5V0C			■	■	■	■	■	■	■	■	■	■												■				M26–M27
	VariMill II ER — 5V0E						■	■	■	■	■										■	■	■	■	■				M34
	VariMill II Long — 5W1S	■	■	■	■	■	■		■	■	■	■	■	■							■	■	■	■	■				M40–M41
	VariMill III ER — 7VNX, 7V1E,7V2E						■	■	■	■	■										■	■	■	■	■				M46–M47
	AluSurf 5A02, 5A03														■	■	■	■	■	■					■				M82–M85
	Trochoidal Milling																												
	VariMill I — 4V05	■	■	■	■	■			■	■	■	■	■	■															M4–M8
	VariMill II — 5V0C			■	■	■	■		■	■	■	■	■								■	■	■	■	■	■			M26–M27
	VariMill II ER — 5V0E						■	■	■	■	■										■	■	■	■	■	■			M34
	VariMill III ER — 7V1E, 7V2E						■	■	■	■	■										■	■	■	■	■	■			M47
	AluSurf 5A02, 5A03														■	■	■	■	■	■									M82–M85

Best Selection Per Application



Best Selection For Trochoidal/High-Speed Machining Concepts



Recommended Adapters per End Mill Platform

SCEM Platform	Recommended Adapters	
	First Choice	Alternate Choice
VariMill I™	HydroForce™	Shrink Fit
VariMill II™/VariMill II™ ER	HydroForce	Shrink Fit
VariMill III™ ER	HydroForce	Shrink Fit
VariMill II™ Long	HydroForce	Shrink Fit
High-Performance Finishers	HydroForce	Shrink Fit
High-Performance Roughers	HydroForce	Weldon® Adapter
AluSurf™/Arcut™/Aluminum Tools	HydroForce	Shrink Fit
Vision Plus™/Vision Plus X-Feed™	HydroForce	Shrink Fit
VariMill GP	Shrink Fit	Weldon Adapter
HSS/WavCut™	Weldon Adapter	–
HSS ER Rougher	Weldon/Whistle Adapter	–

Select Adapter per Technical Data/Characteristics

Technical data/characteristics	Toolholders				
	HydroForce high torque	Shrink Fit	Milling chuck	ER collet chuck	Weldon adapter
torque transmission	★★★★★	★★★★	★★★★★	★★	★★★★★
radial runout (T.I.R.)[1]	★★★★★	★★★★★	★★★★	★★★	★
radial rigidity[2]	★★★★	★★★★★	★★★	★★★	★★★
tool length adjustment	★★★★★	★★★★	★	★★★★	★★
tool shank tolerance requirement	★★★★	★★	★★★	★★★★★	★★★
through coolant	★★★★★	★★★★★	★★★	★★★	★★
minimum quantity lubrication (MQL)	★★★★★	★★★★★	★	★	★
dampening capability	★★★★★	★	★★★	★★★	★★★
shank diameter range[3]	★★★★★	★	★★★★★	★★★★★	★
cost of toolholder	★★	★★★	★	★★★★	★★★★★
low requirement of external devices[4]	★★★★★	★	★★★★	★★★★	★★★★★
ease of handling	★★★★★	★★★	★★	★★★★	★★★★
dust resistance	★★★★★	★★★★★	★★★	★★★	★★★★
high-speed capability	★★★★★	★★★★★	★★★	★★★	★
balancing accuracy	★★★★★	★★★★★	★★★	★★★	★

[1] Radial runout may affect tool life.
[2] Radial rigidity for Weldon holder is low at a direction perpendicular to the screw.
[3] Accepts different shank diameters through the use of reduction sleeves or due to collapse range.
[4] Collet chucks and milling chucks may require the use of a torque or special wrench; Shrink Fit adapter requires a shrinking unit.

● first choice
○ alternate choice

	Series	Range of Diameter Ø min– Ø max inch/metric	Number of Flutes	Cutting Center	Uncoated	TiCN	AlTiN	TiAlN	
High-Performance Solid Carbide End Mills • VariMill™									
VariMill I™									
	4V05	1/8–1-1/4"	4	Yes			X		
	4V0T	1/2–1-1/4"	4	Yes			X		
	4VP5	1/4–1"	4	Yes				X	
	4VPT	1/2–1"	4	Yes			X		
	4VN5	1/4–1"	4	Yes				X	
	4VP0	1/4–1"	4	Yes				X	
	4V00	1/8–1-1/4"	4	Yes			X		
VariMill II™									
	5V0C	3/16–1"	5	Yes			X		
	5VNC	1/4–1"	5	Yes			X		
VariMill II™ ER									
	5V0E	3/8–1"	5	Yes			X		
	5VNE	3/8–1"	5	Yes			X		
VariMill II™ Long									
	5W1S	1/4–1"	5	No			X		
VariMill III™ ER									
	7VNX	3/8–1"	7	No			X		
	7V1E	3/8–1"	7	Yes			X		
High-Performance Solid Carbide End Mills • Roughing									
	4Q03/4Q05	3/16–1"	3/4	Yes			X		
	4QN3	1/4–3/4"	3	Yes				X	
	4M0R	1/4–1"	3/4/6	Yes			X		
	4S0R	1/4–1"	3/4/5	Yes			X		
High-Performance Solid Carbide End Mills • Finishing									
	4C03	1/8–1"	3	Yes	X	X		X	
	4C05	1/8–1"	5	Yes			X		
	4S07	1/4–1"	6	Yes			X		
	4S0F	1/4–1"	6/8/10	Yes				X	
High-Performance Solid Carbide End Mills • Micro End Mills									
	4632	0,4–2,0mm	2	Yes	X			X	
	4633	0,4–3,0mm	3	Yes	X			X	
	4651	1,0–2,0mm	2	Yes	X	X		X	

P				M	K	N		S				H		Page References	
1 2 3	4	5	6	1 2 3	1 2 3	1 2 3 4 5	6	1	2	3	4	1 2	3 4		
Steel <35 HRC	Steel >36–48 HRC	PH and Ferritic Stainless Steel <35 HRC	PH and Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron	Non-Ferrous	Graphite	Iron Based	Nickel Based	Pure Titanium	Titanium Alloys	Hardened Steels H1 = <48 HRC H2 = 48–55	H3 = 56–60 HRC H4 = >60 HRC	Product Information	Cutting Data
High-Performance Solid Carbide End Mills • VariMill™ *(continued)*															
VariMill I™ *(continued)*															
●	●	●	●	●	●			○	●	●	●	●		M4–M8	M17
●	○	●	●	○	○			○	●	●	●	●		M9	M18
●	●	○	○	●	○			○	○	○	○	●		M10–M11	M19
○	○	●	●	●	○			○	●	●	●	●		M12	M20
●	●	○	○	●	○			●	○	○	○	●		M13–M14	M21
●	●	●	●	●	○			●	●	●	●	●		M15	M22
●	●	○	○	●	●			●	○	○	○	●		M16	M23
VariMill II™ *(continued)*															
●	●	●	●	●	○			●	○	○	○	●		M26–M27	M29
●	○	●	●	●	○			○	●	●	●	●		M28	M30
VariMill II™ ER *(continued)*															
○	○	●	●	●				●	●	●	●	○		M34	M36
○	○	●	●	●				●	●	●	●	○		M35	M37
VariMill II™ Long *(continued)*															
●	●	●	●	●	○			○	●	●	●	●		M40–M41	M42
VariMill III™ ER *(continued)*															
		○	○	○					●	●	●	○		M46	M48
		○	○	○					●	●	●	○		M47	M49
High-Performance Solid Carbide End Mills • Roughing *(continued)*															
●	●	●	●	○	●			○	○	○	●	○		M54	M58
●	●	●	●	●	●			●	●	●	●	●		M55	M59
●	●	●	●	●	○			○	○	○	●	●	●	M56	M60
●	●	●		○	●			○		○		●		M57	M61
High-Performance Solid Carbide End Mills • Finishing *(continued)*															
●	●	●	●	●	●			●	●	●	●	●		M64	M68
●	○	○	○	○	○			○	○	○	○	○		M65	M69
●	●	●	●	●	●			○	○	●	●	○		M66	M70
●	○	○	○	●	○			○	○	●	○	○		M67	M71
High-Performance Solid Carbide End Mills • Micro End Mills *(continued)*															
●	●	●	●	●	●	●								M74	M77
●	●	●	●	●	●	●								M75	M78
●	●	●	●	●	●	●								M76	M79

● first choice
○ alternate choice

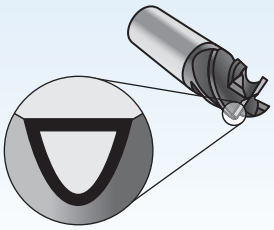
	Series	Range of Diameter Ø min– Ø max inch/metric	Number of Flutes	Cutting Center	Uncoated	TiCN	AlTiN	TiAlN	
High-Performance Solid Carbide End Mills • Aluminum									
AluSurf™									
	5A02	1/4–1"	2	Yes	X				
	5A03	1/4–1"	3	Yes	X				
	5AN2	1/8–1"	2	Yes	X				
	5AN3	1/8–1"	3	Yes	X				
ArCut™									
	4K02	1/8–1"	2	Yes	X	X			
	4K03	1/4–1"	3	Yes	X	X			
High-Performance Aluminum									
	4AN2	1/8–1"	2	Yes	X	X			
	4AN3	3/8–1"	3	Yes	X	X			
	4AP2	1/8–1'	2	Yes	X				
	4AP3	3/8–1"	3	Yes	X				
	4B02	1/4–1"	2	Yes	X				
	4A01	1/8–1"	2	Yes	X	X			
	4AN1	1/4–1"	2	Yes	X				
	4A0R	1/4–1"	3	Yes	X	X			
	4A0B	1/4–3/4"	3	Yes	X				
High-Performance Solid Carbide End Mills • Hard Materials									
VisionPlus™ X-Feed™									
	7FN6	1/4–3/4"	6	No			X		
	7FN7	1/4–3/4"	6	No			X		
VisionPlus™ Micro									
	7N02/7N12/7N22	0,3–3,1mm	2	Yes			X	X	
	423034	0,5–3,0mm	2	Yes			X		
	7N01	0,3–6,0mm	2	Yes			X	X	
	7N21	0,5–3,0mm	2	Yes				X	
VisionPlus™									
	7S05	1/4–1"	4/5/6	Yes			X		
	7S5F	1/8–3/4"	4	Yes			X		
	7S7R	5/32–1"	3/4/6	Yes			X		
	75N2	3,0–12,0mm	2	Yes				X	
	422875	2,0–12,0mm	2	Yes			X		
	7151	1,0–20,0mm	2	Yes				X	
	7061	1,0–12,0mm	2	Yes				X	
	70N1	1,0–12,0mm	2	Yes				X	
	422869/422868	1,0–16,0mm	2	Yes			X		
	422870	2,0–12,0mm	2	Yes			X		
	422873	5,0–10,0mm	2	Yes			X		

P				M	K	N		S				H		Page References	
1 2 3	4	5	6	1 2 3	1 2 3	1 2 3 4 5	6	1	2	3	4	1 2	3 4		
Steel <35 HRC	Steel >36–48 HRC	PH and Ferritic Stainless Steel <35 HRC	PH and Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron	Non-Ferrous	Graphite	Iron Based	Nickel Based	Pure Titanium	Titanium Alloys	Hardened Steels H1 = <48 HRC H2 = 48–55	H3 = 56–60 HRC H4 = >60 HRC	Product Information	Cutting Data
High-Performance Solid Carbide End Mills • Aluminum *(continued)*															
AluSurf™ *(continued)*															
						●								M82–M83	M90
						●								M84–M85	M90
						●								M86–M87	M90
						●								M88–M89	M90
ArCut™ *(continued)*															
						●								M94–M96	M100
						●								M97–M99	M100
High-Performance Aluminum *(continued)*															
						●								M104–M105	M115
						●								M106–M107	M115
						●								M108	M115
						●								M109	M115
						●								M110	M115
						●	○							M111	M116
						●	○							M112	M116
						●								M113	M117
						●								M114	M117
High-Performance Solid Carbide End Mills • Hard Materials *(continued)*															
VisionPlus™ X-Feed™ *(continued)*															
	○											●		M120	M122
												●	●	M121	M123
VisionPlus™ Micro *(continued)*															
●	●	●			●							●	●	M126–M129	M133
○	○											●	●	M130	M134
○	○											●	●	M131	M135
○	○											●	●	M132	M136
VisionPlus™ *(continued)*															
○	●											●	●	M138	M149
○	●											●	●	M139	M150
○	○	○	○	○	○	○		○	○	○	○	●	●	M140	M151
○	○											●	●	M141	M152
○	○											●	●	M142	M152
○	○											●	●	M143	M153
○	○											●	●	M144	M154
○	○											●	●	M145	M155
○	○											●	●	M146	M156
○	○											●	●	M147	M157
○	○											●	●	M148	M158

● first choice
○ alternate choice

	Series	Range of Diameter Ø min– Ø max inch/metric	Number of Flutes	Cutting Center	Uncoated	TiCN	AlTiN	TiAlN	
General Purpose Solid Carbide End Mills • Roughing/Finishing									
VariMill™ GP • 2-Flute									
	I2C	1/8–1"	2	Yes	X			X	
	I2S	1/64–1"	2	Yes	X			X	
	I2B	1/32–1"	2	Yes	X			X	
VariMill GP • 4-Flute									
	I4C	1/16–1 1/4"	4	Yes	X			X	
	I4S	1/64–1"	4	Yes	X			X	
	I4B	1/32–1"	4	Yes				X	
High-Performance High-Speed Steel (HSS-E-PM) • Roughing									
HSS-E ER Rougher									
	620E/621E/623E/625E	1-1/4–2"	6	Yes	X				
WavCut™									
	620W	3/4–2"	4/6	Yes	X				
High-Performance High-Speed Steel									
	6A0R	1/2–1 1/4"	3	Yes	X	X			
	6ANR	1/2–1-1/4"	3	Yes		X			
	6T0R	1/2–1-1/2"	4/5/6	Yes				X	
	6TNR	5/8–1-1/4"	4/5/6	Yes				X	
	3405/3407	3/8–2"	4/6	Yes	X			X	

P				M	K	N		S				H		Page References	
1 2 3	4	5	6	1 2 3	1 2 3	1 2 3 4 5	6	1	2	3	4	1 2	3 4		
Steel <35 HRC	Steel >36–48 HRC	PH and Ferritic Stainless Steel <35 HRC	PH and Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron	Non-Ferrous	Graphite	Iron Based	Nickel Based	Pure Titanium	Titanium Alloys	Hardened Steels H1 = <48 HRC H2 = 48–55	H3 = 56–60 HRC H4 = >60 HRC	Product Information	Cutting Data
General Purpose Solid Carbide End Mills • Roughing/Finishing *(continued)*															
VariMill™ GP • 2-Flute *(continued)*															
●	○			●	●									N4–N5	N11–N12
●	○			●	●									N6–N8	N11–N12
●	○			●	●									N9–N10	N13–N14
VariMill GP • 4-Flute *(continued)*															
●	○			●	●									N20–N22	N28–N29
●	○			●	●									N23–N25	N28–N29
●	○			●	●									N26–N27	N30
High-Performance High Speed Steel (HSS-E-PM) • Roughing *(continued)*															
HSS-E ER Rougher *(continued)*															
				○							●			O4–O5	O5
WavCut™ *(continued)*															
		○		○							○			O8–O9	O16
High-Performance High-Speed Steel *(continued)*															
						●								O10	O17
						●								O11	O17
										○	●			O12	O18
										○	●			O13	O18
										○	●			O14–O15	O18



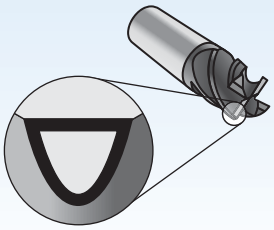
Coatings provide high-speed capability and are engineered for roughing to finishing.

P	Steel
M	Stainless Steel
K	Cast Iron
N	Non-Ferrous
S	High-Temp Alloys
H	Hardened Materials

wear resistance ← → toughness

Grade

Coating	Grade Description		05	10	15	20	25	30	35	40	45
Uncoated, Unocoated -WW, -JJ	Carbide grade made from high-quality, micrograin materials for cutting all types of workpiece materials. Very high toughness ensures a controlled wear rate. The micrograin structure enables extremely sharp cutting edges.	P						■	■	■	
		M					■	■	■		
		K				■	■	■			
		N				■	■	■			
		S					■	■			
WP15PE	Coated carbide grade with thick PVD coating and optimized chemistry and process for increased wear resistance. Outstanding protection in milling of steels to mitigate crater, DOCN (depth-of-cut notching), and flank wear. Excellent performance up to 52 HRC.	P		■	■	■	■				
		M		■	■	■	■				
		K		■	■	■	■				
WS15PE	PVD coated carbide grade with optimized chemistry and process for increased wear resistance. State-of-the art post-coat treatment reduces friction and helps manage heat when cutting super alloys.										
		S	■	■	■	■					
		H	■	■	■	■					
TiN-TT, -TW	This TiN PVD coated grade offers well-balanced machining performance for general purpose applications. This grade offers great versatility at intermediate Metal Removal Rates (MRR).	P					■	■	■	■	
		M					■	■	■	■	
		K					■	■	■	■	
		N					■	■	■	■	
		S					■	■	■	■	
TiAlN-LT1, -LW1	Ultra-fine grain carbide grade with TiAlN PVD multilayer coating for high-performance machining of most materials. This grade is especially designed for dry milling hardened steels due to its unique combination of a high hardness substrate and tough multilayer coating.	P			■	■	■	■			
		H			■	■	■	■			
TiAlN-RT1, -RW1	Ultra-fine carbide grade with TiAlN PVD coating. This grade is a high-performance grade for finishing operations, especially for hardened steels. This grade is characterized by high hardness and wear resistance.	P		■	■	■	■				
		H		■	■	■	■				
TiCN-CT, -CW, -CJ	General purpose coated carbide grade with TiCN PVD coating for use at intermediate cutting speeds. For universal use due to its high wear resistance and hardness. Only use wet or with MQL (Minimum Quantity Lubrication).	P		■	■	■	■				
		M		■	■	■	■				
		K		■	■	■	■				
		N		■	■	■	■				
		H		■	■	■	■				

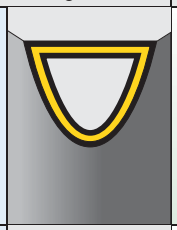
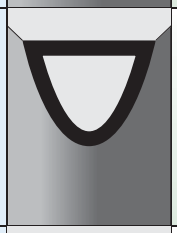
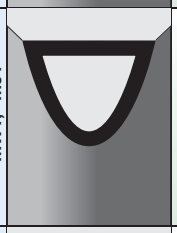
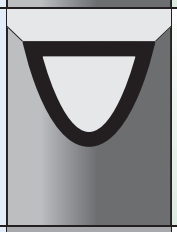
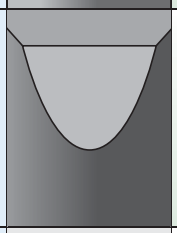
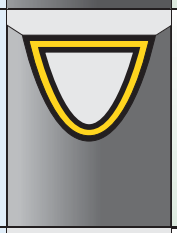
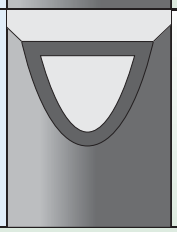


Coatings provide high-speed capability and are engineered for roughing to finishing.

P	Steel
M	Stainless Steel
K	Cast Iron
N	Non-Ferrous
S	High-Temp Alloys
H	Hardened Materials

wear resistance ← → toughness

Grade

Coating		Grade Description		05	10	15	20	25	30	35	40	45
TiAlN-LT, -LW		Coated carbide grade with PVD multilayer coating. This grade is designed for dry milling most types of material, apart from the hardened variety. This grade is characterized by excellent toughness and wear resistance. It provides outstanding protection against cratering and abrasion.	P				■	■	■	■		
			M				■	■	■	■		
			K				■	■	■	■		
			S				■	■	■	■		
TiAlN-RT, -RW,-RJ		Universal carbide grade with TiAlN PVD coating. This grade is a high-performance grade for finishing operations and is characterized by high hardness and wear resistance.	P				■	■	■	■		
			M				■	■	■	■		
			K				■	■	■	■		
			S				■	■	■	■		
AlTiN-MT1, -MW1, -MJ1		AlTiN PVD coated ultra-fine carbide grade. The combination between hard substrate and wear-resistant coating provides outstanding performance in high-feed milling of hardened materials (58–65 HRC).										
			H		■	■	■	■				
AlTiN-MT, -MW		Coated fine-grain grade with AlTiN PVD coating. This grade is a thin, hard PVD coating particularly suitable for cutting steel, cast iron, stainless steel (wet), and titanium (wet) with high metal removal rates. This grade can be used for materials with hardness up to 52 HRC.	P				■	■	■	■		
			M				■	■	■	■		
			K				■	■	■	■		
			S				■	■	■	■		
KC10F		High-quality submicron carbide grade for high-performance machining of non-ferrous alloys. Excellent toughness ensures a controlled wear rate and the submicron structure enables extremely sharp cutting edges.										
			N			■	■	■	■	■		
K30F-DCF		Coated carbide grade with PVD multilayer coating. K30F-DCF is designed for dry milling most types of material, apart from the hardened variety. This grade is characterized by excellent hardness and wear resistance. It provides outstanding protection against cratering and abrasion.	P				■	■	■	■		
			M				■	■	■	■		
			K				■	■	■	■		
K30F-TiCN		General purpose coated carbide grade with TiCN PVD coating for use at intermediate cutting speeds. For universal use due to its high wear resistance and hardness. Only use wet or with MQL (Minimum Quantity Lubrication).	P		■	■	■	■				
			M		■	■	■	■				
			K		■	■	■	■				
			N		■	■	■	■				

Victory™ Grades for High-Performance

Solid Carbide End Mills

Victory

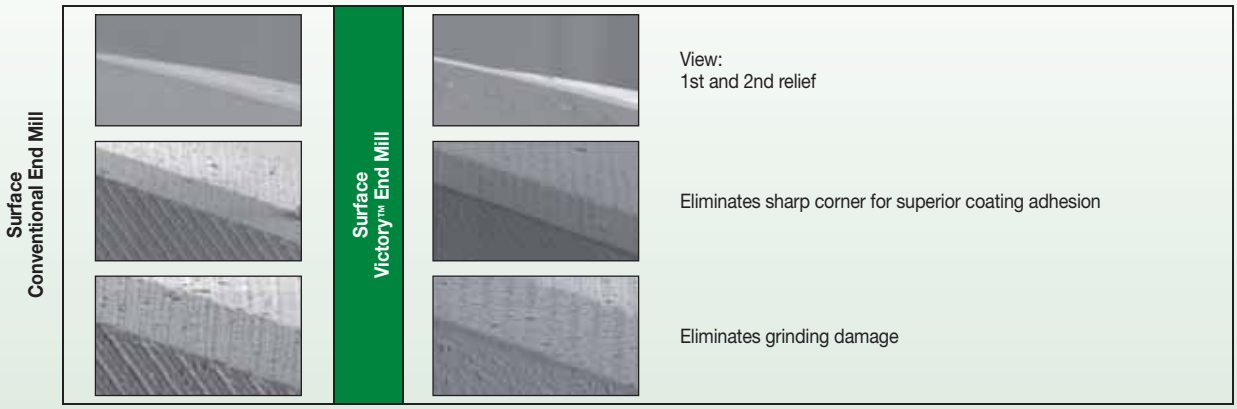
WIDIA™ has taken the next step in solid carbide end mill innovation by introducing the Victory™ Grades WP15PE™ and WS15PE™. Victory combines state-of-the-art surface treatments and proprietary edge technology with the successful market-leading WIDIA geometries, delivering significant improvement to tool life and Metal Removal Rates (MRR). The new Victory Grades can be found across the entire high-performance offering, which includes the VariMill™ family, high-performance roughers, and high-performance finishers.

Features and Benefits

- Innovative edge preparation providing consistent tool life by eliminating most edge microchipping caused by grinding.
- Advanced post-coat finish reducing chip build-up and improving chip flow.
- First-time use of Victory grade nomenclature for better identification of grades.
- Center cutting addition on VariMill II™.

Innovative Advantage of Victory™ Grades

WIDIA VICTORY



WP15PE™	WS15PE™
W = WIDIA™	W = WIDIA
P = Steels	S = High-Temp Alloys
15 = Application Range (Medium to Roughing)	15 = Application Range (Medium to Roughing)
P = Carbide + PVD	P = Carbide + PVD
E = Solid End Mills	E = Solid End Mills
Primary Materials	**Primary Materials**
P0 through P4 Steels	S1 through S4 High-Temp Alloys
M1 through M3 Austenitic Stainless Steels	P5 through P6 Ferritic and Martensitic Stainless Steels
K1 through K3 Cast Irons	H1 Hardened Steels
H1 Hardened Steels	
Secondary Materials	**Secondary Materials**
S1 through S4 High-Temp Alloys	M1 through M3 Austenitic Stainless Steels
H2 Hardened Steels	H2 Hardened Steels

The new Victory grades are spread across the high-performance offering, including high-performance roughers, high-performance finishers, and select VariMill™ platforms.

WIDIA VICTORY

Inch	series	Victory Grade		● first choice ○ alternate choice					
		WP15PE	WS15PE	P	M	K	N	S	H
VariMill I™	4V05, 4V00	✓		●	●	●		○	○
VariMill II™	5V0C, 5VNC	✓		●	●	●		○	○
VariMill II™ ER	5V0E, 5VNE		✓	○	○			●	○
HP Roughers	4Q03, 4M0R, 4S0R	✓		●	●	●		○	○
HP Finishers	4C05, 4Q05, 4S07	✓		●	●	●		○	○

How do the new Victory Catalog numbers work?

Each character in our catalog number signifies a specific trait of that product. Use the following key columns and corresponding images to easily identify which attributes apply.

OLD Grade Nomenclature • Inch

Grade Designation		Series Number			
T	**M**	**5**	**V**	**0**	**S**
		Tool Material	Type of tool	Length of cut	End Geometry
	M = AlTiN **F** = TiAlN **C** = TiCN **R** = TiAlN	**4** = Solid Carbide **5** = Solid Carbide	**V** = VariMill™	**0** Regular **1** Long **2** Extra Long **3** Medium **4** Stub **N** Extended Neck **P** Long Reach; No Neck	**0** 4FL Ball **1** 2FL Ball **2** 2FL CC **3** 3FL CC **4** 4FL NCC **5** 4FL CC **6** 6FL NCC **7** 6FL CC **8** 8FL NCC **9** 8FL CC **A** 3FL Ball **B** 6FL Ball **F** Javelin Finisher **R** Javelin Rougher **S** 5FL NCC **X** Central Coolant Hole **C** Center Cutting **E** Eccentric CC

NEW Victory Nomenclature • Inch

Series Number				
5	**V**	**0**	**C**	**130**
Tool Material	Type of Tool	Length of Cut	End Geometry	Cutting Diameter
4 = Solid Carbide **5** = Solid Carbide	**V** = VariMill	**0** Regular **1** Long **2** Extra Long **3** Medium **4** Stub **N** Extended Neck **P** Long Reach; No Neck	**0** 4FL Ball **1** 2FL Ball **2** 2FL CC **3** 3FL CC **4** 4FL NCC **5** 4FL CC **6** 6FL NCC **7** 6FL CC **8** 8FL NCC **9** 8FL CC **A** 3FL Ball **B** 6FL Ball **F** Javelin Finisher **R** Javelin Rougher **S** 5FL NCC **X** Central Coolant Hole **C** Center Cutting **E** Eccentric CC	**030** 1/8" **050** 3/16" **070** 1/4" **080** 5/16" **100** 3/8" **110** 7/16" **130** 1/2" **140** 9/16" **160** 5/8" **190** 3/4" **250** 1" **320** 1-1/4"

By referencing this easy-to-use guide, you can identify the correct product to meet your needs.

OLD Grade Nomenclature • Inch

130	1	5	B	W
Cutting Diameter	Special Designation	Shank Diameter	Corner Condition	Shank Clamping
030 1/8" **050** 3/16" **070** 1/4" **080** 5/16" **100** 3/8" **110** 7/16" **130** 1/2" **140** 9/16" **160** 5/8" **190** 3/4" **250** 1" **320** 1-1/4"		**0** 3/16" **1** 1/8" **2** 1/4" **3** 5/16" **4** 3/8" **5** 1/2" **6** 5/8" **7** 3/4" **8** 1" **9** 1-1/4"	**A** = .015" **B** = .030" **C** = .060" **D** = .090" **E** = .120" **F** = .250" **N** = Chamfer **X** = SPCL Corner Condition **S** = Sharp	**L** = Plain **W** = Weldon®

NEW Victory Nomenclature • Inch

1	5	B	W	W	P	15	P	E
Special Designation	Shank Diameter	Corner Condition	Shank Clamping	Brand	ISO Material Code	Wear Range	Coating Type	Product Family
	0 3/16" **1** 1/8" **2** 1/4" **3** 5/16" **4** 3/8" **5** 1/2" **6** 5/8" **7** 3/4" **8** 1" **9** 1-1/4"	**A** = .015" **B** = .030" **C** = .060" **D** = .090" **E** = .120" **F** = .250" **N** = Chamfer **X** = SPCL Corner Condition **S** = Sharp	**T** = Plain **W** = Weldon® **V** = SAFE-λOCK®	WIDIA™	**P** = Steel **S** = High-Temperature Alloys	**15** = High Wear	**P** = PVD	**E** = End Mill

Reconditioning Services

WIDIA™ Reconditioning Services Optimize the Total Value of Metalcutting Tools Throughout Their Entire Life

WIDIA Reconditioning Services optimize the value of metalcutting tools throughout their entire lifecycle by giving like-new performance — with rapid turnaround time — so tools are always on hand and perform just like new.

- Local support you can trust.
- Rapid turnaround to minimize inventory.
- Like-new performance continues delivering productivity.
- Application support throughout the tool lifecycle.
- WIDIA proprietary geometry specifications after each regrind.
- WIDIA certified coatings.
- Easy logistics through the reconditioning process.

Simple Logistics

Our unique reconditioning program simplifies sending and receiving reconditioned tools to reduce shipping time and increase on-hand inventory.

To use WIDIA tool reconditioning services, contact your authorized WIDIA distributor to get started.

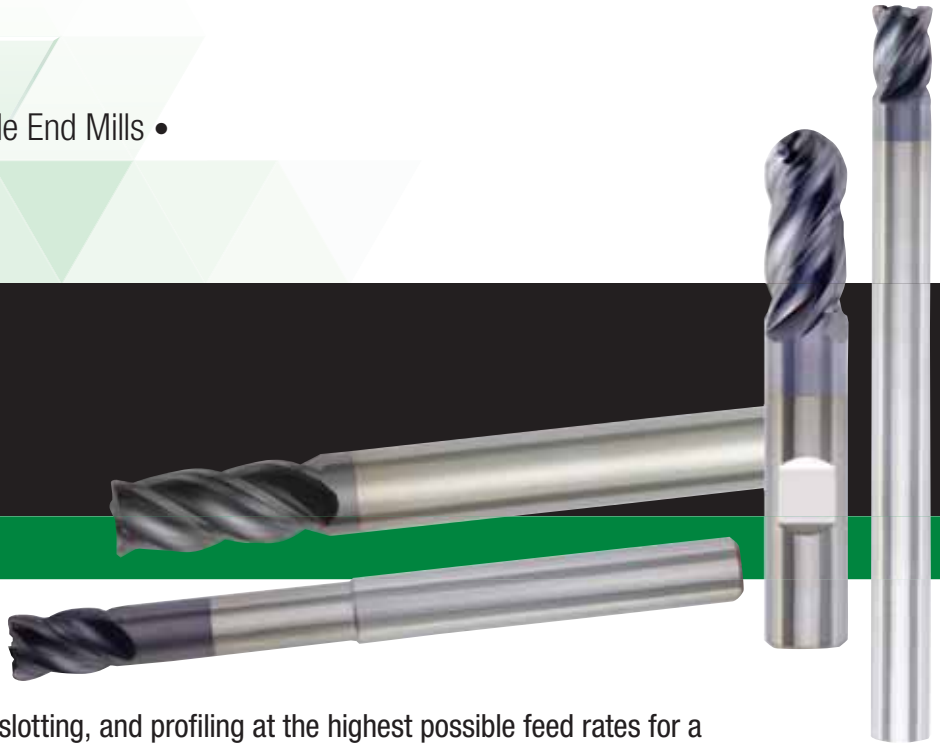
Global Reconditioning Network

To locate a reconditioning center near you, visit **widia.com/services**.

WIDIA™

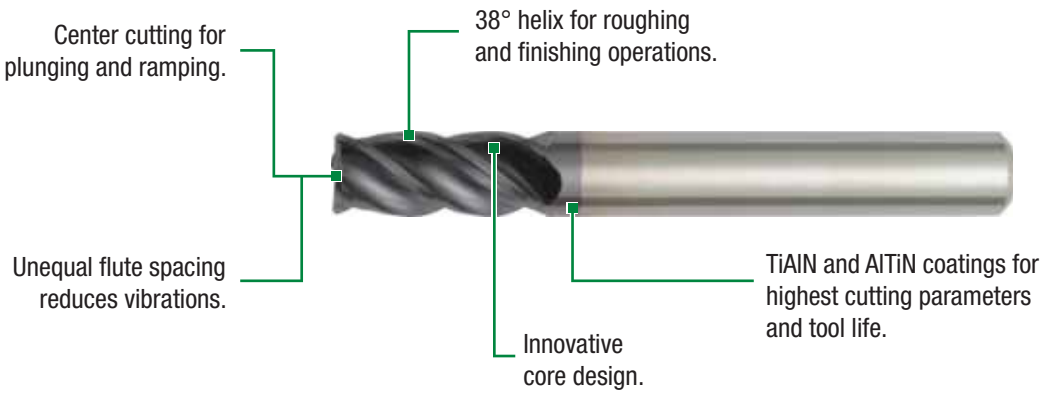
Solid End Milling • High-Performance Solid Carbide End Mills

VariMill I



VariMill I offers plunging, slotting, and profiling at the highest possible feed rates for a wide range of materials. They are designed to provide maximum Metal Removal Rates (MRR) and to achieve superior surface conditions. A wide range of diameters and corner configurations, such as chamfer, radii, and sharp edges, are available from stock.

- High-performance universal tools for almost all workpiece materials.
- Roughing and finishing with one tool.
- Various length-of-cut, long reach and necked versions, ball nose, corner chamfer, and corner radius available.



VariMill I™ Series

- Four unequally spaced flutes.
- Increase your output with less tool changes and increased Metal Removal Rates (MRR).
- No specific tools for roughing and finishing required.
- Less passes due to 1 x D slotting capability.

4V05 Series

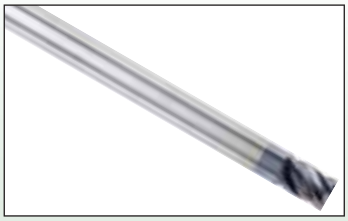
- High metal removal rates and tool life in:
  - — Stainless steels, steels, and alloyed steels.
  - — High-temperature alloys and titanium.
- Radii, sharp, and corner chamfer configuration.

4V0T

- Titanium geometry design.
- Sharp and corner chamfer configuration.

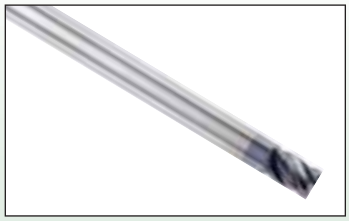
4VP5 Series

- Stainless steel and steel geometry design.
- Sharp and corner chamfer configuration.
- Benefit from long reach design for deep cavities.



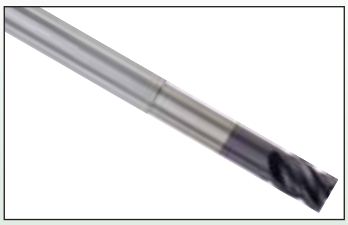
4VPT Series

- Titanium geometry design.
- Sharp and corner chamfer configuration.
- Benefit from long reach design for deep cavities.



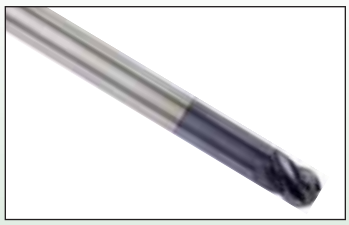
4VN5 Series

- Stainless steel and steel geometry design.
- Sharp and corner chamfer configuration.
- Benefit from long reach and neck design for deep cavities.



4VP0 Series

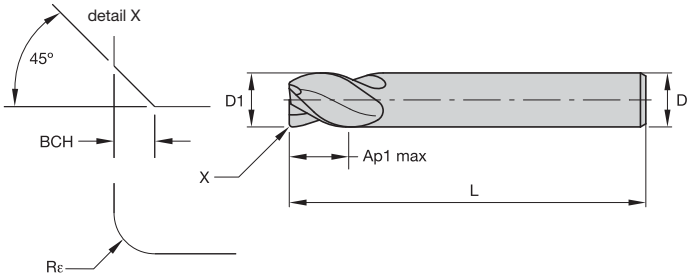
- Center cutting ball nose series.
- Benefit from long reach design for deep cavities.



4V00 Series

- Center cutting ball nose series.
- Benefit from long length of cut.

- Unequal flute spacing.
- Center cutting.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.

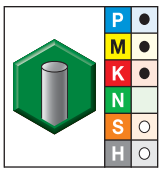


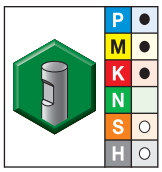
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 4V05 4V15 4V45 4V65 • VariMill I • Victory Grades



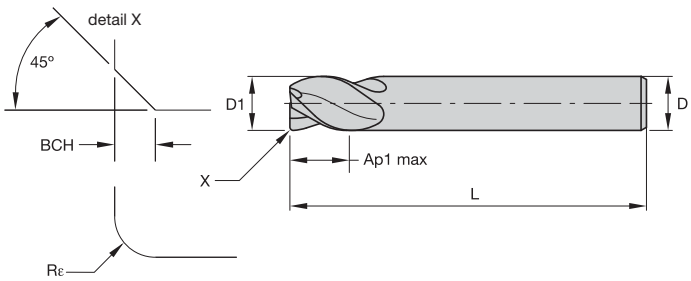


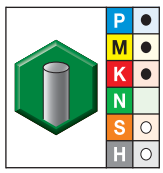
● first choice
○ alternate choice

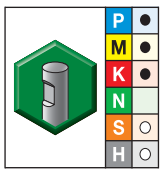
grade WP15PE AlTiN		grade WP15PE AlTiN							
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε	BCH
5576590	4V4503001NT	–		1/8	1/8	1/4	1 1/2	–	.010
5576591	4V4503001ST	–		1/8	1/8	1/4	1 1/2	–	–
5576530	4V0503001AT	–		1/8	1/8	1/2	2	.015	–
5576346	4V0503001ST	–		1/8	1/8	1/2	2	–	–
5576345	4V0503001NT	–		1/8	1/8	1/2	2	–	.010
5576592	4V4505000NT	–		3/16	3/16	5/16	1 1/2	–	.010
5576593	4V4505000ST	–		3/16	3/16	5/16	1 1/2	–	–
5576531	4V0505000AT	–		3/16	3/16	5/8	2 1/4	.015	–
5576532	4V0505000BT	–		3/16	3/16	5/8	2 1/4	.030	–
5576347	4V0505000NT	–		3/16	3/16	5/8	2 1/4	–	.010
5576348	4V0505000ST	–		3/16	3/16	5/8	2 1/4	–	–
5576610	4V4507002BT	–		1/4	1/4	3/8	2	.030	–
5576596	4V4507002ST	–		1/4	1/4	3/8	2	–	–
5576595	4V4507002NT	–		1/4	1/4	3/8	2 1/2	–	.016
5576533	4V0507002AT	–		1/4	1/4	3/4	2 1/2	.015	–
5576534	4V0507002BT	–		1/4	1/4	3/4	2 1/2	.030	–
5576535	4V0507002CT	–		1/4	1/4	3/4	2 1/2	.060	–
5576349	4V0507002NT	–		1/4	1/4	3/4	2 1/2	–	.016
5576510	4V0507002ST	–		1/4	1/4	3/4	2 1/2	–	–
5576577	4V1507002AT	–		1/4	1/4	1 1/4	3 1/4	.015	–

(continued)

(Series 4V05 4V15 4V45 4V65 • VariMill I • Victory Grades — continued)





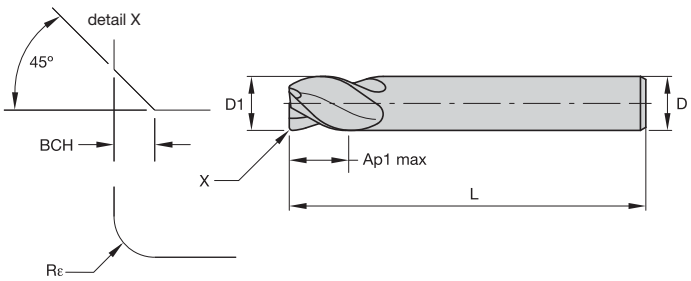


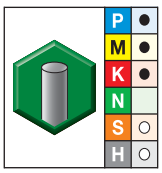
● first choice
○ alternate choice

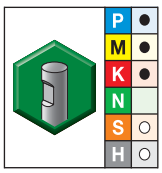
grade WP15PE AlTiN		grade WP15PE AlTiN							
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε	BCH
5576579	4V1507002BT	–		1/4	1/4	1 1/4	3 1/4	.030	–
5576566	4V1507002ST	–		1/4	1/4	1 1/4	3 1/4	–	–
5576611	4V4508003BT	–		5/16	5/16	1/2	2	.030	–
5576597	4V4508003NT	–		5/16	5/16	1/2	2	–	.016
5576598	4V4508003ST	–		5/16	5/16	1/2	2	–	–
5576536	4V0508003AT	–		5/16	5/16	3/4	2 1/2	.015	–
5576537	4V0508003BT	–		5/16	5/16	3/4	2 1/2	.030	–
5576538	4V0508003CT	–		5/16	5/16	3/4	2 1/2	.060	–
5576511	4V0508003NT	–		5/16	5/16	3/4	2 1/2	–	.016
5576512	4V0508003ST	–		5/16	5/16	3/4	2 1/2	–	–
5576580	4V1508003BT	–		5/16	5/16	1 1/4	3 1/4	.030	–
5576567	4V1508003ST	–		5/16	5/16	1 1/4	3 1/4	–	–
5576612	4V4510004BT	–		3/8	3/8	1/2	2	.030	–
5576599	4V4510004NT	–		3/8	3/8	1/2	2	–	.020
5576600	4V4510004ST	–		3/8	3/8	1/2	2	–	–
5576539	4V0510004AT	–		3/8	3/8	7/8	2 1/2	.015	–
5576540	4V0510004BT	–		3/8	3/8	7/8	2 1/2	.030	–
5576542	4V0510004CT	–		3/8	3/8	7/8	2 1/2	.060	–
5576543	4V0510004DT	–		3/8	3/8	7/8	2 1/2	.090	–
5576513	4V0510004NT	–		3/8	3/8	7/8	2 1/2	–	.020
5576514	4V0510004ST	–		3/8	3/8	7/8	2 1/2	–	–
5576581	4V1510004BT	–		3/8	3/8	1 1/2	4	.030	–
5576582	4V1510004CT	–		3/8	3/8	1 1/2	4	.060	–
5576568	4V1510004ST	–		3/8	3/8	1 1/2	4	–	–
5576601	4V451101ANT	–		7/16	7/16	5/8	2 1/2	–	.020
5576602	4V451101AST	–		7/16	7/16	5/8	2 1/2	–	–
5576515	4V051101ANT	–		7/16	7/16	7/8	2 1/2	–	.020
5576516	4V051101AST	–		7/16	7/16	7/8	2 1/2	–	–
5576569	4V151100AST	–		7/16	7/16	2	4	–	–
–		5576613	4V4513005BW	1/2	1/2	5/8	2 1/2	.030	–
–		5576614	4V4513005CW	1/2	1/2	5/8	2 1/2	.060	–
–		5576604	4V4513005NW	1/2	1/2	5/8	2 1/2	–	.020

(continued)

(Series 4V05 4V15 4V45 4V65 • VariMill I • Victory Grades — continued)





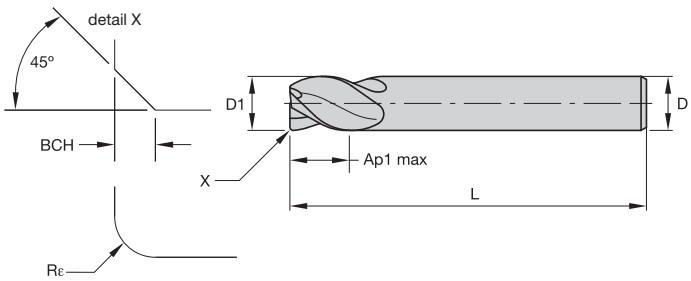


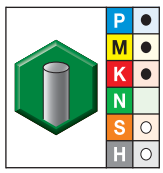
● first choice
○ alternate choice

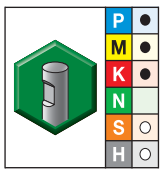
grade WP15PE AlTiN		grade WP15PE AlTiN							
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε	BCH
–		5576605	4V4513005SW	1/2	1/2	5/8	2 1/2	–	–
–		5576518	4V0513005SW	1/2	1/2	1	3	–	–
–		5576517	4V0513005NW	1/2	1/2	1	3	–	.020
–		5576544	4V0513015AW	1/2	1/2	1 1/4	3	.015	–
–		5576545	4V0513015BW	1/2	1/2	1 1/4	3	.030	–
–		5576546	4V0513015CW	1/2	1/2	1 1/4	3	.060	–
–		5576547	4V0513015DW	1/2	1/2	1 1/4	3	.090	–
–		5576548	4V0513015EW	1/2	1/2	1 1/4	3	.120	–
–		5576519	4V0513015NW	1/2	1/2	1 1/4	3	–	.020
–		5576520	4V0513015SW	1/2	1/2	1 1/4	3	–	–
–		5576636	4V6513015BW	1/2	1/2	1 1/2	4	.030	–
–		5576637	4V6513015CW	1/2	1/2	1 1/2	4	.060	–
–		5576621	4V6513015NW	1/2	1/2	1 1/2	4	–	.020
–		5576622	4V6513015SW	1/2	1/2	1 1/2	4	–	–
–		5576583	4V1513005BW	1/2	1/2	2	4	.030	–
–		5576584	4V1513005CW	1/2	1/2	2	4	.060	–
–		5576570	4V1513005SW	1/2	1/2	2	4	–	–
–		5576638	4V6513025BW	1/2	1/2	2 1/4	4 1/2	.030	–
–		5576639	4V6513025CW	1/2	1/2	2 1/4	4 1/2	.060	–
–		5576623	4V6513025SW	1/2	1/2	2 1/4	4 1/2	–	–
–		5576615	4V4516006CW	5/8	5/8	3/4	3	.060	–
–		5576617	4V4516006EW	5/8	5/8	3/4	3	.120	–
–		5576606	4V4516006NW	5/8	5/8	3/4	3	–	.020
–		5576607	4V4516006SW	5/8	5/8	3/4	3	–	–
–		5576549	4V0516006BW	5/8	5/8	1 1/4	3 1/2	.030	–
–		5576550	4V0516006CW	5/8	5/8	1 1/4	3 1/2	.060	–
–		5576551	4V0516006DW	5/8	5/8	1 1/4	3 1/2	.090	–
–		5576552	4V0516006EW	5/8	5/8	1 1/4	3 1/2	.120	–
–		5576528	4V0516006SW	5/8	5/8	1 1/4	3 1/2	–	–
–		5576521	4V0516006NW	5/8	5/8	1 1/4	3 1/4	–	.020
–		5576650	4V6516016CW	5/8	5/8	1 5/8	4 1/8	.060	–
–		5576624	4V6516016NW	5/8	5/8	1 5/8	4 1/8	–	.020

(continued)

(Series 4V05 4V15 4V45 4V65 • VariMill I • Victory Grades — continued)





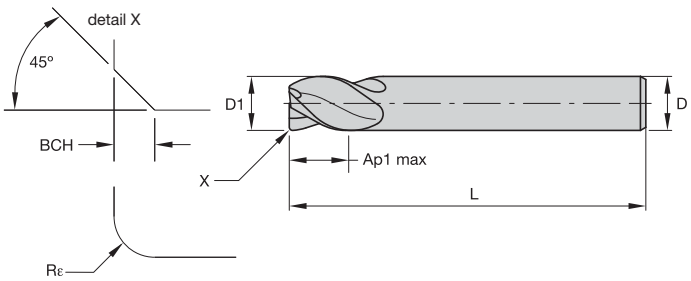


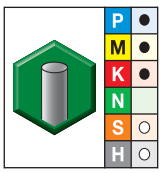
● first choice
○ alternate choice

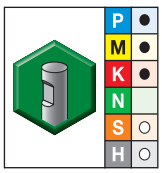
grade WP15PE AlTiN		grade WP15PE AlTiN							
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε	BCH
–		5576625	4V6516016SW	5/8	5/8	1 5/8	4 1/8	–	–
–		5576585	4V1516006CW	5/8	5/8	2 1/4	5	.060	–
–		5576571	4V1516006NW	5/8	5/8	2 1/4	5	–	.020
–		5576572	4V1516006SW	5/8	5/8	2 1/4	5	–	–
–		5576618	4V4519007BW	3/4	3/4	7/8	3 1/2	.030	–
–		5576619	4V4519007CW	3/4	3/4	7/8	3 1/2	.060	–
–		5576620	4V4519007EW	3/4	3/4	7/8	3 1/2	.120	–
–		5576608	4V4519007NW	3/4	3/4	7/8	3 1/2	–	.020
–		5576609	4V4519007SW	3/4	3/4	7/8	3 1/2	–	–
–		5576553	4V0519007BW	3/4	3/4	1 1/2	4	.030	–
–		5576554	4V0519007CW	3/4	3/4	1 1/2	4	.060	–
–		5576555	4V0519007DW	3/4	3/4	1 1/2	4	.090	–
–		5576557	4V0519007EW	3/4	3/4	1 1/2	4	.120	–
–		5576529	4V0519007SW	3/4	3/4	1 1/2	4	–	–
–		5576522	4V0519007NW	3/4	3/4	1 1/2	4	–	.020
–		5576630	4V6519017NW	3/4	3/4	1 5/8	4	–	.020
–		5576631	4V6519017SW	3/4	3/4	1 5/8	4	–	–
–		5576586	4V1519007BW	3/4	3/4	2 1/4	5	.030	–
–		5576587	4V1519007CW	3/4	3/4	2 1/4	5	.060	–
–		5576573	4V1519007NW	3/4	3/4	2 1/4	5	–	.020
–		5576574	4V1519007SW	3/4	3/4	2 1/4	5	–	–
–		5576651	4V6519007BW	3/4	3/4	3	6	.030	–
–		5576652	4V6519007CW	3/4	3/4	3	6	.060	–
–		5576626	4V6519007NW	3/4	3/4	3	6	–	.020
–		5576627	4V6519007SW	3/4	3/4	3	6	–	–
–		5576558	4V0525008BW	1	1	1 1/2	4	.030	–
–		5576560	4V0525008CW	1	1	1 1/2	4	.060	–
–		5576561	4V0525008DW	1	1	1 1/2	4	.090	–
–		5576562	4V0525008EW	1	1	1 1/2	4	.120	–
–		5576563	4V0525008FW	1	1	1 1/2	4	.250	–
–		5576525	4V0525008SW	1	1	1 1/2	4	–	–
–		5576523	4V0525008NW	1	1	1 1/2	4	–	.020

(continued)

(Series 4V05 4V15 4V45 4V65 • VariMill I • Victory Grades — continued)



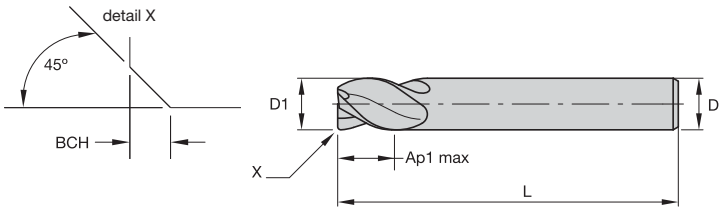




● first choice
○ alternate choice

grade WP15PE AlTiN		grade WP15PE AlTiN							
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε	BCH
–		5576632	4V6525018NW	1	1	2	5	–	.020
–		5576633	4V6525018SW	1	1	2	5	–	–
–		5576588	4V1525008BW	1	1	2 1/4	5	.030	–
–		5576589	4V1525008CW	1	1	2 1/4	5	.060	–
–		5576576	4V1525008SW	1	1	2 1/4	5	–	–
–		5576575	4V1525008NW	1	1	2 1/4	5	–	.020
–		5576653	4V6525028BW	1	1	4	7	.030	–
–		5576654	4V6525028CW	1	1	4	7	.060	–
–		5576634	4V6525028NW	1	1	4	7	–	.020
–		5576635	4V6525028SW	1	1	4	7	–	–
–		5576564	4V0532009BW	1 1/4	1 1/4	2 1/4	5	.030	–
–		5576565	4V0532009EW	1 1/4	1 1/4	2 1/4	5	.120	–
–		5576526	4V0532009NW	1 1/4	1 1/4	2 1/4	5	–	.020
–		5576527	4V0532009SW	1 1/4	1 1/4	2 1/4	5	–	–

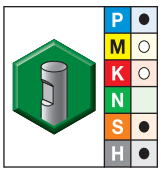
- Unequal flute spacing.
- Center cutting.
- Optimized geometry for titanium machining.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

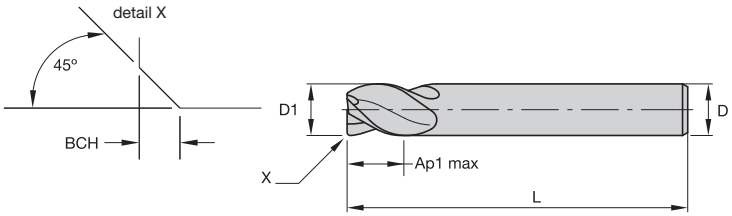
Series 4V0T 4V4T • VariMill I



● first choice
○ alternate choice

grade AlTiN-MW AlTiN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
2870168	TM4V4T13005	1/2	1/2	5/8	2 1/2	.020
2870167	TM4V4T13005S	1/2	1/2	5/8	2 1/2	–
2832003	TM4V0T13015	1/2	1/2	1 1/4	3	.020
2831994	TM4V0T13015S	1/2	1/2	1 1/4	3	–
2870166	TM4V4T16006	5/8	5/8	3/4	3	.020
2870165	TM4V4T16006S	5/8	5/8	3/4	3	–
2831988	TM4V0T16006	5/8	5/8	1 1/4	3 1/2	.020
2831980	TM4V0T16006S	5/8	5/8	1 1/4	3 1/2	–
2870164	TM4V4T19007	3/4	3/4	7/8	3 1/2	.020
2870163	TM4V4T19007S	3/4	3/4	7/8	3 1/2	–
2831974	TM4V0T19007	3/4	3/4	1 1/2	4	.020
2831967	TM4V0T19007S	3/4	3/4	1 1/2	4	–
2831961	TM4V0T25008	1	1	1 1/2	4	.020
2831954	TM4V0T25008S	1	1	1 1/2	4	–
2831947	TM4V0T32009	1 1/4	1 1/4	2 1/4	5	.020
3003329	TM4V0T32009S	1 1/4	1 1/4	2 1/4	5	–

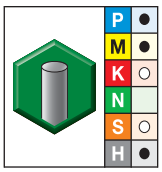
- Unequal flute spacing.
- Center cutting.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series 4VP5 • VariMill I • Extended Reach

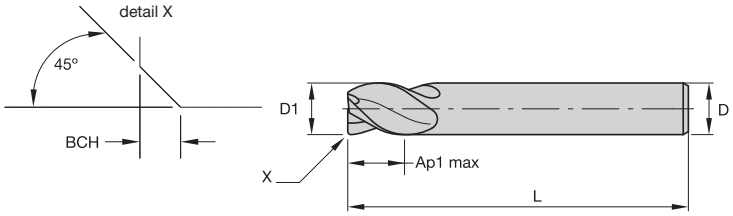


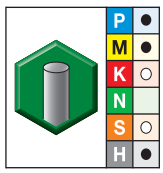
● first choice
○ alternate choice

grade TiAlN-LT TiAlN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
2837046	TF4VP507012S	1/4	1/4	3/8	4	—
2837055	TF4VP507012	1/4	1/4	3/8	4	.016
2837032	TF4VP510014S	3/8	3/8	1/2	4	—
2837038	TF4VP510014	3/8	3/8	1/2	4	.020
2837017	TF4VP513005S	1/2	1/2	5/8	5	—
2837025	TF4VP513005	1/2	1/2	5/8	5	.020
2837002	TF4VP513015S	1/2	1/2	5/8	6	—
2837007	TF4VP513015	1/2	1/2	5/8	6	.020
2836985	TF4VP516006S	5/8	5/8	3/4	5	—
2836992	TF4VP516006	5/8	5/8	3/4	5	.020
2836970	TF4VP516016S	5/8	5/8	3/4	6	—
2836977	TF4VP516016	5/8	5/8	3/4	6	.020
2836951	TF4VP516026S	5/8	5/8	3/4	7	—
2836956	TF4VP516026	5/8	5/8	3/4	7	.020
2836936	TF4VP519007S	3/4	3/4	1	5	—
2836946	TF4VP519007	3/4	3/4	1	5	.020

(continued)

(Series 4VP5 • VariMill I • Extended Reach — continued)

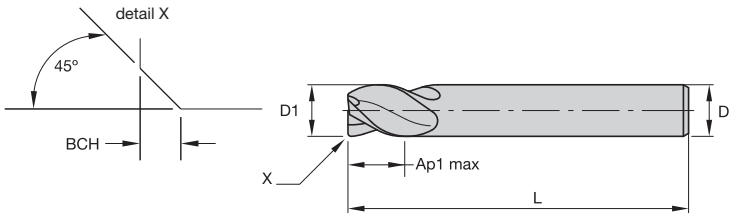




● first choice
○ alternate choice

grade TiAlN-LT TiAlN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
2836921	TF4VP519017S	3/4	3/4	1	6	—
2836930	TF4VP519017	3/4	3/4	1	6	.020
2836907	TF4VP519027S	3/4	3/4	1	7	—
2836916	TF4VP519027	3/4	3/4	1	7	.020
2836892	TF4VP525008S	1	1	1 1/8	5	—
2836900	TF4VP525008	1	1	1 1/8	5	.020
2836879	TF4VP525018S	1	1	1 1/8	6	—
2836887	TF4VP525018	1	1	1 1/8	6	.020
2836863	TF4VP525028S	1	1	1 1/8	7	—
2836872	TF4VP525028	1	1	1 1/8	7	.020

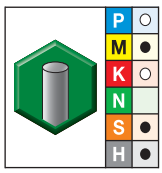
- Unequal flute spacing.
- Center cutting.
- Optimized geometry for titanium machining.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

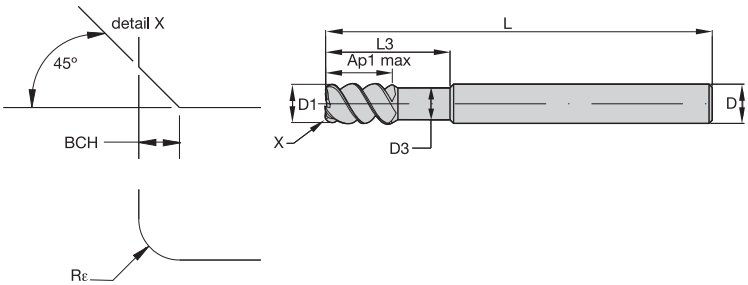
Series 4VPT • VariMill I • Extended Reach



● first choice
○ alternate choice

order #	catalog #	grade AlTiN-MT AlTiN D1	D	length of cut Ap1 max	length L	BCH
2831918	TM4VPT13005	1/2	1/2	5/8	5	.020
2831913	TM4VPT13005S	1/2	1/2	5/8	5	–
2831907	TM4VPT13015	1/2	1/2	5/8	6	.020
2831901	TM4VPT13015S	1/2	1/2	5/8	6	–
2831895	TM4VPT16006	5/8	5/8	3/4	5	.020
3003330	TM4VPT16006S	5/8	5/8	3/4	5	–
2831889	TM4VPT16016	5/8	5/8	3/4	6	.020
3003331	TM4VPT16016S	5/8	5/8	3/4	6	–
2831883	TM4VPT16026	5/8	5/8	3/4	7	.020
2831878	TM4VPT16026S	5/8	5/8	3/4	7	–
2831871	TM4VPT19007	3/4	3/4	1	5	.020
3003332	TM4VPT19007S	3/4	3/4	1	5	–
2831865	TM4VPT19017	3/4	3/4	1	6	.020
3004373	TM4VPT19017S	3/4	3/4	1	6	–
2831858	TM4VPT19027	3/4	3/4	1	7	.020
2988603	TM4VPT19027S	3/4	3/4	1	7	–
2831852	TM4VPT25008	1	1	1 1/8	5	.020
3004374	TM4VPT25008S	1	1	1 1/8	5	–
2831847	TM4VPT25018	1	1	1 1/8	6	.020
2831840	TM4VPT25018S	1	1	1 1/8	6	–
2831835	TM4VPT25028	1	1	1 1/8	7	.020
3004375	TM4VPT25028S	1	1	1 1/8	7	–

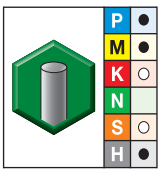
- Unequal flute spacing.
- Center cutting.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.

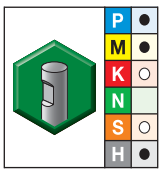


End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series 4VN5 • VariMill I • Extended Reach and Neck



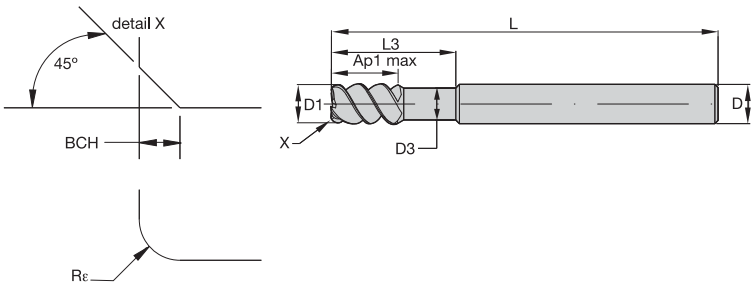


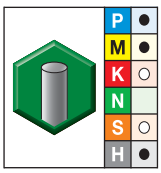
● first choice
○ alternate choice

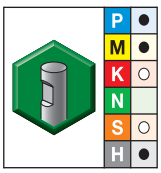
grade TiAlN-LT TiAlN		grade TiAlN-LW TiAlN					length of cut		length		
order #	catalog #	order #	catalog #	D1	D	D3	Ap1 max	L3	L	Rε	BCH
3738940	TF4VN507012A	–		1/4	1/4	.24	3/8	1 1/4	4	.015	–
3738941	TF4VN507012B	–		1/4	1/4	.24	3/8	1 1/4	4	.030	–
2837188	TF4VN507012	–		1/4	1/4	.24	3/8	1 1/4	4	–	.016
3738973	TF4VN510014B	–		3/8	3/8	.35	1/2	1 7/8	4	.030	–
3738974	TF4VN510014C	–		3/8	3/8	.35	1/2	1 7/8	4	.060	–
2837182	TF4VN510014	–		3/8	3/8	.35	1/2	1 7/8	4	–	.020
–		3738975	TF4VN513005B	1/2	1/2	.47	5/8	2 1/4	4	.030	–
–		3738976	TF4VN513005C	1/2	1/2	.47	5/8	2 1/4	4	.060	–
–		3738977	TF4VN513005E	1/2	1/2	.47	5/8	2 1/4	4	.120	–
–		2837178	TF4VN513005	1/2	1/2	.47	5/8	2 1/4	4	–	.020
–		3738978	TF4VN516006C	5/8	5/8	.59	3/4	2 1/4	4 1/8	.060	–
–		3738979	TF4VN516006E	5/8	5/8	.59	3/4	2 1/4	4 1/8	.120	–
–		2837171	TF4VN516006	5/8	5/8	.59	3/4	2 1/4	4 1/8	–	.020
–		2837160	TF4VN516016	5/8	5/8	.59	3/4	3 1/8	5	–	.020
–		2837154	TF4VN519007	3/4	3/4	.71	1	2 1/4	4 1/4	–	.020
–		3738980	TF4VN519017B	3/4	3/4	.71	1	3 1/4	5 1/4	.030	–
–		3738981	TF4VN519017C	3/4	3/4	.71	1	3 1/4	5 1/4	.060	–
–		3738982	TF4VN519017E	3/4	3/4	.71	1	3 1/4	5 1/4	.120	–
–		2837146	TF4VN519017	3/4	3/4	.71	1	3 1/4	5 1/4	–	.020
–		2837125	TF4VN525008	1	1	.94	1 1/8	2 1/4	4 1/2	–	.020

(continued)

(Series 4VN5 • VariMill I • Extended Reach and Neck — continued)



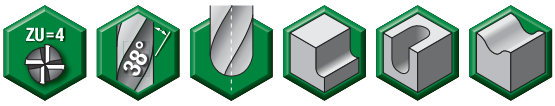


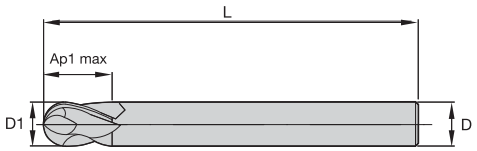


● first choice
○ alternate choice

grade TiAlN-LT TiAlN		grade TiAlN-LW TiAlN									
order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε	BCH
–		3738993	TF4VN525018B	1	1	.94	1 1/8	3 1/4	5 1/2	.030	–
–		3738994	TF4VN525018C	1	1	.94	1 1/8	3 1/4	5 1/2	.060	–
–		3738995	TF4VN525018E	1	1	.94	1 1/8	3 1/4	5 1/2	.120	–
–		2837117	TF4VN525018	1	1	.94	1 1/8	3 1/4	5 1/2	–	.020
–		2837110	TF4VN525028	1	1	.94	1 1/8	4 1/4	6 1/2	–	.020

- Unequal flute spacing.
- Center cutting.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.

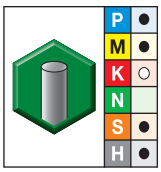




End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

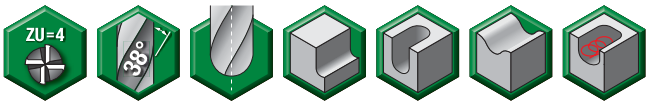
Series 4VP0 • VariMill I • Extended Reach • Ball Nose

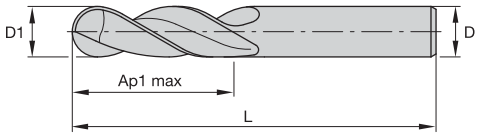


● first choice
○ alternate choice

grade TiAlN-LT TiAlN					
order #	catalog #	D1	D	length of cut Ap1 max	length L
2837105	TF4VP007012	1/4	1/4	3/8	4
3018276	TF4VP010014	3/8	3/8	1/2	4
2837088	TF4VP013005	1/2	1/2	5/8	5
2837081	TF4VP016016	5/8	5/8	3/4	6
2837073	TF4VP019017	3/4	3/4	1	6
2837061	TF4VP025018	1	1	1 1/8	6

- Unequal flute spacing.
- Center cutting.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.



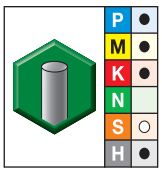


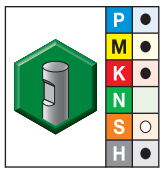
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 4V00 • VariMill I • Extended Length of Cut • Ball Nose • Victory Grades





● first choice
○ alternate choice

grade WP15PE AlTiN		grade WP15PE AlTiN					
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
5576655	4V0003001XT	–		1/8	1/8	1/2	2
5576656	4V0005000XT	–		3/16	3/16	5/8	2 1/4
5576658	4V0007002XT	–		1/4	1/4	3/4	2 1/2
5576659	4V0008003XT	–		5/16	5/16	3/4	2 1/2
5576660	4V0010004XT	–		3/8	3/8	7/8	2 1/2
5576661	4V001101AXT	–		7/16	7/16	7/8	2 1/2
–		5576662	4V0013005XW	1/2	1/2	1	3
–		5576663	4V0013015XW	1/2	1/2	1 1/4	3
–		5576664	4V0016006XW	5/8	5/8	1 1/4	3 1/2
–		5576665	4V0019007XW	3/4	3/4	1 1/2	4
–		5576666	4V0025008XW	1	1	1 1/2	4
–		5576667	4V0032009XW	1 1/4	1 1/4	2 1/4	5

Series 4V05 • VariMill I • Victory Grades

WIDIA VICTORY



Material Group		Side Milling (A) and Slotting (B)			WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.										
		A		B	Cutting Speed — vc SFM				D1 — Diameter									
								frac.	1/8	3/16	1/4	5/16	7/16	3/8	1/2	5/8	3/4	1	1 1/4
		ap	ae	ap	min		max	dec.	.1250	.1875	.2500	.3125	.4375	.3750	.5000	.6250	.7500	1.0000	1.2500
P	0	1.5 x D	0.5 x D	1 x D	490	–	660	IPT	.0009	.0013	.0018	.0023	.0031	.0027	.0034	.0039	.0044	.0049	.0049
	1	1.5 x D	0.5 x D	1 x D	490	–	660	IPT	.0009	.0013	.0018	.0023	.0031	.0027	.0034	.0039	.0044	.0049	.0049
	2	1.5 x D	0.5 x D	1 x D	460	–	620	IPT	.0009	.0013	.0018	.0023	.0031	.0027	.0034	.0039	.0044	.0049	.0049
	3	1.5 x D	0.5 x D	1 x D	390	–	520	IPT	.0007	.0011	.0015	.0020	.0026	.0023	.0029	.0034	.0039	.0045	.0048
	4	1.5 x D	0.5 x D	0.75 x D	300	–	490	IPT	.0007	.0010	.0014	.0017	.0023	.0020	.0026	.0030	.0034	.0039	.0040
	5	1.5 x D	0.5 x D	1 x D	200	–	330	IPT	.0006	.0009	.0012	.0016	.0021	.0018	.0023	.0027	.0031	.0036	.0039
	6	1.5 x D	0.5 x D	0.75 x D	160	–	250	IPT	.0005	.0008	.0010	.0013	.0017	.0015	.0019	.0022	.0025	.0028	.0029
M	1	1.5 x D	0.5 x D	1 x D	300	–	380	IPT	.0007	.0011	.0015	.0020	.0026	.0023	.0029	.0034	.0039	.0045	.0048
	2	1.5 x D	0.5 x D	1 x D	200	–	260	IPT	.0006	.0009	.0012	.0016	.0021	.0018	.0023	.0027	.0031	.0036	.0039
	3	1.5 x D	0.5 x D	1 x D	200	–	230	IPT	.0005	.0008	.0010	.0013	.0017	.0015	.0019	.0022	.0025	.0028	.0029
K	1	1.5 x D	0.5 x D	1 x D	390	–	490	IPT	.0009	.0013	.0018	.0023	.0031	.0027	.0034	.0039	.0044	.0049	.0049
	2	1.5 x D	0.5 x D	1 x D	360	–	460	IPT	.0007	.0011	.0015	.0020	.0026	.0023	.0029	.0034	.0039	.0045	.0048
	3	1.5 x D	0.5 x D	1 x D	360	–	430	IPT	.0006	.0009	.0012	.0016	.0021	.0018	.0023	.0027	.0031	.0036	.0039
S	1	1.5 x D	0.3 x D	0.3 x D	160	–	300	IPT	.0007	.0011	.0015	.0020	.0026	.0023	.0029	.0034	.0039	.0045	.0048
	2	1.5 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0004	.0006	.0008	.0010	.0014	.0012	.0015	.0018	.0021	.0024	.0026
	3	1.5 x D	0.5 x D	1 x D	200	–	260	IPT	.0006	.0009	.0012	.0016	.0021	.0018	.0023	.0027	.0031	.0036	.0039
	4	1.5 x D	0.5 x D	1 x D	160	–	200	IPT	.0005	.0008	.0011	.0014	.0019	.0017	.0021	.0025	.0028	.0033	.0036
H	1	1.5 x D	0.5 x D	0.75 x D	260	–	460	IPT	.0007	.0010	.0014	.0017	.0023	.0020	.0026	.0030	.0034	.0039	.0040
	2	1.5 D	0.2 x D	0.5 x D	230	–	390	IPT	.0005	.0008	.0010	.0013	.0017	.0015	.0019	.0022	.0025	.0028	.0029

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 4V0T 4V4T • VariMill I

Material Group		Side Milling (A) and Slotting (B)			AlTiN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.					
		A		B	Cutting Speed — vc SFM				D1 — Diameter				
								frac.	1/2	5/8	3/4	1	1-1/4
		ap	ae	ap	min		max	dec.	.5000	.6250	.7500	1.0000	1.2500
P	0	1.5 x D	0.5 x D	1 x D	490	–	660	IPT	.0034	.0039	.0044	.0049	.0049
	1	1.5 x D	0.5 x D	1 x D	490	–	660	IPT	.0034	.0039	.0044	.0049	.0049
	2	1.5 x D	0.5 x D	1 x D	460	–	620	IPT	.0034	.0039	.0044	.0049	.0049
	3	1.5 x D	0.5 x D	1 x D	390	–	520	IPT	.0029	.0034	.0039	.0045	.0048
	4	1.5 x D	0.5 x D	0.75 x D	300	–	490	IPT	.0026	.0030	.0034	.0039	.0040
	5	1.5 x D	0.5 x D	1 x D	200	–	330	IPT	.0023	.0027	.0031	.0036	.0039
	6	1.5 x D	0.5 x D	0.75 x D	160	–	250	IPT	.0019	.0022	.0025	.0028	.0029
M	1	1.5 x D	0.5 x D	1 x D	300	–	380	IPT	.0029	.0034	.0039	.0045	.0048
	2	1.5 x D	0.5 x D	1 x D	200	–	260	IPT	.0023	.0027	.0031	.0036	.0039
	3	1.5 x D	0.5 x D	1 x D	200	–	230	IPT	.0019	.0022	.0025	.0028	.0029
K	1	1.5 x D	0.5 x D	1 x D	390	–	490	IPT	.0034	.0039	.0044	.0049	.0049
	2	1.5 x D	0.5 x D	1 x D	360	–	460	IPT	.0029	.0034	.0039	.0045	.0048
	3	1.5 x D	0.5 x D	1 x D	360	–	430	IPT	.0023	.0027	.0031	.0036	.0039
S	1	1.5 x D	0.3 x D	0.3 x D	160	–	300	IPT	.0029	.0034	.0039	.0045	.0048
	2	1.5 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0015	.0018	.0021	.0024	.0026
	3	1.5 x D	0.5 x D	1 x D	200	–	260	IPT	.0023	.0027	.0031	.0036	.0039
	4	1.5 x D	0.5 x D	1 x D	160	–	200	IPT	.0021	.0025	.0028	.0033	.0036
H	1	1.5 x D	0.5 x D	0.75 x D	260	–	460	IPT	.0026	.0030	.0034	.0039	.0040
	2	1.5 x D	0.2 x D	0.5 x D	230	–	390	IPT	.0019	.0022	.0025	.0028	.0029

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 4VP5 • VariMill I

Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.						
		A		B	Cutting Speed — vc SFM				D1 — Diameter					
								frac.	1/4	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3750	.5000	.6250	.7500	1.000
P	0	0.75 x D	0.5 x D	0.75 x D	490	–	660	IPT	.0018	.0027	.0034	.0039	.0044	.0049
	1	0.75 x D	0.5 x D	0.75 x D	490	–	660	IPT	.0018	.0027	.0034	.0039	.0044	.0049
	2	0.75 x D	0.5 x D	0.75 x D	460	–	620	IPT	.0018	.0027	.0034	.0039	.0044	.0049
	3	0.75 x D	0.5 x D	0.75 x D	390	–	520	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	4	0.75 x D	0.5 x D	0.5 x D	300	–	490	IPT	.0014	.0020	.0026	.0030	.0034	.0039
	5	0.75 x D	0.5 x D	0.75 x D	200	–	330	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	6	0.75 x D	0.5 x D	0.5 x D	160	–	250	IPT	.0010	.0015	.0019	.0022	.0025	.0028
M	1	0.75 x D	0.5 x D	0.75 x D	300	–	380	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	2	0.75 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	3	0.75 x D	0.5 x D	0.75 x D	200	–	230	IPT	.0010	.0015	.0019	.0022	.0025	.0028
K	1	0.75 x D	0.5 x D	0.75 x D	390	–	490	IPT	.0018	.0027	.0034	.0039	.0044	.0049
	2	0.75 x D	0.5 x D	0.75 x D	360	–	460	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	3	0.75 x D	0.5 x D	0.75 x D	360	–	430	IPT	.0012	.0018	.0023	.0027	.0031	.0036
S	1	0.75 x D	0.3 x D	0.3 x D	160	–	300	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	2	0.75 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0008	.0012	.0015	.0018	.0021	.0024
	3	0.75 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	4	0.75 x D	0.5 x D	0.75 x D	160	–	200	IPT	.0011	.0017	.0021	.0025	.0028	.0033
H	1	0.75 x D	0.5 x D	0.5 x D	260	–	460	IPT	.0014	.0020	.0026	.0030	.0034	.0039
	2	0.75 x D	0.2 x D	0.75 x D	230	–	390	IPT	.0010	.0015	.0019	.0022	.0025	.0028

NOTE: Lower value of cuting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordiongly on diameters greater than 1/2".
Side milling aplications — for longest reach (L3) tools, reduce ae by 30%.
Slot milling aplications — for longest reach (L3) tools, reduce ae by 30%.

Series 4VPT • VariMill I • Extended Reach

Material Group												
		Side Milling (A) and Slotting (B)			AlTiN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.				
		A		B	Cutting Speed — vc SFM				D1 — Diameter			
								frac.	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.5000	.6250	.7500	1.000
P	1	0.75 x D	0.5 x D	0.75 x D	500	–	650	IPT	.0035	.0039	.0043	.0050
	2	0.75 x D	0.5 x D	0.75 x D	450	–	625	IPT	.0035	.0039	.0043	.0050
	3	0.75 x D	0.5 x D	0.75 x D	400	–	525	IPT	.0029	.0034	.0038	.0046
	4	0.75 x D	0.5 x D	0.5 x D	300	–	475	IPT	.0026	.0030	.0033	.0039
	5	0.75 x D	0.5 x D	0.75 x D	200	–	325	IPT	.0023	.0027	.0030	.0036
	6	0.75 x D	0.5 x D	0.5 x D	150	–	225	IPT	.0019	.0022	.0024	.0028
M	1	0.75 x D	0.5 x D	0.75 x D	260	–	330	IPT	.0029	.0034	.0038	.0046
	2	0.75 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0023	.0027	.0030	.0036
	3	0.75 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0019	.0022	.0024	.0028
K	1	0.75 x D	0.5 x D	0.75 x D	390	–	520	IPT	.0035	.0039	.0043	.0050
	2	0.75 x D	0.5 x D	0.75 x D	360	–	460	IPT	.0029	.0034	.0038	.0046
	3	0.75 x D	0.5 x D	0.75 x D	330	–	430	IPT	.0023	.0027	.0030	.0036
S	1	0.75 x D	0.3 x D	0.3 x D	150	–	275	IPT	.0029	.0034	.0038	.0046
	2	0.75 x D	0.3 x D	0.3 x D	70	–	130	IPT	.0016	.0018	.0020	.0025
	3	0.75 x D	0.5 x D	0.75 x D	160	–	260	IPT	.0023	.0027	.0030	.0036
	4	0.75 x D	0.5 x D	0.75 x D	150	–	210	IPT	.0022	.0025	.0028	.0033
H	1	0.75 x D	0.5 x D	0.5 x D	260	–	450	IPT	.0026	.0030	.0033	.0039

NOTE: Side milling applications — for longest reach (L3) tools, reduce ae by 30%.
Slot milling applications — for longest reach (L3) tools, reduce ap by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 4VN5 • VariMill I

Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.						
		A		B	Cutting Speed — vc SFM				D1 — Diameter					
								frac.	1/4	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3750	.5000	.6250	.7500	1.000
P	1	0.75 x D	0.5 x D	0.75 x D	500	–	650	IPT	.0018	.0027	.0035	.0039	.0043	.0050
	2	0.75 x D	0.5 x D	0.75 x D	450	–	625	IPT	.0018	.0027	.0035	.0039	.0043	.0050
	3	0.75 x D	0.5 x D	0.75 x D	400	–	525	IPT	.0015	.0023	.0029	.0034	.0038	.0046
	4	0.75 x D	0.5 x D	0.5 x D	300	–	475	IPT	.0014	.0020	.0026	.0030	.0033	.0039
	5	0.75 x D	0.5 x D	0.75 x D	200	–	325	IPT	.0012	.0018	.0023	.0027	.0030	.0036
	6	0.75 x D	0.5 x D	0.5 x D	150	–	225	IPT	.0010	.0015	.0019	.0022	.0024	.0028
M	1	0.75 x D	0.5 x D	0.75 x D	260	–	330	IPT	.0015	.0023	.0029	.0034	.0038	.0046
	2	0.75 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0012	.0018	.0023	.0027	.0030	.0036
	3	0.75 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0010	.0015	.0019	.0022	.0024	.0028
K	1	0.75 x D	0.5 x D	0.75 x D	390	–	520	IPT	.0018	.0027	.0035	.0039	.0043	.0050
	2	0.75 x D	0.5 x D	0.75 x D	360	–	460	IPT	.0015	.0023	.0029	.0034	.0038	.0046
	3	0.75 x D	0.5 x D	0.75 x D	330	–	430	IPT	.0012	.0018	.0023	.0027	.0030	.0036
S	1	0.75 x D	0.3 x D	0.3 x D	150	–	275	IPT	.0015	.0023	.0029	.0034	.0038	.0046
	2	0.75 x D	0.3 x D	0.3 x D	70	–	130	IPT	.0008	.0012	.0016	.0018	.0020	.0025
	3	0.75 x D	0.5 x D	0.75 x D	160	–	260	IPT	.0012	.0018	.0023	.0027	.0030	.0036
	4	0.75 x D	0.5 x D	0.75 x D	150	–	210	IPT	.0011	.0017	.0022	.0025	.0028	.0033
H	1	0.75 x D	0.5 x D	0.5 x D	260	–	450	IPT	.0014	.0020	.0026	.0030	.0033	.0039

NOTE: Side milling applications — for longest reach (L3) tools, reduce ae by 30%.
Slot milling applications — for longest reach (L3) tools, reduce ap by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 4VP0 • VariMill I

Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.						
		A		B	Cutting Speed — vc SFM				D1 — Diameter					
								frac.	1/4	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3750	.5000	.6250	.7500	1.000
P	0	0.75 x D	0.5 x D	0.75 x D	490	–	660	IPT	.0018	.0027	.0034	.0039	.0044	.0049
	1	0.75 x D	0.5 x D	0.75 x D	490	–	660	IPT	.0018	.0027	.0034	.0039	.0044	.0049
	2	0.75 x D	0.5 x D	0.75 x D	460	–	620	IPT	.0018	.0027	.0034	.0039	.0044	.0049
	3	0.75 x D	0.5 x D	0.75 x D	390	–	520	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	4	0.75 x D	0.5 x D	0.5 x D	300	–	490	IPT	.0014	.0020	.0026	.0030	.0034	.0039
	5	0.75 x D	0.5 x D	0.75 x D	200	–	330	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	6	0.75 x D	0.5 x D	0.5 x D	160	–	250	IPT	.0010	.0015	.0019	.0022	.0025	.0028
M	1	0.75 x D	0.5 x D	0.75 x D	300	–	380	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	2	0.75 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	3	0.75 x D	0.5 x D	0.75 x D	200	–	230	IPT	.0010	.0015	.0019	.0022	.0025	.0028
K	1	0.75 x D	0.5 x D	0.75 x D	390	–	490	IPT	.0018	.0027	.0034	.0039	.0044	.0049
	2	0.75 x D	0.5 x D	0.75 x D	360	–	460	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	3	0.75 x D	0.5 x D	0.75 x D	360	–	430	IPT	.0012	.0018	.0023	.0027	.0031	.0036
S	1	0.75 x D	0.3 x D	0.3 x D	160	–	300	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	2	0.75 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0008	.0012	.0015	.0018	.0021	.0024
	3	0.75 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	4	0.75 x D	0.5 x D	0.75 x D	160	–	200	IPT	.0011	.0017	.0021	.0025	.0028	.0033
H	1	0.75 x D	0.5 x D	0.5 x D	260	–	460	IPT	.0014	.0020	.0026	.0030	.0034	.0039

NOTE: Lower value of cuting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters greater than 1/2".
Side milling aplications — for longest reach (L3) tools, reduce ae by 30%.
Slot milling aplications — for longest reach (L3) tools, reduce ae by 30%.

Series 4V00 • VariMill I • Victory Grades

WIDIA VICTORY

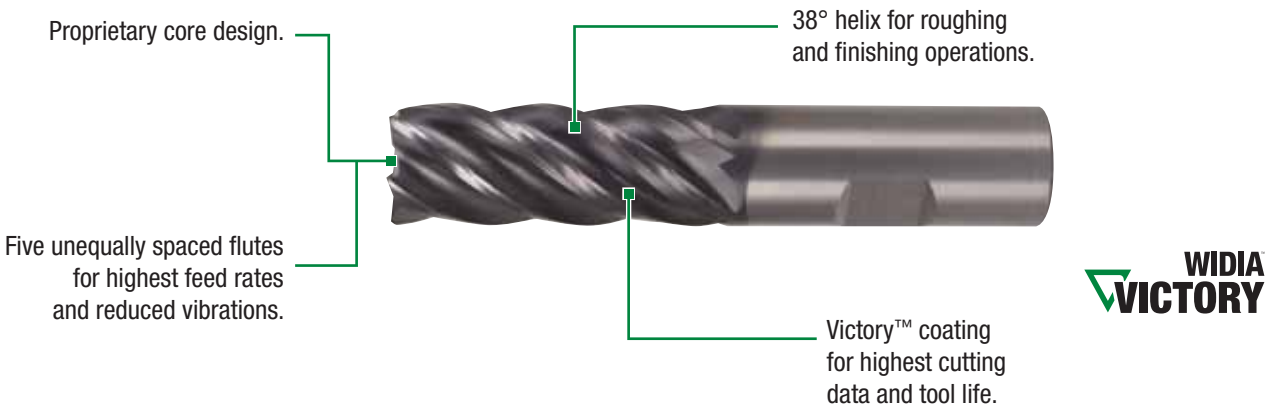
Material Group		Side Milling (A) and Slotting (B)			WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.										
		A		B	Cutting Speed — vc SFM				D1 — Diameter									
		ap	ae	ap	min		max	frac.	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	1	1-1/4
								dec.	.1250	.1875	.2500	.3125	.3750	.4375	.5000	.6250	.7500	1.0000	1.2500
P	0	1.25 x D	0.5 x D	1 x D	490	–	660	IPT	.0009	.0013	.0018	.0023	.0027	.0031	.0034	.0039	.0044	.0049	.0049
	1	1.25 x D	0.5 x D	1 x D	490	–	660	IPT	.0009	.0013	.0018	.0023	.0027	.0031	.0034	.0039	.0044	.0049	.0049
	2	1.25 x D	0.5 x D	1 x D	460	–	620	IPT	.0009	.0013	.0018	.0023	.0027	.0031	.0034	.0039	.0044	.0049	.0049
	3	1.25 x D	0.5 x D	1 x D	390	–	520	IPT	.0007	.0011	.0015	.0020	.0023	.0026	.0029	.0034	.0039	.0045	.0048
	4	1.25 x D	0.5 x D	0.75 x D	300	–	490	IPT	.0007	.0010	.0014	.0017	.0020	.0023	.0026	.0030	.0034	.0039	.0040
	5	1.25 x D	0.5 x D	1 x D	200	–	330	IPT	.0006	.0009	.0012	.0016	.0018	.0021	.0023	.0027	.0031	.0036	.0039
	6	1.25 x D	0.5 x D	0.75 x D	160	–	250	IPT	.0005	.0008	.0010	.0013	.0015	.0017	.0019	.0022	.0025	.0028	.0029
M	1	1.25 x D	0.5 x D	1 x D	300	–	380	IPT	.0007	.0011	.0015	.0020	.0023	.0026	.0029	.0034	.0039	.0045	.0048
	2	1.25 x D	0.5 x D	1 x D	200	–	260	IPT	.0006	.0009	.0012	.0016	.0018	.0021	.0023	.0027	.0031	.0036	.0039
	3	1.25 x D	0.5 x D	1 x D	200	–	230	IPT	.0005	.0008	.0010	.0013	.0015	.0017	.0019	.0022	.0025	.0028	.0029
K	1	1.25 x D	0.5 x D	1 x D	390	–	490	IPT	.0009	.0013	.0018	.0023	.0027	.0031	.0034	.0039	.0044	.0049	.0049
	2	1.25 x D	0.5 x D	1 x D	360	–	460	IPT	.0007	.0011	.0015	.0020	.0023	.0026	.0029	.0034	.0039	.0045	.0048
	3	1.25 x D	0.5 x D	1 x D	360	–	430	IPT	.0006	.0009	.0012	.0016	.0018	.0021	.0023	.0027	.0031	.0036	.0039
S	1	1 x D	0.3 x D	0.3 x D	160	–	300	IPT	.0007	.0011	.0015	.0020	.0023	.0026	.0029	.0034	.0039	.0045	.0048
	2	1 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0004	.0006	.0008	.0010	.0012	.0014	.0015	.0018	.0021	.0024	.0026
	3	1.25 x D	0.5 x D	1 x D	200	–	260	IPT	.0006	.0009	.0012	.0016	.0018	.0021	.0023	.0027	.0031	.0036	.0039
	4	1.25 x D	0.5 x D	1 x D	160	–	200	IPT	.0005	.0008	.0011	.0014	.0017	.0019	.0021	.0025	.0028	.0033	.0036
H	1	1.25 x D	0.5 x D	0.75 x D	260	–	460	IPT	.0007	.0010	.0014	.0017	.0020	.0023	.0026	.0030	.0034	.0039	.0040
	2	1.25 x D	0.2 x D	0.5 x D	230	–	390	IPT	.0005	.0008	.0010	.0013	.0015	.0017	.0019	.0022	.0025	.0028	.0029

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

VariMill II

VariMill II end mills are the proven leader in the field of high-performance, chatter-free machining. They are designed to provide maximum metal removal rates and to achieve supreme surface conditions. Utilizing an innovative and proprietary design with unequal flute spacing, VariMill II carbide end mills provide users with the most versatile technology available, capable of outperforming other high-performance tools.

- 1 x D slotting in titanium and stainless steels with five unequally spaced flutes.
- Roughing and finishing with one tool.
- Various lengths-of-cut; necked and corner radius versions available.



WIDIA VICTORY

VariMill II™ Series

- Five unequally spaced flutes boosting your output with higher feed rates.
- Center cutting.
- Roughing and finishing with one tool.
- Less passes due to 1 x D slotting capability on almost all materials, including titanium.
- Ramping up to 3°.

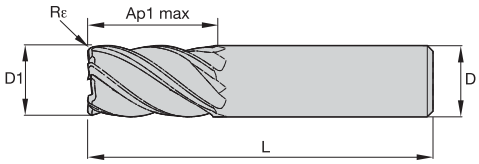
5V0C Series

- Highest metal removal rates and tool life in:
  - Stainless steels, steels, and alloyed steels.
  - Cast iron.
  - High temperature alloys and titanium.
- Corner radii and sharp edges.

5VNC Series

- Steels, stainless steels, and high temperature alloys.
- Radii corner and neck design for depths requiring additional passes.

- Unequal flute spacing.
- Center cutting.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Slotting up to 1 x D.
- Standard items listed. Additional styles and coatings made to order.

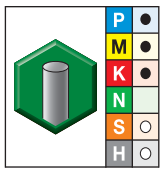


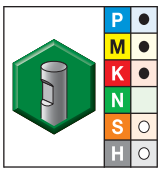
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 5V0C • VariMill II • Victory Grades



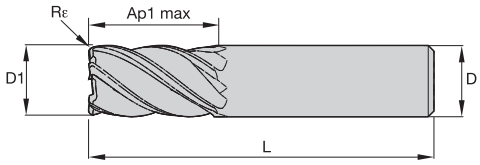


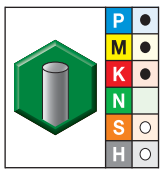
● first choice
○ alternate choice

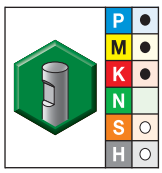
grade WP15PE AlTiN		grade WP15PE AlTiN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
5577051	5V0C05000AT		–	3/16	3/16	5/8	2 1/4	.015
5577052	5V0C05000BT		–	3/16	3/16	5/8	2 1/4	.030
5577053	5V0C05000ST		–	3/16	3/16	5/8	2 1/4	–
5577054	5V0C07002AT		–	1/4	1/4	3/4	2 1/2	.015
5577055	5V0C07002BT		–	1/4	1/4	3/4	2 1/2	.030
5577056	5V0C07002CT		–	1/4	1/4	3/4	2 1/2	.060
5577057	5V0C07002ST		–	1/4	1/4	3/4	2 1/2	–
5577058	5V0C08003AT		–	5/16	5/16	3/4	2 1/2	.015
5577059	5V0C08003BT		–	5/16	5/16	3/4	2 1/2	.030
5577100	5V0C08003CT		–	5/16	5/16	3/4	2 1/2	.060
5577101	5V0C08003ST		–	5/16	5/16	3/4	2 1/2	–
5577102	5V0C10004AT		–	3/8	3/8	7/8	2 1/2	.015
5577103	5V0C10004BT		–	3/8	3/8	7/8	2 1/2	.030
5577104	5V0C10004CT		–	3/8	3/8	7/8	2 1/2	.060
5577105	5V0C10004ST		–	3/8	3/8	7/8	2 1/2	–
5577106	5V0C13015AT	5577107	5V0C13015AW	1/2	1/2	1 1/4	3	.015
5577108	5V0C13015BT	5577109	5V0C13015BW	1/2	1/2	1 1/4	3	.030
5577110	5V0C13015CT	5577111	5V0C13015CW	1/2	1/2	1 1/4	3	.060
5577112	5V0C13015DT	5577113	5V0C13015DW	1/2	1/2	1 1/4	3	.090
5577114	5V0C13015ET	5577115	5V0C13015EW	1/2	1/2	1 1/4	3	.120

(continued)

(Series 5V0C • VariMill II • Victory Grades — continued)



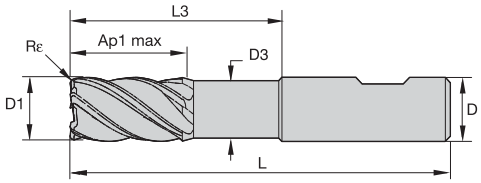




● first choice
○ alternate choice

grade WP15PE AlTiN		grade WP15PE AlTiN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
5577116	5V0C13015ST	5577117	5V0C13015SW	1/2	1/2	1 1/4	3	–
5577118	5V0C16006BT	5577119	5V0C16006BW	5/8	5/8	1 1/4	3 1/2	.030
5577130	5V0C16006CT	5577131	5V0C16006CW	5/8	5/8	1 1/4	3 1/2	.060
5577132	5V0C16006DT	5577133	5V0C16006DW	5/8	5/8	1 1/4	3 1/2	.090
5577134	5V0C16006ST	5577135	5V0C16006SW	5/8	5/8	1 1/4	3 1/2	–
5577136	5V0C19007BT	5577137	5V0C19007BW	3/4	3/4	1 1/2	4	.030
5577138	5V0C19007CT	5577139	5V0C19007CW	3/4	3/4	1 1/2	4	.060
5577160	5V0C19007DT	5577161	5V0C19007DW	3/4	3/4	1 1/2	4	.090
5577162	5V0C19007ET	5577163	5V0C19007EW	3/4	3/4	1 1/2	4	.120
5577164	5V0C19007ST	5577165	5V0C19007SW	3/4	3/4	1 1/2	4	–
5577166	5V0C25008BT	5577167	5V0C25008BW	1	1	1 3/4	4 1/2	.030
5577168	5V0C25008CT	5577169	5V0C25008CW	1	1	1 3/4	4 1/2	.060
5577180	5V0C25008DT	5577181	5V0C25008DW	1	1	1 3/4	4 1/2	.090
5577182	5V0C25008ET	5577183	5V0C25008EW	1	1	1 3/4	4 1/2	.120
5577184	5V0C25008ST	5577185	5V0C25008SW	1	1	1 3/4	4 1/2	–

- Unequal flute spacing.
- Center cutting.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Slotting up to 1 x D.
- Standard items listed. Additional styles and coatings made to order.

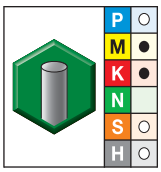


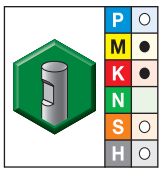
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 5VNC • VariMill II • With Neck • Victory Grades





● first choice
○ alternate choice

grade WP15PE AlTiN		grade WP15PE AlTiN								
order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
5594727	5VNC07012AT		–	1/4	1/4	.24	1/2	1.250	4	.015
5594728	5VNC10014AT		–	3/8	3/8	.35	7/8	1.875	4	.015
5594729	5VNC13005BT	5594850	5VNC13005BW	1/2	1/2	.47	1 1/4	2.250	4	.030
5594851	5VNC16006BT	5594852	5VNC16006BW	5/8	5/8	.59	1 1/4	2.250	4	.030
5594853	5VNC19017BT	5594854	5VNC19017BW	3/4	3/4	.71	1 1/2	3.250	5.5	.030
5594855	5VNC25018BT	5594856	5VNC25018BW	1	1	.94	1 3/4	3.250	5.5	.030

■ Series 5V0C • VariMill II • Victory Grades

WIDIA VICTORY



Material Group		Side Milling (A) and Slotting (B)			WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.								
		A		B	Cutting Speed — vc SFM				D1 — Diameter							
								frac.	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	1.5 x D	0.5 x D	1 x D	490	–	660	IPT	.0014	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	1	1.5 x D	0.5 x D	1 x D	490	–	660	IPT	.0014	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	2	1.5 x D	0.5 x D	1 x D	460	–	620	IPT	.0014	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	3	1.5 x D	0.5 x D	1 x D	390	–	520	IPT	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	1.5 x D	0.5 x D	0.75 x D	300	–	490	IPT	.0010	.0014	.0018	.0020	.0026	.0030	.0034	.0039
	5	1.5 x D	0.5 x D	1 x D	200	–	330	IPT	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
M	1	1.5 x D	0.5 x D	1 x D	300	–	380	IPT	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	1.5 x D	0.5 x D	1 x D	200	–	260	IPT	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	3	1.5 x D	0.5 x D	1 x D	200	–	230	IPT	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
K	1	1.5 x D	0.5 x D	1 x D	390	–	490	IPT	.0014	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	2	1.5 x D	0.5 x D	1 x D	360	–	460	IPT	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	3	1.5 x D	0.5 x D	1 x D	360	–	430	IPT	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
S	1	1.5 x D	0.3 x D	0.3 x D	160	–	300	IPT	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	1.5 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0006	.0008	.0010	.0012	.0015	.0018	.0021	.0024
	3	1.5 x D	0.3 x D	0.3 x D	200	–	260	IPT	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	4	1.5 x D	0.5 x D	1 x D	160	–	200	IPT	.0008	.0011	.0014	.0017	.0021	.0025	.0028	.0033
H	1	1.5 x D	0.5 x D	0.75 x D	260	–	460	IPT	.0010	.0014	.0018	.0020	.0026	.0030	.0034	.0039
	2	1.5 x D	0.2 x D	0.5 x D	230	–	390	IPT	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

■ Series 5VNC • VariMill II • With Neck • Victory Grades



Material Group		Side Milling (A) and Slotting (B)			WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.							
		A		B	Cutting Speed — vc SFM				D1 — Diameter						
								frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	5	1.5 x D	0.5 x D	1 x D	200	–	330	IPT	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	6	1.5 x D	0.5 x D	0.75 x D	160	–	250	IPT	.0010	.0013	.0015	.0019	.0022	.0025	.0028
M	1	1.5 x D	0.5 x D	1 x D	300	–	380	IPT	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	1.5 x D	0.5 x D	1 x D	200	–	260	IPT	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	3	1.5 x D	0.5 x D	1 x D	200	–	230	IPT	.0010	.0013	.0015	.0019	.0022	.0025	.0028
K	1	1.5 x D	0.5 x D	1 x D	390	–	490	IPT	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	2	1.5 x D	0.5 x D	1 x D	360	–	460	IPT	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	3	1.5 x D	0.5 x D	1 x D	360	–	430	IPT	.0012	.0016	.0018	.0023	.0027	.0031	.0036
S	1	1.5 x D	0.3 x D	0.3 x D	160	–	300	IPT	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	1.5 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0008	.0010	.0012	.0015	.0018	.0021	.0024
	3	1.5 x D	0.3 x D	0.3 x D	200	–	260	IPT	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	4	1.5 x D	0.5 x D	1 x D	160	–	200	IPT	.0011	.0014	.0017	.0021	.0025	.0028	.0033
H	1	1.5 x D	0.5 x D	0.75 x D	260	–	460	IPT	.0014	.0018	.0020	.0026	.0030	.0034	.0039
	2	1.5 x D	0.2 x D	0.5 x D	230	–	390	IPT	.0010	.0013	.0015	.0019	.0022	.0025	.0028

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

HydroForce™ HT Chuck

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

HydroForce™ HT Chuck High Torque for High Metal Removal Rates (MRR) and Superior Surface Finish

- HydroForce gives you an unmatched combination of accuracy and clamping forces.
- Compact and stable design.
- Advanced hydraulic clamping with lowest runout and superior vibration dampening.
- Balanced quality to lower vibration, especially at high speeds.
- Focused and flexible product offering.

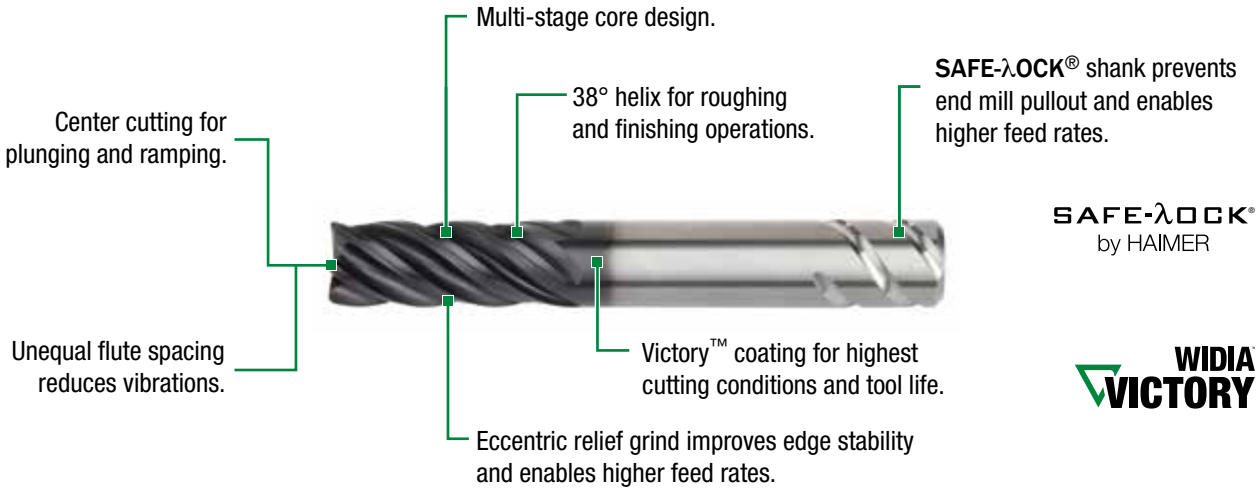
To learn more about our innovations, contact your local Authorized Distributor or visit **widia.com**.

WIDIA™

VariMill II ER

Engineered with Eccentric Relief (ER) grind at the cutting edges for greater edge strength, enabling higher metal removal rates and increased productivity. The new VariMill II ER is the first WIDIA™ off-the-shelf end mill available with **SAFE-λOCK®** by HAIMER, providing excellent stability, eliminating end mill pullout, and increasing concentric tool clamping. Though primarily designed for roughing and finishing applications in the aerospace industry, VariMill II ER can be used as a solution for any titanium or stainless steel application and is capable of slotting, ramping, and plunging.

- High-performance tools for titanium and stainless steel workpiece materials.
- Roughing and finishing with one tool, lowering tool costs.
- Various radius and necked versions available.
- Standard offering with **SAFE-λOCK®** by HAIMER.



SAFE-λOCK® by HAIMER

WIDIA VICTORY

VariMill II™ ER Series

- Unique geometry providing increased tool life and higher metal removal rates in difficult-to-machine workpiece materials.
- Increased output due to fewer tool changes and higher metal removal rates.
- Roughing and finishing with one tool, lowering tool costs.
- 1 x D slotting capability requires less passes, increasing productivity.

5V0E Series

- Eccentric relief for edge stability and strength.
- Extensive radii corner offering.

5VNE Series

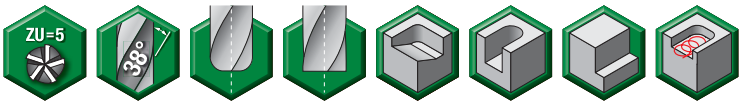
- Eccentric relief for edge stability and strength.
- Extensive radii corner offering.
- Neck design for depths requiring additional passes.

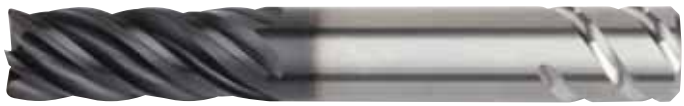
Application Example

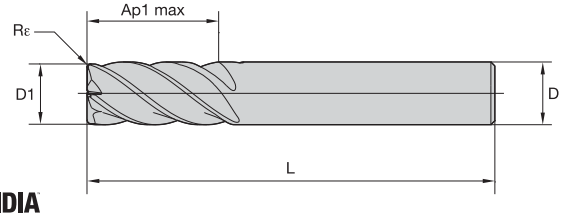
Side milling of INCONEL® 718 component.

Workpiece material:	INCONEL 718
Tool:	D = 5/8"
Cutting data:	ap = 1.08"
	ae = .05"
	vc = 65 SFM
	fz = .0019 in/z
Result:	Increased tool life from 2 workpieces to 5.

- Unequal flute spacing.
- Center cutting.
- Optimized geometry for titanium and stainless steel.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.





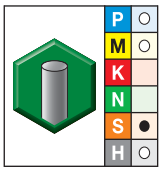


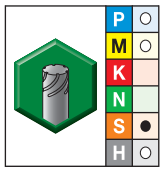
End Mill Tolerances

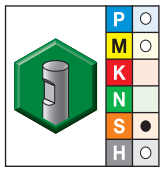
D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 5V0E • VariMill II ER • Victory Grades



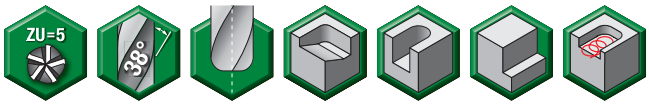


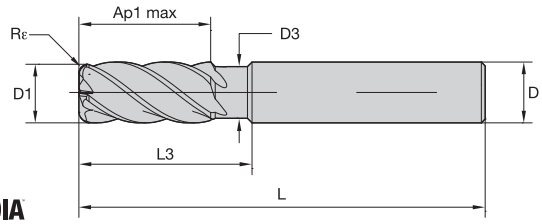


● first choice
○ alternate choice

grade WS15PE AlTiN		grade WS15PE AlTiN		grade WS15PE AlTiN						
order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
5594857	5V0E10004AT		–		–	3/8	3/8	7/8	2 1/2	.015
5594858	5V0E10004BT		–		–	3/8	3/8	7/8	2 1/2	.030
5594859	5V0E10004ST		–		–	3/8	3/8	7/8	2 1/2	–
	–	5594860	5V0E13015AV	5594861	5V0E13015AW	1/2	1/2	1 1/4	3	.015
	–	5594862	5V0E13015BV	5594863	5V0E13015BW	1/2	1/2	1 1/4	3	.030
	–	5594864	5V0E13015CV	5594865	5V0E13015CW	1/2	1/2	1 1/4	3	.060
	–	5594866	5V0E13015DV	5594867	5V0E13015DW	1/2	1/2	1 1/4	3	.090
	–	5594868	5V0E13015EV	5594869	5V0E13015EW	1/2	1/2	1 1/4	3	.120
	–	5594870	5V0E13015SV	5594871	5V0E13015SW	1/2	1/2	1 1/4	3	–
	–	5594872	5V0E16006BV	5594873	5V0E16006BW	5/8	5/8	1 1/4	3 1/2	.030
	–	5594874	5V0E16006CV	5594875	5V0E16006CW	5/8	5/8	1 1/4	3 1/2	.060
	–	5594876	5V0E16006SV	5594877	5V0E16006SW	5/8	5/8	1 1/4	3 1/2	–
	–	5594878	5V0E19007BV	5594879	5V0E19007BW	3/4	3/4	1 1/2	4	.030
	–	5594880	5V0E19007CV	5594881	5V0E19007CW	3/4	3/4	1 1/2	4	.060
	–	5594882	5V0E19007DV	5594883	5V0E19007DW	3/4	3/4	1 1/2	4	.090
	–	5594884	5V0E19007EV	5594885	5V0E19007EW	3/4	3/4	1 1/2	4	.120
	–	5594886	5V0E19007SV	5594887	5V0E19007SW	3/4	3/4	1 1/2	4	–
	–	5594888	5V0E25008BV	5594889	5V0E25008BW	1	1	1 3/4	4 1/2	.030
	–	5594890	5V0E25008CV	5594891	5V0E25008CW	1	1	1 3/4	4 1/2	.060
	–	5594892	5V0E25008EV	5594893	5V0E25008EW	1	1	1 3/4	4 1/2	.120
	–	5594894	5V0E25008FV	5594895	5V0E25008FW	1	1	1 3/4	4 1/2	.250
	–	5594896	5V0E25008SV	5594897	5V0E25008SW	1	1	1 3/4	4 1/2	–

- Unequal flute spacing.
- Center cutting.
- Optimized geometry for titanium and stainless steel.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Standard items listed. Additional styles and coatings made to order.



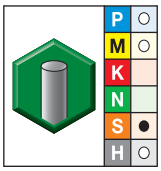


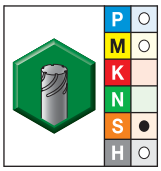
WIDIA VICTORY

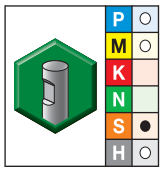
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series 5VNE • VariMill II ER • With Neck • Victory Grades







● first choice
○ alternate choice

grade WS15PE AlTiN		grade WS15PE AlTiN		grade WS15PE AlTiN								
order #	catalog #	order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
5594898	5VNE10014AT	–		–		3/8	3/8	.35	7/8	1.875	4	.015
–		5594899	5VNE13005BV	5594900	5VNE13005BW	1/2	1/2	.47	1 1/4	2.250	4	.030
–		5594901	5VNE16006BV	5594902	5VNE16006BW	5/8	5/8	.59	1 1/4	2.250	4	.030
–		5594903	5VNE19017BV	5594904	5VNE19017BW	3/4	3/4	.71	1 1/2	3.250	5.5	.030
–		5594905	5VNE25018BV	5594906	5VNE25018BW	1	1	.94	1 3/4	3.250	5.5	.030

■ Series 5V0E • VariMill II ER • Victory Grades

Material Group		Side Milling (A) and Slotting (B)			WS15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.					
		A		B	Cutting Speed — vc SFM				D1 — Diameter				
								frac.	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.3750	.5000	.6250	.7500	1.0000
P	5	1.5 x D	0.5 x D	1 x D	200	–	330	IPT	.0018	.0023	.0027	.0031	.0036
	6	1.5 x D	0.5 x D	0.75 x D	160	–	250	IPT	.0015	.0019	.0022	.0025	.0028
M	1	1.5 x D	0.5 x D	1 x D	300	–	380	IPT	.0023	.0029	.0034	.0039	.0045
	2	1.5 x D	0.5 x D	1 x D	200	–	260	IPT	.0018	.0023	.0027	.0031	.0036
	3	1.5 x D	0.5 x D	1 x D	200	–	230	IPT	.0015	.0019	.0022	.0025	.0028
S	1	1.5 x D	0.3 x D	0.3 x D	160	–	300	IPT	.0023	.0029	.0034	.0039	.0045
	2	1.5 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0012	.0015	.0018	.0021	.0024
	3	1.5 x D	0.5 x D	1 x D	200	–	260	IPT	.0018	.0023	.0027	.0031	.0036
	4	1.5 x D	0.5 x D	1 x D	160	–	200	IPT	.0017	.0021	.0025	.0028	.0033
H	1	1.5 x D	0.5 x D	0.75 x D	260	–	460	IPT	.0020	.0026	.0030	.0034	.0039
	2	1.5 x D	0.2 x D	0.5 x D	230	–	390	IPT	.0015	.0019	.0022	.0025	.0028

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

■ Series 5VNE • VariMill II ER • With Neck • Victory Grades

WIDIA VICTORY

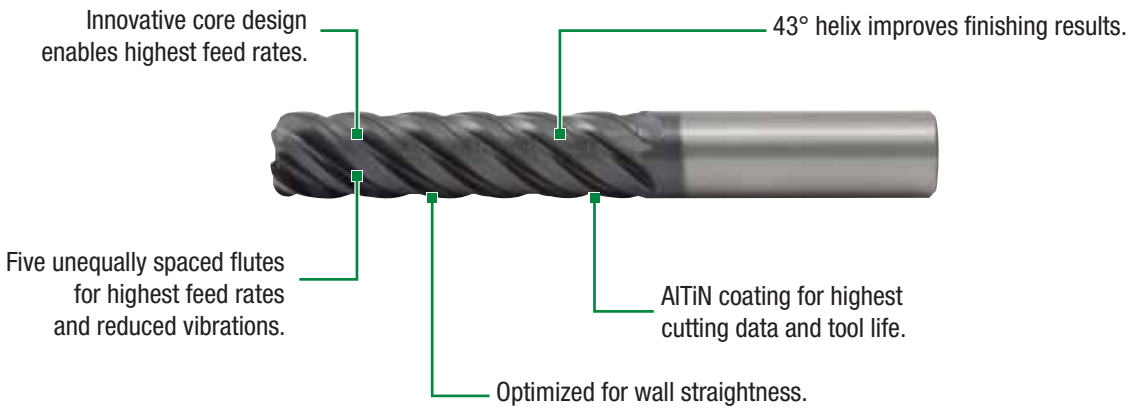
Material Group		Side Milling (A) and Slotting (B)			WS15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.				
		A		B	Cutting Speed — vc SFM				D1 — Diameter			
								frac.	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.3750	.5000	.6250	.7500	1.0000
P	5	1.5 x D	0.5 X D	1 x D	200	–	330	IPT	.0018	.0023	.0027	.0031	.0036
	6	1.5 x D	0.5 X D	0.75 x D	160	–	250	IPT	.0015	.0019	.0022	.0025	.0028
M	1	1.5 x D	0.5 X D	1 x D	300	–	380	IPT	.0023	.0029	.0034	.0039	.0045
	2	1.5 x D	0.5 X D	1 x D	200	–	260	IPT	.0018	.0023	.0027	.0031	.0036
	3	1.5 x D	0.5 X D	1 x D	200	–	230	IPT	.0015	.0019	.0022	.0025	.0028
S	1	1.5 x D	0.3 X D	0.3 X D	160	–	300	IPT	.0023	.0029	.0034	.0039	.0045
	2	1.5 x D	0.3 X D	0.3 X D	80	–	130	IPT	.0012	.0015	.0018	.0021	.0024
	3	1.5 x D	0.3 X D	0.3 X D	200	–	260	IPT	.0018	.0023	.0027	.0031	.0036
	4	1.5 x D	0.5 X D	1 x D	160	–	200	IPT	.0017	.0021	.0025	.0028	.0033
H	1	1.5 x D	0.5 X D	0.75 x D	260	–	460	IPT	.0020	.0026	.0030	.0034	.0039
	2	1.5 x D	0.2 X D	0.5 x D	230	–	390	IPT	.0015	.0019	.0022	.0025	.0028

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

VariMill II Long

Designed to achieve highest surface quality and tool life in titanium, stainless steels, and steels. Innovative core and tool geometry design enable chatter-free corner machining in one pass. VariMill II Long covers 4 x D lengths-of-cut for semi-finishing and fine finishing operations with radii and sharp corner versions from stock.

- Tailored 43° helix improves surface finish.
- Less passes in side milling with 4 x D length-of-cut capability.
- One tool for semi-finishing and fine finishing operations.
- No need for feed rate reduction when machining corners.

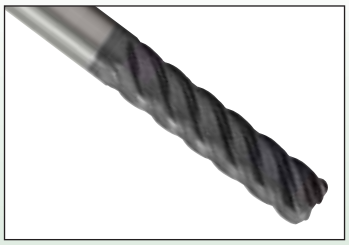


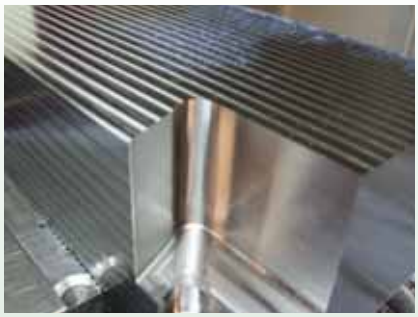
VariMill II™ Long Series

- Achieve excellent surface finish and outstanding wall straightness.
- Benefit from high accuracy even with thin wall machining.
- Simplify your programming of cavities by keeping the feed rate and radial engagement constant.

5W1S Series

- Highest surface quality and tool life in:
  - — Titanium
  - — Stainless steels
- Corner radii and sharp edges.
- 4 x D length of cut.



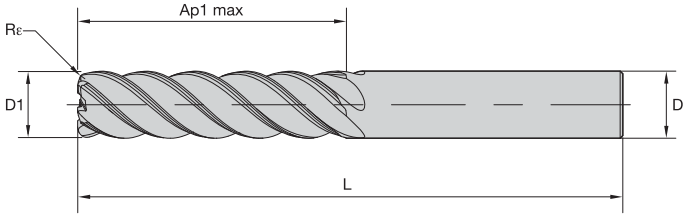


Application Example

Side milling 60° angled corner with constant feed rate.

Workpiece material:	Titanium 6Al-4V
Tool:	D = 5/8"
Cutting data:	ap = 2.5"
	ae = .02"
	vc = 328 SFM
	fz = .0023 IPT
Result:	Surface finish 16 RMS

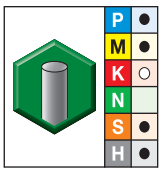
- Unequal flute spacing.
- Non-center cutting.
- For finishing and semi-finishing applications.
- Standard items listed. Additional styles and coatings made to order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002"	≤1/8"	+0/-.00024"
		>1/8–1/4"	+0/-.00031"
		>1/4–3/8"	+0/-.00035"
		>3/8–23/32"	+0/-.00043"
		>23/32–1-3/16"	0/.00051"

Series 5W1S • VariMill II Long • 4 x D Length of Cut

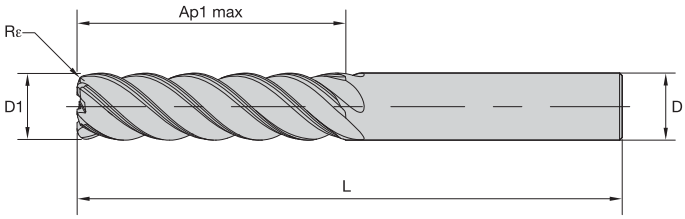


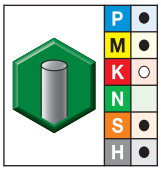
● first choice
○ alternate choice

grade AlTiN-MT AlTiN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
5095168	TM5W1S07002A	1/4	1/4	1	3	.015
5095169	TM5W1S07002B	1/4	1/4	1	3	.030
5095167	TM5W1S07002S	1/4	1/4	1	3	–
5095341	TM5W1S08003A	5/16	5/16	1 1/4	3	.015
5095342	TM5W1S08003B	5/16	5/16	1 1/4	3	.030
5095340	TM5W1S08003S	5/16	5/16	1 1/4	3	–
5095345	TM5W1S10004A	3/8	3/8	1 1/2	4	.015
5095346	TM5W1S10004B	3/8	3/8	1 1/2	4	.030
5095347	TM5W1S10004C	3/8	3/8	1 1/2	4	.060
5095343	TM5W1S10004S	3/8	3/8	1 1/2	4	–
5095420	TM5W1S13005A	1/2	1/2	2	5	.015
5095421	TM5W1S13005B	1/2	1/2	2	5	.030
5095422	TM5W1S13005C	1/2	1/2	2	5	.060
5095348	TM5W1S13005S	1/2	1/2	2	5	–
5095425	TM5W1S16006A	5/8	5/8	2 1/2	5 1/4	.015
5095426	TM5W1S16006B	5/8	5/8	2 1/2	5 1/4	.030
5095427	TM5W1S16006C	5/8	5/8	2 1/2	5 1/4	.060
5095533	TM5W1S16006D	5/8	5/8	2 1/2	5 1/4	.090
5095428	TM5W1S16006E	5/8	5/8	2 1/2	5 1/4	.120
5095423	TM5W1S16006S	5/8	5/8	2 1/2	5 1/4	–

(continued)

(Series 5W1S • VariMill II Long • 4 x D Length of Cut — continued)





● first choice
○ alternate choice

order #	catalog #	grade AlTiN-MT AlTiN	D1	D	length of cut Ap1 max	length L	Rε
5095471	TM5W6S19007A		3/4	3/4	3	6	.015
5095472	TM5W1S19007B		3/4	3/4	3	6	.030
5095473	TM5W1S19007C		3/4	3/4	3	6	.060
5095534	TM5W1S19007D		3/4	3/4	3	6	.090
5095474	TM5W1S19007E		3/4	3/4	3	6	.120
5095429	TM5W1S19007S		3/4	3/4	3	6	—
5095477	TM5W1S25008A		1	1	4	7	.015
5095530	TM5W1S25008B		1	1	4	7	.030
5095531	TM5W1S25008C		1	1	4	7	.060
5095535	TM5W1S25008D		1	1	4	7	.090
5095532	TM5W1S25008E		1	1	4	7	.120
5095475	TM5W1S25008S		1	1	4	7	—

Series 5W1S • VariMill II Long

Material Group		Side Milling (A)		AlTiN-MT		Recommended feed per tooth (IPT = inch/th) for side milling (A).							
		A		Cutting Speed — vc SFM			D1 — Diameter						
						frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	min	max	dec.	.2500	.3125	.3750	.5000	.6250	.7500	1.000
P	1	Ap1 max	0.05 x D*	990	1320	IPT	.0018	.0023	.0027	.0035	.0039	.0043	.0050
	2	Ap1 max	0.05 x D*	924	1254	IPT	.0018	.0023	.0027	.0035	.0039	.0043	.0050
	3	Ap1 max	0.05 x D*	792	1056	IPT	.0015	.0020	.0023	.0029	.0034	.0038	.0046
	4	Ap1 max	0.05 x D*	594	990	IPT	.0014	.0018	.0020	.0026	.0030	.0033	.0039
	5	Ap1 max	0.05 x D*	396	660	IPT	.0012	.0016	.0018	.0023	.0027	.0030	.0036
	6	Ap1 max	0.05 x D*	330	495	IPT	.0010	.0013	.0015	.0019	.0022	.0024	.0028
M	1	Ap1 max	0.05 x D*	594	759	IPT	.0015	.0020	.0023	.0029	.0034	.0038	.0046
	2	Ap1 max	0.05 x D*	396	528	IPT	.0012	.0016	.0018	.0023	.0027	.0030	.0036
	3	Ap1 max	0.05 x D*	396	462	IPT	.0010	.0013	.0015	.0019	.0022	.0024	.0028
K	1	Ap1 max	0.05 x D*	792	990	IPT	.0018	.0023	.0027	.0035	.0039	.0043	.0050
	2	Ap1 max	0.05 x D*	726	858	IPT	.0015	.0020	.0028	.0029	.0034	.0038	.0046
	3	Ap1 max	0.05 x D*	660	858	IPT	.0012	.0016	.0018	.0023	.0027	.0030	.0036
S	1	Ap1 max	0.05 x D*	330	594	IPT	.0015	.0020	.0028	.0029	.0034	.0038	.0046
	2	Ap1 max	0.05 x D*	165	264	IPT	.0008	.0010	.0012	.0016	.0018	.0020	.0025
	3	Ap1 max	0.05 x D*	396	528	IPT	.0012	.0016	.0018	.0023	.0027	.0030	.0036
	4	Ap1 max	0.05 x D*	330	396	IPT	.0011	.0014	.0017	.0022	.0025	.0028	.0033
H	1	Ap1 max	0.05 x D*	462	528	IPT	.0014	.0018	.0020	.0026	.0030	.0033	.0039

**For the above cutting data, do not exceed an overall ae of .032".*

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machinining centers, please adjust parameters accordingly on >1/2" diameter.

X-Feed™ End Mills for High-Feed Milling

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

Specifically engineered to machine hardened steel up to 67 HRC at extreme speeds and feeds

- Unique tool with new 6-flute style for high productivity.
- Necked shanks provide extended reach in deep cavities.
- High feed rates, up to 0.24" per tooth on a 3/4" tool.
- Machine hardened materials at 2–3x the metal removal rate of competitive end mills.
- Wide range of cutting diameters: down to 1/4" for small and medium pocket work.
- Innovative new geometry maximizes metal removal rates.
- High metal removal rates and lower manufacturing costs.

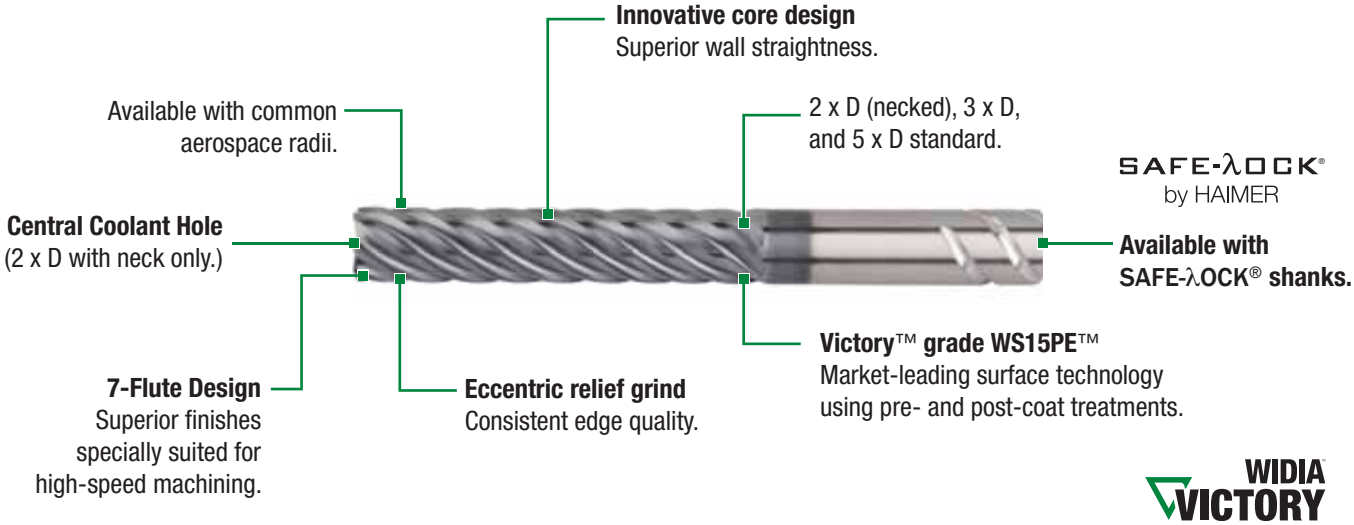
To learn more about our innovations, contact your local Authorized Distributor or visit **widia.com**.

WIDIA™

VariMill III ER

The trend towards more efficiency and increased productivity using high-speed machining techniques such as trochoidal and peel milling will continue to be a focus for aerospace components. The new VariMill III ER is designed to provide the highest Metal Removal Rates (MRR) and extended tool life in the most demanding materials in the aerospace industry. VariMill III ER is designed to be applied in titanium and stainless steel workpiece materials for both semi-finishing and finishing applications.

- 7-flute eccentric relief design provides edge strength along with high productivity.
- Superior surface finishes and wall straightness capability from specialized core.
- Finishing and semi-finishing at up to 30% of the diameter with one tool.
- Central coolant hole on necked 2 x D length-of-cut tools designed for pocketing applications.
- First choice for high-speed machining in difficult-to-cut workpiece materials.



WIDIA VICTORY

VariMill III™ ER Series

- Seven unequally spaced flutes provide the maximum output and surface quality.
- Eccentric relief for edge strength and stability.
- Semi-finishing and finishing with one tool.
- Victory™ grade WS15PE™ for increased heat and wear resistance.

7VNX Series

- Titanium and stainless steel geometry design.
- Corner radii.
- 2 x D length of cut.
- Necked 5 x D reach.
- Central coolant hole.
- **SAFE-λOCK®**.

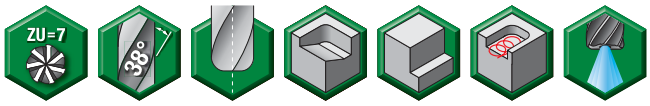
7V2E Series

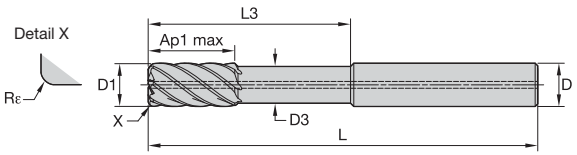
- Titanium and stainless steel geometry design.
- Corner radii.
- 5 x D length of cut.
- Center cutting.
- **SAFE-λOCK®**.

7V1E Series

- Titanium and stainless steel geometry design.
- Corner radii.
- 3 x D length of cut.
- Center cutting.
- **SAFE-λOCK®**.

- Unequal flute spacing.
- Non-center cutting.
- Ramping angle 3°.
- Coolant through the tool.
- Optimized for difficult-to-machine workpiece materials.
- Semi-finishing to finishing applications.
- Standard items listed. Additional styles and coatings made to order.



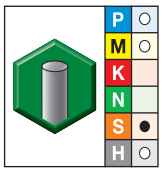


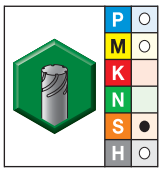
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 7VNX • VariMill III ER • With Neck • Coolant Hole • Victory Grades

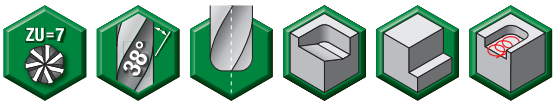


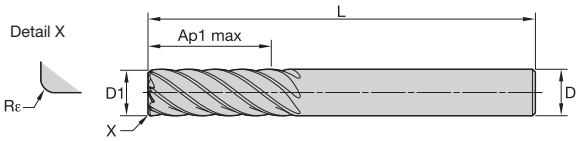


● first choice
○ alternate choice

grade WS15PE AlTiN		grade WS15PE AlTiN								
order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
5971348	7VNX10004AT		–	3/8	3/8	.35	3/4	2.125	4	.015
5971349	7VNX10004BT		–	3/8	3/8	.35	3/4	2.125	4	.030
5971424	7VNX13005BT		–	1/2	1/2	.47	1	2.375	4 1/2	.030
5971425	7VNX13005CT		–	1/2	1/2	.47	1	2.375	4 1/2	.060
5971426	7VNX13005ET		–	1/2	1/2	.47	1	2.375	4 1/2	.120
5971433	7VNX16006BT		–	5/8	5/8	.59	1 1/4	2.750	5	.030
5971434	7VNX16006CT		–	5/8	5/8	.59	1 1/4	2.750	5	.060
5971439	7VNX19007BT	5971442	7VNX19007BV	3/4	3/4	.71	1 1/2	3.125	5 1/2	.030
5971440	7VNX19007CT	5971443	7VNX19007CV	3/4	3/4	.71	1 1/2	3.125	5 1/2	.060
5971441	7VNX19007ET	5971444	7VNX19007EV	3/4	3/4	.71	1 1/2	3.125	5 1/2	.120
5971454	7VNX25008CT	5971455	7VNX25008CV	1	1	.94	2	3.375	6	.060

- Unequal flute spacing.
- Center cutting.
- Ramping angle 3°.
- Optimized for difficult-to-machine workpiece materials.
- Semi-finishing to finishing applications.
- High-speed machining capability.
- Standard items listed. Additional styles and coatings made to order.



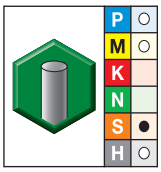


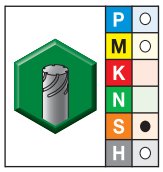
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 7V1E 7V2E • VariMill III ER • Victory Grades





● first choice
○ alternate choice

grade WS15PE AlTiN		grade WS15PE AlTiN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
5971350	7V1E10004AT		–	3/8	3/8	1 1/8	3	.015
5971421	7V1E10004BT		–	3/8	3/8	1 1/8	3	.030
5971422	7V2E10004AT		–	3/8	3/8	1 7/8	4	.015
5971423	7V2E10004BT		–	3/8	3/8	1 7/8	4	.030
5971427	7V1E13005BT		–	1/2	1/2	1 1/2	3 1/2	.030
5971428	7V1E13005CT		–	1/2	1/2	1 1/2	3 1/2	.060
5971429	7V1E13005ET		–	1/2	1/2	1 1/2	3 1/2	.120
	–	5971430	7V2E13005BV	1/2	1/2	2 1/2	4 1/2	.030
	–	5971431	7V2E13005CV	1/2	1/2	2 1/2	4 1/2	.060
	–	5971432	7V2E13005EV	1/2	1/2	2 1/2	4 1/2	.120
5971435	7V1E16006BT		–	5/8	5/8	1 7/8	4	.030
5971436	7V1E16006CT		–	5/8	5/8	1 7/8	4	.060
	–	5971437	7V2E16006BV	5/8	5/8	3 1/8	5 1/2	.030
	–	5971438	7V2E16006CV	5/8	5/8	3 1/8	5 1/2	.060
5971445	7V1E19007BT	5971448	7V1E19007BV	3/4	3/4	2 1/4	5	.030
5971446	7V1E19007CT	5971449	7V1E19007CV	3/4	3/4	2 1/4	5	.060
5971447	7V1E19007ET	5971450	7V1E19007EV	3/4	3/4	2 1/4	5	.120
	–	5971451	7V2E19007BV	3/4	3/4	3 3/4	6	.030
	–	5971452	7V2E19007CV	3/4	3/4	3 3/4	6	.060
	–	5971453	7V2E19007EV	3/4	3/4	3 3/4	6	.120
5971456	7V1E25008CT	5971457	7V1E25008CV	1	1	3	5 1/2	.060
	–	5971458	7V2E25008CV	1	1	5	7 1/2	.060

Series 7VNX • VariMill III ER • With Neck • Semi-Finishing • Victory Grades

WIDIA VICTORY

Material Group		Side Milling (A)		WS15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A).					
		A		Cutting Speed — vc SFM				D1 — Diameter				
							frac.	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.3750	.5000	.6250	.7500	1.0000
P	4	Ap1 max	0.3 x D	300	–	490	IPT	.0020	.0026	.0030	.0034	.0039
	5	Ap1 max	0.3 x D	200	–	330	IPT	.0018	.0023	.0027	.0031	.0036
M	1	Ap1 max	0.3 x D	300	–	380	IPT	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.3 x D	200	–	260	IPT	.0018	.0023	.0027	.0031	.0036
	3	Ap1 max	0.3 x D	200	–	230	IPT	.0015	.0019	.0022	.0025	.0028
S	1	Ap1 max	0.3 x D	160	–	300	IPT	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.3 x D	80	–	130	IPT	.0012	.0015	.0018	.0021	.0024
	3	Ap1 max	0.3 x D	200	–	260	IPT	.0018	.0023	.0027	.0031	.0036
	4	Ap1 max	0.3 x D	160	–	200	IPT	.0017	.0021	.0025	.0028	.0033
H	1	Ap1 max	0.3 x D	260	–	460	IPT	.0020	.0026	.0030	.0034	.0039
	2	Ap1 max	0.3 x D	230	–	390	IPT	.0015	.0019	.0022	.0025	.0028

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 7VNX • VariMill III ER • With Neck • Finishing • Victory Grades

WIDIA VICTORY

Material Group		Side Milling (A)		WS15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A).					
		A		Cutting Speed — vc SFM				D1 — Diameter				
							frac.	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.3750	.5000	.6250	.7500	1.0000
P	4	Ap1 max	0.06 x D	590	–	980	IPT	.0025	.0031	.0036	.0040	.0046
	5	Ap1 max	0.06 x D	390	–	660	IPT	.0022	.0028	.0033	.0037	.0043
M	1	Ap1 max	0.06 x D	590	–	750	IPT	.0027	.0035	.0041	.0046	.0054
	2	Ap1 max	0.06 x D	390	–	520	IPT	.0022	.0028	.0033	.0037	.0043
	3	Ap1 max	0.06 x D	390	–	460	IPT	.0018	.0023	.0027	.0030	.0034
S	1	Ap1 max	0.06 x D	330	–	590	IPT	.0027	.0035	.0041	.0046	.0054
	2	Ap1 max	0.06 x D	160	–	260	IPT	.0015	.0018	.0022	.0025	.0029
	3	Ap1 max	0.06 x D	390	–	520	IPT	.0022	.0028	.0033	.0037	.0043
	4	Ap1 max	0.06 x D	330	–	390	IPT	.0020	.0026	.0030	.0034	.0040
H	1	Ap1 max	0.06 x D	520	–	920	IPT	.0025	.0031	.0036	.0040	.0046
	2	Ap1 max	0.06 x D	460	–	790	IPT	.0018	.0023	.0027	.0030	.0034

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 7V1E • VariMill III ER • Semi-Finishing • Victory Grades

WIDIA VICTORY

Material Group		Side Milling (A)		WS15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A).					
		A		Cutting Speed — vc SFM				D1 — Diameter				
							frac.	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.3750	.5000	.6250	.7500	1.0000
P	4	3 x D	0.2 x D	300	–	490	IPT	.0020	.0026	.0030	.0034	.0039
	5	3 x D	0.2 x D	200	–	330	IPT	.0018	.0023	.0027	.0031	.0036
M	1	3 x D	0.2 x D	300	–	380	IPT	.0023	.0029	.0034	.0039	.0045
	2	3 x D	0.2 x D	200	–	260	IPT	.0018	.0023	.0027	.0031	.0036
	3	3 x D	0.2 x D	200	–	230	IPT	.0015	.0019	.0022	.0025	.0028
S	1	3 x D	0.2 x D	160	–	300	IPT	.0023	.0029	.0034	.0039	.0045
	2	3 x D	0.2 x D	80	–	130	IPT	.0012	.0015	.0018	.0021	.0024
	3	3 x D	0.2 x D	200	–	260	IPT	.0018	.0023	.0027	.0031	.0036
	4	3 x D	0.2 x D	160	–	200	IPT	.0017	.0021	.0025	.0028	.0033
H	1	3 x D	0.2 x D	260	–	460	IPT	.0020	.0026	.0030	.0034	.0039
	2	3 x D	0.2 x D	230	–	390	IPT	.0015	.0019	.0022	.0025	.0028

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 7V1E • VariMill III ER • Finishing • Victory Grades

WIDIA VICTORY

Material Group		Side Milling (A)		WS15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A).					
		A		Cutting Speed — vc SFM				D1 — Diameter				
							frac.	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.3750	.5000	.6250	.7500	1.0000
P	4	3 x D	0.06 x D	590	–	980	IPT	.0025	.0031	.0036	.0040	.0046
	5	3 x D	0.06 x D	390	–	660	IPT	.0022	.0028	.0033	.0037	.0043
M	1	3 x D	0.06 x D	590	–	750	IPT	.0027	.0035	.0041	.0046	.0054
	2	3 x D	0.06 x D	390	–	520	IPT	.0022	.0028	.0033	.0037	.0043
	3	3 x D	0.06 x D	390	–	460	IPT	.0018	.0023	.0027	.0030	.0034
S	1	3 x D	0.06 x D	330	–	590	IPT	.0027	.0035	.0041	.0046	.0054
	2	3 x D	0.06 x D	160	–	260	IPT	.0015	.0018	.0022	.0025	.0029
	3	3 x D	0.06 x D	390	–	520	IPT	.0022	.0028	.0033	.0037	.0043
	4	3 x D	0.06 x D	330	–	390	IPT	.0020	.0026	.0030	.0034	.0040
H	1	3 x D	0.06 x D	520	–	920	IPT	.0025	.0031	.0036	.0040	.0046
	2	3 x D	0.06 x D	460	–	790	IPT	.0018	.0023	.0027	.0030	.0034

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 7V2E • VariMill III ER • Finishing • Victory Grades

Material Group		Side Milling (A)		WS15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A).					
		A		Cutting Speed — vc SFM				D1 — Diameter				
							frac.	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.3750	.5000	.6250	.7500	1.0000
P	0	5 x D	0.05 x D	980	–	1310	IPT	.0033	.0041	.0047	.0053	.0059
	1	5 x D	0.05 x D	980	–	1310	IPT	.0033	.0041	.0047	.0053	.0059
	2	5 x D	0.05 x D	920	–	1250	IPT	.0033	.0041	.0047	.0053	.0059
	3	5 x D	0.05 x D	790	–	1050	IPT	.0027	.0035	.0041	.0046	.0054
	4	5 x D	0.05 x D	590	–	980	IPT	.0025	.0031	.0036	.0040	.0046
	5	5 x D	0.05 x D	390	–	660	IPT	.0022	.0028	.0033	.0037	.0043
	6	5 x D	0.05 x D	330	–	490	IPT	.0018	.0023	.0027	.0030	.0034
M	1	5 x D	0.05 x D	590	–	750	IPT	.0027	.0035	.0041	.0046	.0054
	2	5 x D	0.05 x D	390	–	520	IPT	.0022	.0028	.0033	.0037	.0043
	3	5 x D	0.05 x D	390	–	460	IPT	.0018	.0023	.0027	.0030	.0034
K	1	5 x D	0.05 x D	790	–	980	IPT	.0033	.0041	.0047	.0053	.0059
	2	5 x D	0.05 x D	720	–	920	IPT	.0027	.0035	.0041	.0046	.0054
	3	5 x D	0.05 x D	720	–	850	IPT	.0022	.0028	.0033	.0037	.0043
S	1	5 x D	0.05 x D	330	–	590	IPT	.0027	.0035	.0041	.0046	.0054
	2	5 x D	0.05 x D	160	–	260	IPT	.0015	.0018	.0022	.0025	.0029
	3	5 x D	0.05 x D	390	–	520	IPT	.0022	.0028	.0033	.0037	.0043
	4	5 x D	0.05 x D	330	–	390	IPT	.0020	.0026	.0030	.0034	.0040
H	1	5 x D	0.05 x D	520	–	920	IPT	.0025	.0031	.0036	.0040	.0046
	2	5 x D	0.06 x D	460	–	790	IPT	.0018	.0023	.0027	.0030	.0034

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Designed to significantly reduce machining time in aluminum!

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

AluSurf™ Carbide End Mills for High Metal Removal Rates and Superior Surface Finishes

- Use only one tool for roughing and finishing operations.
- Slotting is effective up to full, 1 x D axial depth; side milling (profiling) is effective up to 0.5 x D, radial by 1.5 x D axial depth.
- Three-flute series uses unequal flute spacing for chatter-free performance.
- Effective in a full range of machine speeds.
- Multiple corner radii and extended neck configurations are available as standard.

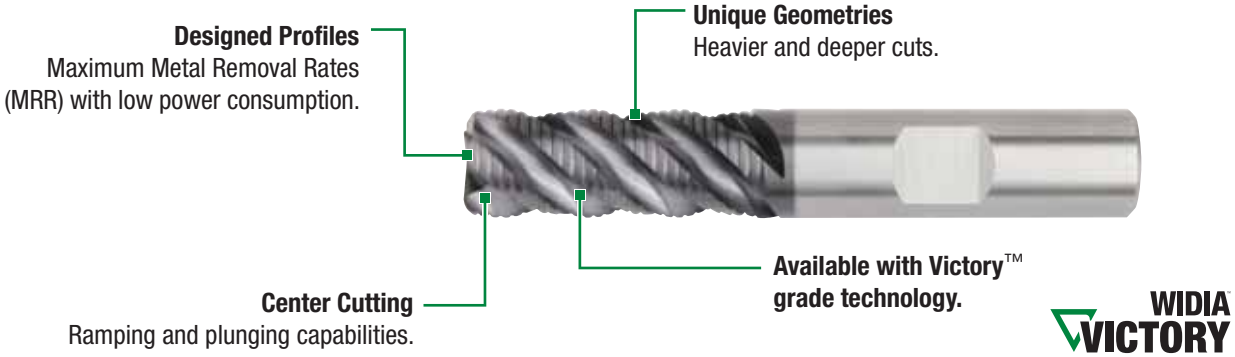
To learn more about our innovations, contact your local Authorized Distributor or visit **widia.com**.

WIDIA™

HP ROUGHER

Special proprietary carbide substrates and state-of-the-art surface technology, combined with unique geometries, provides end users with the capability to significantly reduce machining time with heavier and deeper cuts, fewer passes, and faster surface speed. WIDIA™ geometries are uniquely formed and fine-tuned to optimize chip form, size, and evacuation generated by a given workpiece material.

- For all ferrous workpiece materials.
- Low power consumption at high speeds with long tool life.
- Provides maximum metal removal rates in both slotting and profiling operations.
- Alternative solution for productivity gains on light machines.



High-Performance Solid Carbide Roughers

- Reduce machine time with heavier, deeper cuts requiring fewer passes.
- Lower power consumption at higher speeds providing productivity even when horsepower may be limited.
- Maximum Metal Removal Rates (MRR) in both slotting and profiling.

4Q03 4Q05 Series

- Center cutting.
- Chipbreaker profile.
- All ferrous workpiece materials.

4M0R Series

- Center cutting.
- Flat shallow profile.
- Steels, stainless steel, high-temperature alloys.

4QN3 Series

- Center cutting.
- Chipbreaker profile.
- Necked for reach.
- Steels, stainless steels, high-temperature alloys, and hardened steels.

4S0R Series

- Center cutting.
- Fine profile.
- All ferrous workpiece materials.

Rougher Profiles

Finishing End Mill

Straight cutting edge
Ra = 0,5–0,8
Rz = 4–6

Fine-Profile Rougher

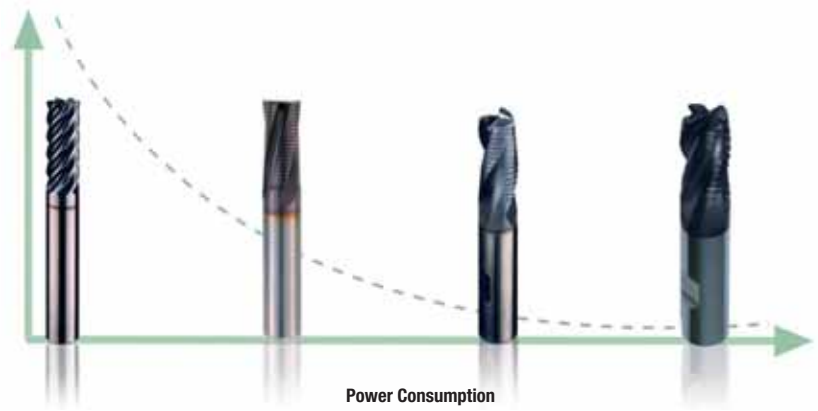
Cord profile
Ra = 12–14
Rz = 90–110

Semi-Finishing End Mill

Flat profile
Ra = 2,5–3,5
Rz = 20–25

Coarse Profile Rougher

Roughing profile
Ra = 2,5–3,5
Rz = 20–25



Coarse profile
For slotting, pocketing, and heavy profile cuts in ferrous materials.

Fine profile
For profile cuts and shallow slots (less than .50) in ferrous materials.

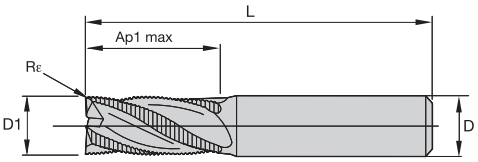
Extra-Fine profile
For profiling cuts in medium to hard steels.

Chamfered profile
For machining non-ferrous materials.

Flat shallow profile
For machining alloyed steels, stainless steels, high-temp alloys, titanium, and hard materials.

Chipbreaker profile
For roughing and semi-finishing.

- Center cutting.
- Chipbreaker profile.
- Standard items listed. Additional styles and coatings made-to-order.

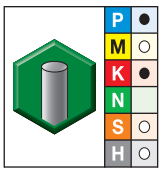


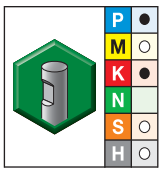
End Mill Tolerances

D1	tolerance d11	D	tolerance h6 + / -
< 1/8"	-.0008/-.0031	< 1/8"	0/.00024
1/8–7/32"	-.0012/-.0041	1/8–7/32"	0/.00031
1/4–3/8"	-.0016/-.0051	1/4–3/8"	0/.00035
13/32–11/16"	-.002/-.0063	13/32–11/16"	0/.00043
23/32–1-3/16"	-.0026/-.0077	23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 4Q03 4Q05 4Q43 • Victory Grades

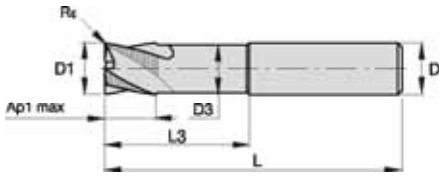




● first choice
○ alternate choice

grade WP15PE AlTiN		grade WP15PE AlTiN							
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε	ZU
	–	5576744	4Q4305000XW	3/16	3/16	5/16	2	.010	3
5576674	4Q0305000XT		–	3/16	3/16	5/8	2	.010	3
	–	5576745	4Q4307002XW	1/4	1/4	3/8	2	.020	3
	–	5576675	4Q0307002XW	1/4	1/4	3/4	2 1/2	.020	3
	–	5576746	4Q4308003XW	5/16	5/16	7/16	2	.020	3
	–	5576676	4Q0308003XW	5/16	5/16	13/16	2 1/2	.020	3
	–	5576747	4Q4310014XW	3/8	3/8	1/2	2	.020	3
	–	5576677	4Q0310014XW	3/8	3/8	1	2 1/2	.020	3
	–	5576748	4Q4313015BW	1/2	1/2	5/8	2 1/2	.030	3
	–	5576678	4Q0313015BW	1/2	1/2	1 1/4	3	.030	3
	–	5576749	4Q4316016BW	5/8	5/8	3/4	3	.030	3
	–	5576679	4Q0316006BW	5/8	5/8	1 5/8	3 1/2	.030	3
	–	5576750	4Q4319017BW	3/4	3/4	1	3 1/2	.030	3
	–	5576740	4Q0319007BW	3/4	3/4	1 5/8	4	.030	3
	–	5576742	4Q0519007BW	3/4	3/4	1 5/8	4	.030	4
	–	5576741	4Q0325008BW	1	1	2	4	.030	3
	–	5576743	4Q0525008BW	1	1	2	4	.030	4

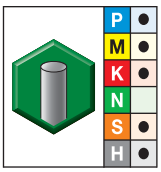
- Center cutting.
- Chipbreaker profile.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance d11	D	tolerance h6 + / -
< 1/8"	-.0008/-.0031	< 1/8"	0/.00024
1/8–7/32"	-.0012/-.0041	1/8–7/32"	0/.00031
1/4–3/8"	-.0016/-.0051	1/4–3/8"	0/.00035
13/32–11/16"	-.002/-.0063	13/32–11/16"	0/.00043
23/32–1-3/16"	-.0026/-.0077	23/32–1 3/16"	0/.00051

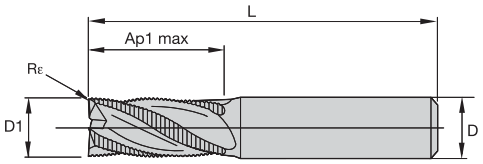
Series 4QN3



● first choice
○ alternate choice

grade TiAlN-LT TiAlN								
order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
2837893	TF4QN307012A	1/4	1/4	.24	3/8	2 1/4	4	.020
2837886	TF4QN310014A	3/8	3/8	.35	1/2	2 1/4	4	.020
2837879	TF4QN310024A	3/8	3/8	.35	1/2	3 1/4	5	.020
2837870	TF4QN313005A	1/2	1/2	.47	5/8	2 1/4	5	.030
2837862	TF4QN313015A	1/2	1/2	.47	5/8	3 1/4	6	.030
2837856	TF4QN313025A	1/2	1/2	.47	5/8	4	6	.030
2837849	TF4QN316006A	5/8	5/8	.59	3/4	2 1/4	5	.030
2837845	TF4QN316016A	5/8	5/8	.59	3/4	3 1/4	6	.030
2837833	TF4QN316026A	5/8	5/8	.59	3/4	4 1/4	7	.030
2837826	TF4QN319007A	3/4	3/4	.71	1	2 1/4	5	.030
2837821	TF4QN319017A	3/4	3/4	.71	1	3 1/4	6	.030
2837812	TF4QN319027A	3/4	3/4	.71	1	4 1/4	7	.030

- Center cutting.
- Flat shallow profile.
- Standard items listed. Additional styles and coatings made-to-order.

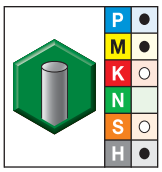


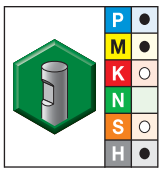
End Mill Tolerances

D1	tolerance d11	D	tolerance h6 + / -
< 1/8"	-.0008/-.0031	< 1/8"	0/.00024
1/8–7/32"	-.0012/-.0041	1/8–7/32"	0/.00031
1/4–3/8"	-.0016/-.0051	1/4–3/8"	0/.00035
13/32–11/16"	-.002/-.0063	13/32–11/16"	0/.00043
23/32–1-3/16"	-.0026/-.0077	23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 4M0R 4M4R • Victory Grades

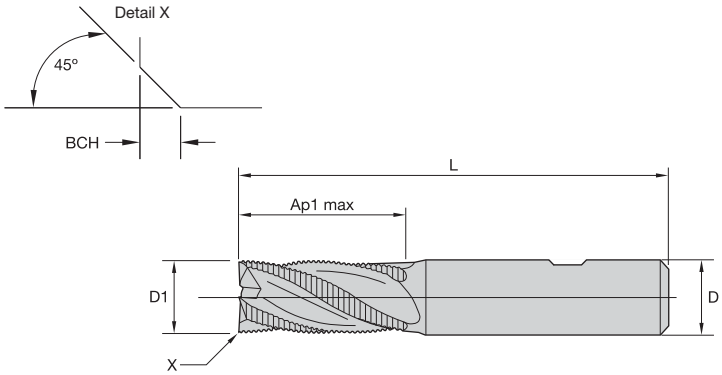




● first choice
○ alternate choice

grade WP15PE AlTiN		grade WP15PE AlTiN							
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε	ZU
5577384	4M4R07002BT	–		1/4	1/4	3/8	2	.030	3
5577315	4M0R07002BT	–		1/4	1/4	3/4	2 1/2	.030	4
5577385	4M4R10004BT	–		3/8	3/8	1/2	2	.030	4
5577316	4M0R10004BT	–		3/8	3/8	7/8	2 1/2	.030	4
–		5577386	4M4R13005XW	1/2	1/2	5/8	2 1/2	.040	4
–		5577317	4M0R13005XW	1/2	1/2	1 1/4	3	.040	4
–		5577387	4M4R16006XW	5/8	5/8	3/4	3	.040	4
–		5577318	4M0R16006XW	5/8	5/8	1 1/4	3 1/2	.040	4
–		5577319	4M0R16016XW	5/8	5/8	1 1/4	3 1/2	.040	6
–		5577388	4M4R19009XW	3/4	3/4	7/8	3 1/2	.050	4
–		5577380	4M0R19007XW	3/4	3/4	1 1/2	4	.050	4
–		5577381	4M0R19017XW	3/4	3/4	1 1/2	4	.050	6
–		5577383	4M0R25018XW	1	1	1 1/2	4	.050	6
–		5577382	4M0R25008XW	1	1	1 1/2	4	.050	4

- Center cutting.
- Fine profile.
- Standard items listed. Additional styles and coatings made-to-order.

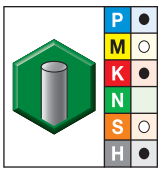


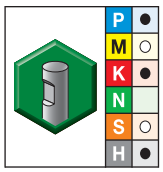
End Mill Tolerances

D1	tolerance d11	D	tolerance h6 + / -
< 1/8"	-.0008/-.0031	< 1/8"	0/.00024
1/8–7/32"	-.0012/-.0041	1/8–7/32"	0/.00031
1/4–3/8"	-.0016/-.0051	1/4–3/8"	0/.00035
13/32–11/16"	-.002/-.0063	13/32–11/16"	0/.00043
23/32–1-3/16"	-.0026/-.0077	23/32–1 3/16"	0/.00051

WIDIA VICTORY

Series 4S0R • Victory Grades

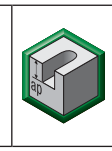


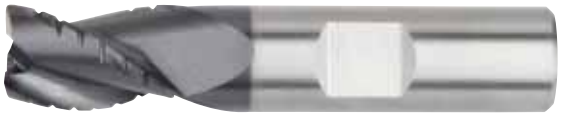


● first choice
○ alternate choice

grade WP15PE AlTiN		grade WP15PE AlTiN							
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH	ZU
5577389	4S0R07002NT	–		1/4	1/4	3/4	2 1/2	.012	3
–		5577390	4S0R10004NW	3/8	3/8	7/8	2 1/2	.020	4
–		5577391	4S0R13005NW	1/2	1/2	1	3	.020	4
–		5577392	4S0R16006NW	5/8	5/8	1 1/4	3 1/2	.020	4
–		5577393	4S0R19007NW	3/4	3/4	1 1/2	4	.020	4
–		5577394	4S0R25008NW	1	1	1 1/2	4	.020	5
–		5577395	4S0R25018NW	1	1	1 1/2	4	.020	4

■ Series 4Q03 4Q05 4Q43 • Victory Grades





Material Group		Side Milling (A) and Slotting (B)			WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.								
		A		B	Cutting Speed — vc SFM				D1 — Diameter							
								frac.	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	1 x D	0.5 x D	0.75 x D	490	–	660	IPT	.0014	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	1	1 x D	0.5 x D	0.75 x D	490	–	660	IPT	.0014	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	2	1 x D	0.5 x D	0.75 x D	460	–	620	IPT	.0014	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	3	1 x D	0.5 x D	0.75 x D	390	–	520	IPT	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	1 x D	0.4 x D	0.5 x D	300	–	490	IPT	.0010	.0014	.0018	.0020	.0026	.0030	.0034	.0039
	5	1 x D	0.5 x D	0.75 x D	200	–	330	IPT	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	6	1 x D	0.4 x D	0.5 x D	160	–	250	IPT	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
M	1	1 x D	0.5 x D	0.75 x D	300	–	380	IPT	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	1 x D	0.4 x D	0.75 x D	200	–	260	IPT	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	3	1 x D	0.4 x D	0.75 x D	200	–	230	IPT	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
K	1	1 x D	0.5 x D	0.75 x D	390	–	490	IPT	.0014	.0018	.0023	.0027	.0034	.0040	.0044	.0049
	2	1 x D	0.5 x D	0.75 x D	360	–	460	IPT	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	3	1 x D	0.4 x D	0.75 x D	360	–	430	IPT	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
S	1	1 x D	0.3 x D	0.4 x D	160	–	300	IPT	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	1 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0006	.0008	.0010	.0012	.0015	.0018	.0021	.0024
	3	1 x D	0.4 x D	0.75 x D	200	–	260	IPT	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	4	1 x D	0.4 x D	0.75 x D	160	–	200	IPT	.0008	.0011	.0014	.0017	.0021	.0025	.0028	.0033
H	1	1 x D	0.2 x D	0.3 x D	260	–	460	IPT	.0010	.0014	.0018	.0020	.0026	.0030	.0034	.0039

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 4QN3



Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.					
		A		B	Cutting Speed — vc SFM				D1 — Diameter				
								frac.	1/4	3/8	1/2	5/8	3/4
		ap	ae	ap	min		max	dec.	.2500	.3750	.5000	.6250	.7500
P	1	1 x D	0.3 x D	0.5 x D	500	–	650	IPT	.0018	.0027	.0035	.0039	.0043
	2	1 x D	0.3 x D	0.5 x D	450	–	625	IPT	.0018	.0027	.0035	.0039	.0043
	3	1 x D	0.3 x D	0.5 x D	400	–	525	IPT	.0015	.0023	.0029	.0034	.0038
	4	1 x D	0.25 x D	0.25 x D	350	–	475	IPT	.0014	.0020	.0026	.0030	.0033
	5	1 x D	0.3 x D	0.5 x D	200	–	325	IPT	.0012	.0018	.0023	.0027	.0030
	6	1 x D	0.25 x D	0.25 x D	150	–	225	IPT	.0010	.0015	.0019	.0022	.0024
M	1	1 x D	0.3 x D	0.5 x D	250	–	325	IPT	.0015	.0023	.0029	.0034	.0038
	2	1 x D	0.3 x D	0.5 x D	190	–	260	IPT	.0012	.0018	.0023	.0027	.0030
	3	1 x D	0.3 x D	0.5 x D	200	–	260	IPT	.0010	.0015	.0019	.0022	.0024
K	1	1 x D	0.3 x D	0.5 x D	400	–	525	IPT	.0018	.0027	.0035	.0039	.0043
	2	1 x D	0.3 x D	0.5 x D	360	–	460	IPT	.0015	.0023	.0029	.0034	.0038
	3	1 x D	0.3 x D	0.5 x D	330	–	430	IPT	.0012	.0018	.0023	.0027	.0030
S	1	1 x D	0.25 x D	0.25 x D	150	–	275	IPT	.0015	.0023	.0029	.0034	.0038
	2	1 x D	0.25 x D	0.25 x D	65	–	125	IPT	.0008	.0012	.0016	.0018	.0020
	3	1 x D	0.3 x D	0.5 x D	160	–	275	IPT	.0012	.0018	.0023	.0027	.0030
	4	1 x D	0.3 x D	0.5 x D	150	–	220	IPT	.0011	.0017	.0022	.0025	.0028
H	1	1 x D	0.25 x D	0.25 x D	300	–	450	IPT	.0014	.0020	.0026	.0030	.0033

NOTE: Side milling applications — For longest reach (L3) tools, reduce ae by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

■ Series 4M0R 4M4R • Victory Grades

Material Group		Side Milling (A) and Slotting (B)			WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.						
		A		B	Cutting Speed — vc SFM				D1 — Diameter					
								frac.	1/4	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3750	.5000	.6250	.7500	1.0000
P	3	1 x D	0.5 x D	0.75 x D	390	–	520	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	4	1 x D	0.3 x D	0.75 x D	300	–	490	IPT	.0014	.0020	.0026	.0030	.0034	.0039
	5	1 x D	0.5 x D	0.75 x D	200	–	330	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	6	1 x D	0.3 x D	0.3 x D	160	–	250	IPT	.0010	.0015	.0019	.0022	.0025	.0028
M	1	1 x D	0.5 x D	0.75 x D	300	–	380	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	2	1 x D	0.5 x D	0.75 x D	200	–	260	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	3	1 x D	0.5 x D	0.75 x D	200	–	230	IPT	.0010	.0015	.0019	.0022	.0025	.0028
K	1	1 x D	0.5 x D	1 x D	390	–	490	IPT	.0018	.0027	.0034	.0040	.0044	.0049
	2	1 x D	0.5 x D	1 x D	360	–	460	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	3	1 x D	0.5 x D	1 x D	360	–	430	IPT	.0012	.0018	.0023	.0027	.0031	.0036
S	1	1 x D	0.3 x D	0.75 x D	160	–	300	IPT	.0015	.0023	.0029	.0034	.0039	.0045
	2	1 x D	0.3 x D	0.3 x D	80	–	130	IPT	.0008	.0012	.0015	.0018	.0021	.0024
	3	1 x D	0.4 x D	0.75 x D	200	–	260	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	4	1 x D	0.4 x D	0.75 x D	160	–	200	IPT	.0011	.0017	.0021	.0025	.0028	.0033
H	1	1 x D	0.3 x D	0.3 x D	260	–	460	IPT	.0014	.0020	.0026	.0030	.0034	.0039
	2	1 x D	0.2 x D	0.2 x D	230	–	390	IPT	.0010	.0015	.0019	.0022	.0025	.0028
	3	1 x D	0.2 x D	0.2 x D	200	–	300	IPT	.0008	.0012	.0015	.0018	.0021	.0024

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

■ Series 4S0R • Victory Grades

WIDIA VICTORY



Material Group		Side Milling (A) and Slotting (B)			WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.						
		A		B	Cutting Speed — vc SFM				D1 — Diameter					
								frac.	1/4	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3750	.5000	.6250	.7500	1.0000
P	0	1 x D	0.5 x D	0.5 x D	490	–	660	IPT	.0015	.0022	.0027	.0032	.0035	.0039
	1	1 x D	0.5 x D	0.5 x D	490	–	660	IPT	.0015	.0022	.0027	.0032	.0035	.0039
	2	1 x D	0.5 x D	0.5 x D	460	–	620	IPT	.0015	.0022	.0027	.0032	.0035	.0039
	3	1 x D	0.4 x D	0.5 x D	390	–	520	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	4	1 x D	0.3 x D	0.4 x D	300	–	490	IPT	.0011	.0016	.0021	.0024	.0027	.0031
	5	1 x D	0.4 x D	0.5 x D	200	–	330	IPT	.0010	.0015	.0019	.0022	.0025	.0029
M	1	1 x D	0.4 x D	0.5 x D	300	–	380	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	2	1 x D	0.4 x D	0.5 x D	200	–	260	IPT	.0010	.0015	.0019	.0022	.0025	.0029
	3	1 x D	0.4 x D	0.5 x D	200	–	230	IPT	.0008	.0012	.0015	.0018	.0020	.0023
K	1	1 x D	0.5 x D	0.5 x D	390	–	490	IPT	.0015	.0022	.0027	.0032	.0035	.0039
	2	1 x D	0.4 x D	0.5 x D	360	–	460	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	3	1 x D	0.4 x D	0.5 x D	360	–	430	IPT	.0010	.0015	.0019	.0022	.0025	.0029
S	1	1 x D	0.5 x D	0.3 x D	160	–	300	IPT	.0012	.0018	.0023	.0027	.0031	.0036
	3	1 x D	0.5 x D	0.4 x D	200	–	260	IPT	.0010	.0015	.0019	.0022	.0025	.0029
H	1	1 x D	0.3 x D	0.3 x D	260	–	460	IPT	.0011	.0016	.0021	.0024	.0027	.0031

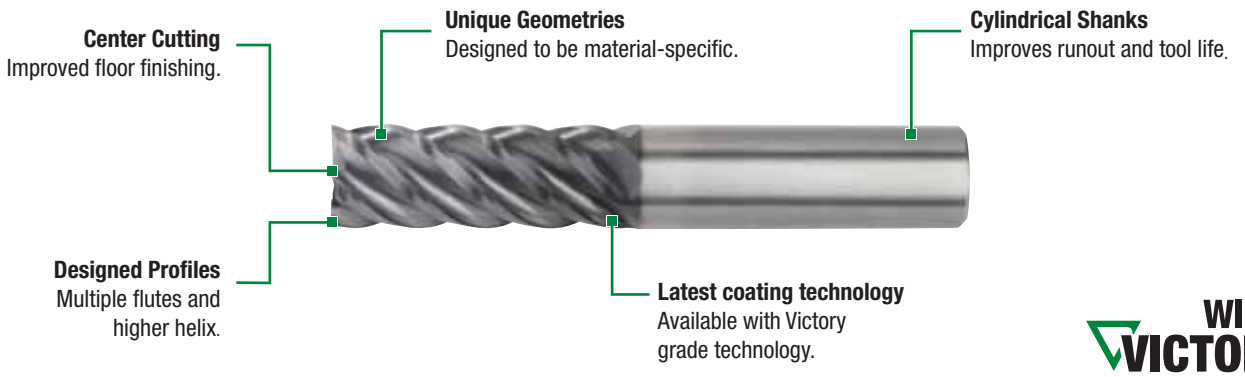
NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

High-Performance Finishing Solid Carbide End Mills

HP Finishers

Only the finest carbide substrates with market-leading geometries and state-of-the-art surface technology are used to ensure the highest quality finishing end mills are produced. These tools are fully compliant with NAS specifications. Whether you require higher metal removal rates, improved surface finishes, fewer passes, or longer tool life, WIDIA-Hanita™ high-performance finishing end mills deliver the reliability and consistency you can depend on during your critical finishing operations.

- Specific geometries targeted for steels, stainless steels, high-temperature alloys, and titanium.
- Stub, regular, long, and extra long lengths for all applications.
- Special designs with higher number of flutes and increased helix angles for super finishing applications.
- Latest coating technology, including Victory™ grades.



WIDIA VICTORY

High-Performance Solid Carbide Finishing

- Specifically designed geometries for finishing in a wide range of materials.
- Higher number of flutes and higher helix angles for super finishing applications.
- High Metal Removal Rates (MRR) requiring fewer passes and longer tool life while providing superior surface finishes.

4C03 Series

- Center cutting.
- 3-flute.
- 35° helix.
- Material-specific coatings.

4S07 Series

- Center cutting.
- 6-flute.
- High helix.
- Use for super finishing in multiple workpiece materials.

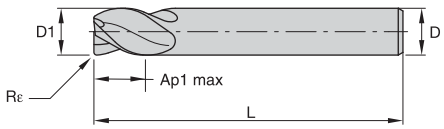
4C05 4C15 Series

- Center cutting.
- 5-flute.
- High helix.
- Works in a variety of workpiece materials.
- Light finishing cuts.

4S0F Series

- Center cutting.
- High number of flutes.
- Light finishing cuts in multiple materials.
- Use for super finishing.

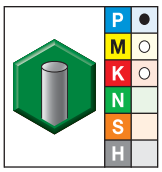
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

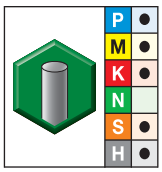


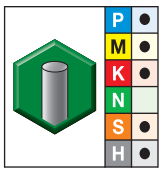
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	< 1/8"	0/.00024
		1/8–7/32"	0/.00031
		1/4–3/8"	0/.00035
		13/32-11/16"	0/.00043
		23/32–1 3/16"	0/.00051

Series 4C03 4C43



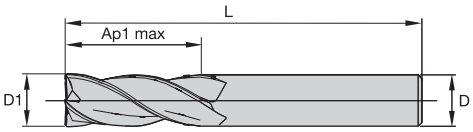




● first choice
○ alternate choice

grade UNCOATED		grade TiCN-CT TiCN		grade TiAlN-RT TiAlN						
order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
2863974	4C0303001A	2842506	TC4C0303001A		–	1/8	1/8	1/2	1 1/2	.010
2863884	4C4305000A	3208530	TC4C4305000A		–	3/16	3/16	5/16	1 1/2	.010
2863972	4C0305000A	2842502	TC4C0305000A		–	3/16	3/16	5/8	2	.010
2863880	4C4307002A	2842361	TC4C4307002A	2831637	TR4C4307002A	1/4	1/4	1/2	2	.018
2863969	4C0307002A	2842498	TC4C0307002A	2831802	TR4C0307002A	1/4	1/4	3/4	2 1/2	.018
2863879	4C4308003A	2842358	TC4C4308003A		–	5/16	5/16	7/16	2	.018
2863966	4C0308003A	2842493	TC4C0308003A	2831796	TR4C0308003A	5/16	5/16	13/16	2 1/2	.018
	–	2842353	TC4C4310004A	2831623	TR4C4310004A	3/8	3/8	1/2	2	.018
2863964	4C0310004A	2842487	TC4C0310004A	2831789	TR4C0310004A	3/8	3/8	7/8	2 1/2	.018
	–	3320829	4C431101AA		–	7/16	7/16	9/16	2 1/2	.018
	–	2842348	TC4C431101AA		–	7/16	7/16	9/16	2 1/2	.018
2863959	4C031101AA	2842484	TC4C031101AA		–	7/16	7/16	7/8	2 1/2	.018
2863873	4C4313005A	2842344	TC4C4313005A	2831609	TR4C4313005A	1/2	1/2	5/8	2 1/2	.030
2863956	4C0313005A	2842479	TC4C0313005A	2831778	TR4C0313005A	1/2	1/2	1	3	.030
2863953	4C0313015A	2842474	TC4C0313015A	2831773	TR4C0313015A	1/2	1/2	1 1/4	3	.030
2863868	4C4316006A	2842338	TC4C4316006A	2831604	TR4C4316006A	5/8	5/8	3/4	3	.030
2863951	4C0316006A	2842469	TC4C0316006A	2831768	TR4C0316006A	5/8	5/8	1 1/4	3 1/2	.030
2863865	4C4319007A	2842332	TC4C4319007A	2831598	TR4C4319007A	3/4	3/4	1	3	.030
2863947	4C0319007A	2842464	TC4C0319007A	2831761	TR4C0319007A	3/4	3/4	1 1/2	4	.030
2863944	4C0325008A	2842458	TC4C0325008A	2831754	TR4C0325008A	1	1	1 1/2	4	.030

- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

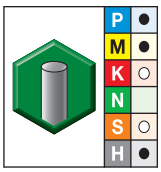


End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

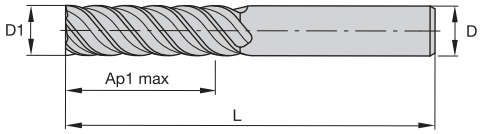
Series 4C05 4C15 • Victory Grades



● first choice
○ alternate choice

grade WP15PE AlTiN					
order #	catalog #	D1	D	length of cut Ap1 max	length L
5577187	4C0503001ST	1/8	1/8	1/2	1 1/2
5577188	4C0505000ST	3/16	3/16	5/8	2
5577189	4C0507002ST	1/4	1/4	3/4	2 1/2
5577247	4C1507002ST	1/4	1/4	1 1/4	4
5577240	4C0508003ST	5/16	5/16	13/16	2 1/2
5577248	4C1508003ST	5/16	5/16	1 1/4	4
5577241	4C0510004ST	3/8	3/8	7/8	2 1/2
5577249	4C1510004ST	3/8	3/8	1 1/2	4
5577242	4C0513005ST	1/2	1/2	1	3
5577243	4C0513015ST	1/2	1/2	1 1/4	3
5577250	4C1513005ST	1/2	1/2	2	4 1/2
5577244	4C0516006ST	5/8	5/8	1 1/4	3 1/2
5577251	4C1516006ST	5/8	5/8	2 1/4	5
5577245	4C0519007ST	3/4	3/4	1 1/2	4
5577252	4C1519007ST	3/4	3/4	2 1/4	5
5577246	4C0525008ST	1	1	1 1/2	4
5577253	4C1525008ST	1	1	2 1/4	5

- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

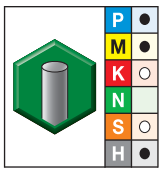


End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

WIDIA VICTORY

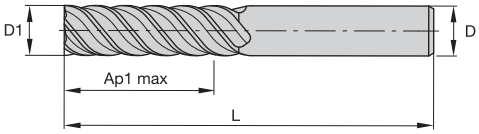
Series 4S07 • Victory Grades



● first choice
○ alternate choice

grade WP15PE AlTiN					
order #	catalog #	D1	D	length of cut Ap1 max	length L
5577255	4S0707002ST	1/4	1/4	3/4	2 1/2
5577256	4S0708003ST	5/16	5/16	13/16	2 1/2
5577254	4S0710004ST	3/8	3/8	7/8	2 1/2
5577257	4S071100AST	7/16	7/16	7/8	2 1/2
5577258	4S0713005ST	1/2	1/2	1	3
5577259	4S0716006ST	5/8	5/8	1 1/4	3 1/2
5577260	4S0719007ST	3/4	3/4	1 1/2	4
5577261	4S0725008ST	1	1	1 1/2	4

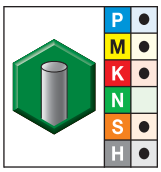
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	< 1/8"	0/.00024
		1/8–7/32"	0/.00031
		1/4–3/8"	0/.00035
		13/32–11/16"	0/.00043
		23/32–1 3/16"	0/.00051

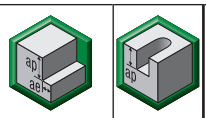
Series 4S0F 4S1F



● first choice
○ alternate choice

grade TiAlN-RT TiAlN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	ZU
3321644	TR4S0F07002	1/4	1/4	3/4	2 1/2	6
3321645	TR4S0F10004	3/8	3/8	7/8	2 1/2	6
3125357	TR4S0F13005	1/2	1/2	1	3	8
3321654	TR4S1F13005	1/2	1/2	2	4 1/2	8
3321646	TR4S0F16006	5/8	5/8	1 1/4	3 1/2	8
3321655	TR4S1F16006	5/8	5/8	2 1/4	5	8
3321647	TR4S0F19007	3/4	3/4	1 1/2	4	8
3321656	TR4S1F19007	3/4	3/4	2 1/4	5	8
3321648	TR4S0F25008	1	1	1 1/2	4	10
3321657	TR4S1F25008	1	1	2 1/4	5	10

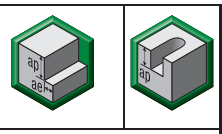
Series 4C03



Material Group		Side Milling (A) and Slotting (B)			uncoated			TiCN			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.										
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter									
		ap	ae	ap	min		max	min		max	min		max	frac.	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	1
		ap	ae	ap	min		max	min		max	min		max	dec.	.1250	.1875	.2500	.3125	.3750	.4375	.5000	.6250	.7500	1.0000
P	0	1.5 x D	0.3 x D	0.5 x D	245	–	330	392	–	528	490	–	660	IPT	.0088	.0135	.0183	.0234	.0273	.0308	.0340	.0395	.0438	.0489
	1	1.5 x D	0.3 x D	0.5 x D	245	–	330	392	–	528	490	–	660	IPT	.0088	.0135	.0183	.0234	.0273	.0308	.0340	.0395	.0438	.0489
	2	1.5 x D	0.3 x D	0.5 x D	230	–	310	368	–	496	460	–	620	IPT	.0088	.0135	.0183	.0234	.0273	.0308	.0340	.0395	.0438	.0489
	3	1.5 x D	0.3 x D	0.5 x D	195	–	260	312	–	416	390	–	520	IPT	.0072	.0111	.0152	.0195	.0229	.0260	.0289	.0341	.0386	.0451
	4	1.5 x D	0.3 x D	0.3 x D	150	–	245	240	–	392	300	–	490	IPT	.0066	.0101	.0138	.0175	.0204	.0231	.0257	.0301	.0337	.0386
	5	1.5 x D	0.3 x D	0.5 x D	100	–	165	160	–	264	200	–	330	IPT	.0059	.0091	.0123	.0156	.0183	.0208	.0231	.0273	.0309	.0361
	6	1.5 x D	0.3 x D	0.3 x D	80	–	125	128	–	200	160	–	250	IPT	.0050	.0076	.0103	.0131	.0153	.0173	.0191	.0223	.0249	.0281
M	1	1.5 x D	0.3 x D	0.5 x D	150	–	190	240	–	304	300	–	380	IPT	.0072	.0111	.0152	.0195	.0229	.0260	.0289	.0341	.0386	.0451
	2	1.5 x D	0.3 x D	0.5 x D	100	–	130	160	–	208	200	–	260	IPT	.0059	.0091	.0123	.0156	.0183	.0208	.0231	.0273	.0309	.0361
	3	1.5 x D	0.3 x D	0.5 x D	100	–	115	160	–	184	200	–	230	IPT	.0050	.0076	.0103	.0131	.0153	.0173	.0191	.0223	.0249	.0281
K	1	1.5 x D	0.3 x D	0.5 x D	195	–	245	312	–	392	390	–	490	IPT	.0088	.0135	.0183	.0234	.0273	.0308	.0340	.0395	.0438	.0489
	2	1.5 x D	0.3 x D	0.5 x D	180	–	230	288	–	368	360	–	460	IPT	.0072	.0111	.0152	.0195	.0229	.0260	.0289	.0341	.0386	.0451
	3	1.5 x D	0.3 x D	0.5 x D	180	–	215	288	–	344	360	–	430	IPT	.0059	.0091	.0123	.0156	.0183	.0208	.0231	.0273	.0309	.0361
S	1	1.5 x D	0.3 x D	0.3 x D	80	–	150	128	–	240	160	–	300	IPT	.0072	.0111	.0152	.0195	.0229	.0260	.0289	.0341	.0386	.0451
	2	1.5 x D	0.3 x D	0.3 x D	40	–	65	64	–	104	80	–	130	IPT	.0039	.0060	.0081	.0103	.0121	.0138	.0153	.0182	.0206	.0243
	3	1.5 x D	0.3 x D	0.3 x D	100	–	130	160	–	208	200	–	260	IPT	.0059	.0091	.0123	.0156	.0183	.0208	.0231	.0273	.0309	.0361
	4	1.5 x D	0.3 x D	0.5 x D	80	–	100	128	–	160	160	–	200	IPT	.0048	.0077	.0108	.0143	.0168	.0191	.0213	.0251	.0284	.0331
H	1	1.5 x D	0.3 x D	0.3 x D	130	–	230	208	–	368	260	–	460	IPT	.0066	.0101	.0138	.0175	.0204	.0231	.0257	.0301	.0337	.0386

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

Series 4C43



Material Group		Side Milling (A) and Slotting (B)			uncoated			TiCN			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.								
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter							
		ap	ae	ap	min		max	min		max	min		max	frac.	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	min		max	min		max	dec.	.1250	.1880	.2500	.3130	.3750	.5000	.6250	.7500	1.000
P	0	1.25 x D	0.3 x D	0.5 x D	245	–	330	392	–	528	490	–	660	IPT	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	1.25 x D	0.3 x D	0.5 x D	245	–	330	392	–	528	490	–	660	IPT	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	1.25 x D	0.3 x D	0.5 x D	230	–	310	368	–	496	460	–	620	IPT	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	1.25 x D	0.3 x D	0.5 x D	195	–	260	312	–	416	390	–	520	IPT	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	1.25 x D	0.3 x D	0.3 x D	150	–	245	240	–	392	300	–	490	IPT	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
	5	1.25 x D	0.3 x D	0.5 x D	100	–	165	160	–	264	200	–	330	IPT	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	6	1.25 x D	0.3 x D	0.3 x D	80	–	125	128	–	200	160	–	250	IPT	.0005	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
M	1	1.25 x D	0.3 x D	0.5 x D	150	–	190	240	–	304	300	–	380	IPT	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	1.25 x D	0.3 x D	0.5 x D	100	–	130	160	–	208	200	–	260	IPT	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	3	1.25 x D	0.3 x D	0.5 x D	100	–	115	160	–	184	200	–	230	IPT	.0005	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
K	1	1.25 x D	0.3 x D	0.5 x D	195	–	245	312	–	392	390	–	490	IPT	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	1.25 x D	0.3 x D	0.5 x D	180	–	230	288	–	368	360	–	460	IPT	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	3	1.25 x D	0.3 x D	0.5 x D	180	–	215	288	–	344	360	–	430	IPT	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
S	1	1.25 x D	0.3 x D	0.3 x D	80	–	150	128	–	240	160	–	300	IPT	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	1.25 x D	0.3 x D	0.3 x D	40	–	65	64	–	104	80	–	130	IPT	.0004	.0006	.0008	.0010	.0012	.0015	.0018	.0021	.0024
	3	1.25 x D	0.3 x D	0.3 x D	100	–	130	160	–	208	200	–	260	IPT	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	4	1.25 x D	0.3 x D	0.5 x D	80	–	100	128	–	160	160	–	200	IPT	.0005	.0008	.0011	.0014	.0017	.0021	.0025	.0028	.0033
H	1	1.25 x D	0.3 x D	0.3 x D	130	–	230	208	–	368	260	–	460	IPT	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039

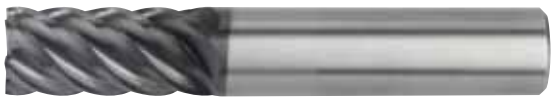
Series 4C05 4C15 • Victory Grades

WIDIA VICTORY


Material Group		Side Milling (A)		WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A).								
		A		Cutting Speed — vc SFM				D1 — Diameter							
		ap	ae	min		max	frac.	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	490	–	660	IPT	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	490	–	660	IPT	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	460	–	620	IPT	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	390	–	520	IPT	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	300	–	490	IPT	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
	5	Ap1 max	0.1 x D	200	–	330	IPT	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	6	Ap1 max	0.1 x D	160	–	250	IPT	.0005	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
M	1	Ap1 max	0.1 x D	300	–	380	IPT	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	200	–	260	IPT	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	3	Ap1 max	0.1 x D	200	–	230	IPT	.0005	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
K	1	Ap1 max	0.1 x D	390	–	490	IPT	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	360	–	460	IPT	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	3	Ap1 max	0.1 x D	360	–	430	IPT	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
H	1	Ap1 max	0.1 x D	260	–	460	IPT	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
	2	Ap1 max	0.1 x D	230	–	390	IPT	.0005	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 4S07 • Victory Grades



Material Group		Side Milling (A)		WP15PE			Recommended feed per tooth (IPT = inch/th) for side milling (A).									
		A		Cutting Speed — vc SFM				D1 — Diameter								
							frac.	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.1250	.1875	.2500	.3125	.3750	.4375	.5000	.6250	.7500	1.0000
P	0	1 x D	0.2 x D	490	–	660	IPT	.0009	.0013	.0018	.0023	.0027	.0031	.0034	.0039	.0044	.0049
	1	1 x D	0.2 x D	490	–	660	IPT	.0009	.0013	.0018	.0023	.0027	.0031	.0034	.0039	.0044	.0049
	2	1 x D	0.2 x D	460	–	620	IPT	.0009	.0013	.0018	.0023	.0027	.0031	.0034	.0039	.0044	.0049
	3	1 x D	0.1 x D	390	–	520	IPT	.0007	.0011	.0015	.0020	.0023	.0026	.0029	.0034	.0039	.0045
	4	1 x D	0.1 x D	300	–	490	IPT	.0007	.0010	.0014	.0017	.0020	.0023	.0026	.0030	.0034	.0039
	5	1 x D	0.1 x D	200	–	330	IPT	.0006	.0009	.0012	.0016	.0018	.0021	.0023	.0027	.0031	.0036
	6	1 x D	0.1 x D	160	–	250	IPT	.0005	.0008	.0010	.0013	.0015	.0017	.0019	.0022	.0025	.0028
M	1	1 x D	0.1 x D	300	–	380	IPT	.0007	.0011	.0015	.0020	.0023	.0026	.0029	.0034	.0039	.0045
	2	1 x D	0.1 x D	200	–	260	IPT	.0006	.0009	.0012	.0016	.0018	.0021	.0023	.0027	.0031	.0036
	3	1 x D	0.1 x D	200	–	230	IPT	.0005	.0008	.0010	.0013	.0015	.0017	.0019	.0022	.0025	.0028
K	1	1 x D	0.1 x D	390	–	490	IPT	.0009	.0013	.0018	.0023	.0027	.0031	.0034	.0039	.0044	.0049
	2	1 x D	0.1 x D	360	–	460	IPT	.0007	.0011	.0015	.0020	.0023	.0026	.0029	.0034	.0039	.0045
	3	1 x D	0.1 x D	360	–	430	IPT	.0006	.0009	.0012	.0016	.0018	.0021	.0023	.0027	.0031	.0036
S	1	1 x D	0.1 x D	160	–	300	IPT	.0007	.0011	.0015	.0020	.0023	.0026	.0029	.0034	.0039	.0045
	2	1 x D	0.1 x D	80	–	130	IPT	.0004	.0006	.0008	.0010	.0012	.0014	.0015	.0018	.0021	.0024
	3	1 x D	0.15 x D	200	–	260	IPT	.0006	.0009	.0012	.0016	.0018	.0021	.0023	.0027	.0031	.0036
	4	1 x D	0.15 x D	160	–	200	IPT	.0005	.0008	.0011	.0014	.0017	.0019	.0021	.0025	.0028	.0033
H	1	1 x D	0.1 x D	260	–	460	IPT	.0007	.0010	.0014	.0017	.0020	.0023	.0026	.0030	.0034	.0039

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series 4S0F 4S1F

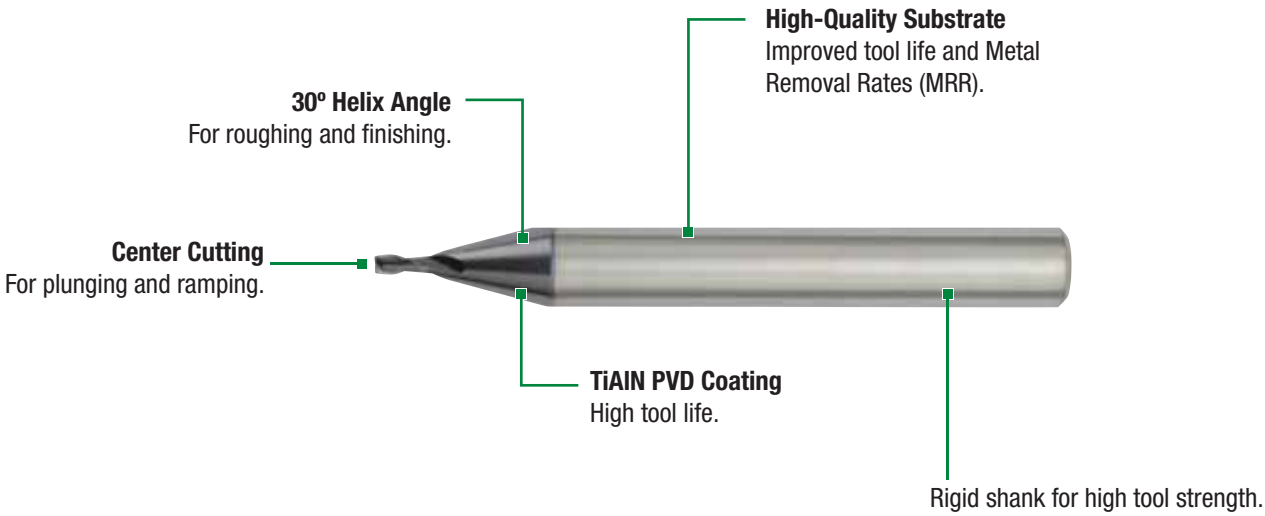
Material Group		Side Milling (A)		TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A).						
		A		Cutting Speed — vc SFM				D1 — Diameter					
							frac.	1/4	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.2500	.3750	.5000	.6250	.7500	1.000
P	1	1.5 x D	0.07 x D	500	–	650	IPT	.0018	.0027	.0035	.0039	.0043	.0050
	2	1.5 x D	0.07 x D	450	–	625	IPT	.0018	.0027	.0035	.0039	.0043	.0050
	3	1.5 x D	0.07 x D	400	–	525	IPT	.0015	.0023	.0029	.0034	.0038	.0046
	4	1.5 x D	0.03 x D	300	–	475	IPT	.0014	.0020	.0026	.0030	.0033	.0039
	5	1.5 x D	0.05 x D	200	–	325	IPT	.0012	.0018	.0023	.0027	.0030	.0036
	6	1.5 x D	0.03 x D	150	–	225	IPT	.0010	.0015	.0019	.0022	.0024	.0028
M	1	1.5 x D	0.07 x D	260	–	330	IPT	.0015	.0023	.0029	.0034	.0038	.0046
	2	1.5 x D	0.07 x D	200	–	260	IPT	.0012	.0018	.0023	.0027	.0030	.0036
	3	1.5 x D	0.05 x D	200	–	260	IPT	.0010	.0015	.0019	.0022	.0024	.0028
K	1	1.5 x D	0.07 x D	390	–	520	IPT	.0018	.0027	.0035	.0039	.0043	.0050
	2	1.5 x D	0.07 x D	360	–	460	IPT	.0015	.0023	.0029	.0034	.0038	.0046
	3	1.5 x D	0.05 x D	330	–	430	IPT	.0012	.0018	.0023	.0027	.0030	.0036
S	1	1.5 x D	0.03 x D	150	–	275	IPT	.0015	.0023	.0029	.0034	.0038	.0046
	2	1.5 x D	0.02 x D	70	–	130	IPT	.0008	.0012	.0016	.0018	.0020	.0025
	3	1.5 x D	0.05 x D	160	–	260	IPT	.0012	.0018	.0023	.0027	.0030	.0036
	4	1.5 x D	0.05 x D	150	–	210	IPT	.0011	.0017	.0022	.0025	.0028	.0033
H	1	1.5 x D	0.03 x D	260	–	450	IPT	.0014	.0020	.0026	.0030	.0033	.0039

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Micro Solid Carbide End Mills

Micro solid carbide end mills offer plunging, slotting, profiling, and 3D milling for a wide range of materials and applications. They are designed to provide efficient machining in a wide range of steel, cast iron, copper and copper alloys, and aluminum materials. Micro square and ball nose tools, designed for the most demanding end users, offer exceptional tool life and precision at high operating parameters.

- 2-flute ball nose and 2–3 flute cutters with sharp corner.
- Micro tools for a wide range of materials.
- Roughing and finishing in one tool.
- Diameter range from 0.4–3mm.



Micro Solid Carbide End Mills

- Increases your manufacturing flexibility and cost efficiency.
- Suitable for roughing and finishing.
- Rigid shank gives extra toughness and strength.

4632 Series

- Wide range of diameters from 0.4–2mm.
- Medium steel, aluminum, copper, and cast iron.
- Center cut.
- Available coated and uncoated.

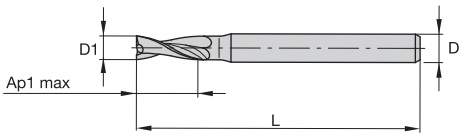
4633 Series

- Wide range of diameters from 0.4–3mm.
- Medium steel, aluminum, copper, and cast iron.
- Center cut.
- Available coated and uncoated.
- Rigid shank gives extra toughness and strength.

4651 Series

- Ball nose tool in range of diameter from 1–2mm with 3mm shank.
- Medium steel, aluminum, copper, and cast iron.
- Center cut ball nose.
- Available coated and uncoated.

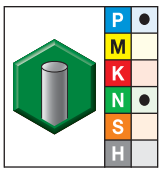
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

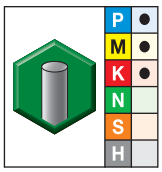


End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

Series 4632

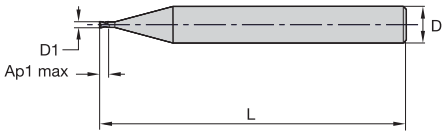




● first choice
○ alternate choice

grade UNCOATED		grade TiAlN-RT TiAlN					
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
1656841	463200400..	1602266	463200400RT	0,4	3	1,50	38
1656844	463200500..	1602268	463200500RT	0,5	3	1,50	38
1656849	463200600..	1602270	463200600RT	0,6	3	1,50	38
1656853	463200800..	1602273	463200800RT	0,8	3	1,50	38
1656858	463201000..	1602274	463201000RT	1,0	3	2,00	38
1656863	463201500..	1602275	463201500RT	1,5	3	2,00	38
1656867	463202000..		–	2,0	3	8,00	38

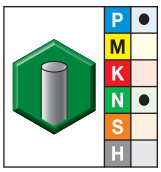
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

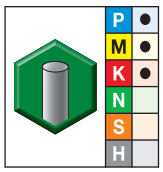


End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

Series 4633

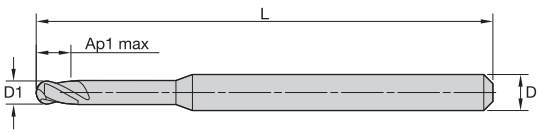




● first choice
○ alternate choice

grade UNCOATED		grade TiAlN-RT TiAlN					
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
1656873	463300400..	1656875	463300400RT	0,4	3	1,50	38
1656878	463300500..	1656880	463300500RT	0,5	3	1,50	38
1656883	463300600..	1656885	463300600RT	0,6	3	1,50	38
1656888	463300800..	1656890	463300800RT	0,8	3	1,50	38
1656893	463301000..	1656895	463301000RT	1,0	3	2,00	38
1656898	463301200..	1656900	463301200RT	1,2	3	2,00	38
1656901	463301500..	1656903	463301500RT	1,5	3	2,00	38
1656906	463301800..	1656908	463301800RT	1,8	3	2,00	38
1656909	463302000..	1656910	463302000RT	2,0	3	8,00	38
	–	1656913	463302500RT	2,5	3	9,00	38
	–	1656916	463303000RT	3,0	3	12,00	38

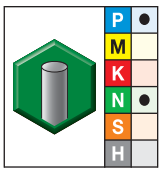
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

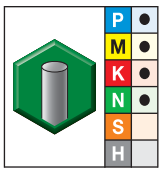


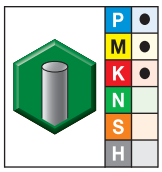
End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

Series 4651







● first choice
○ alternate choice

grade UNCOATED		grade TiCN-CT TiCN		grade TiAlN-RT TiAlN					
order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
1656950	465101000..	1656951	465101000CT	1611066	465101000RT	1,0	3	2,00	38
1656952	465101200..	1656953	465101200CT	1656954	465101200RT	1,2	3	2,00	38
1656955	465101500..	1656956	465101500CT	1656957	465101500RT	1,5	3	2,00	38
–		1656959	465101800CT	1656960	465101800RT	1,8	3	2,00	38
1656971	465102000..	1656972	465102000CT	1602538	465102000RT	2,0	3	2,00	38

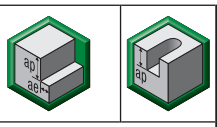
Series 4632



Material Group		Side Milling (A) and Slotting (B)			uncoated			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.							
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter						
		ap	ae	ap	min		max	min		max	mm	0.4	0.5	0.6	0.8	1.0	1.5	2.0
P	0	1 x D	0.1 x D	0.25 x D	246	–	328	492	–	656	IPT	.0001	.0001	.0002	.0002	.0003	.0004	.0006
	1	1 x D	0.1 x D	0.25 x D	246	–	328	492	–	656	IPT	.0001	.0001	.0002	.0002	.0003	.0004	.0006
	2	1 x D	0.1 x D	0.25 x D	–	–	–	459	–	623	IPT	.0001	.0001	.0002	.0002	.0003	.0004	.0006
	3	1 x D	0.1 x D	0.25 x D	–	–	–	394	–	525	IPT	.0001	.0001	.0001	.0002	.0002	.0004	.0005
	4	1 x D	0.1 x D	0.25 x D	–	–	–	295	–	492	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0005
M	1	1 x D	0.1 x D	0.25 x D	–	–	–	295	–	377	IPT	.0001	.0001	.0001	.0002	.0002	.0004	.0005
	2	1 x D	0.1 x D	0.25 x D	–	–	–	197	–	262	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0004
K	1	1 x D	0.1 x D	0.25 x D	–	–	–	394	–	492	IPT	.0001	.0001	.0002	.0002	.0003	.0004	.0006
	2	1 x D	0.1 x D	0.25 x D	–	–	–	361	–	459	IPT	.0001	.0001	.0001	.0002	.0002	.0004	.0005
N	1	1 x D	0.1 x D	0.25 x D	820	–	3280	1640	–	6560	IPT	.0002	.0002	.0003	.0003	.0004	.0006	.0009
	2	1 x D	0.1 x D	0.25 x D	820	–	2460	1640	–	4920	IPT	.0002	.0002	.0002	.0003	.0004	.0006	.0008
	5	1 x D	0.1 x D	0.25 x D	410	–	1312	820	–	3280	IPT	.0002	.0002	.0002	.0003	.0004	.0006	.0008

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

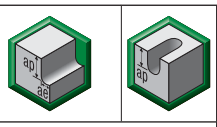
Series 4633



Material Group		Side Milling (A) and Slotting (B)			uncoated			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.										
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter									
		ap	ae	ap	min		max	min		max	mm	0.4	0.5	0.6	0.8	1.0	1.2	1.5	1.8	2.0	2.5	3.0
P	0	1 x D	0.1 x D	0.25 x D	246	–	328	492	–	656	IPT	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0006	.0008	.0009
	1	1 x D	0.1 x D	0.25 x D	246	–	328	492	–	656	IPT	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0006	.0008	.0009
	2	1 x D	0.1 x D	0.25 x D	–	–	–	459	–	623	IPT	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0006	.0008	.0009
	3	1 x D	0.1 x D	0.25 x D	–	–	–	394	–	525	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0006	.0007
	4	1 x D	0.1 x D	0.25 x D	–	–	–	295	–	492	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0003	.0004	.0005	.0006	.0007
M	1	1 x D	0.1 x D	0.25 x D	–	–	–	295	–	377	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0006	.0007
	2	1 x D	0.1 x D	0.25 x D	–	–	–	197	–	262	IPT	.0001	.0001	.0001	.0002	.0002	.0002	.0003	.0004	.0004	.0005	.0006
K	1	1 x D	0.1 x D	0.25 x D	–	–	–	394	–	492	IPT	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0006	.0008	.0009
	2	1 x D	0.1 x D	0.25 x D	–	–	–	361	–	459	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0004	.0005	.0006	.0007
N	1	1 x D	0.1 x D	0.25 x D	820	–	3280	1640	–	6560	IPT	.0002	.0002	.0003	.0003	.0004	.0005	.0006	.0008	.0009	.0011	.0013
	2	1 x D	0.1 x D	0.25 x D	820	–	2460	1640	–	4920	IPT	.0002	.0002	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0010	.0012
	5	1 x D	0.1 x D	0.25 x D	410	–	1312	820	–	3280	IPT	.0002	.0002	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0010	.0012

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

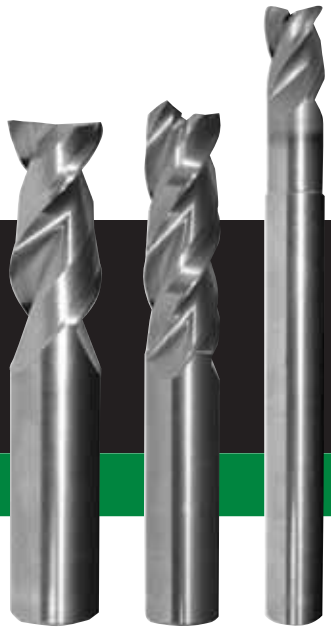
Series 4651




Material Group		Side Milling (A) and Slotting (B)			uncoated			TiAlN			TiCN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.					
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter				
		ap	ae	ap	min		max	min		max	min		max	mm	1.0	1.2	1.5	1.8	2.0
P	0	0.5 x D	0.5 x D	0.5 x D	246	–	328	492	–	656	394	–	525	IPT	.0003	.0004	.0004	.0005	.0006
	1	0.5 x D	0.5 x D	0.5 x D	246	–	328	492	–	656	394	–	525	IPT	.0003	.0004	.0004	.0005	.0006
	2	0.5 x D	0.5 x D	0.5 x D	–	–	–	459	–	623	367	–	499	IPT	.0003	.0004	.0004	.0005	.0006
	3	0.3 x D	0.3 x D	0.3 x D	–	–	–	394	–	525	315	–	420	IPT	.0002	.0003	.0004	.0004	.0005
	4	0.3 x D	0.3 x D	0.3 x D	–	–	–	295	–	492	236	–	394	IPT	.0002	.0003	.0003	.0004	.0005
M	1	0.3 x D	0.3 x D	0.3 x D	–	–	–	295	–	377	236	–	302	IPT	.0002	.0003	.0004	.0004	.0005
	2	0.3 x D	0.3 x D	0.3 x D	–	–	–	197	–	262	157	–	210	IPT	.0002	.0002	.0003	.0004	.0004
K	1	0.5 x D	0.5 x D	0.5 x D	–	–	–	394	–	492	315	–	394	IPT	.0003	.0004	.0004	.0005	.0006
	2	0.5 x D	0.5 x D	0.5 x D	–	–	–	361	–	459	289	–	367	IPT	.0002	.0003	.0004	.0004	.0005
N	1	0.5 x D	0.5 x D	0.5 x D	820	–	3280	1640	–	6560	1312	–	5248	IPT	.0004	.0005	.0006	.0008	.0009
	2	0.5 x D	0.5 x D	0.5 x D	820	–	2460	1640	–	4920	1312	–	3936	IPT	.0004	.0005	.0006	.0007	.0008
	5	0.5 x D	0.5 x D	0.5 x D	410	–	1312	820	–	3280	656	–	2624	IPT	.0004	.0005	.0006	.0007	.0008

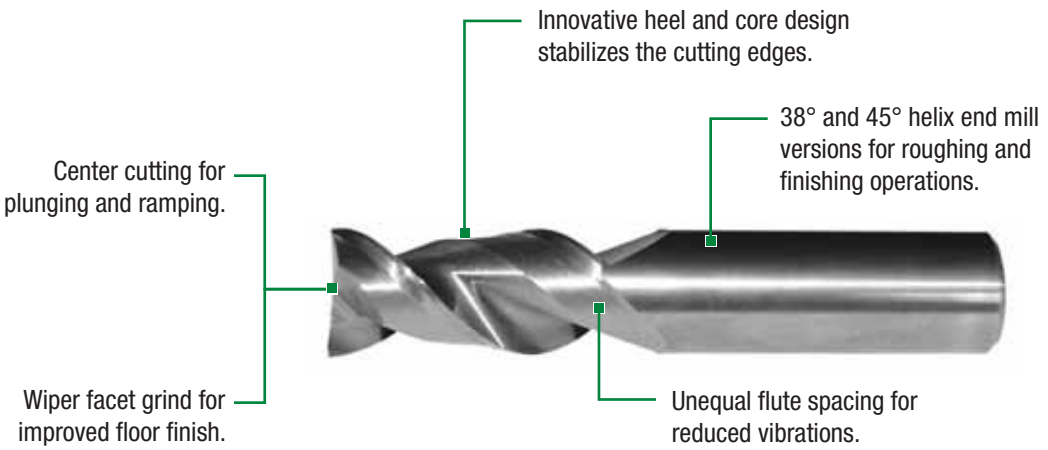
NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

AluSurf Aluminum



AluSurf provides extraordinary Metal Removal Rates (MRR) by combining roughing and finishing operations for any aluminum plunging, slotting, and profiling application. Its proprietary flute geometry is designed for rigidity and improved chip evacuation generating exceptional wall-to-floor perpendicularity, even in thin wall applications. To ensure a superior floor surface finish the AluSurf front geometry is equipped with a wiper facet grind.

- One tool for roughing and finishing operations.
- Slotting depths up to 1 x D and peripheral milling up to 1.5 x D axial at .5 x D radially.
- Unequal flute spacing for chatter-free performance (3-flute series only).
- Multiple corner radii and extended neck configurations available as standard.



AluSurf™ Series

- Increase your output due to less tool changes and increased Metal Removal Rates (MRR).
- No specific tools for roughing and finishing necessary.
- Less passes due to 1 x D slotting capability.
- Perfect for MQL (Minimum Quantity Lubrication) methods.

5A02 Series

- 2-flute, 45° helix.
- Radii and sharp corner configuration.

5AN2 Series

- 2-flute, 45° helix.
- Extended neck for long-reach applications.
- Radii and sharp corner configuration.

5A03 Series

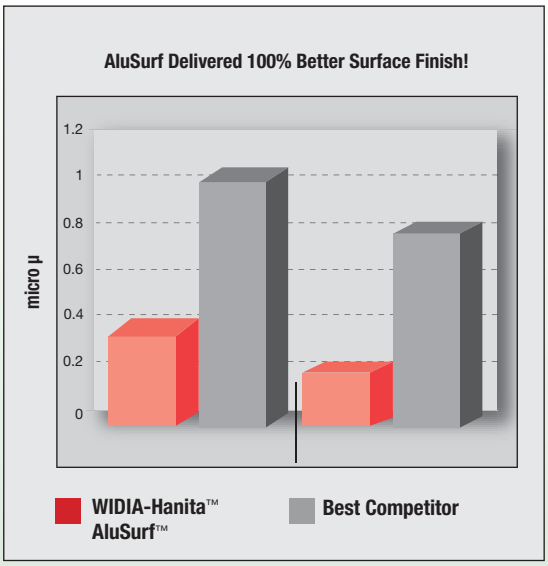
- 3-flute, 38° helix.
- Unequal flute spacing.
- Radii and sharp corner configuration.

5AN3 Series

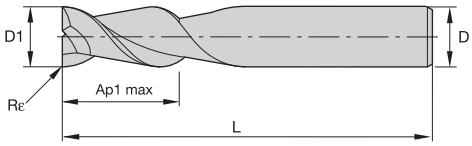
- 3-flute, 38° helix.
- Unequal flute spacing.
- Extended neck for long-reach applications.
- Radii and sharp corner configuration.

Operation	Slotting
Customer:	Aluminum Block
Material:	6061 Aluminum
Workpiece:	AluSurf solid carbide end mill.
Results:	100% better surface finish on walls and floor.

	COMPETITOR	WIDIA-Hanita™
tool:	uncoated tools	uncoated tools
end mill:	5/8" (16mm) 3-flute	5/8" (16mm) 3-flute
material:	aluminum	aluminum
depth of cut (ap):	.3150" (8mm)	.3150" (8mm)
width of cut (ae):	.3150" (8mm)	.3150" (8mm)
speed (Vc):	2,000 SFM (610 m/min)	2,000 SFM (610 m/min)
RPM (N):	12,000 RPM	12,000 RPM
feed rate (Vf):	142 IPM (3,600 mm/min)	142 IPM (3,600 mm/min)
chip load per tooth (Fz):	.004 in/th (0,1 mm/th)	.004 in/th (0,1 mm/th)
metal removal rate:	14 in³/min (230 cm³/min)	14 in³/min (230 cm³/min)



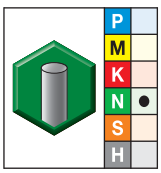
- Center cutting.
- Wiper facet design for improved floor finishes.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 5A02 • AluSurf

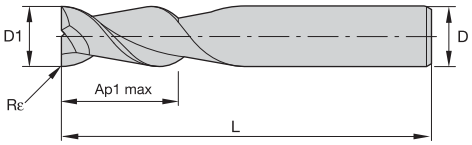


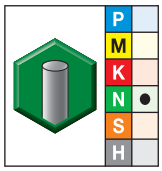
● first choice
○ alternate choice

grade UNCOATED						
order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
3336099	5A0207002A	1/4	1/4	1/2	2 1/2	.015
3649650	5A0207002B	1/4	1/4	1/2	2 1/2	.030
3738203	5A0207002C	1/4	1/4	1/2	2 1/2	.060
3336098	5A0207002	1/4	1/4	1/2	2 1/2	–
3336101	5A0208003B	5/16	5/16	5/8	2 1/2	.030
3336100	5A0208003	5/16	5/16	5/8	2 1/2	–
3336103	5A0210004B	3/8	3/8	3/4	2 1/2	.030
3649651	5A0210004C	3/8	3/8	3/4	2 1/2	.060
3336102	5A0210004	3/8	3/8	3/4	2 1/2	–
3336105	5A0213015B	1/2	1/2	1 1/4	3	.030
3649652	5A0213015C	1/2	1/2	1 1/4	3	.060
3738879	5A0213015D	1/2	1/2	1 1/4	3	.090
3649753	5A0213015E	1/2	1/2	1 1/4	3	.120
3336104	5A0213015	1/2	1/2	1 1/4	3	–
3738881	5A0216006B	5/8	5/8	1 1/4	3 1/2	.030
3336107	5A0216006C	5/8	5/8	1 1/4	3 1/2	.060
3738882	5A0216006D	5/8	5/8	1 1/4	3 1/2	.090
3336106	5A0216006	5/8	5/8	1 1/4	3 1/2	–
3649754	5A0219007B	3/4	3/4	1 1/2	4	.030
3336109	5A0219007C	3/4	3/4	1 1/2	4	.060

(continued)

(Series 5A02 • AluSurf — continued)



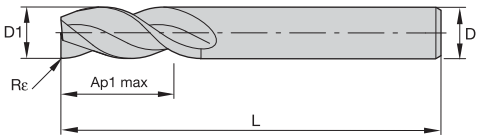


● first choice
○ alternate choice

grade UNCOATED

order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
3738923	**5A0219007D**	3/4	3/4	1 1/2	4	.090
3649755	**5A0219007E**	3/4	3/4	1 1/2	4	.120
3336108	**5A0219007**	3/4	3/4	1 1/2	4	—
3649756	**5A0225008B**	1	1	1 1/2	4	.030
3336111	**5A0225008C**	1	1	1 1/2	4	.060
3738928	**5A0225008D**	1	1	1 1/2	4	.090
3649757	**5A0225008E**	1	1	1 1/2	4	.120
3336110	**5A0225008**	1	1	1 1/2	4	—

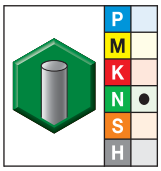
- Center cutting.
- Unequal flute spacing.
- Wiper facet design for improved floor finishes.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 5A03 • AluSurf



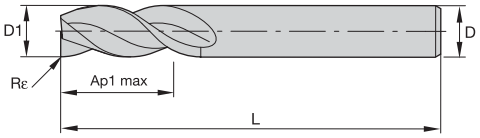
grade UNCOATED

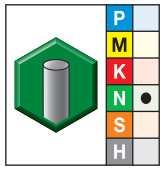
● first choice
○ alternate choice

order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
3336113	5A0307002A	1/4	1/4	1/2	2 1/2	.015
3649758	5A0307002B	1/4	1/4	1/2	2 1/2	.030
3738929	5A0307002C	1/4	1/4	1/2	2 1/2	.060
3336112	5A0307002	1/4	1/4	1/2	2 1/2	–
3336115	5A0308003B	5/16	5/16	5/8	2 1/2	.030
3336114	5A0308003	5/16	5/16	5/8	2 1/2	–
3336117	5A0310004B	3/8	3/8	3/4	2 1/2	.030
3649759	5A0310004C	3/8	3/8	3/4	2 1/2	.060
3336116	5A0310004	3/8	3/8	3/4	2 1/2	–
3336119	5A0313015B	1/2	1/2	1 1/4	3	.030
3649760	5A0313015C	1/2	1/2	1 1/4	3	.060
3739147	5A0313015D	1/2	1/2	1 1/4	3	.090
3649761	5A0313015E	1/2	1/2	1 1/4	3	.120
3336118	5A0313015	1/2	1/2	1 1/4	3	–
3738933	5A0316006B	5/8	5/8	1 1/4	3 1/2	.030
3336121	5A0316006C	5/8	5/8	1 1/4	3 1/2	.060
3738934	5A0316006D	5/8	5/8	1 1/4	3 1/2	.090
3336120	5A0316006	5/8	5/8	1 1/4	3 1/2	–
3649762	5A0319007B	3/4	3/4	1 1/2	4	.030
3336123	5A0319007C	3/4	3/4	1 1/2	4	.060

(continued)

(Series 5A03 • AluSurf — continued)



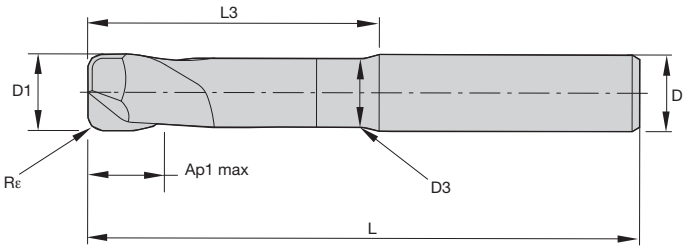


● first choice
○ alternate choice

grade UNCOATED

order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
3738937	**5A0319007D**	3/4	3/4	1 1/2	4	.090
3649763	**5A0319007E**	3/4	3/4	1 1/2	4	.120
3336122	**5A0319007**	3/4	3/4	1 1/2	4	–
3649764	**5A0325008B**	1	1	1 1/2	4	.030
3336125	**5A0325008C**	1	1	1 1/2	4	.060
3649765	**5A0325008E**	1	1	1 1/2	4	.120
3336124	**5A0325008**	1	1	1 1/2	4	–

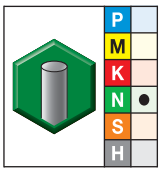
- Center cutting.
- Wiper facet design for improved floor finishes.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 5AN2 • AluSurf



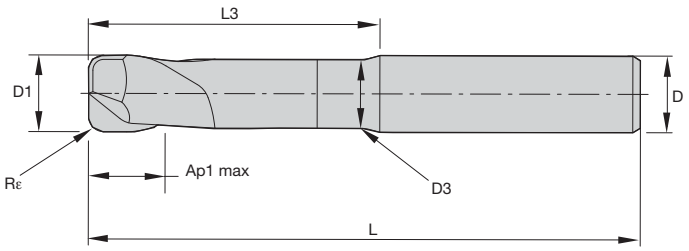
grade UNCOATED

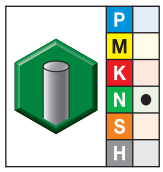
● first choice
○ alternate choice

order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
3336000	5AN203042A	1/8	1/4	.12	3/16	1/2	3	.015
3336001	5AN205042A	3/16	1/4	.18	1/4	9/16	3	.015
3336002	5AN207042A	1/4	1/4	.23	5/16	3/4	3	.015
3659287	5AN207042	1/4	1/4	.23	5/16	3/4	3	–
3683906	5AN207012B	1/4	1/4	.23	3/8	2 1/4	4	.030
3659288	5AN207012	1/4	1/4	.23	3/8	2 1/4	4	–
3336083	5AN208043B	5/16	5/16	.29	3/8	1	4	.030
3683907	5AN208023B	5/16	5/16	.29	3/8	2	4	.030
3659289	5AN208023	5/16	5/16	.29	3/8	2	4	–
3336084	5AN210044B	3/8	3/8	.35	7/16	1 1/8	4	.030
3683908	5AN210044C	3/8	3/8	.35	7/16	1 1/8	4	.060
3659290	5AN210044	3/8	3/8	.35	7/16	1 1/8	4	–
3683909	5AN210014B	3/8	3/8	.35	7/16	2 1/4	4	.030
3683910	5AN210014C	3/8	3/8	.35	7/16	2 1/4	4	.060
3474843	5AN210014	3/8	3/8	.35	7/16	2 1/4	4	–
3336085	5AN213045B	1/2	1/2	.47	9/16	1 1/2	5	.030
3683911	5AN213045C	1/2	1/2	.47	9/16	1 1/2	5	.060
3683912	5AN213045D	1/2	1/2	.47	9/16	1 1/2	5	.090
3659292	5AN213045	1/2	1/2	.47	9/16	1 1/2	5	–
3683913	5AN213005B	1/2	1/2	.47	9/16	2 1/4	5	.030

(continued)

(Series 5AN2 • AluSurf — continued)



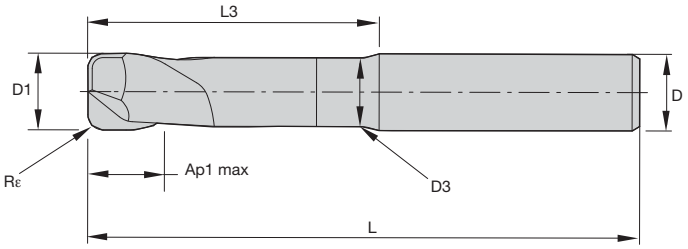


● first choice
○ alternate choice

grade UNCOATED

order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
3683914	5AN213005C	1/2	1/2	.47	9/16	2 1/4	5	.060
3683915	5AN213005D	1/2	1/2	.47	9/16	2 1/4	5	.090
3474844	5AN213005	1/2	1/2	.47	9/16	2 1/4	5	–
3683916	5AN213015B	1/2	1/2	.47	9/16	3 1/4	6	.030
3683917	5AN213015C	1/2	1/2	.47	9/16	3 1/4	6	.060
3683918	5AN213015D	1/2	1/2	.47	9/16	3 1/4	6	.090
3659487	5AN213015	1/2	1/2	.47	9/16	3 1/4	6	–
3336086	5AN216046C	5/8	5/8	.59	3/4	2	5	.060
3683919	5AN216016B	5/8	5/8	.59	3/4	3 1/4	6	.030
3683920	5AN216016C	5/8	5/8	.59	3/4	3 1/4	6	.060
3683921	5AN216016D	5/8	5/8	.59	3/4	3 1/4	6	.090
3659488	5AN216016	5/8	5/8	.59	3/4	3 1/4	6	–
3336087	5AN219047C	3/4	3/4	.70	7/8	2 1/2	5	.060
3683922	5AN219057B	3/4	3/4	.70	1	1 1/2	6	.030
3683923	5AN219057C	3/4	3/4	.70	1	1 1/2	6	.060
3683924	5AN219057D	3/4	3/4	.70	1	1 1/2	6	.090
3659489	5AN219057	3/4	3/4	.70	1	1 1/2	6	–
3683925	5AN219077B	3/4	3/4	.70	1	2 1/4	6	.030
3683926	5AN219077C	3/4	3/4	.70	1	2 1/4	6	.060
3683927	5AN219077D	3/4	3/4	.70	1	2 1/4	6	.090
3659490	5AN219077	3/4	3/4	.70	1	2 1/4	6	–
3683928	5AN219017B	3/4	3/4	.70	1	3 1/4	6	.030
3683929	5AN219017C	3/4	3/4	.70	1	3 1/4	6	.060
3683930	5AN219017D	3/4	3/4	.70	1	3 1/4	6	.090
3659491	5AN219017	3/4	3/4	.70	1	3 1/4	6	–
3683931	5AN225048B	1	1	.94	1 1/8	3	5 1/2	.030
3336088	5AN225048C	1	1	.94	1 1/8	3	5 1/2	.060
3659492	5AN225048	1	1	.94	1 1/8	3	5 1/2	–
3683932	5AN225028B	1	1	.94	1 1/8	4 1/4	7	.030
3683933	5AN225028C	1	1	.94	1 1/8	4 1/4	7	.060
3659493	5AN225028	1	1	.94	1 1/8	4 1/4	7	–

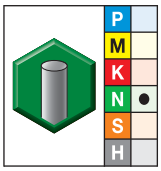
- Center cutting.
- Unequal flute spacing.
- Wiper facet design for improved floor finishes.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 5AN3 • AluSurf



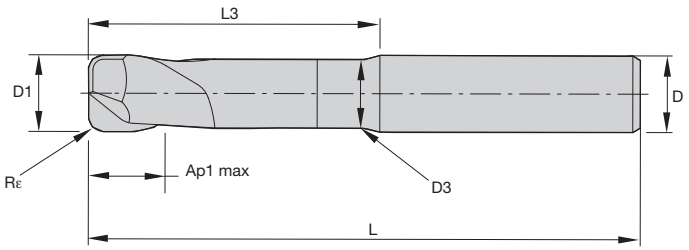
grade UNCOATED

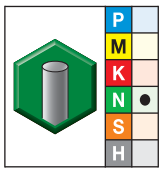
● first choice
○ alternate choice

order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
3336089	5AN303042A	1/8	1/4	.12	3/16	1/2	3	.015
3336090	5AN305042A	3/16	1/4	.18	1/4	9/16	3	.015
3336091	5AN307042A	1/4	1/4	.23	5/16	3/4	3	.015
3336092	5AN308043B	5/16	5/16	.29	3/8	1	4	.030
3336093	5AN310044B	3/8	3/8	.35	7/16	1 1/8	4	.030
3474848	5AN310044C	3/8	3/8	.35	7/16	1 1/8	4	.060
3663015	5AN310044	3/8	3/8	.35	7/16	1 1/8	4	–
3684127	5AN310014B	3/8	3/8	.35	7/16	2 1/4	4	.030
3684128	5AN310014C	3/8	3/8	.35	7/16	2 1/4	4	.060
3474847	5AN310014	3/8	3/8	.35	7/16	2 1/4	4	–
3336094	5AN313045B	1/2	1/2	.47	9/16	1 1/2	5	.030
3684129	5AN313045C	1/2	1/2	.47	9/16	1 1/2	5	.060
3684130	5AN313045D	1/2	1/2	.47	9/16	1 1/2	5	.090
3664610	5AN313045	1/2	1/2	.47	9/16	1 1/2	5	–
3684131	5AN313005B	1/2	1/2	.47	9/16	2 1/4	5	.030
3684132	5AN313005C	1/2	1/2	.47	9/16	2 1/4	5	.060
3684143	5AN313005D	1/2	1/2	.47	9/16	2 1/4	5	.090
3664611	5AN313005	1/2	1/2	.47	9/16	2 1/4	5	–
3684144	5AN313015B	1/2	1/2	.47	9/16	3 1/4	6	.030
3684145	5AN313015C	1/2	1/2	.47	9/16	3 1/4	6	.060

(continued)

(Series 5AN3 • AluSurf — continued)





● first choice
○ alternate choice

grade UNCOATED

order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
3684146	5AN313015D	1/2	1/2	.47	9/16	3 1/4	6	.090
3664636	5AN313015	1/2	1/2	.47	9/16	3 1/4	6	–
3336095	5AN316046C	5/8	5/8	.59	3/4	2	5	.060
3684147	5AN316016B	5/8	5/8	.59	3/4	3 1/4	6	.030
3684148	5AN316016C	5/8	5/8	.59	3/4	3 1/4	6	.060
3684149	5AN316016D	5/8	5/8	.59	3/4	3 1/4	6	.090
3664637	5AN316016	5/8	5/8	.59	3/4	3 1/4	6	–
3336096	5AN319047C	3/4	3/4	.70	7/8	2 1/2	5	.060
3684150	5AN319057B	3/4	3/4	.70	1	1 1/2	6	.030
3684151	5AN319057C	3/4	3/4	.70	1	1 1/2	6	.060
3684152	5AN319057D	3/4	3/4	.70	1	1 1/2	6	.090
3474883	5AN319057	3/4	3/4	.70	1	1 1/2	6	–
3684153	5AN319077B	3/4	3/4	.70	1	2 1/4	6	.030
3684154	5AN319077C	3/4	3/4	.70	1	2 1/4	6	.060
3684155	5AN319077D	3/4	3/4	.70	1	2 1/4	6	.090
3664639	5AN319077	3/4	3/4	.70	1	2 1/4	6	–
3684156	5AN319017B	3/4	3/4	.70	1	3 1/4	6	.030
3684157	5AN319017C	3/4	3/4	.70	1	3 1/4	6	.060
3684158	5AN319017D	3/4	3/4	.70	1	3 1/4	6	.090
3664640	5AN319017	3/4	3/4	.70	1	3 1/4	6	–
3684159	5AN319067B	3/4	3/4	.70	1	4 1/4	7	.030
3664641	5AN319067	3/4	3/4	.70	1	4 1/4	7	–
3684160	5AN325048B	1	1	.94	1 1/8	3	5 1/2	.030
3336097	5AN325048C	1	1	.94	1 1/8	3	5 1/2	.060
3664642	5AN325048	1	1	.94	1 1/8	3	5 1/2	–
3684161	5AN325028B	1	1	.94	1 1/8	4 1/4	7	.030
3664694	5AN325028C	1	1	.94	1 1/8	4 1/4	7	.060
3684162	5AN325028D	1	1	.94	1 1/8	4 1/4	7	.090
3664693	5AN325028	1	1	.94	1 1/8	4 1/4	7	–

■ Series 5A02 5A03 • AluSurf



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.							
		A		B	Cutting Speed — vc SFM				D1 — Diameter						
								frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3130	.3750	.5000	.6250	.7500	1.000
N	1	1.5 x D	0.5 x D	1 x D	1640	–	6560	IPT	.0023	.0028	.0034	.0045	.0056	.0068	.0090
	2	1.5 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0018	.0023	.0027	.0036	.0045	.0054	.0072
	3	1.5 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0016	.0020	.0024	.0032	.0039	.0047	.0063
	4	1.5 x D	0.5 x D	1 x D	1310	–	2460	IPT	.0016	.0020	.0024	.0032	.0039	.0047	.0063
	5	1.5 x D	0.5 x D	1 x D	820	–	3280	IPT	.0020	.0025	.0030	.0041	.0051	.0061	.0081

NOTE: For cutting aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

■ Series 5AN2 5AN3 • AluSurf



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.								
		A		B	Cutting Speed — vc SFM				D1 — Diameter							
								frac.	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.1250	.1880	.2500	.3130	.3750	.5000	.6250	.7500	1.000
N	1	1 x D	0.5 x D	1 x D	1640	–	6560	IPT	.0013	.0019	.0025	.0031	.0038	.0050	.0063	.0075	.0100
	2	1 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
	3	1 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	4	1 x D	0.5 x D	1 x D	1310	–	2460	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	4	1 x D	0.5 x D	1 x D	820	–	3280	IPT	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090

NOTE: Side milling applications — For longest reach (L3) tools, reduce ae by 30%.
Slot milling applications — For longest reach (L3) tools, reduce ap by 30%.
For cutting aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

Putting your round tools in a position to succeed

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

Precision Collet Chuck

- Minimizes runout to dramatically boost performance.
- Creates an upsurge in tool life.
- Eliminates pullout with **SAFE-λOCK®** by HAIMER option.
- Chatter-free refined balancing to G2.5@25,000 RPM.
- Extreme versatility for use with most rotating applications.

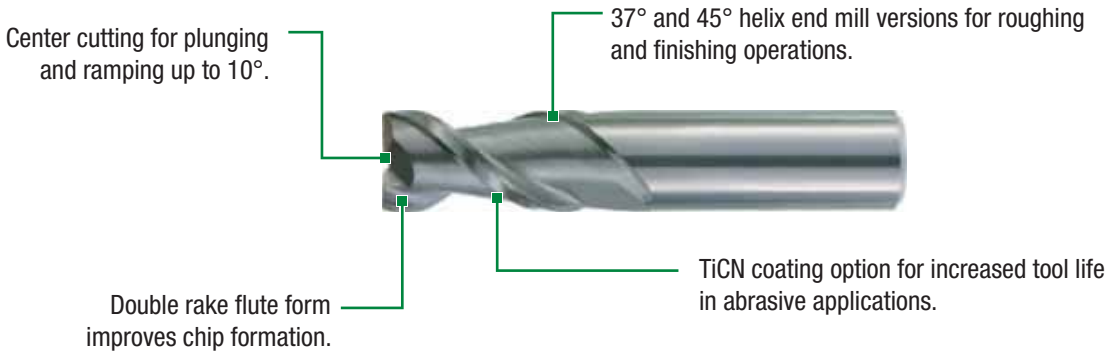
To learn more about our innovations, contact your local Authorized Distributor or visit **widia.com**.

WIDIA™

ArCut Aluminum

ArCut end mills are equipped with a double rake face chip flute form, having a smaller than normal contact zone. This accelerates the chip during formation, resulting in a short curled chip, improving chip evacuation and surface quality. Due to the short curled chips, machining corners is drastically improved as chip packing is avoided. ArCut end mills are also a preferred choice when highly accurate machined straight walls are required.

- One tool for roughing and finishing operations.
- Slotting depths up to 1 x D.
- Double rake design to manage chip formation.



ArCut™ Series

- Increase your output due to less tool changes and increased Metal Removal Rates (MRR).
- No specific tools for roughing and finishing necessary.
- Optimize chip formation and evacuation.

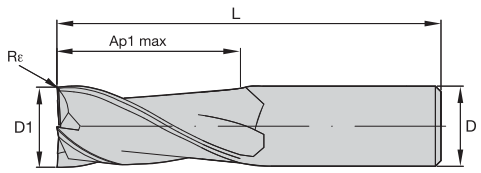
4K02 Series

- 2-flute, 45° helix.
- Radii and sharp corner configuration.

4K03 Series

- 3-flute, 37° helix.
- Radii and sharp corner configuration.

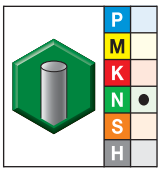
- Center cutting.
- Maximum ramp angle = 10°.
- Double rake flute form for chatter-free machining.

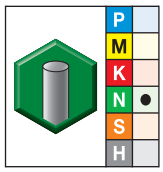


End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	< 1/8"	0/.00024
		1/8–7/32"	0/.00031
		1/4–3/8"	0/.00035
		13/32–11/16"	0/.00043
		23/32–1 3/16"	0/.00051

Series 4K02 • Series 4K02 4K12 4K22 4K42 4K62 • ArCut



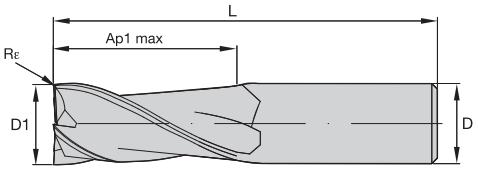


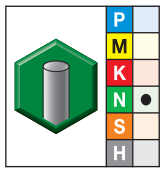
● first choice
○ alternate choice

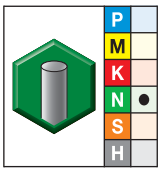
grade UNCOATED		grade TiCN-CT TiCN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
2863577	4K4203071	2841813	TC4K4203071	1/8	1/8	1/4	2	–
3638629	4K0203071A		–	1/8	1/8	1/2	2	.015
2863838	4K0203071	2842224	TC4K0203071	1/8	1/8	1/2	2	–
2863570	4K4205070	2841803	TC4K4205070	3/16	3/16	5/16	2	–
3638630	4K0205070A		–	3/16	3/16	5/8	2	.015
2863833	4K0205070	2842214	TC4K0205070	3/16	3/16	5/8	2	–
3638631	4K4207072B		–	1/4	1/4	3/8	2	.030
2863566	4K4207072	2841793	TC4K4207072	1/4	1/4	3/8	2	–
3638632	4K0207072A		–	1/4	1/4	3/4	2 1/2	.015
3638643	4K0207072B		–	1/4	1/4	3/4	2 1/2	.030
2863826	4K0207072	2842204	TC4K0207072	1/4	1/4	3/4	2 1/2	–
3638644	4K1207072A		–	1/4	1/4	1 1/4	3 1/4	.015
3638645	4K1207072B		–	1/4	1/4	1 1/4	3 1/4	.030
2863728	4K1207072	2842046	TC4K1207072	1/4	1/4	1 1/4	3 1/4	–
3638646	4K2207072A		–	1/4	1/4	1 3/4	4	.015
3638647	4K2207072B		–	1/4	1/4	1 3/4	4	.030
2863644	4K2207072	2841908	TC4K2207072	1/4	1/4	1 3/4	4	–
3638648	4K4208073B		–	5/16	5/16	7/16	2	.030
2863560	4K4208073	2841784	TC4K4208073	5/16	5/16	7/16	2	–
3638649	4K0208073B		–	5/16	5/16	13/16	2 1/2	.030

(continued)

(Series 4K02 • Series 4K02 4K12 4K22 4K42 4K62 • ArCut — continued)





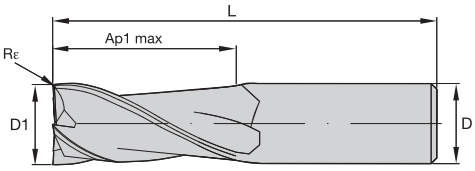


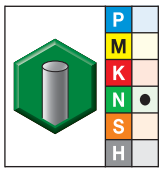
● first choice
○ alternate choice

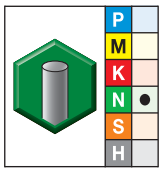
grade UNCOATED		grade TiCN-CT TiCN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
3638650	4K0208073C		–	5/16	5/16	13/16	2 1/2	.060
2863820	4K0208073	2842193	TC4K0208073	5/16	5/16	13/16	2 1/2	–
3638651	4K1208073B		–	5/16	5/16	1 1/4	3 1/4	.030
2863722	4K1208073	2842037	TC4K1208073	5/16	5/16	1 1/4	3 1/4	–
3638652	4K4210074B		–	3/8	3/8	1/2	2	.030
2863552	4K4210074	2841772	TC4K4210074	3/8	3/8	1/2	2	–
3638653	4K0210074B		–	3/8	3/8	7/8	2 1/2	.030
3638654	4K0210074C		–	3/8	3/8	7/8	2 1/2	.060
2863815	4K0210074	2842183	TC4K0210074	3/8	3/8	7/8	2 1/2	–
3638655	4K1210074B		–	3/8	3/8	1 1/2	4	.030
3638656	4K1210074C		–	3/8	3/8	1 1/2	4	.060
2863715	4K1210074	2842027	TC4K1210074	3/8	3/8	1 1/2	4	–
3638657	4K2210074B		–	3/8	3/8	2 1/2	4	.030
3638658	4K2210074C		–	3/8	3/8	2 1/2	4	.060
2863638	4K2210074	2841899	TC4K2210074	3/8	3/8	2 1/2	4	–
2863810	4K021107A	2983521	TC4K021107A	7/16	7/16	7/8	2 1/2	–
3638659	4K4213075B		–	1/2	1/2	5/8	2 1/2	.030
3638660	4K4213075C		–	1/2	1/2	5/8	2 1/2	.060
2863546	4K4213075	2841762	TC4K4213075	1/2	1/2	5/8	2 1/2	–
2863804	4K0213075	2842170	TC4K0213075	1/2	1/2	1	3	–
3638661	4K0213085B		–	1/2	1/2	1 1/4	3	.030
3638662	4K0213085C		–	1/2	1/2	1 1/4	3	.060
3638663	4K0213085E		–	1/2	1/2	1 1/4	3	.120
3061880	4K0213085	2842163	TC4K0213085	1/2	1/2	1 1/4	3	–
3638664	4K6213055B		–	1/2	1/2	1 1/2	4	.030
3638665	4K6213055C		–	1/2	1/2	1 1/2	4	.060
2863499	4K6213055	3041444	TC4K6213055	1/2	1/2	1 1/2	4	–
3638666	4K1213075B		–	1/2	1/2	2	4	.030
3638667	4K1213075C		–	1/2	1/2	2	4	.060
2863709	4K1213075	2842016	TC4K1213075	1/2	1/2	2	4	–
3638668	4K6213065B		–	1/2	1/2	2 1/2	5	.030
3638669	4K6213065C		–	1/2	1/2	2 1/2	5	.060
2863497	4K6213065	3048586	TC4K6213065	1/2	1/2	2 1/2	5	–
3638670	4K2213075B		–	1/2	1/2	3	5	.030
3061692	4K2213075	2841890	TC4K2213075	1/2	1/2	3	5	–
2863541	4K4216076	2841753	TC4K4216076	5/8	5/8	3/4	3	–

(continued)

(Series 4K02 • Series 4K02 4K12 4K22 4K42 4K62 • ArCut — continued)



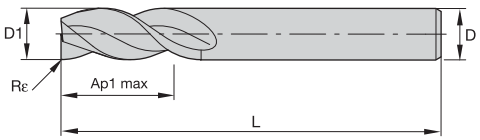




● first choice
○ alternate choice

grade UNCOATED		grade TiCN-CT TiCN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
2863794	4K0216076	2842154	TC4K0216076	5/8	5/8	1 1/4	3 1/2	–
3638675	4K6216076C		–	5/8	5/8	1 5/8	3 1/2	.060
2863494	4K6216076	2841675	TC4K6216076	5/8	5/8	1 5/8	3 1/2	–
3638676	4K1216076C		–	5/8	5/8	2 1/4	5	.060
2863704	4K1216076	2842007	TC4K1216076	5/8	5/8	2 1/4	5	–
3638677	4K2216076C		–	5/8	5/8	3	5 1/4	.060
2863628	4K2216076	3048585	TC4K2216076	5/8	5/8	3	5 1/4	–
3638678	4K4219077B		–	3/4	3/4	7/8	3	.030
3638679	4K4219077C		–	3/4	3/4	7/8	3	.060
3638680	4K4219077E		–	3/4	3/4	7/8	3	.120
2863534	4K4219077	2841743	TC4K4219077	3/4	3/4	7/8	3	–
3638681	4K0219077B		–	3/4	3/4	1 1/2	4	.030
3638682	4K0219077C		–	3/4	3/4	1 1/2	4	.060
3638683	4K0219077E		–	3/4	3/4	1 1/2	4	.120
2863788	4K0219077	2842145	TC4K0219077	3/4	3/4	1 1/2	4	–
2863491	4K6219067	2841672	TC4K6219067	3/4	3/4	1 5/8	4	–
3638684	4K1219077B		–	3/4	3/4	2 1/4	5	.030
3638685	4K1219077C		–	3/4	3/4	2 1/4	5	.060
2863698	4K1219077	2841997	TC4K1219077	3/4	3/4	2 1/4	5	–
3638686	4K6219077B		–	3/4	3/4	3	5 1/4	.030
3738131	4K6219077C		–	3/4	3/4	3	5 1/4	.060
2863488	4K6219077	2991957	TC4K6219077	3/4	3/4	3	5 1/4	–
2863623	4K2219077	3082933	TC4K2219077	3/4	3/4	4	6 1/4	–
3638689	4K0225078B		–	1	1	1 1/2	4	.030
3638690	4K0225078C		–	1	1	1 1/2	4	.060
3638691	4K0225078E		–	1	1	1 1/2	4	.120
2863782	4K0225078	2971373	TC4K0225078	1	1	1 1/2	4	–
2863485	4K6225078	3048587	TC4K6225078	1	1	2	4 1/2	–
3638692	4K1225078B		–	1	1	2 1/4	5	.030
3638693	4K1225078C		–	1	1	2 1/4	5	.060
2863691	4K1225078	2841987	TC4K1225078	1	1	2 1/4	5	–
3638694	4K2225078B		–	1	1	3	5 1/2	.030
3638695	4K2225078C		–	1	1	3	5 1/2	.060
2863617	4K2225078	3056326	TC4K2225078	1	1	3	5 1/2	–
2863482	4K6225088	3048588	TC4K6225088	1	1	4	7	–

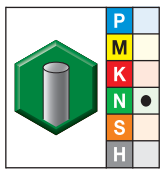
- Center cutting.
- Maximum ramp angle = 10°.
- Double rake flute form for chatter-free machining.

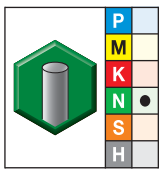


End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	< 1/8"	0/.00024
		1/8–7/32"	0/.00031
		1/4–3/8"	0/.00035
		13/32–11/16"	0/.00043
		23/32–1 3/16"	0/.00051

Series 4K03 • Series 4K03 4K13 4K23 4K43 4K63 • ArCut



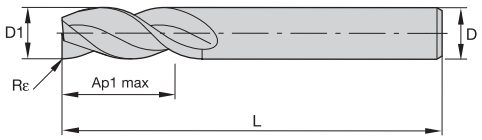


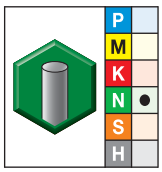
● first choice
○ alternate choice

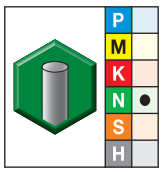
grade UNCOATED		grade TiCN-CT TiCN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
3638696	4K4307072B		–	1/4	1/4	3/8	2	.030
2863529	4K4307072	2841733	TC4K4307072	1/4	1/4	3/8	2	–
3638697	4K0307072A		–	1/4	1/4	3/4	2 1/2	.015
3638698	4K0307072B		–	1/4	1/4	3/4	2 1/2	.030
2863775	4K0307072	2842127	TC4K0307072	1/4	1/4	3/4	2 1/2	–
3638699	4K1307072A		–	1/4	1/4	1 1/4	3 1/4	.015
3638700	4K1307072B		–	1/4	1/4	1 1/4	3 1/4	.030
2863686	4K1307072	2841978	TC4K1307072	1/4	1/4	1 1/4	3 1/4	–
3638701	4K2307072A		–	1/4	1/4	1 3/4	4	.015
3638702	4K2307072B		–	1/4	1/4	1 3/4	4	.030
2863610	4K2307072	2841870	TC4K2307072	1/4	1/4	1 3/4	4	–
3638743	4K4308073B		–	5/16	5/16	7/16	2	.030
2863525	4K4308073	3019793	TC4K4308073	5/16	5/16	7/16	2	–
3638744	4K0308073B		–	5/16	5/16	13/16	2 1/2	.030
3638745	4K0308073C		–	5/16	5/16	13/16	2 1/2	.060
2863769	4K0308073	2842118	TC4K0308073	5/16	5/16	13/16	2 1/2	–
3638746	4K1308073B		–	5/16	5/16	1 1/4	3 1/4	.030
2863679	4K1308073	2841967	TC4K1308073	5/16	5/16	1 1/4	3 1/4	–
3638747	4K4310074B		–	3/8	3/8	1/2	2	.030
2863521	4K4310074	2841716	TC4K4310074	3/8	3/8	1/2	2	–

(continued)

(Series 4K03 • Series 4K03 4K13 4K23 4K43 4K63 • ArCut — continued)





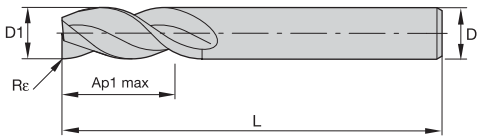


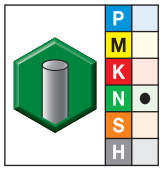
● first choice
○ alternate choice

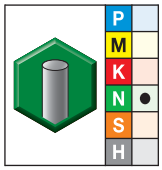
grade UNCOATED		grade TiCN-CT TiCN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
3638748	4K0310074B		–	3/8	3/8	7/8	2 1/2	.030
3638749	4K0310074C		–	3/8	3/8	7/8	2 1/2	.060
2863765	4K0310074	2842108	TC4K0310074	3/8	3/8	7/8	2 1/2	–
3638750	4K1310074B		–	3/8	3/8	1 1/2	4	.030
3638751	4K1310074C		–	3/8	3/8	1 1/2	4	.060
2863674	4K1310074	2841958	TC4K1310074	3/8	3/8	1 1/2	4	–
3638752	4K2310074B		–	3/8	3/8	2 1/2	4	.030
3638753	4K2310074C		–	3/8	3/8	2 1/2	4	.060
2863605	4K2310074	2841858	TC4K2310074	3/8	3/8	2 1/2	4	–
2863761	4K031107A	2842103	TC4K031107A	7/16	7/16	7/8	2 1/2	–
3638754	4K4313075B		–	1/2	1/2	5/8	2 1/2	.030
3638755	4K4313075C		–	1/2	1/2	5/8	2 1/2	.060
2863515	4K4313075	2841705	TC4K4313075	1/2	1/2	5/8	2 1/2	–
2863754	4K0313075	2990466	TC4K0313075	1/2	1/2	1	3	–
3638756	4K0313085B		–	1/2	1/2	1 1/4	3	.030
3638758	4K0313085C		–	1/2	1/2	1 1/4	3	.060
3638759	4K0313085E		–	1/2	1/2	1 1/4	3	.120
2863752	4K0313085	2842087	TC4K0313085	1/2	1/2	1 1/4	3	–
3638760	4K6313055B		–	1/2	1/2	1 1/2	4	.030
3638761	4K6313055C		–	1/2	1/2	1 1/2	4	.060
2863479	4K6313055	2870236	TC4K6313055	1/2	1/2	1 1/2	4	–
3638762	4K1313075B		–	1/2	1/2	2	4	.030
3638763	4K1313075C		–	1/2	1/2	2	4	.060
2863667	4K1313075	2841948	TC4K1313075	1/2	1/2	2	4	–
3638764	4K6313065B		–	1/2	1/2	2 1/2	5	.030
3638765	4K6313065C		–	1/2	1/2	2 1/2	5	.060
2863476	4K6313065	2841665	TC4K6313065	1/2	1/2	2 1/2	5	–
3638766	4K2313075B		–	1/2	1/2	3	5	.030
3638767	4K2313075C		–	1/2	1/2	3	5	.060
2863599	4K2313075	2841848	TC4K2313075	1/2	1/2	3	5	–
3638768	4K4316076C		–	5/8	5/8	3/4	3	.060
3638769	4K4316076E		–	5/8	5/8	3/4	3	.120
2863507	4K4316076	2841695	TC4K4316076	5/8	5/8	3/4	3	–
3638770	4K0316076C		–	5/8	5/8	1 1/4	3 1/2	.060
2863746	4K0316076	2990464	TC4K0316076	5/8	5/8	1 1/4	3 1/2	–
3638771	4K6316076C		–	5/8	5/8	1 5/8	3 1/2	.060

(continued)

(Series 4K03 • Series 4K03 4K13 4K23 4K43 4K63 • ArCut — continued)



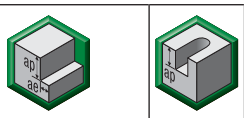




● first choice
○ alternate choice

grade UNCOATED		grade TiCN-CT TiCN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
2863473	4K6316076	2841660	TC4K6316076	5/8	5/8	1 5/8	3 1/2	–
3638772	4K1316076C		–	5/8	5/8	2 1/4	5	.060
2863661	4K1316076	2841939	TC4K1316076	5/8	5/8	2 1/4	5	–
3638773	4K2316076C		–	5/8	5/8	3	5 1/4	.060
2863595	4K2316076	2841844	TC4K2316076	5/8	5/8	3	5 1/4	–
3638774	4K4319077B		–	3/4	3/4	7/8	3	.030
3638775	4K4319077C		–	3/4	3/4	7/8	3	.060
3638776	4K4319077E		–	3/4	3/4	7/8	3	.120
2863502	4K4319077	2841686	TC4K4319077	3/4	3/4	7/8	3	–
3638777	4K0319077B		–	3/4	3/4	1 1/2	4	.030
3638778	4K0319077C		–	3/4	3/4	1 1/2	4	.060
3638779	4K0319077E		–	3/4	3/4	1 1/2	4	.120
2863739	4K0319077	2842066	TC4K0319077	3/4	3/4	1 1/2	4	–
2863470	4K6319067	2841655	TC4K6319067	3/4	3/4	1 5/8	4	–
3638780	4K1319077B		–	3/4	3/4	2 1/4	5	.030
3638781	4K1319077C		–	3/4	3/4	2 1/4	5	.060
2863656	4K1319077	2841928	TC4K1319077	3/4	3/4	2 1/4	5	–
3638782	4K6319077B		–	3/4	3/4	3	5 1/4	.030
3738132	4K6319077C		–	3/4	3/4	3	5 1/4	.060
2530382	4K6319077	2841650	TC4K6319077	3/4	3/4	3	5 1/4	–
3638783	4K2319077B		–	3/4	3/4	4	6 1/4	.030
3638784	4K2319077C		–	3/4	3/4	4	6 1/4	.060
2530406	4K2319077	2841834	TC4K2319077	3/4	3/4	4	6 1/4	–
3638785	4K0325078B		–	1	1	1 1/2	4	.030
3638786	4K0325078C		–	1	1	1 1/2	4	.060
3638787	4K0325078E		–	1	1	1 1/2	4	.120
2863734	4K0325078	2842056	TC4K0325078	1	1	1 1/2	4	–
2863464	4K6325078	2841645	TC4K6325078	1	1	2	4 1/2	–
3638788	4K1325078B		–	1	1	2 1/4	5	.030
3638789	4K1325078C		–	1	1	2 1/4	5	.060
2863650	4K1325078	2990465	TC4K1325078	1	1	2 1/4	5	–
3638790	4K2325078B		–	1	1	3	5 1/2	.030
3638791	4K2325078C		–	1	1	3	5 1/2	.060
2863584	4K2325078	2841823	TC4K2325078	1	1	3	5 1/2	–
2863461	4K6325088	2841640	TC4K6325088	1	1	4	7	–

■ Series 4K02 4K03 • ArCut



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.									
		A		B	Cutting Speed — vc SFM				D1 — Diameter								
								frac.	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.1250	.1880	.2500	.3130	.3750	.5000	.6250	.7500	1.000
N	1	Ap1 max	0.5 x D	1.0 x D	1640	–	6560	IPT	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090
	2	Ap1 max	0.5 x D	1.0 x D	1640	–	4920	IPT	.0009	.0014	.0018	.0023	.0027	.0036	.0045	.0054	.0072
	3	Ap1 max	0.5 x D	1.0 x D	1640	–	4920	IPT	.0008	.0012	.0016	.0020	.0024	.0032	.0039	.0047	.0063
	4	Ap1 max	0.5 x D	1.0 x D	1310	–	2460	IPT	.0008	.0012	.0016	.0020	.0024	.0032	.0039	.0047	.0063
	5	Ap1 max	0.5 x D	1.0 x D	820	–	3280	IPT	.0010	.0015	.0020	.0025	.0030	.0041	.0051	.0061	.0081

NOTE: For cutting aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

NOVO KNOWS CAD/CAM

With the addition of NOVO™ to your team, your CAD/CAM capabilities become much more accurate, streamlined, and productive.

Before NOVO: The programmer would be in their CAD/CAM software, programming a part. Using the outdated method of finding a tool in a catalog, and then manually inputting the tooling information from the catalog into the CAD/CAM software.

The concern is that assumptions are made, and only partial tooling information is entered.

With NOVO: The powerful digital intelligence of NOVO not only helps the programmer find the right tool for the metalcutting job, but also automatically integrates all the tooling data into a complete CAD/CAM solution.

The integration of all the tooling data increases the viability of the part being programmed, and is delivered quickly — saving you time.

NOVO can ensure you have the right tools on your machines, in the right sequence. Resulting in flawless execution that accelerates every job, and maximizes every shift. **widia.com/novo**

High-Performance Aluminum
Solid Carbide End Mills

HP Aluminum End Mills Series

WIDIA™ solid carbide end mills provide maximum Metal Removal Rates (MRR) and superior surface quality while reducing machining time in aluminum. The center cutting design allows for plunging, slotting, and profiling applications in any type of aluminum workpiece materials. The proprietary flute geometry is designed to deliver exceptional chip evacuation while generating floor-to-wall straightness, especially thin wall applications. With many styles to choose from, you can be sure WIDIA will have a solution for your aluminum applications.

- Capable of slotting depths up to 1 x D and side milling up to 1.5 x D axially at 0.5 x D radially (please follow application data for specific tool).
- Unequal flute spacing for chatter-free performance with 3-flute series.
- Multiple corner radii and extended neck configurations available as standard.

HP Aluminum End Mills Series

- Increase your output due to less tool changes and increased Metal Removal Rates (MRR).
- No specific tools for roughing and finishing necessary.
- Less passes due to 1 x D slotting capability.
- Perfect for MQL (Minimum Quantity Lubrication) applications.

4AN2 Series

- 2-flute, 37° helix.
- Extended neck for long-reach applications.
- TiCN coated option for abrasive aluminum applications.
- Sharp corner configuration.

4AN3 Series

- 3-flute, 37° helix.
- Extended neck for long-reach applications.
- TiCN coated option for abrasive aluminum applications.
- Sharp corner configuration.

4AP2 Series

- 2-flute, 37° helix.
- Sharp corner configuration.

4AP3 Series

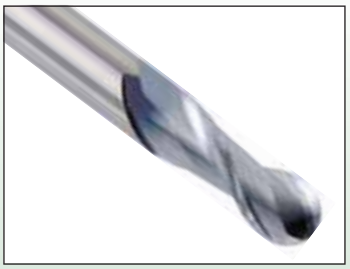
- 3-flute, 38° helix.
- Unequal flute spacing Radii and sharp corner configuration.

4B02 Series

- 2-flute, 30° helix.
- TiCN coated option for abrasive aluminum applications.
- Protective radii configuration.

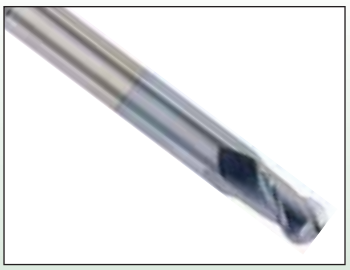
4A01 Series

- 2-flute, 37° helix.
- TiCN coated option for abrasive aluminum applications.



4AN1 Series

- 2-flute, 37° helix.
- Extended neck for long-reach applications.
- TiCN coated option for abrasive aluminum applications.



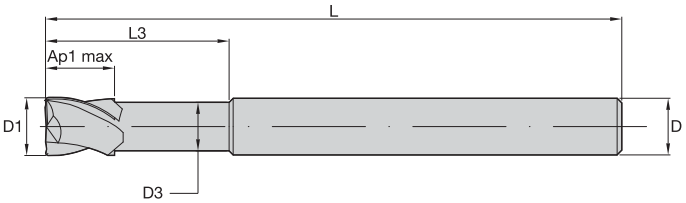
4A0R Series

- 3-flute, 30° helix.
- Coarse cord style roughing profile.

4A0B Series

- 3-flute, 30° helix.
- Coarse cord style roughing profile.

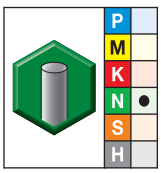
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

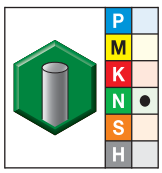


End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 4AN2



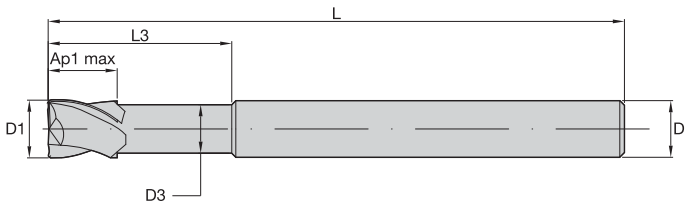


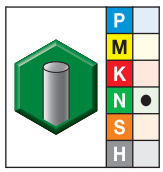
● first choice
○ alternate choice

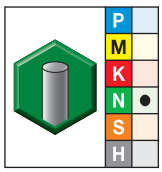
grade UNCOATED		grade TiCN-CT TiCN					length of cut		length
order #	catalog #	order #	catalog #	D1	D	D3	Ap1 max	L3	L
2870516	4AN203001	2965251	TC4AN203001	1/8	1/8	.12	1/4	1/2	3
2870513	4AN203011	2950852	TC4AN203011	1/8	1/8	.12	1/4	3/4	3
2870511	4AN203021	3056325	TC4AN203021	1/8	1/8	.12	1/4	1	3
2870509	4AN205000	3035269	TC4AN205000	3/16	3/16	.18	1/4	1/2	3
2870508	4AN205010	3105270	TC4AN205010	3/16	3/16	.18	1/4	3/4	3
2870505	4AN205020	2898545	TC4AN205020	3/16	3/16	.18	1/4	1	3
2870503	4AN207022	2870295	TC4AN207022	1/4	1/4	.24	3/8	1	4
2870501	4AN207032	2950851	TC4AN207032	1/4	1/4	.24	3/8	1 1/2	4
2864276	4AN207012	2842805	TC4AN207012	1/4	1/4	.24	3/8	2 1/4	4
2870500	4AN208003	3320921	TC4AN208003	5/16	5/16	.29	7/16	1	4
2870498	4AN208013	3320922	TC4AN208013	5/16	5/16	.29	7/16	1 1/2	4
2951832	4AN208023		–	5/16	5/16	.29	7/16	2	4
2870495	4AN210034	3032084	TC4AN210034	3/8	3/8	.35	1/2	3/4	4
3965508	4AN210024		–	3/8	3/8	.34	1/2	1 1/8	2 1/2
2870493	4AN210044		–	3/8	3/8	.35	1/2	1 1/8	4
2864265	4AN210014	2842798	TC4AN210014	3/8	3/8	.35	1/2	2 1/4	4
3965513	4AN213055		–	1/2	1/2	.47	5/8	1 1/8	3
2870491	4AN213035	3005443	TC4AN213035	1/2	1/2	.47	5/8	1 1/8	5
2870489	4AN213045	3041429	TC4AN213045	1/2	1/2	.47	5/8	1 1/2	5
3965514	4AN213065		–	1/2	1/2	.47	5/8	2 1/4	4

(continued)

(Series 4AN2 — continued)



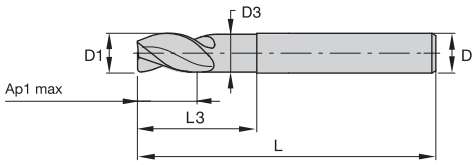




● first choice
○ alternate choice

grade UNCOATED		grade TiCN-CT TiCN							
order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
2864258	4AN213005	2842788	TC4AN213005	1/2	1/2	.47	5/8	2 1/4	5
2864255	4AN213015	2842784	TC4AN213015	1/2	1/2	.47	5/8	3 1/4	6
2864252	4AN213025	2842778	TC4AN213025	1/2	1/2	.47	5/8	4	6
3965515	4AN216026		–	5/8	5/8	.59	3/4	1 1/2	4
2870485	4AN216046		–	5/8	5/8	.59	3/4	1 1/2	5
2864245	4AN216006	2842772	TC4AN216006	5/8	5/8	.59	3/4	2 1/4	5
2864244	4AN216016	2842766	TC4AN216016	5/8	5/8	.59	3/4	3 1/4	6
2870487	4AN216036	2870289	TC4AN216036	5/8	5/8	.59	3/4	4	6
3965516	4AN219027		–	3/4	3/4	.70	1	1 1/2	4
2870481	4AN219057	3133433	TC4AN219057	3/4	3/4	.71	1	1 1/2	6
3965517	4AN219097		–	3/4	3/4	.70	1	2 1/4	4
3965518	4AN219087		–	3/4	3/4	.70	1	2 1/4	5
	–	2842754	TC4AN219007	3/4	3/4	.71	1	2 1/4	5
2870477	4AN219077	2870284	TC4AN219077	3/4	3/4	.71	1	2 1/4	6
2870484	4AN219047	3165768	TC4AN219047	3/4	3/4	.71	1	2 3/4	6
2864233	4AN219017	2842749	TC4AN219017	3/4	3/4	.71	1	3 1/4	6
2870479	4AN219067	3367685	TC4AN219067	3/4	3/4	.71	1	4 1/4	7
3965519	4AN225058		–	1	1	.94	1 1/8	1 1/2	4
3048583	4AN225038	3320925	TC4AN225038	1	1	.94	1 1/8	1 1/2	6
3965520	4AN225068		–	1	1	.94	1 1/8	2 1/4	5
2870475	4AN225078		–	1	1	.94	1 1/8	2 1/4	6
2898628	4AN225048	3320926	TC4AN225048	1	1	.94	1 1/8	2 3/4	6
2864212	4AN225018		–	1	1	.94	1 1/8	3 1/4	6
2864209	4AN225028	1902255	TC4AN225028	1	1	.94	1 1/8	4 1/4	7

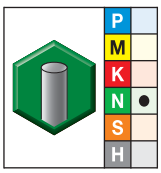
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

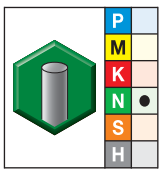


End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 4AN3



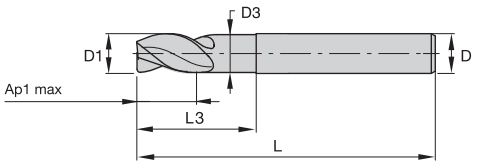


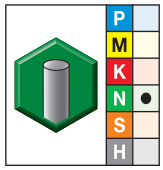
● first choice
○ alternate choice

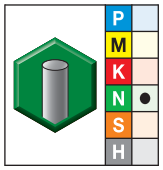
grade UNCOATED		grade TiCN-CT TiCN							
order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
2870471	4AN310034	2870278	TC4AN310034	3/8	3/8	.35	1/2	3/4	4
3965521	4AN310024		–	3/8	3/8	.34	1/2	1 1/8	2 1/2
2870470	4AN310044	2870275	TC4AN310044	3/8	3/8	.35	1/2	1 1/8	4
2870474	4AN310014	2870281	TC4AN310014	3/8	3/8	.35	1/2	2 1/4	4
3965522	4AN313025		–	1/2	1/2	.47	5/8	1 1/8	3
2870463	4AN313035	2870269	TC4AN313035	1/2	1/2	.47	5/8	1 1/8	5
2870461	4AN313045	2870266	TC4AN313045	1/2	1/2	.47	5/8	1 1/2	5
3965523	4AN313055		–	1/2	1/2	.47	5/8	2 1/4	4
2870468	4AN313005	2870272	TC4AN313005	1/2	1/2	.47	5/8	2 1/4	5
2870466	4AN313015	2951772	TC4AN313015	1/2	1/2	.47	5/8	3 1/4	5
3965524	4AN316026		–	5/8	5/8	.59	3/4	1 1/2	4
2870455	4AN316046	3133261	TC4AN316046	5/8	5/8	.59	3/4	1 1/2	5
2870459	4AN316006	3133262	TC4AN316006	5/8	5/8	.59	3/4	2 1/4	5
2870457	4AN316016	2870263	TC4AN316016	5/8	5/8	.59	3/4	3 1/4	6
3965553	4AN319037		–	3/4	3/4	.70	1	1 1/2	4
2870444	4AN319057	3320928	TC4AN319057	3/4	3/4	.71	1	1 1/2	6
3965528	4AN319087		–	3/4	3/4	.70	1	2 1/4	4
3965526	4AN319097		–	3/4	3/4	.70	1	2 1/4	5
2870438	4AN319077		–	3/4	3/4	.71	1	2 1/4	6
2870447	4AN319047	3122745	TC4AN319047	3/4	3/4	.71	1	2 3/4	6

(continued)

(Series 4AN3 — continued)



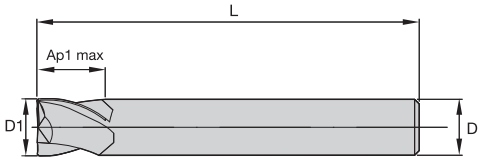




● first choice
○ alternate choice

grade UNCOATED		grade TiCN-CT TiCN					length of cut		length
order #	catalog #	order #	catalog #	D1	D	D3	Ap1 max	L3	L
2870451	4AN319017	2973503	TC4AN319017	3/4	3/4	.71	1	3 1/4	6
2870441	4AN319067	3019217	TC4AN319067	3/4	3/4	.71	1	4 1/4	7
3965529	4AN325058	–		1	1	.94	1	1 1/2	4
3965531	4AN325068	–		1	1	.94	1	2 1/4	5
2870427	4AN325038	3320929	TC4AN325038	1	1	.94	1 1/8	1 1/2	6
3022868	4AN325078	–		1	1	.94	1 1/8	2 1/4	6
2870424	4AN325048	–		1	1	.94	1 1/8	2 3/4	6
2870432	4AN325018	–		1	1	.94	1 1/8	3 1/4	6
2870430	4AN325028	–		1	1	.94	1 1/8	4 1/4	7

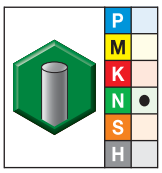
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 4AP2

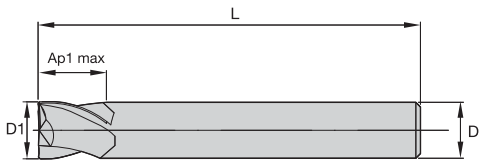


grade UNCOATED

● first choice
○ alternate choice

order #	catalog #	D1	D	length of cut Ap1 max	length L
2870421	4AP203001	1/8	1/8	1/4	3
2870418	4AP205000	3/16	3/16	1/4	3
2870415	4AP207012	1/4	1/4	3/8	4
2870409	4AP210014	3/8	3/8	1/2	4
2870406	4AP213005	1/2	1/2	5/8	5
2870403	4AP216006	5/8	5/8	3/4	5
2870400	4AP216026	5/8	5/8	3/4	8
2870397	4AP219017	3/4	3/4	1	6
2870394	4AP219027	3/4	3/4	1	8
2870391	4AP225018	1	1	1 1/8	6
2870388	4AP225028	1	1	1 1/8	8

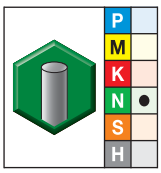
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 4AP3

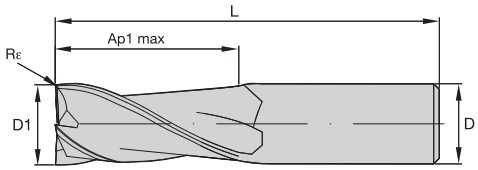


grade UNCOATED

● first choice
○ alternate choice

order #	catalog #	D1	D	length of cut Ap1 max	length L
2870382	4AP310014	3/8	3/8	1/2	4
2870379	4AP313005	1/2	1/2	5/8	5
2870372	4AP316006	5/8	5/8	3/4	5
2870369	4AP319017	3/4	3/4	1	6
2870363	4AP325018	1	1	1 1/8	6

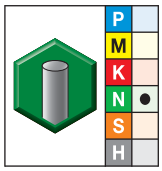
- Center cutting.
- For heavy stock removal.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 4B02

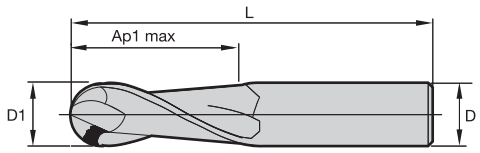


grade UNCOATED

● first choice
○ alternate choice

order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
2864060	4B0207072A	1/4	1/4	3/8	2	.018
2864057	4B0208073A	5/16	5/16	1/2	2	.018
2864051	4B0210074A	3/8	3/8	9/16	2	.018
2864041	4B0213075A	1/2	1/2	3/4	3	.030
2864035	4B0216076A	5/8	5/8	1	3	.030
2864029	4B0219077A	3/4	3/4	1 1/8	4	.030
2864024	4B0225078A	1	1	1 1/2	4	.030

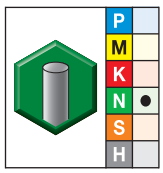
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



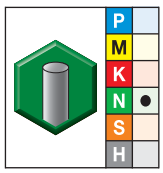
End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 4A01 • Series 4A01 4A11 4A41



grade UNCOATED

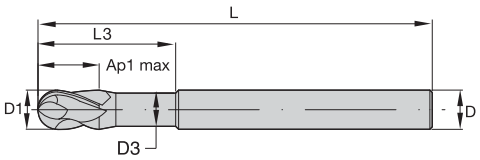


grade TiCN-CT TiCN

● first choice
○ alternate choice

order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
2864388	4A4103001	2842903	TC4A4103001	1/8	1/8	1/4	2
2864580	4A0103001	2843170	TC4A0103001	1/8	1/8	1/2	2
2864385	4A4105000	2842899	TC4A4105000	3/16	3/16	5/16	2
2864576	4A0105000	2843165	TC4A0105000	3/16	3/16	5/8	2
2864382	4A4107002	2842891	TC4A4107002	1/4	1/4	3/8	2
2864573	4A0107002	2843160	TC4A0107002	1/4	1/4	3/4	2 1/2
2864482	4A1107002	2843015	TC4A1107002	1/4	1/4	1 1/4	3 1/4
2864570	4A0108003	2898548	TC4A0108003	5/16	5/16	13/16	2 1/2
2864567	4A0110004	2843156	TC4A0110004	3/8	3/8	7/8	2 1/2
2864476	4A1110004	2843006	TC4A1110004	3/8	3/8	1 1/2	4
2864373	4A4113005	2842886	TC4A4113005	1/2	1/2	5/8	2 1/2
2864560	4A0113005	2843149	TC4A0113005	1/2	1/2	1	3
2864558	4A0113015	2843144	TC4A0113015	1/2	1/2	1 1/4	3
2864473	4A1113005	2843001	TC4A1113005	1/2	1/2	2	4
2864370	4A4116006		–	5/8	5/8	3/4	3
2864555	4A0116006	2843139	TC4A0116006	5/8	5/8	1 1/4	3 1/2
2864470	4A1116006		–	5/8	5/8	2 1/4	5
2864367	4A4119007		–	3/4	3/4	7/8	3
2864552	4A0119007	2843134	TC4A0119007	3/4	3/4	1 1/2	4
2864466	4A1119007		–	3/4	3/4	2 1/2	5
2864549	4A0125008	2843129	TC4A0125008	1	1	1 1/2	4
2864464	4A1125008		–	1	1	2 1/4	5

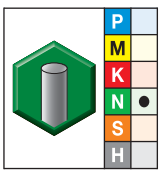
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
< 1/8"	0/.00024	< 1/8"	0/.00024
1/8–7/32"	0/.00031	1/8–7/32"	0/.00031
1/4–3/8"	0/.00035	1/4–3/8"	0/.00035
13/32–11/16"	0/.00043	13/32–11/16"	0/.00043
23/32–1 3/16"	0/.00051	23/32–1 3/16"	0/.00051

Series 4AN1

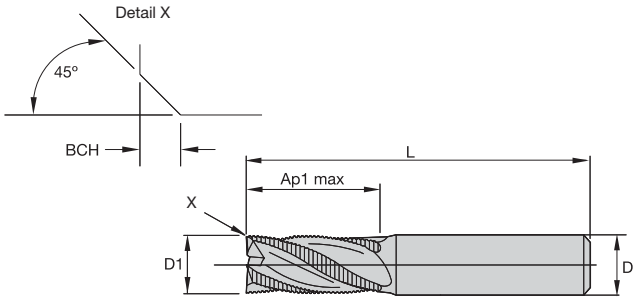


grade UNCOATED

● first choice
○ alternate choice

order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
2864330	4AN107012	1/4	1/4	.24	3/8	2 1/4	4
2864327	4AN110014	3/8	3/8	.35	1/2	2 1/4	4
2864323	4AN113005	1/2	1/2	.47	5/8	2 1/4	5
2864320	4AN113015	1/2	1/2	.47	5/8	3 1/4	6
2864318	4AN113025	1/2	1/2	.47	5/8	4	6
2864314	4AN116006	5/8	5/8	.59	3/4	2 1/4	5
2864311	4AN116016	5/8	5/8	.59	3/4	3 1/4	6
2864308	4AN116026	5/8	5/8	.59	3/4	4 1/4	7
2864305	4AN119007	3/4	3/4	.71	1	2 1/4	5
2864303	4AN119017	3/4	3/4	.71	1	3 1/4	6
2864300	4AN119027	3/4	3/4	.71	1	4 1/4	7
2864297	4AN125008	1	1	.94	1 1/8	2 1/4	5
2864293	4AN125018	1	1	.94	1 1/8	3 1/4	6
2864291	4AN125028	1	1	.94	1 1/8	4 1/4	7

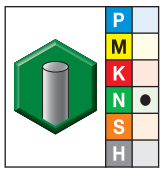
- Center cutting.
- Coarse profile.
- Standard items listed. Additional styles and coatings made-to-order.

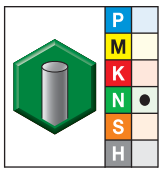


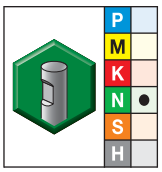
End Mill Tolerances

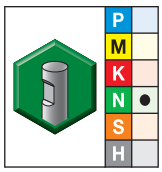
D1	d11	D	tolerance h6 + / -
< 1/8"	-.0008/-.0031	< 1/8"	0/.00024
1/8–7/32"	-.0012/-.0041	1/8–7/32"	0/.00031
1/4–3/8"	-.0016/-.0051	1/4–3/8"	0/.00035
13/32–11/16"	-.002/-.0063	13/32–11/16"	0/.00043
23/32–1 3/16"	-.0026/-.0077	23-32–1 3/16"	0/.00051

Series 4A0R • Series 4A0R 4A1R 4A4R





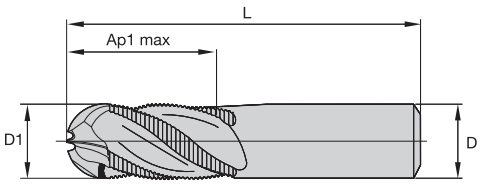




● first choice
○ alternate choice

grade UNCOATED		grade TiCN-CT TiCN		grade UNCOATED-WW		grade TiCN-CW TiCN						
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
2864498	4A0R07002	2843045	TC4A0R07002		–		–	1/4	1/4	3/4	2 1/2	.024
2864345	4A4R10004		–		–		–	3/8	3/8	1/2	2	.024
	–		–	2864495	4A0R10004	2843040	TC4A0R10004	3/8	3/8	7/8	2 1/2	.024
2864342	4A4R13005		–		–		–	1/2	1/2	5/8	2 1/2	.040
	–		–	2864492	4A0R13005	2843035	TC4A0R13005	1/2	1/2	1	3	.040
2864420	4A1R13005		–		–	2842926	TC4A1R13005	1/2	1/2	2	4 1/2	.040
	–		–	2864490	4A0R16006	2843030	TC4A0R16006	5/8	5/8	1 1/4	3 1/2	.040
2864419	4A1R16006		–		–	2842921	TC4A1R16006	5/8	5/8	2 1/4	5	.040
	–		–	2864488	4A0R19007	2843025	TC4A0R19007	3/4	3/4	1 1/2	4	.040
2864416	4A1R19007		–		–	2842915	TC4A1R19007	3/4	3/4	2 1/4	5	.040
	–		–	2864485	4A0R25008	2843020	TC4A0R25008	1	1	1 1/2	4	.040
2864412	4A1R25008		–		–	2842911	TC4A1R25008	1	1	2 1/4	5	.040

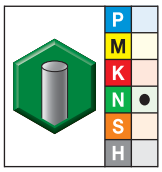
- Center cutting.
- Coarse profile.
- Standard items listed. Additional styles and coatings made-to-order.

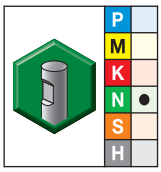


End Mill Tolerances

D1	d11	D	tolerance h6 + / -
< 1/8"	-.0008/-.0031	< 1/8"	0/.00024
1/8–7/32"	-.0012/-.0041	1/8–7/32"	0/.00031
1/4–3/8"	-.0016/-.0051	1/4–3/8"	0/.00035
13/32–11/16"	-.002/-.0063	13/32–11/16"	0/.00043
23/32–1 3/16"	-.0026/-.0077	23-32–1 3/16"	0/.00051

Series 4A0B





● first choice
○ alternate choice

grade UNCOATED		grade UNCOATED-WW					
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
3320818	4A0B07002	–		1/4	1/4	3/4	2 1/2
–		3320819	4A0B10004	3/8	3/8	7/8	2 1/2
–		3320820	4A0B13005	1/2	1/2	1	3
–		3320821	4A0B16006	5/8	5/8	1 1/4	3 1/2
–		3320822	4A0B19007	3/4	3/4	1 1/2	4

Series 4AN2 4AN3 4AP2 4AP3



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.								
		A		B	Cutting Speed — vc SFM				D1 — Diameter							
								frac.	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.125	.188	.250	.313	.375	.500	.625	.750	1.000
N	1	1 x D	0.5 x D	1.0 x D	1640	–	6560	IPT	.0013	.0019	.0025	.0031	.0038	.0050	.0063	.0075	.0100
	2	1 x D	0.5 x D	1.0 x D	1640	–	4920	IPT	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
	3	1 x D	0.5 x D	1.0 x D	1640	–	4920	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	4	1 x D	0.5 x D	1.0 x D	1310	–	2460	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	5	1 x D	0.5 x D	1.0 x D	820	–	3280	IPT	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090

NOTE: Side milling applications — For longest reach (L3) tools, reduce ae by 30%.
Slot milling applications — For longest reach (L3) tools, reduce ap by 30%.
For cutting, aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters > 1/2".

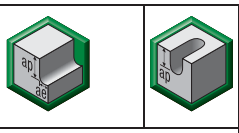
Series 4B02



Material Group		For Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.						
		A		B	Cutting Speed — vc SFM									
								frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.250	.313	.375	.500	.625	.750	1.000
N	1	1 x D	0.5 x D	1.5 x D	1600	–	6500	IPT	.0100	.0150	.0200	.0300	.0350	.0450	.0500
	2	1 x D	0.5 x D	1.5 x D	1600	–	4500	IPT	.0100	.0150	.0030	.0300	.0350	.0450	.0500

NOTE: For cutting aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

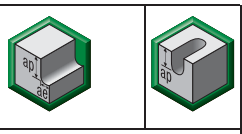
Series 4A01 4A41



Material Group		Side Milling (A) and Slotting (B) A ap	A ae	B ap	uncoated Cutting Speed — vc SFM min		max	Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%. frac. / dec.	D1 — Diameter 1/8 .1250	3/16 .1880	1/4 .2500	5/16 .3130	3/8 .3750	1/2 .5000	5/8 .6250	3/4 .7500	1 1.000
N	1	1 x D	0.5 x D	1 x D	1640	–	6560	IPT	.0013	.0019	.0025	.0031	.0038	.0050	.0063	.0075	.0100
	2	1 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
	3	1 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	4	1 x D	0.5 x D	1 x D	1310	–	2460	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	5	1 x D	0.5 x D	1 x D	820	–	3280	IPT	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090

NOTE: For cutting aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

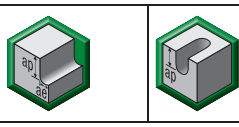
Series 4A11



Material Group		Side Milling (A) and Slotting (B) A ap	A ae	B ap	uncoated Cutting Speed — vc SFM min		max	Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%. frac. / dec.	D1 — Diameter 1/8 .1250	3/16 .1875	1/4 .2500	5/16 .3125	3/8 .3750	1/2 .5000	5/8 .6250	3/4 .7500	1 1.000
N	1	1 x D	0.25 x D	0.5 x D	1640	–	6560	IPT	.0013	.0019	.0025	.0031	.0038	.0050	.0063	.0075	.0100
	2	1 x D	0.25 x D	0.5 x D	1640	–	4920	IPT	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
	3	1 x D	0.25 x D	0.5 x D	1640	–	4920	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	4	1 x D	0.25 x D	0.5 x D	1310	–	2460	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	5	1 x D	0.25 x D	0.5 x D	820	–	3280	IPT	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090

Application Data • Series 4AN1

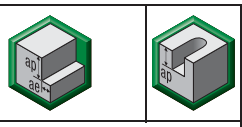
Series 4AN1



Material Group		Side Milling (A) and Slotting (B) A ap	A ae	B ap	uncoated Cutting Speed — vc SFM min		max	Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%. frac. / dec.	D1 — Diameter 1/8 .1250	3/16 .1875	1/4 .2500	5/16 .3125	3/8 .3750	1/2 .5000	5/8 .6250	3/4 .7500	1 1.000
N	1	1 x D	0.25 x D	0.5 x D	1640	–	6560	IPT	.0013	.0019	.0025	.0031	.0038	.0050	.0063	.0075	.0100
	2	1 x D	0.25 x D	0.5 x D	1640	–	4920	IPT	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
	3	1 x D	0.25 x D	0.5 x D	1640	–	4920	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	4	1 x D	0.25 x D	0.5 x D	1310	–	2460	IPT	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
	5	1 x D	0.25 x D	0.5 x D	820	–	3280	IPT	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090

NOTE: Side milling applications — For longest reach (L3) tools, reduce ae by 30%.
Slot milling applications — For longest reach (L3) tools, reduce ap by 30%.
For cutting aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

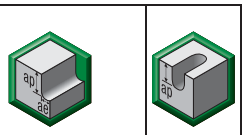
Series 4A0R



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.							
		A		B	Cutting Speed — vc SFM				D1 — Diameter						
								frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3125	.3750	.5000	.6250	.7500	1.000
N	1	1.5 x D	0.5 x D	1 x D	1640	–	6560	IPT	.0030	.0038	.0045	.0060	.0075	.0090	.0120
	2	1.5 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0024	.0030	.0036	.0048	.0060	.0072	.0096
	3	1.5 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0021	.0026	.0032	.0042	.0053	.0063	.0084
	4	1.5 x D	0.5 x D	1 x D	1310	–	2460	IPT	.0021	.0026	.0032	.0042	.0053	.0063	.0084
	5	1.5 x D	0.5 x D	1 x D	820	–	3280	IPT	.0027	.0034	.0041	.0054	.0068	.0081	.0108

NOTE: Side milling applications — For longest reach (L3) tools, reduce ae by 30%.
Slot milling applications — For longest reach (L3) tools, reduce ap by 30%.
For cutting aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

Series 4A0B



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.							
		A		B	Cutting Speed — vc SFM				D1 — Diameter						
								frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3125	.3750	.5000	.6250	.7500	1.000
N	1	1.5 x D	0.5 x D	1 x D	1640	–	6560	IPT	.0028	.0034	.0041	.0055	.0069	.0083	.0110
	2	1.5 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0022	.0028	.0033	.0044	.0055	.0066	.0088
	3	1.5 x D	0.5 x D	1 x D	1640	–	4920	IPT	.0019	.0024	.0029	.0039	.0048	.0058	.0077
	4	1.5 x D	0.5 x D	1 x D	1310	–	2460	IPT	.0019	.0024	.0029	.0039	.0048	.0058	.0077
	5	1.5 x D	0.5 x D	1 x D	820	–	3280	IPT	.0025	.0031	.0037	.0050	.0062	.0074	.0099

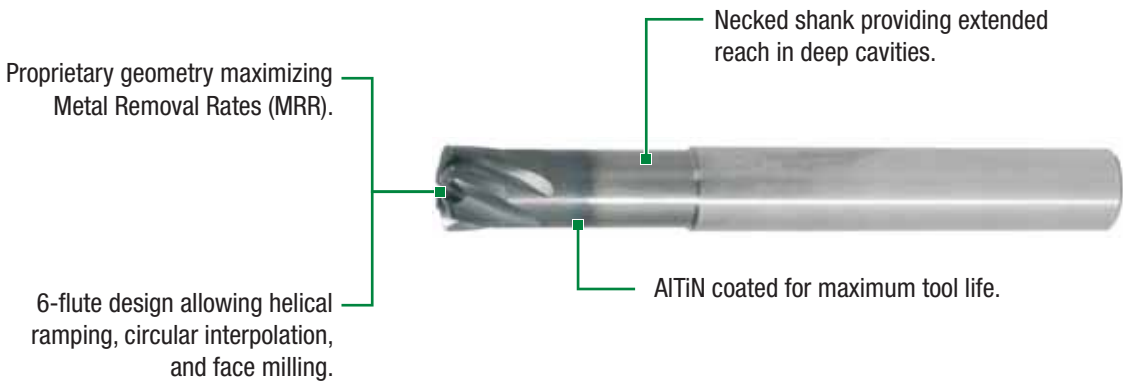
NOTE: For cutting aluminum with high silicon, coating is recommended.
For spindles with ceramic bearings, multiply ap by 0.5.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

X-Feed™ End Mills for High-Feed Milling

X-Feed

X-Feed significantly reduces manufacturing time machining heat-treated steels up to 67 HRC hardness, having 50% more effective cutting edges than regular solid carbide tooling. X-Feed combines roughing and semi-finishing into one operation by taking shallow depths-of-cut at extremely high feed rates, maximizing Metal Removal Rates (MRR). X-Feed, which has a 3 x D neck and extended reach design, is perfectly suited for pocketing using 3D machining techniques such as ramping and helical interpolation. During face milling, the proprietary front-end geometry of X-Feed is entirely in contact with the workpiece, providing up to 55% engagement compared to the regular 5–10% provided by ball nose-type tooling.

- Proprietary 6-flute design for high productivity.
- One tool for roughing and semi-finishing operations.
- Covering hardened materials ranging from 37–67 HRC with two dedicated geometries.
- Custom solutions tailored for machining titanium and other high-temperature alloys available.



X-Feed™ Series

- Significantly reduces manufacturing time in machining hardened steels.
- Providing the benefits of indexable style high-feed milling starting as small as 1/4".
- Increases your capability to perform 3D machining, helical ramping, circular interpolation, face milling, and pocketing.
- One tool for roughing and semi-finishing.

7FN6 Series

- 6-flute.
- Extended neck for long-reach applications.
- Applicable for hardened steels from 40–52 HRC.

7FN7 Series

- 6-flute.
- Extended neck for long-reach applications.
- Applicable for hardened steels from 50–67 HRC.

Operation Pocket Milling

Customer: Die and Mold Manufacturer

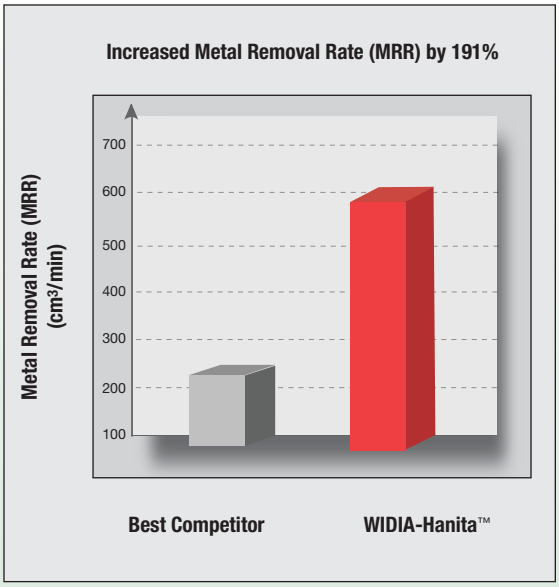
Material: AISI 4340 hardened steel (52 HRC)

Workpiece: Mold

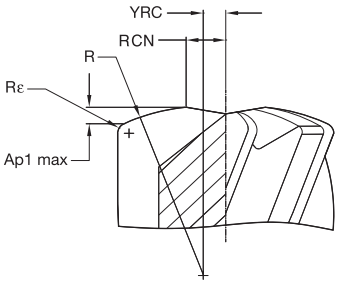
Results:
- 3x better Metal Removal Rate (MRR) than competitive tool!
- Machined at more than 3x faster feed!

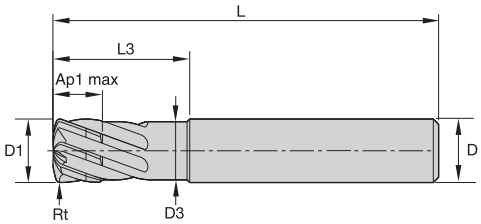
	COMPETITOR	WIDIA-Hanita™
tool:	6-flute H/P for die & mold	TM7FN613005
material:	medium-hardened steel (52 HRC)	medium-hardened steel (52 HRC)
surface speed:	400 SFM (120 m/min)	530 SFM (160 m/min)
feed per tooth:	.013" (0,34mm)	.013" (0,34mm)
depth of cut:	.031" (0,8mm)	.023" (0,6mm)
table feed:	170 in/min (4,331 mm/min)	600 in/min (15,287 mm/min)
metal removal rate:	1.4 in^3 (22,8 cm^3)	3.7 in^3 (60,5 cm^3)

Individual results may vary.



- Non-center cutting.
- High feed.
- Standard items listed. Additional styles and coatings made-to-order.

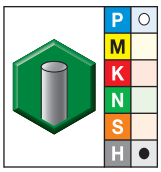




End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	< 1/8"	0/.00024
		1/8–7/32"	0/.00031
		1/4–3/8"	0/.00035
		13/32–11/16"	0/.00043
		23/32–1 3/16"	0/.00051

Series 7FN6 • 37–52 HRC • Vision Plus X-Feed



● first choice
○ alternate choice

grade AlTiN-MT1 AlTiN								
order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rt
3484760	TM7FN607002	1/4	1/4	.21	.013	3/4	2 1/2	.027
3484761	TM7FN608003	5/16	5/16	.27	.017	1	3	.034
3484762	TM7FN610004	3/8	3/8	.34	.020	1 1/4	3 1/2	.040
3484763	TM7FN613005	1/2	1/2	.46	.027	1 1/2	4	.054
3484764	TM7FN616006	5/8	5/8	.59	.033	2	4 1/2	.067
3484765	TM7FN619007	3/4	3/4	.71	.040	2 1/2	5	.080

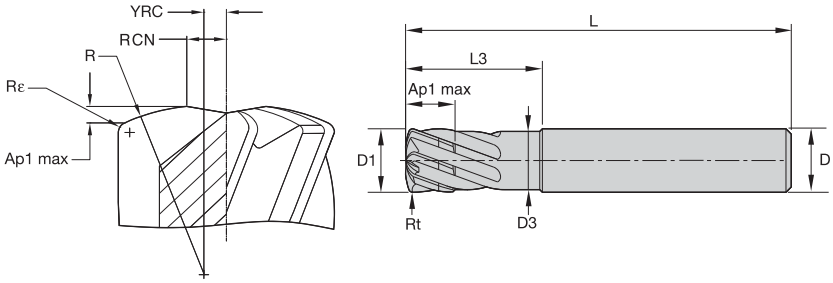
NOTE: YRC = distance from center line to the crown of the R radius.
RCN = distance from center line to the start of the cutting edge. This dimension can also help determine the minimum circle size when helical ramping.
R = the head radius size.
Rε = the shoulder radius or radius at the corner of the cutter.

Programming Data

Tool List 7FN6

Geometrical Parameters									Ramping Guide for Circular and Linear Interpolation						
									Circular Interpolation		Linear Interpolation				
									Allowed Range of Hole Diameter		Calculated Length (mm) per Ramp Angle				
diameter	Ap1 max	Rfm	Rt	Rc	Xfm	Yfm	YD	Number			Ramp Angle (degree)				
[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	flutes	Smallest	Largest	1	2	3	4	5
1/4	0.0133	1/4	0.0269	0.0160	0.0133	0.0313	0.0525	6	0.355	0.5	0.76	0.38	0.25	0.19	0.15
5/16	0.0166	5/16	0.0336	0.0200	0.0166	0.0391	0.0656	6	0.44375	0.625	0.95	0.48	0.32	0.24	0.19
3/8	0.0200	3/8	0.0399	0.0235	0.0200	0.0469	0.0788	6	0.5325	0.75	1.14	0.57	0.38	0.29	0.23
1/2	0.0266	1/2	0.0538	0.0320	0.0266	0.0625	0.1050	6	0.71	1	1.52	0.76	0.51	0.38	0.30
5/8	0.0333	5/8	0.0672	0.0400	0.0333	0.0781	0.1313	6	0.8875	1.25	1.91	0.95	0.63	0.48	0.38
3/4	0.0399	3/4	0.0798	0.0470	0.0399	0.0938	0.1575	6	1.065	1.5	2.29	1.14	0.76	0.57	0.46
1	0.0532	1	0.1059	0.0620	0.0532	0.1250	0.2100	6	1.42	2	3.05	1.52	1.02	0.76	0.61
Recommended Feed											100%	70%	50%	30%	10%

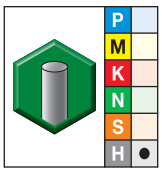
- Non-center cutting.
- High feed.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	< 1/8"	0/.00024
		1/8–7/32"	0/.00031
		1/4–3/8"	0/.00035
		13/32–11/16"	0/.00043
		23/32–1 3/16"	0/.00051

Series 7FN7 • >52 HRC • Vision Plus X-Feed



● first choice
○ alternate choice

order #	catalog #	grade AlTiN-MT1 AlTiN D1	D	D3	length of cut Ap1 max	L3	length L	Rt
3484767	TM7FN707002	1/4	1/4	.21	.008	3/4	2 1/2	.024
3484768	TM7FN708003	5/16	5/16	.27	.010	1	3	.030
3484769	TM7FN710004	3/8	3/8	.34	.012	1 1/4	3 1/2	.036
3484770	TM7FN713005	1/2	1/2	.46	.016	1 1/2	4	.048
3484771	TM7FN716006	5/8	5/8	.59	.021	2	4 1/2	.061
3484772	TM7FN719007	3/4	3/4	.71	.025	2 1/2	5	.072

NOTE: YRC = distance from center line to the crown of the R radius.
RCN = distance from center line to the start of the cutting edge. This dimension can also help determine the minimum circle size when helical ramping.
R = the head radius size.
Rε = the shoulder radius or radius at the corner of the cutter.

Programming Data

Tool List 7FN7

Geometrical Parameters									Ramping Guide for Circular and Linear Interpolation						
									Circular Interpolation		Linear Interpolation				
									Allowed Range of Hole Diameter		Calculated Length (mm) per Ramp Angle				
diameter	Ap1 max	Rfm	Rt	Rc	Xfm	Yfm	YD	Number			Ramp Angle (degree)				
[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	flutes	Smallest	Largest	1	2	3	4	5
1/4	.0082	3/8	.0242	.0160	.0082	.0313	.0550	6	0.36	0.5	0.47	0.24	0.16	0.12	0.09
5/16	.0103	1/2	.0303	.0200	.0103	.0391	.0688	6	0.45	0.625	0.59	0.29	0.20	0.15	0.12
3/8	.0123	9/16	.0358	.0240	.0123	.0469	.0825	6	0.54	0.75	0.71	0.35	0.24	0.18	0.14
1/2	.0164	3/4	.0484	.0320	.0164	.0625	.1100	6	0.72	1	0.94	0.47	0.31	0.23	0.19
5/8	.0205	15/16	.0605	.0400	.0205	.0781	.1375	6	0.9	1.25	1.18	0.59	0.39	0.29	0.23
3/4	.0246	1 1/8	.0716	.0470	.0246	.0938	.1650	6	1.08	1.5	1.41	0.71	0.47	0.35	0.28
1	.0328	1 1/2	.0948	.0620	.0328	.1250	.2200	6	1.44	2	1.88	0.94	0.63	0.47	0.38
Recommended Feed											100%	70%	50%	30%	10%

Series 7FN6 • Vision Plus X-Feed

Material Group												
		Profile Milling		AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A)					
		A		Cutting Speed — vc SFM				D1 — Diameter				
							frac.	1/4	5/16	3/8	1/2	5/8	3/4
		ap	ae	min		max	dec.	.2500	.3130	.3750	.5000	.6250	.7500
P	4	0.05 x D	0.55 x D	528	–	594	IPT	.0130	.0160	.0190	.0250	.0260	.0280
H	1	0.05 x D	0.55 x D	462	–	528	IPT	.0130	.0160	.0190	.0250	.0260	.0280
	2	0.05 x D	0.55 x D	330	–	396	IPT	.0080	.0090	.0110	.0150	.0190	.0230

Series 7FN7 • Vision Plus X-Feed

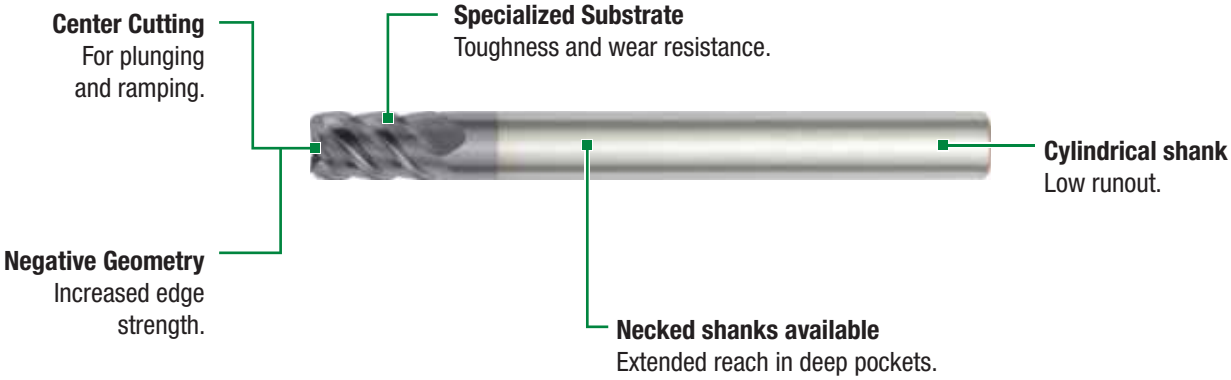
Material Group												
		Profile Milling		AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A)					
		A		Cutting Speed — vc SFM				D1 — Diameter				
							frac.	1/4	5/16	3/8	1/2	5/8	3/4
		ap	ae	min		max	dec.	0.250	0.313	0.375	0.500	0.625	0.750
H	2	0.03 x D	0.55 x D	330	–	396	IPT	.0080	.0090	.0110	.0150	.0190	.0230
	3	0.03 x D	0.55 x D	265	–	330	IPT	.0080	.0090	.0110	.0150	.0190	.0230
	4	0.03 x D	0.55 x D	165	–	230	IPT	.0060	.0080	.0090	.0130	.0160	.0190

High-Performance Solid Carbide End Mills •
Vision Plus™

Vision Plus

Engineered to machine hardened steels up to 67 HRC at extreme speeds and feeds, Vision Plus solid carbide end mills are designed with a special substrate and geometries to extend tool life and lower manufacturing costs. Vision Plus end mills offer a complete portfolio for the die and mold industry or any application that requires machining of hardened workpiece materials. Vision Plus end mills will make your next application in hardened materials more productive and efficient.

- Capable of machining hardened steels up to 67 HRC.
- Complete line of Vision Plus micro end mills.
- Unique design allows higher feeds and speeds, increasing Metal Removal Rates (MRR).
- Wide range of diameters from 0.012–1" (0,3–25mm).
- AlTiN coating for maximum wear resistance.



Vision Plus™ Series

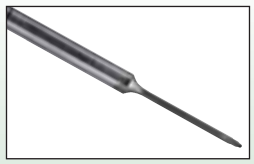
- Machine hardened materials up to 67 HRC.
- Long overall length for deep-reach applications.
- Reinforced core for better rigidity.
- High helix for better surface finishes.

7N02 Series
- Center cutting.
- 2-flute.
- 30° helix.
- Extended neck for long-reach applications.
- JIS.
- Sharp corner.
- 0,3–3,1mm diameter range.

423034 Series
- Center cutting.
- 2-flute.
- 30° helix.
- Ball nose.
- 0,5–3mm diameter range.

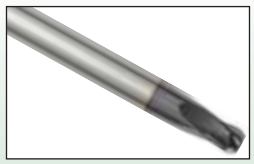
7N01 Series
- Center cutting.
- 2-flute.
- 30° helix.
- Ball nose.
- JIS.
- 0,3–6mm diameter range.

7N21 Series
- Center cutting.
- 2-flute.
- 30° helix.
- Ball nose.
- Extended neck for long-reach applications.
- 0,5–3mm diameter range.



7S05 Series
- Center cutting.
- 4-,5-, and 6-flutes.
- 50° helix.
- Sharp corner.
- 1/4–1" diameter range.

7S5F Series
- Center cutting.
- 4-flute.
- 15° helix.
- Ball nose.
- 1/8–3/4" diameter range.



7S7R Series
- Center cutting.
- 3-,4-, and 6-flutes.
- 45° helix.
- Roughing end mill.
- Works in multiple materials.
- 5/32–1" diameter range.

75N2 Series
- Center cutting.
- 2-flute.
- 30° helix.
- Radii corner.
- Extended neck for long-reach applications.
- 3–12mm diameter range.

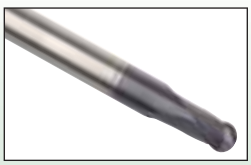
422875 Series
- Center cutting.
- 2-flute.
- 20° helix.
- Extended neck for long-reach applications.
- Torus corner.
- 2–12mm diameter range.

7151 Series
- Center cutting.
- 2-flute.
- 15° helix.
- Ball nose.
- 1–20mm diameter range.

7061 Series
- Center cutting.
- 2-flute.
- 30° helix.
- Ball nose.
- Extended neck for long-reach applications.
- 1–12mm diameter range.

70N1 Series
- Center cutting.
- 2-flute.
- 30° helix.
- Ball nose.
- Extended neck for long-reach applications.
- 1–12mm diameter range.

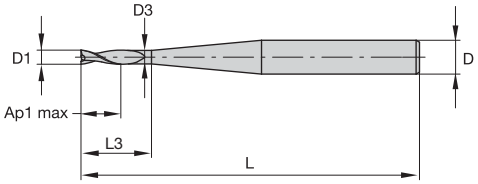
422869 Series
- Center cutting.
- 2-flute.
- 30° helix.
- Ball nose.
- Extended neck for long-reach applications.
- 1–16mm diameter range.



422870 Series
- Center cutting.
- 2-flute.
- 20° helix.
- Ball nose.
- Extended neck for long-reach applications.
- 2–12mm diameter range.

422873 Series
- Center cutting.
- 2-flute.
- 0° helix.
- Extended neck for long-reach applications.
- 3–10mm diameter range.

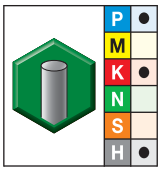
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

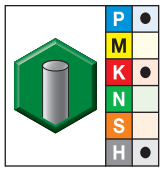


End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

Series 7N02 7N12 7N22 • Vision Plus Micro



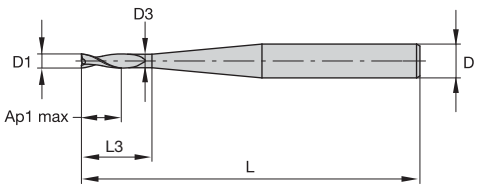


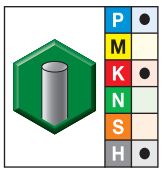
● first choice
○ alternate choice

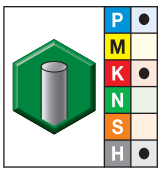
grade AlTiN-MJ1 AlTiN		grade TiAlN-RJ1 TiAlN							
order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
3321518	7N0200302MJ	2256390	7N0200302RJ	0,3	6	0,84	0,40	0,40	50
3321529	7N2200400MJ	2256438	7N2200400RJ	0,4	3	0,34	0,60	2,00	38
3321530	7N2200410MJ	2256439	7N2200410RJ	0,4	3	0,34	0,60	4,00	38
	–	2256391	7N0200402RJ	0,4	6	0,84	0,60	0,60	50
3089244	7N0200402MJ		–	0,4	6	–	0,60	0,60	50
3321531	7N2200500MJ	2256440	7N2200500RJ	0,5	3	0,44	0,70	2,00	38
3321532	7N2200510MJ	2256441	7N2200510RJ	0,5	3	0,44	0,70	4,00	38
3321533	7N2200520MJ	2256442	7N2200520RJ	0,5	3	0,44	0,70	6,00	38
3321519	7N0200502MJ	2256392	7N0200502RJ	0,5	6	0,44	0,70	1,50	50
3089248	7N1200502MJ	2256403	7N1200502RJ	0,5	6	0,44	0,70	2,50	60
3321534	7N2200600MJ	2256443	7N2200600RJ	0,6	3	0,54	0,90	2,00	38
3321535	7N2200610MJ	2256444	7N2200610RJ	0,6	3	0,54	0,90	4,00	38
3321536	7N2200620MJ	2256445	7N2200620RJ	0,6	3	0,54	0,90	6,00	38
3321520	7N0200602MJ	2256393	7N0200602RJ	0,6	6	0,54	0,90	1,80	50
3089249	7N1200602MJ	2256404	7N1200602RJ	0,6	6	0,54	0,90	3,00	60
3321537	7N2200701MJ	2256446	7N2200701RJ	0,7	4	0,64	1,00	2,00	50
3321538	7N2200711MJ	2256447	7N2200711RJ	0,7	4	0,64	1,00	4,00	50
3321539	7N2200721MJ	2256448	7N2200721RJ	0,7	4	0,64	1,00	6,00	50
3321540	7N2200801MJ	2256449	7N2200801RJ	0,8	4	0,74	1,20	4,00	50
3321541	7N2200811MJ	2256450	7N2200811RJ	0,8	4	0,74	1,20	6,00	50

(continued)

(Series 7N02 7N12 7N22 • Vision Plus Micro — continued)





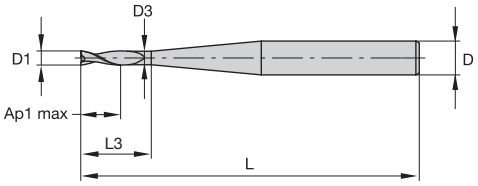


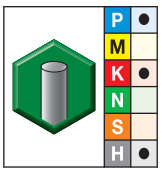
● first choice
○ alternate choice

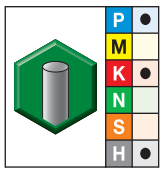
grade AlTiN-MJ1 AlTiN		grade TiAlN-RJ1 TiAlN							
order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
3321542	7N2200821MJ	2256451	7N2200821RJ	0,8	4	0,74	1,20	8,00	50
3321521	7N0200802MJ	2256394	7N0200802RJ	0,8	6	0,74	1,20	2,40	50
3089250	7N1200802MJ	2256405	7N1200802RJ	0,8	6	0,74	1,20	4,00	60
3321543	7N2200901MJ	2256452	7N2200901RJ	0,9	4	0,84	1,35	6,00	50
3321544	7N2200911MJ	2256453	7N2200911RJ	0,9	4	0,84	1,35	8,00	50
3321545	7N2200921MJ	2256454	7N2200921RJ	0,9	4	0,84	1,35	10,00	50
3321546	7N2201001MJ	2256455	7N2201001RJ	1,0	4	0,94	1,50	6,00	50
3321547	7N2201011MJ	2256456	7N2201011RJ	1,0	4	0,94	1,50	8,00	50
3321548	7N2201021MJ	2256457	7N2201021RJ	1,0	4	0,94	1,50	10,00	50
3321549	7N2201031MJ	2256458	7N2201031RJ	1,0	4	0,94	1,50	12,00	50
3089245	7N0201002MJ	2256395	7N0201002RJ	1,0	6	0,94	1,50	2,50	50
3089251	7N1201002MJ	2256406	7N1201002RJ	1,0	6	0,94	1,50	5,00	60
3321550	7N2201201MJ	2256459	7N2201201RJ	1,2	4	1,14	1,50	6,00	50
3321551	7N2201211MJ	2256460	7N2201211RJ	1,2	4	1,14	1,80	8,00	50
3321552	7N2201221MJ	2256461	7N2201221RJ	1,2	4	1,14	1,80	10,00	50
3321553	7N2201231MJ	2256462	7N2201231RJ	1,2	4	1,14	1,80	12,00	50
3321522	7N0201202MJ	2256396	7N0201202RJ	1,2	6	1,14	1,80	3,00	50
3089252	7N1201202MJ	2256407	7N1201202RJ	1,2	6	1,14	1,80	6,00	60
3321554	7N2201401MJ	2256463	7N2201401RJ	1,4	4	1,34	2,10	6,00	50
3321555	7N2201411MJ	2256464	7N2201411RJ	1,4	4	1,34	2,10	8,00	50
3321556	7N2201421MJ		–	1,4	4	1,34	2,10	10,00	50
3321557	7N2201431MJ	2256466	7N2201431RJ	1,4	4	1,34	2,10	12,00	50
3321558	7N2201441MJ	2256467	7N2201441RJ	1,4	4	1,34	2,10	16,00	50
	–	2256465	7N2201421RJ	1,4	4	1,35	2,10	10,00	50
3089246	7N0201402MJ	2256397	7N0201402RJ	1,4	6	1,34	2,10	3,50	50
3321527	7N1201402MJ	2256408	7N1201402RJ	1,4	6	1,34	2,10	7,00	60
	–	3454427	7N2201561RJ	1,5	4	1,44	2,30	5,70	50
3321559	7N2201501MJ	2256468	7N2201501RJ	1,5	4	1,44	2,30	6,00	50
3321560	7N2201511MJ	2256469	7N2201511RJ	1,5	4	1,44	2,30	10,00	50
3321561	7N2201521MJ	2256470	7N2201521RJ	1,5	4	1,44	2,30	12,00	50
3321562	7N2201531MJ	2256471	7N2201531RJ	1,5	4	1,44	2,30	16,00	50
3321563	7N2201541MJ	2256472	7N2201541RJ	1,5	4	1,44	2,30	18,00	63

(continued)

(Series 7N02 7N12 7N22 • Vision Plus Micro — continued)





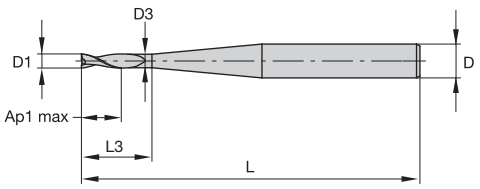


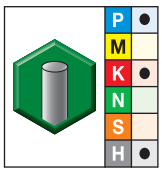
● first choice
○ alternate choice

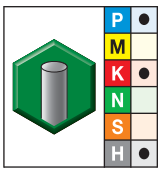
grade AlTiN-MJ1 AlTiN		grade TiAlN-RJ1 TiAlN							
order #	catalog #	order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
3321564	7N2201551MJ	2256473	7N2201551RJ	1,5	4	1,44	2,30	20,00	63
3321523	7N0201502MJ	2256398	7N0201502RJ	1,5	6	1,44	2,30	3,80	50
3089253	7N1201502MJ	2256409	7N1201502RJ	1,5	6	1,44	2,30	7,50	60
3321566	7N2201611MJ	2256475	7N2201611RJ	1,6	4	1,54	2,40	10,00	50
3321567	7N2201621MJ	2256476	7N2201621RJ	1,6	4	1,54	2,40	12,00	50
3321568	7N2201631MJ	2256477	7N2201631RJ	1,6	4	1,54	2,40	16,00	50
3321569	7N2201641MJ	2256478	7N2201641RJ	1,6	4	1,54	2,40	20,00	63
	–	3454428	7N2201571RJ	1,6	4	1,54	2,80	11,70	50
3321565	7N2201601MJ	2256474	7N2201601RJ	1,6	4	1,57	2,40	6,00	50
3321524	7N0201602MJ	2256399	7N0201602RJ	1,6	6	1,54	2,40	4,00	50
3321528	7N1201602MJ	2256410	7N1201602RJ	1,6	6	1,54	2,40	8,00	60
3321570	7N2201701MJ	2256479	7N2201701RJ	1,7	4	1,64	2,60	6,00	50
3321571	7N2201711MJ	2256480	7N2201711RJ	1,7	4	1,64	2,60	10,00	50
3321572	7N2201721MJ	2256481	7N2201721RJ	1,7	4	1,64	2,60	12,00	50
3321573	7N2201731MJ	2256482	7N2201731RJ	1,7	4	1,64	2,60	16,00	50
3321574	7N2201741MJ	2256483	7N2201741RJ	1,7	4	1,64	2,60	20,00	63
3321575	7N2201801MJ	2256484	7N2201801RJ	1,8	4	1,74	2,70	6,00	50
3321576	7N2201811MJ	2256485	7N2201811RJ	1,8	4	1,74	2,70	10,00	50
3321577	7N2201821MJ	2256486	7N2201821RJ	1,8	4	1,74	2,70	12,00	50
3321578	7N2201831MJ	2256487	7N2201831RJ	1,8	4	1,74	2,70	16,00	50
3321579	7N2201841MJ	2256488	7N2201841RJ	1,8	4	1,74	2,70	20,00	63
3321525	7N0201802MJ	2256400	7N0201802RJ	1,8	6	1,74	2,70	4,50	50
3089254	7N1201802MJ	2256411	7N1201802RJ	1,8	6	1,74	2,70	9,00	60
3321580	7N2201901MJ	2256489	7N2201901RJ	1,9	4	1,84	2,80	6,00	50
3321581	7N2201911MJ	2256490	7N2201911RJ	1,9	4	1,84	2,80	10,00	50
3321582	7N2201921MJ	2256491	7N2201921RJ	1,9	4	1,84	2,80	12,00	50
3321583	7N2201931MJ	2256492	7N2201931RJ	1,9	4	1,84	2,80	16,00	50
3321584	7N2201941MJ	2256493	7N2201941RJ	1,9	4	1,84	2,80	20,00	63
3321585	7N2202001MJ	2256494	7N2202001RJ	2,0	4	1,96	3,00	6,00	50
3321586	7N2202011MJ	2256495	7N2202011RJ	2,0	4	1,96	3,00	10,00	50
3321587	7N2202021MJ	2256496	7N2202021RJ	2,0	4	1,96	3,00	16,00	50
3321588	7N2202031MJ	2256497	7N2202031RJ	2,0	4	1,96	3,00	20,00	63

(continued)

(Series 7N02 7N12 7N22 • Vision Plus Micro — continued)



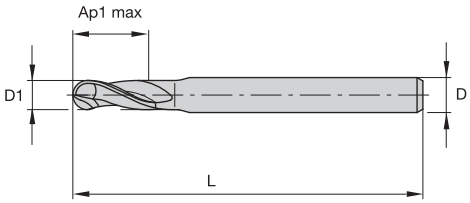




● first choice
○ alternate choice

grade AlTiN-MJ1 AlTiN		grade TiAlN-RJ1 TiAlN					length of cut		length
order #	catalog #	order #	catalog #	D1	D	D3	Ap1 max	L3	L
3321589	7N2202041MJ	2256498	7N2202041RJ	2,0	4	1,96	3,00	20,00	75
3089247	7N0202002MJ	2256401	7N0202002RJ	2,0	6	1,96	3,00	5,00	50
3089255	7N1202002MJ	2256412	7N1202002RJ	2,0	6	1,96	3,00	10,00	60
	–	3454429	7N2202051RJ	2,1	4	2,00	3,00	8,00	50
	–	3454430	7N2202061RJ	2,1	4	2,00	3,00	12,00	50
	–	3454431	7N2202071RJ	2,1	4	2,00	3,00	14,00	50
	–	3454432	7N2202091RJ	2,1	4	2,00	3,00	25,00	63
3321590	7N2202501MJ	2256499	7N2202501RJ	2,5	4	2,40	3,70	8,00	50
3321591	7N2202511MJ	2256500	7N2202511RJ	2,5	4	2,40	3,70	10,00	50
3321592	7N2202521MJ	2256501	7N2202521RJ	2,5	4	2,44	3,70	16,00	63
3321593	7N2202531MJ	2256502	7N2202531RJ	2,5	4	2,44	3,70	20,00	63
3321594	7N2202541MJ	2256503	7N2202541RJ	2,5	4	2,44	3,70	30,00	80
3321526	7N0202502MJ	2256402	7N0202502RJ	2,5	6	2,44	3,70	5,00	50
3089256	7N1202502MJ	2256413	7N1202502RJ	2,5	6	2,44	3,70	12,50	60
3321595	7N2203002MJ	2256504	7N2203002RJ	3,0	6	2,94	4,50	8,00	50
3321596	7N2203012MJ	2256505	7N2203012RJ	3,0	6	2,94	4,50	10,00	50
3321597	7N2203022MJ	2256506	7N2203022RJ	3,0	6	2,94	4,50	16,00	63
3321598	7N2203032MJ	2256507	7N2203032RJ	3,0	6	2,94	4,50	20,00	63
3321599	7N2203042MJ	2256508	7N2203042RJ	3,0	6	2,94	4,50	20,00	80
	–	3454433	7N2203052RJ	3,1	6	3,00	4,50	12,00	50
	–	3454434	7N2203062RJ	3,1	6	3,00	4,50	25,00	76

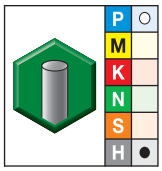
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance h8 + / -	D	tolerance h6 + / -
≤ 3	0/0,014	≤ 3	0/0,006
> 3–6	0/0,018	> 3–6	0/0,008
> 6–10	0/0,022	> 6–10	0/0,009
> 10–18	0/0,027	> 10–18	0/0,011
> 18–30	0/0,033	> 18–30	0/0,013

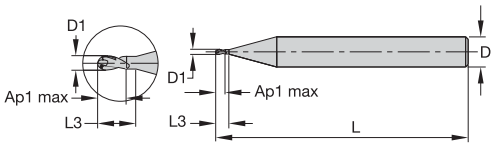
Series 423034 • Vision Plus Micro



● first choice
○ alternate choice

grade K10UF-DCHP AlTiN order #	catalog #	D1	D	length of cut Ap1 max	length L
2343490	423034-000005	0,5	3	1,50	38
2343492	423034-000006	0,6	3	1,60	38
2343494	423034-000008	0,8	3	1,80	38
2343496	423034-000010	1,0	3	2,00	38
2343498	423034-000012	1,2	3	2,20	38
2343500	423034-000015	1,5	3	2,50	38
2343502	423034-000020	2,0	3	3,00	38
2343504	423034-000025	2,5	3	4,00	38
2343506	423034-000030	3,0	3	5,00	38

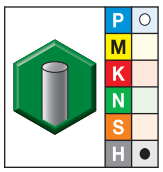
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

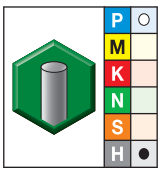


End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

Series 7N01 • Vision Plus Micro

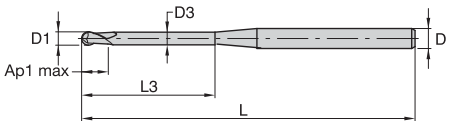




● first choice
○ alternate choice

grade AlTiN-MJ1 AlTiN		grade TiAlN-RJ1 TiAlN					length of cut Ap1 max		length L
order #	catalog #	order #	catalog #	D1	D	D3		L3	
3321510	7N0100302MJ	2256358	7N0100302RJ	0,3	6	–	0,30	0,30	50
3321511	7N0100402MJ	2256359	7N0100402RJ	0,4	6	–	0,40	0,40	50
3089237	7N0100502MJ	2256360	7N0100502RJ	0,5	6	0,45	0,50	1,50	50
3089238	7N0100602MJ	2256361	7N0100602RJ	0,6	6	0,55	0,60	1,80	50
3321512	7N0100802MJ	2256362	7N0100802RJ	0,8	6	0,75	0,80	2,40	50
3321513	7N0101002MJ	2256363	7N0101002RJ	1,0	6	0,95	2,50	2,50	50
3089239	7N0101202MJ	2256364	7N0101202RJ	1,2	6	1,15	1,20	3,00	50
3089240	7N0101402MJ	2256365	7N0101402RJ	1,4	6	1,35	1,40	3,50	50
3321514	7N0101502MJ	2256366	7N0101502RJ	1,5	6	1,45	1,50	3,80	50
3089241	7N0101602MJ	2256367	7N0101602RJ	1,6	6	1,55	1,60	4,00	50
3089242	7N0101802MJ	2256368	7N0101802RJ	1,8	6	1,75	1,80	4,50	50
3321515	7N0102002MJ	2256369	7N0102002RJ	2,0	6	1,95	2,00	5,00	50
3321516	7N0102502MJ	2256370	7N0102502RJ	2,5	6	2,40	2,50	5,00	50
3321517	7N0103002MJ	2256371	7N0103002RJ	3,0	6	2,85	3,00	6,00	50
3089243	7N0104002MJ	2256372	7N0104002RJ	4,0	6	3,85	4,00	6,00	50
3091240	7N0106002MJ	2256373	7N0106002RJ	6,0	6	5,85	6,00	9,00	50

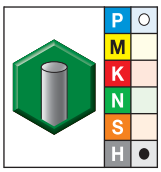
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

Series 7N21 • Vision Plus Micro



● first choice
○ alternate choice

grade TiAlN-RT1
TiAlN

order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
3665122	7N2100501RT	0,5	4	0,44	1,00	5,00	63
3665140	7N2100601RT	0,6	4	0,54	1,00	6,00	63
3665141	7N2100801RT	0,8	4	0,74	1,30	8,00	63
3665142	7N2101001RT	1,0	4	0,94	1,60	10,00	63
3665163	7N2101201RT	1,2	4	1,14	1,90	12,00	63
3665164	7N2101501RT	1,5	4	1,44	2,40	16,00	63
3665166	7N2102001RT	2,0	4	1,94	3,20	20,00	63
3665167	7N2102501RT	2,5	4	2,44	3,80	25,00	63
3665168	7N2103001RT	3,0	4	2,90	4,50	30,00	63

Series 7N02 7N12 7N22 • Vision Plus Micro

Material Group		Side Milling (A) and Slotting (B)			AlTiN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.									
		A		B	Cutting Speed — vc SFM				D1 — Diameter								
		ap	ae	ap	min		max	mm	0.3	0.4	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	0	1.25 x D	0.25 x D	0.75 x D	492	–	656	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0005	.0007	.0008
	1	1.25 x D	0.25 x D	0.75 x D	492	–	656	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0005	.0007	.0008
	2	1.25 x D	0.25 x D	0.75 x D	459	–	623	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0005	.0007	.0008
	3	1.25 x D	0.25 x D	0.75 x D	394	–	525	IPT	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0006	.0007
	4	1.25 x D	0.25 x D	0.5 x D	295	–	492	IPT	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0005	.0006
	5	1.25 x D	0.25 x D	0.5 x D	197	–	328	IPT	.0001	.0001	.0001	.0001	.0001	.0002	.0003	.0004	.0005	.0006
K	1	1.25 x D	0.25 x D	0.75 x D	394	–	492	IPT	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0005	.0007	.0008
	2	1.25 x D	0.25 x D	0.5 x D	361	–	459	IPT	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0006	.0007
H	1	1.25 x D	0.25 x D	0.5 x D	262	–	459	IPT	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0005	.0006
	2	1.25 x D	0.25 x D	0.3 x D	230	–	394	IPT	.0000	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0005
	3	1.25 x D	0.25 x D	0.25 x D	197	–	295	IPT	.0000	.0000	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
For tools with reach > 3 x D, reduce fz by 20%.
For tools with reach > 5 x D, reduce fz by 30%.

Series 423034 • Vision Plus Micro

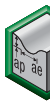
Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing**							
		A		Cutting Speed — vc SFM				D1 — Diameter							
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.04 x D	0.04 x D	1210	–	1613	IPT	.0005	.0006	.0008	.0010	.0015	.0020	.0025	.0031
	4	0.04 x D	0.04 x D	907	–	1512	IPT	.0005	.0005	.0007	.0009	.0014	.0019	.0023	.0028
H	1	0.03 x D	0.03 x D	806	–	1411	IPT	.0005	.0005	.0007	.0009	.0014	.0019	.0023	.0028
	2	0.03 x D	0.03 x D	706	–	1210	IPT	.0003	.0004	.0006	.0007	.0010	.0014	.0018	.0021
	3	0.02 x D	0.02 x D	605	–	907	IPT	.0003	.0003	.0004	.0005	.0008	.0011	.0014	.0017
	4	0.02 x D	0.02 x D	504	–	706	IPT	.0002	.0002	.0003	.0004	.0006	.0007	.0009	.0011

Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing**							
		A		Cutting Speed — vc SFM				D1 — Diameter							
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.1 x D	0.05 x D	840	–	1120	IPT	.0003	.0004	.0005	.0007	.0010	.0013	.0017	.0020
	4	0.1 x D	0.05 x D	630	–	1050	IPT	.0003	.0004	.0005	.0006	.0009	.0012	.0016	.0019
H	1	0.07 x D	0.1 x D	560	–	980	IPT	.0003	.0004	.0005	.0006	.0009	.0012	.0016	.0019
	2	0.05 x D	0.04 x D	490	–	840	IPT	.0002	.0003	.0004	.0005	.0007	.0009	.0012	.0014
	3	0.03 x D	0.03 x D	420	–	630	IPT	.0002	.0002	.0003	.0004	.0006	.0007	.0009	.0011
	4	0.03 x D	0.03 x D	350	–	490	IPT	.0001	.0001	.0002	.0002	.0004	.0005	.0006	.0007

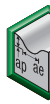
Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing**							
		A		Cutting Speed — vc SFM				D1 — Diameter							
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.2 x D	0.1 x D	605	–	806	IPT	.0002	.0002	.0003	.0003	.0005	.0007	.0008	.0010
	4	0.2 x D	0.1 x D	454	–	756	IPT	.0002	.0002	.0002	.0003	.0005	.0006	.0008	.0009
H	1	0.15 x D	0.1 x D	403	–	706	IPT	.0002	.0002	.0002	.0003	.0005	.0006	.0008	.0009
	2	0.1 x D	0.075 x D	353	–	605	IPT	.0001	.0001	.0002	.0002	.0003	.0005	.0006	.0007
	3	0.05 x D	0.05 x D	302	–	454	IPT	.0001	.0001	.0001	.0002	.0003	.0004	.0005	.0006
	4	0.05 x D	0.05 x D	252	–	353	IPT	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004

NOTE: Please use reference table for correction of vc based on average degree of the mold. See page M159.

Series 7N01 • Vision Plus Micro




Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing**							
		A		Cutting Speed — vc SFM				D1 — Diameter						
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.04 x D	0.04 x D	1210	–	1613	IPT	.0005	.0006	.0008	.0010	.0015	.0020	.0025	.0031
	4	0.04 x D	0.04 x D	907	–	1512	IPT	.0005	.0005	.0007	.0009	.0014	.0019	.0023	.0028
H	1	0.03 x D	0.03 x D	806	–	1411	IPT	.0005	.0005	.0007	.0009	.0014	.0019	.0023	.0028
	2	0.03 x D	0.03 x D	706	–	1210	IPT	.0003	.0004	.0006	.0007	.0010	.0014	.0018	.0021
	3	0.02 x D	0.02 x D	605	–	907	IPT	.0003	.0003	.0004	.0005	.0008	.0011	.0014	.0017
	4	0.02 x D	0.02 x D	504	–	706	IPT	.0002	.0002	.0003	.0004	.0006	.0007	.0009	.0011




Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing**							
		A		Cutting Speed — vc SFM				D1 — Diameter						
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.1 x D	0.05 x D	840	–	1120	IPT	.0003	.0004	.0005	.0007	.0010	.0013	.0017	.0020
	4	0.1 x D	0.05 x D	630	–	1050	IPT	.0003	.0004	.0005	.0006	.0009	.0012	.0016	.0019
H	1	0.07 x D	0.1 x D	560	–	980	IPT	.0003	.0004	.0005	.0006	.0009	.0012	.0016	.0019
	2	0.05 x D	0.04 x D	490	–	840	IPT	.0002	.0003	.0004	.0005	.0007	.0009	.0012	.0014
	3	0.03 x D	0.03 x D	420	–	630	IPT	.0002	.0002	.0003	.0004	.0006	.0007	.0009	.0011
	4	0.03 x D	0.03 x D	350	–	490	IPT	.0001	.0001	.0002	.0002	.0004	.0005	.0006	.0007


Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing**							
		A		Cutting Speed — vc SFM				D1 — Diameter						
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.2 x D	0.1 x D	605	–	806	IPT	.0002	.0002	.0003	.0003	.0005	.0007	.0008	.0010
	4	0.2 x D	0.1 x D	454	–	756	IPT	.0002	.0002	.0002	.0003	.0005	.0006	.0008	.0009
H	1	0.15 x D	0.1 x D	403	–	706	IPT	.0002	.0002	.0002	.0003	.0005	.0006	.0008	.0009
	2	0.1 x D	0.075 x D	353	–	605	IPT	.0001	.0001	.0002	.0002	.0003	.0005	.0006	.0007
	3	0.05 x D	0.05 x D	302	–	454	IPT	.0001	.0001	.0001	.0002	.0003	.0004	.0005	.0006
	4	0.05 x D	0.05 x D	252	–	353	IPT	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004

NOTE: Please use reference table for correction of vc based on average degree of the mold. See page M159.

Series 7N21 • Vision Plus Micro

Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing**							
		A		Cutting Speed — vc SFM				D1 — Diameter							
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.04 x D	0.04 x D	1210	–	1613	IPT	.0005	.0006	.0008	.0010	.0015	.0020	.0025	.0031
	4	0.04 x D	0.04 x D	907	–	1512	IPT	.0005	.0005	.0007	.0009	.0014	.0019	.0023	.0028
H	1	0.03 x D	0.03 x D	806	–	1411	IPT	.0005	.0005	.0007	.0009	.0014	.0019	.0023	.0028
	2	0.03 x D	0.03 x D	706	–	1210	IPT	.0003	.0004	.0006	.0007	.0010	.0014	.0018	.0021
	3	0.02 x D	0.02 x D	605	–	907	IPT	.0003	.0003	.0004	.0005	.0008	.0011	.0014	.0017
	4	0.02 x D	0.02 x D	504	–	706	IPT	.0002	.0002	.0003	.0004	.0006	.0007	.0009	.0011

Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing**							
		A		Cutting Speed — vc SFM				D1 — Diameter							
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.1 x D	0.05 x D	840	–	1120	IPT	.0003	.0004	.0005	.0007	.0010	.0013	.0017	.0020
	4	0.1 x D	0.05 x D	630	–	1050	IPT	.0003	.0004	.0005	.0006	.0009	.0012	.0016	.0019
H	1	0.07 x D	0.1 x D	560	–	980	IPT	.0003	.0004	.0005	.0006	.0009	.0012	.0016	.0019
	2	0.05 x D	0.04 x D	490	–	840	IPT	.0002	.0003	.0004	.0005	.0007	.0009	.0012	.0014
	3	0.03 x D	0.03 x D	420	–	630	IPT	.0002	.0002	.0003	.0004	.0006	.0007	.0009	.0011
	4	0.03 x D	0.03 x D	350	–	490	IPT	.0001	.0001	.0002	.0002	.0004	.0005	.0006	.0007

Material Group		Profile Milling		K10UF-DCHP AlTiN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing**							
		A		Cutting Speed — vc SFM				D1 — Diameter							
		ap	ae	min		max	mm	0.5	0.6	0.8	1.0	1.5	2.0	2.5	3.0
P	3	0.2 x D	0.1 x D	605	–	806	IPT	.0002	.0002	.0003	.0003	.0005	.0007	.0008	.0010
	4	0.2 x D	0.1 x D	454	–	756	IPT	.0002	.0002	.0002	.0003	.0005	.0006	.0008	.0009
H	1	0.15 x D	0.1 x D	403	–	706	IPT	.0002	.0002	.0002	.0003	.0005	.0006	.0008	.0009
	2	0.1 x D	0.075 x D	353	–	605	IPT	.0001	.0001	.0002	.0002	.0003	.0005	.0006	.0007
	3	0.05 x D	0.05 x D	302	–	454	IPT	.0001	.0001	.0001	.0002	.0003	.0004	.0005	.0006
	4	0.05 x D	0.05 x D	252	–	353	IPT	.0001	.0001	.0001	.0001	.0002	.0002	.0003	.0004

NOTE: Please use reference table for correction of vc based on average degree of the mold. See page M159.

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EXTREME **RESULTS.**

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WIDIA-Hanita™ provides exceptional application and design engineering services. Whether you need tools produced according to a blueprint, a finished part, or a drawing, assistance in process development, or expertise in optimizing an application, our world-renowned Advanced Engineering Team is available. Our engineering departments are fully integrated with specialized production cells located in our focused factories throughout the world. ISO-Certified manufacturing facilities, with state-of-the-art CNC equipment, simulation capabilities, CAD/CAM production, and inspection processes, ensure that customers receive the highest-quality product with accurate compliance to specifications and repeatability for future production.

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- Tool Design
- Project Development

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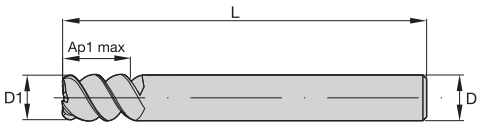
WIDIA™

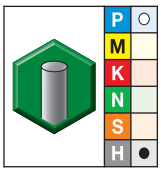
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

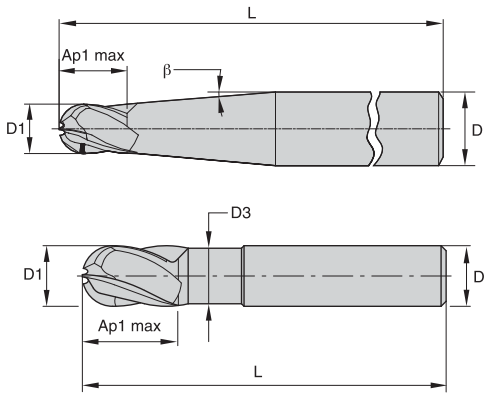
Series 7S05 • Series 7S05 7S15 7S25 • Vision Plus



● first choice
○ alternate choice

grade AlTiN-MT1 AlTiN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	ZU
3083618	TM7S0507002	1/4	1/4	3/8	3	4
3321600	TM7S1507002	1/4	1/4	5/8	3	4
3060845	TM7S2507002	1/4	1/4	7/8	3	4
3043480	TM7S0508000	5/16	5/16	1/2	4	4
3054914	TM7S1508000	5/16	5/16	3/4	4	4
3082394	TM7S2508000	5/16	5/16	1 1/8	4	4
3100520	TM7S0510004	3/8	3/8	9/16	4	4
3048589	TM7S1510004	3/8	3/8	15/16	4	5
3054915	TM7S2510004	3/8	3/8	1 5/16	4	5
3047518	TM7S0513005	1/2	1/2	3/4	5	4
3084183	TM7S1513005	1/2	1/2	1 1/4	5	6
3081614	TM7S2513005	1/2	1/2	1 3/4	5	6
3044788	TM7S0516006	5/8	5/8	1 5/16	5	4
3063997	TM7S1516006	5/8	5/8	1 9/16	5	6
3050197	TM7S2516006	5/8	5/8	2 3/16	5	6
3119082	TM7S0519007	3/4	3/4	1 1/8	6	4
3091702	TM7S1519007	3/4	3/4	1 7/8	6	6
3321602	TM7S2519007	3/4	3/4	2 5/8	6	6
3125355	TM7S0525008	1	1	1 1/2	6	5
3321601	TM7S1525008	1	1	2 1/2	6	6
3104294	TM7S2525008	1	1	3 1/2	6	6

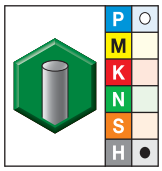
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

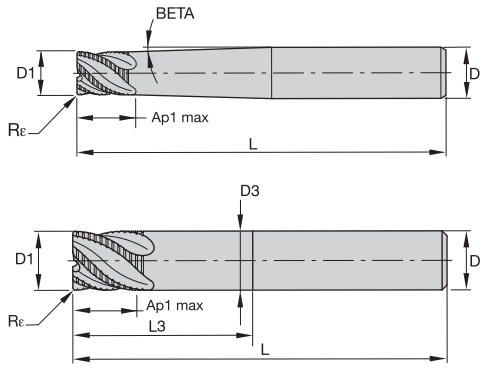
Series 7S5F • Vision Plus



● first choice
○ alternate choice

grade AlTiN-MT1 AlTiN								
order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	BETA
3047519	TM7S5F03002	1/8	1/4	–	1/8	1/8	3	2.5
3040874	TM7S5F04002	5/32	1/4	–	5/32	5/32	3	2.5
3062915	TM7S5F05002	3/16	1/4	–	3/16	3/16	3	2.5
3058580	TM7S5F07004	1/4	3/8	–	1/4	1/4	4	2.5
3061865	TM7S5F08004	5/16	3/8	–	5/16	5/16	4	2.5
3058738	TM7S5F10005	3/8	1/2	–	3/8	3/8	5	2.5
3062363	TM7S5F13006	1/2	5/8	–	1/2	1/2	5	2.5
3058739	TM7S5F16006	5/8	5/8	.59	5/8	3/4	5	–
3289670	TM7S5F19007	3/4	3/4	.71	3/4	3/4	6	–

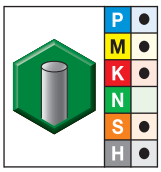
- Center cutting.
- Flat shallow profile.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance d11	D	tolerance h6 + / -
< 1/8"	-.0008/-.0031	< 1/8"	0/.00024
1/8–7/32"	-.0012/-.0041	1/8–7/32"	0/.00031
1/4–3/8"	-.0016/-.0051	1/4–3/8"	0/.00035
13/32–11/16"	-.002/-.0063	13/32–11/16"	0/.00043
23/32–1 3/16"	-.0026/-.0077	23/32–1 3/16"	0/.00051

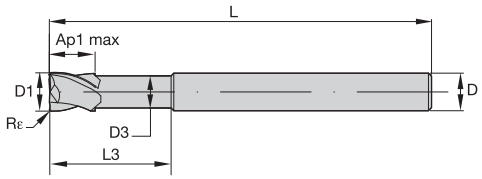
Series 7S7R • Vision Plus



● first choice
○ alternate choice

order #	catalog #	grade AlTiN-MT1 AlTiN D1	D	D3	length of cut Ap1 max	L3	length L	Rε	BETA	ZU
3063998	TM7S7R04002A	5/32	1/4	—	5/32	5/32	3	.030	2.500	3
3096624	TM7S7R05002A	3/16	1/4	—	3/16	3/16	3	.030	2.500	3
3116104	TM7S7R07004A	1/4	3/8	—	1/4	1/4	4	.030	2.500	4
3119746	TM7S7R08004A	5/16	3/8	—	5/16	5/16	4	.030	2.500	4
3096974	TM7S7R10005A	3/8	1/2	—	3/8	3/8	5	.030	2.500	4
3116105	TM7S7R13006A	1/2	5/8	.470	1/2	—	5	.040	—	4
3113795	TM7S7R16006A	5/8	5/8	.588	5/8	5/8	5	.040	—	6
3044789	TM7S7R19007A	3/4	3/4	.705	3/4	3/4	6	.050	—	6
3061866	TM7S7R25008A	1	1	.940	1	1	6	.050	—	6

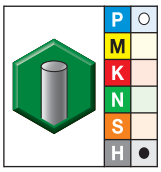
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

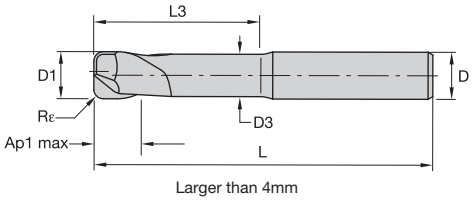
Series 75N2 • Vision Plus



● first choice
○ alternate choice

grade TiAlN-RT1 TiAlN								
order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
2544530	75N203022RT	3,0	6	2,80	3,00	9,00	75	0,30
2544735	75N203042RT	3,0	6	2,80	3,00	9,00	75	0,50
2544736	75N203062RT	3,0	6	2,80	3,00	9,00	75	1,00
2544737	75N204022RT	4,0	6	3,70	4,00	12,00	75	0,30
2544738	75N204042RT	4,0	6	3,70	4,00	12,00	75	0,50
2544739	75N204062RT	4,0	6	3,70	4,00	12,00	75	1,00
2544740	75N205022RT	5,0	6	4,60	5,00	15,00	75	0,30
2544741	75N205042RT	5,0	6	4,60	5,00	15,00	75	1,00
2544742	75N206032RT	6,0	6	5,50	6,00	18,00	75	0,30
2545163	75N206042RT	6,0	6	5,50	6,00	18,00	75	0,50
2545164	75N206052RT	6,0	6	5,50	6,00	18,00	75	0,75
2545166	75N206062RT	6,0	6	5,50	6,00	18,00	75	1,00
2545167	75N206072RT	6,0	6	5,50	6,00	18,00	75	1,50
2545168	75N208023RT	8,0	8	7,40	8,00	24,00	100	0,50
2545169	75N208043RT	8,0	8	7,40	8,00	24,00	100	1,00
2545170	75N208063RT	8,0	8	7,40	8,00	24,00	100	1,50
2545171	75N210024RT	10,0	10	9,20	10,00	30,00	100	0,50
2545172	75N210034RT	10,0	10	9,20	10,00	30,00	100	0,75
2545183	75N210044RT	10,0	10	9,20	10,00	30,00	100	1,00
2545184	75N210064RT	10,0	10	9,20	10,00	30,00	100	2,00
2545185	75N212025RT	12,0	12	11,00	12,00	36,00	125	0,50
2545186	75N212035RT	12,0	12	11,00	12,00	36,00	125	0,75
2545187	75N212045RT	12,0	12	11,00	12,00	36,00	125	1,00
2545188	75N212055RT	12,0	12	11,00	12,00	36,00	125	1,50
2545189	75N212065RT	12,0	12	11,00	12,00	36,00	125	2,00

- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

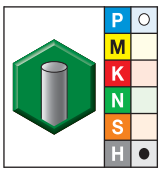


Larger than 4mm

End Mill Tolerances

D1	tolerance h8 + / -	D	tolerance h6 + / -
≤ 3	0/0,014	≤ 3	0/0,006
> 3–6	0/0,018	> 3–6	0/0,008
> 6–10	0/0,022	> 6–10	0/0,009
> 10–18	0/0,027	> 10–18	0/0,011
> 18–30	0/0,033	> 18–30	0/0,013

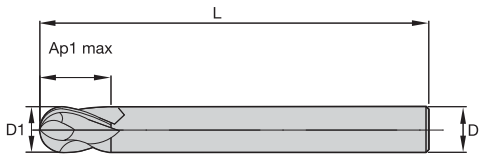
Series 422875 • Vision Plus



● first choice
○ alternate choice

order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	Rε
grade K10UF-DCHP AlTiN								
2343319	422875-002003	2,0	6	1,90	2,00	17,50	70	0,30
2343303	422875-002005	2,0	6	1,90	2,00	17,50	70	0,50
2343305	422875-003005	3,0	6	2,90	3,00	18,50	70	0,50
2343321	422875-003010	3,0	6	2,90	3,00	18,50	70	1,00
2343307	422875-004005	4,0	6	3,80	4,00	19,50	80	0,50
2343323	422875-004010	4,0	6	3,80	4,00	19,50	80	1,00
2343309	422875-005005	5,0	6	4,80	5,00	42,00	80	0,50
2343325	422875-005010	5,0	6	4,80	5,00	42,00	80	1,00
2343327	422875-006005	6,0	6	5,80	6,00	42,00	80	0,50
2343311	422875-006010	6,0	6	5,80	6,00	42,00	80	1,00
2629541	422875-008005	8,0	8	7,80	8,00	51,00	90	0,50
2343329	422875-008010	8,0	8	7,80	8,00	51,00	90	1,00
2629555	422875-008015	8,0	8	7,80	8,00	51,00	90	1,50
2343313	422875-008020	8,0	8	7,80	8,00	51,00	90	2,00
2629559	422875-010005	10,0	10	9,70	10,00	57,00	100	0,50
2629560	422875-010010	10,0	10	9,70	10,00	57,00	100	1,00
3048961	422875-010015	10,0	10	9,70	10,00	57,00	100	1,50
2343331	422875-010020	10,0	10	9,70	10,00	57,00	100	2,00
2343315	422875-010030	10,0	10	9,70	10,00	57,00	100	3,00
2629561	422875-012005	12,0	12	11,70	12,00	62,00	110	0,50
2629573	422875-012010	12,0	12	11,70	12,00	62,00	110	1,00
2343333	422875-012030	12,0	12	11,70	12,00	62,00	110	3,00
2343317	422875-012040	12,0	12	11,70	12,00	62,00	110	4,00

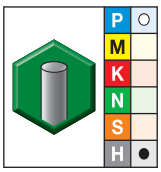
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

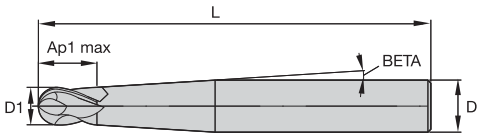
Series 7151 • Vision Plus



● first choice
○ alternate choice

grade TiAlN-RT1 TiAlN					
order #	catalog #	D1	D	length of cut Ap1 max	length L
1860036	715101000RT	1,0	3	3,00	38
1860090	715102000RT	2,0	3	3,00	38
1860103	715102500RT	2,5	3	3,00	38
1860106	715103000RT	3,0	3	3,00	38
1860109	715104001RT	4,0	4	4,00	50
1860111	715105001RT	5,0	5	5,00	50
1860112	715106002RT	6,0	6	6,00	50
1860133	715108003RT	8,0	8	8,00	63
1860134	715110004RT	10,0	10	10,00	76
1860135	715112005RT	12,0	12	12,00	76
1860136	715116006RT	16,0	16	16,00	89
1860137	715120007RT	20,0	20	20,00	104

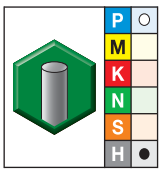
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

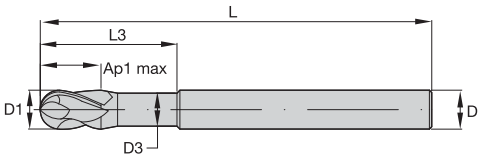
Series 7061 • Vision Plus



● first choice
○ alternate choice

grade TiAlN-RT1 TiAlN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	BETA
2495994	706101001RT	1,0	4	1,00	63	3.50
2495995	706102001RT	2,0	4	2,00	63	3.50
2495996	706102501RT	2,5	4	2,50	63	3.00
2495997	706103002RT	3,0	6	3,00	75	1.50
2495998	706104002RT	4,0	6	4,00	75	1.50
2495999	706105002RT	5,0	6	5,00	75	1.50
2496000	706106004RT	6,0	10	6,00	100	1.50
2496001	706108004RT	8,0	10	8,00	100	1.50
2496002	706110005RT	10,0	12	10,00	125	1.50
2496023	706112006RT	12,0	16	12,00	125	1.50

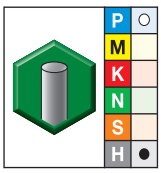
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤ 3	-0,014/-0,028	≤ 3	0/0,006
> 3–6	-0,020/-0,038	> 3–6	0/0,008
> 6–10	-0,025/-0,047	> 6–10	0/0,009
> 10–18	-0,032/-0,059	> 10–18	0/0,011
> 18–30	-0,040/-0,073	> 18–30	0/0,013

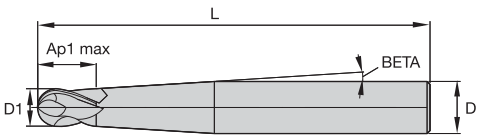
Series 70N1 • Vision Plus



● first choice
○ alternate choice

order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
		grade TiAlN-RT1 TiAlN					
2545190	70N101001RT	1,0	4	0,80	1,00	3,00	63
2545191	70N101501RT	1,5	4	1,30	1,50	4,50	63
2545192	70N102002RT	2,0	6	1,80	2,00	6,00	76
2545213	70N103002RT	3,0	6	2,80	3,00	9,00	76
2545214	70N104002RT	4,0	6	3,70	4,00	12,00	76
2545215	70N105002RT	5,0	6	4,60	5,00	15,00	76
2545216	70N106002RT	6,0	6	5,50	6,00	18,00	76
2545217	70N108003RT	8,0	8	7,50	8,00	24,00	100
2545218	70N110004RT	10,0	10	9,50	10,00	30,00	100
2545219	70N112005RT	12,0	12	11,50	12,00	36,00	125

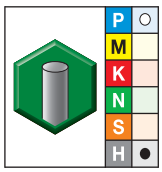
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance h8 + / -	D	tolerance h6 + / -
≤ 3	0/0,014	≤ 3	0/0,006
> 3–6	0/0,018	> 3–6	0/0,008
> 6–10	0/0,022	> 6–10	0/0,009
> 10–18	0/0,027	> 10–18	0/0,011
> 18–30	0/0,033	> 18–30	0/0,013

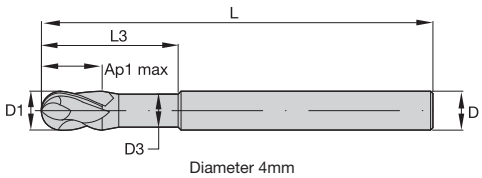
Series 422869 422868 • Vision Plus



● first choice
○ alternate choice

grade K10UF-DCHP AlTiN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	BETA
2343179	422869-000010	1,0	4	1,00	40	7.50
2343183	422869-000020	2,0	6	2,00	45	7.50
2343186	422869-000030	3,0	6	3,00	45	7.50
2343188	422869-000040	4,0	6	4,00	45	7.50
2343190	422869-000050	5,0	6	5,00	50	7.50
2343169	422868-000060	6,0	6	6,00	80	–
2343192	422869-000060	6,0	6	6,00	50	–
2343171	422868-000080	8,0	8	8,00	90	–
2343194	422869-000080	8,0	8	8,00	60	–
2343173	422868-000100	10,0	10	10,00	100	–
2343196	422869-000100	10,0	10	10,00	70	–
2343198	422869-000120	12,0	12	12,00	75	–
2343200	422869-000160	16,0	16	16,00	80	–

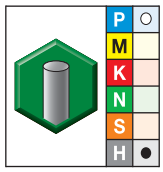
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance h8 + / -	D	tolerance h6 + / -
≤ 3	0/0,014	≤ 3	0/0,006
> 3–6	0/0,018	> 3–6	0/0,008
> 6–10	0/0,022	> 6–10	0/0,009
> 10–18	0/0,027	> 10–18	0/0,011
> 18–30	0/0,033	> 18–30	0/0,013

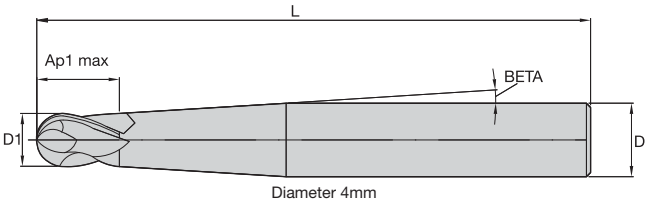
Series 422870 • Vision Plus



● first choice
○ alternate choice

grade K10UF-DCHP AlTiN							
order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L
2343202	422870-000020	2,0	6	1,90	2,00	17,50	70
2343204	422870-000030	3,0	6	2,90	3,00	18,50	70
2343206	422870-000040	4,0	6	3,80	4,00	19,50	80
2343208	422870-000050	5,0	6	4,80	5,00	39,00	80
2343210	422870-000060	6,0	6	5,80	6,00	42,00	80
2343212	422870-000080	8,0	8	7,80	8,00	52,00	90
2343214	422870-000100	10,0	10	9,70	10,00	58,00	100
2343216	422870-000120	12,0	12	11,70	12,00	63,00	110

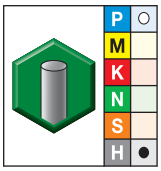
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance h10 + / -	D	tolerance h6 + / -
≤ 3	0/0,040	≤ 3	0/0,006
> 3–6	0/0,048	> 3–6	0/0,008
> 6–10	0/0,058	> 6–10	0/0,009
> 10–18	0/0,070	> 10–18	0/0,011
> 18–30	0/0,084	> 18–30	0/0,013

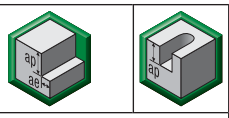
Series 422873 • Vision Plus



● first choice
○ alternate choice

grade K10UF-DCHP AlTiN						
order #	catalog #	D1	D	length of cut Ap1 max	length L	BETA
2343265	422873-050100	5,0	8	6,00	100	1.75
2343269	422873-060100	6,0	10	8,00	100	2.52
2343275	422873-100100	10,0	12	15,00	100	1.83
2343277	422873-100150	10,0	12	15,00	150	0.80

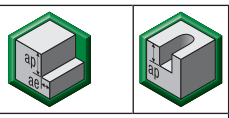
Series 7S05 • Vision Plus



Material Group		Side Milling (A) and Slotting (B)			AlTiN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.						
		A		B	Cutting Speed — vc SFM				D1 — Diameter					
								frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.2500	.3100	.3800	.5000	.6300	.7500	1.000
P	3	1 x D	0.4 x D	1 x D	390	–	520	IPT	.0017	.0021	.0025	.0032	.0037	.0042	.0050
	4	1 x D	0.4 x D	0.75 x D	300	–	490	IPT	.0015	.0019	.0022	.0029	.0033	.0036	.0043
H	1	1 x D	0.4 x D	0.75 x D	260	–	460	IPT	.0015	.0019	.0022	.0029	.0033	.0036	.0043
	2	1 x D	0.3 x D	0.5 x D	230	–	390	IPT	.0011	.0014	.0017	.0021	.0024	.0027	.0031
	3	1 x D	0.15 x D	0.3 x D	200	–	300	IPT	.0009	.0011	.0013	.0017	.0020	.0022	.0027
	4	1 x D	0.1 x D	0.15 x D	160	–	230	IPT	.0006	.0008	.0009	.0011	.0013	.0015	.0018

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
When using tools with 6 flutes, reduce slotting ap by 60%.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters on diameters >1/2".

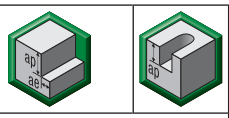
Series 7S15 • Vision Plus



Material Group		Side Milling (A) and Slotting (B)			AlTiN-MT			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.							
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter						
											frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	min		max	dec.	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	3	2.0 x D	0.3 x D	0.75 x D	390	–	520	390	–	520	IPT	.0017	.0021	.0025	.0032	.0038	.0042	.0050
	4	2.0 x D	0.25 x D	0.5 x D	300	–	490	300	–	490	IPT	.0015	.0019	.0022	.0028	.0033	.0037	.0042
H	1	2.0 x D	0.25 x D	0.5 x D	260	–	460	260	–	460	IPT	.0015	.0019	.0022	.0028	.0033	.0037	.0042
	2	2.0 x D	0.2 x D	0.4 x D	230	–	390	230	–	390	IPT	.0011	.0014	.0017	.0021	.0025	.0027	.0031
	3	2.0 x D	0.1 x D	0.2 x D	200	–	300	200	–	300	IPT	.0009	.0011	.0013	.0017	.0020	.0023	.0027
	4	2.0 x D	0.05 x D	0.05 x D	160	–	230	160	–	230	IPT	.0006	.0008	.0009	.0011	.0013	.0015	.0018

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters on diameters >1/2".
For better surface finish, reduce feed per tooth.

Series 7S25 • Vision Plus



Material Group		Side Milling (A) and Slotting (B)			AlTiN-MT			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.							
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter						
											frac.	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	min		max	dec.	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	3	3.0 x D	0.2 x D	0.5 x D	390	–	520	390	–	520	IPT	.0017	.0021	.0025	.0032	.0038	.0042	.0050
	4	3.0 x D	0.2 x D	0.3 x D	300	–	490	300	–	490	IPT	.0015	.0019	.0022	.0028	.0033	.0037	.0042
H	1	3.0 x D	0.2 x D	0.3 x D	260	–	460	260	–	460	IPT	.0015	.0019	.0022	.0028	.0033	.0037	.0042
	2	3.0 x D	0.15 x D	0.2 x D	230	–	390	230	–	390	IPT	.0011	.0014	.0017	.0021	.0025	.0027	.0031
	3	3.0 x D	0.05 x D	–	200	–	300	200	–	300	IPT	.0009	.0011	.0013	.0017	.0020	.0023	.0027
	4	3.0 x D	0.03 x D	–	160	–	230	160	–	230	IPT	.0006	.0008	.0009	.0011	.0013	.0015	.0018

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters on diameters >1/2".
For better surface finish, reduce feed per tooth.

Series 7S5F • Vision Plus

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A)									
		A		Cutting Speed — vc SFM				D1 — Diameter								
							frac.	1/8	5/32	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4
		ap	ae	min		max	dec.	.1250	.1563	.1875	.2500	.3125	.3750	.4375	.5000	.6250	.7500
P	3	0.5 x D	0.5 x D	910	–	1210	IPT	.0031	.0039	.0048	.0065	.0084	.0098	.0112	.0124	.0147	.0166
	4	0.5 x D	0.5 x D	680	–	1130	IPT	.0029	.0036	.0044	.0059	.0075	.0088	.0099	.0110	.0129	.0145
H	1	0.5 x D	0.5 x D	600	–	1060	IPT	.0029	.0036	.0044	.0059	.0075	.0088	.0099	.0110	.0129	.0145
	2	0.5 x D	0.5 x D	530	–	910	IPT	.0022	.0027	.0033	.0044	.0056	.0066	.0074	.0082	.0096	.0107
	3	0.5 x D	0.5 x D	450	–	680	IPT	.0017	.0021	.0026	.0035	.0044	.0052	.0059	.0066	.0078	.0089
	4	0.5 x D	0.5 x D	380	–	530	IPT	.0011	.0014	.0017	.0023	.0030	.0035	.0039	.0044	.0052	.0058

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A)									
		A		Cutting Speed — vc SFM				D1 — Diameter								
							frac.	1/8	5/32	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4
		ap	ae	min		max	dec.	.1250	.1563	.1875	.2500	.3125	.3750	.4375	.5000	.6250	.7500
P	3	0.1 x D	0.1 x D	790	–	1050	IPT	.0022	.0027	.0033	.0046	.0059	.0069	.0078	.0087	.0102	.0116
	4	0.1 x D	0.1 x D	590	–	980	IPT	.0020	.0025	.0030	.0041	.0052	.0061	.0069	.0077	.0090	.0101
H	1	0.1 x D	0.1 x D	520	–	920	IPT	.0020	.0025	.0030	.0041	.0052	.0061	.0069	.0077	.0090	.0101
	2	0.1 x D	0.1 x D	460	–	790	IPT	.0015	.0019	.0023	.0031	.0039	.0046	.0052	.0057	.0067	.0075
	3	0.1 x D	0.1 x D	390	–	590	IPT	.0012	.0015	.0018	.0024	.0031	.0036	.0041	.0046	.0054	.0062
	4	0.1 x D	0.1 x D	330	–	460	IPT	.0008	.0010	.0012	.0016	.0021	.0024	.0027	.0031	.0036	.0041

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A)									
		A		Cutting Speed — vc SFM				D1 — Diameter								
							frac.	1/8	5/32	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4
		ap	ae	min		max	dec.	.1250	.1563	.1875	.2500	.3125	.3750	.4375	.5000	.6250	.7500
P	3	0.2 x D	0.2 x D	510	–	680	IPT	.0009	.0012	.0014	.0020	.0025	.0030	.0034	.0038	.0044	.0050
	4	0.2 x D	0.2 x D	380	–	640	IPT	.0009	.0011	.0013	.0018	.0023	.0027	.0030	.0033	.0039	.0044
H	1	0.2 x D	0.2 x D	340	–	600	IPT	.0009	.0011	.0013	.0018	.0023	.0027	.0030	.0033	.0039	.0044
	2	0.2 x D	0.2 x D	300	–	510	IPT	.0007	.0008	.0010	.0013	.0017	.0020	.0022	.0025	.0029	.0032
	3	0.2 x D	0.2 x D	260	–	380	IPT	.0005	.0006	.0008	.0011	.0013	.0016	.0018	.0020	.0024	.0027
	4	0.2 x D	0.2 x D	210	–	300	IPT	.0003	.0004	.0005	.0007	.0009	.0010	.0012	.0013	.0016	.0018

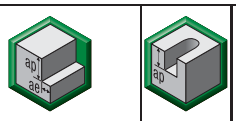
NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
For better surface finish, reduce feed per tooth.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters on diameters >1/2".

Series 7S7R • Vision Plus

Material Group																	
		Side Milling (A) and Slotting (B)			AlTiN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.									
		A		B	Cutting Speed — vc SFM				D1 — Diameter								
								frac.	5/32	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	ap	min		max	dec.	.1563	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.000
P	3	0.8 x D	0.5 x D	0.75 x D	390	–	520	IPT	.0009	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	0.8 x D	0.4 x D	0.5 x D	300	–	490	IPT	.0008	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
	5	0.8 x D	0.5 x D	0.75 x D	200	–	330	IPT	.0007	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	6	0.8 x D	0.4 x D	0.5 x D	160	–	250	IPT	.0006	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
M	1	0.8 x D	0.5 x D	0.75 x D	300	–	380	IPT	.0009	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	0.8 x D	0.4XD	0.75 x D	200	–	260	IPT	.0007	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	3	0.8 x D	0.4 x D	0.75 x D	200	–	230	IPT	.0006	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
K	1	0.8 x D	0.5 x D	0.75 x D	390	–	490	IPT	.0011	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	0.8 x D	0.5 x D	0.75 x D	360	–	460	IPT	.0009	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	3	0.8 x D	0.4 x D	0.75 x D	360	–	430	IPT	.0007	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
S	1	0.8 x D	0.4 x D	0.75 x D	160	–	300	IPT	.0009	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	0.8 x D	0.4 x D	0.75 x D	80	–	130	IPT	.0005	.0006	.0008	.0010	.0012	.0015	.0018	.0021	.0024
	3	0.8 x D	0.25 x D	0.3 x D	200	–	260	IPT	.0007	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
	4	0.8 x D	0.3 x D	0.5 x D	160	–	200	IPT	.0006	.0008	.0011	.0014	.0017	.0021	.0025	.0028	.0033
H	1	0.8 x D	0.5 x D	0.5 x D	260	–	460	IPT	.0008	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
	2	0.8 x D	0.2 x D	0.3 x D	230	–	390	IPT	.0006	.0008	.0010	.0013	.0015	.0019	.0022	.0025	.0028
	3	0.8 x D	0.15 x D	0.2 x D	200	–	300	IPT	.0005	.0006	.0008	.0010	.0012	.0015	.0018	.0021	.0024

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
When using tools with 6 flutes, reduce slotting ap by 40%.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters on diameters >1/2".

Series 75N2 • Vision Plus



Material Group		Side Milling (A) and Slotting (B) A ap	A ae	B ap	TiAlN Cutting Speed — vc SFM min		max	Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%. mm	D1 — Diameter 3.0	4.0	5.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0
P	3	0.75 x D	0.1 x D	0.4 x D	390	–	520	IPT	.0007	.0009	.0012	.0014	.0020	.0024	.0028	.0031	.0034	.0037	.0040	.0045
	4	0.75 x D	0.1 x D	0.4 x D	300	–	490	IPT	.0006	.0008	.0011	.0013	.0018	.0021	.0025	.0028	.0030	.0033	.0035	.0038
H	1	0.75 x D	0.1 x D	0.4 x D	260	–	460	IPT	.0006	.0008	.0011	.0013	.0018	.0021	.0025	.0028	.0030	.0033	.0035	.0038
	2	0.75 x D	0.05 x D	0.3 x D	230	–	390	IPT	.0005	.0006	.0008	.0010	.0013	.0016	.0018	.0021	.0022	.0024	.0026	.0028
	3	0.75 x D	0.03 x D	0.2 X D	200	–	300	IPT	.0004	.0005	.0006	.0008	.0010	.0013	.0015	.0017	.0018	.0020	.0021	.0024
	4	0.75 x D	0.01 x D	0.1 x D	160	–	230	IPT	.0002	.0003	.0004	.0005	.0007	.0008	.0010	.0011	.0012	.0013	.0014	.0016

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

Series 422875 • Vision Plus



Material Group		Side Milling (A) and Slotting (B) A ap	A ae	B ap	K10UF-DCHP AlTiN Cutting Speed — vc SFM min		max	Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%. mm	D1 — Diameter 3.0	4.0	5.0	6.0	8.0	10.0	12.0
P	3	0.5 x D	0.4 x D	0.3 x D	350	–	470	IPT	.0007	.0009	.0012	.0014	.0020	.0024	.0028
	4	0.5 x D	0.4 x D	0.3 x D	270	–	440	IPT	.0006	.0008	.0011	.0013	.0018	.0021	.0025
H	1	0.5 x D	0.4 x D	0.3 x D	240	–	410	IPT	.0006	.0008	.0011	.0013	.0018	.0021	.0025
	2	0.5 x D	0.3 x D	0.2 x D	210	–	350	IPT	.0005	.0006	.0008	.0010	.0013	.0016	.0018
	3	0.5 x D	0.15 x D	0.15 x D	180	–	270	IPT	.0004	.0005	.0006	.0008	.0010	.0013	.0015
	4	0.5 x D	0.1 x D	0.1 x D	150	–	210	IPT	.0002	.0003	.0004	.0005	.0007	.0008	.0010

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
For better surface finish, reduce feed per tooth.

Series 7151 • Vision Plus

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.05 x D	0.05 x D	905	–	1207	IPT	.0010	.0019	.0024	.0029	.0040	.0050	.0061	.0085	.0102	.0119	.0148	.0160	.0171
	4	0.05 x D	0.05 x D	679	–	1132	IPT	.0009	.0018	.0022	.0027	.0036	.0046	.0056	.0076	.0091	.0106	.0130	.0140	.0149
H	1	0.05 x D	0.05 x D	604	–	1056	IPT	.0009	.0018	.0022	.0027	.0036	.0046	.0056	.0076	.0091	.0106	.0130	.0140	.0149
	2	0.05 x D	0.05 x D	528	–	905	IPT	.0007	.0013	.0017	.0020	.0027	.0035	.0042	.0057	.0068	.0079	.0096	.0104	.0110
	3	0.05 x D	0.05 x D	453	–	679	IPT	.0005	.0011	.0013	.0016	.0022	.0027	.0033	.0045	.0054	.0063	.0079	.0085	.0091
	4	0.05 x D	0.05 x D	377	–	528	IPT	.0004	.0007	.0009	.0011	.0014	.0018	.0022	.0030	.0036	.0042	.0052	.0056	.0060

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.1 x D	0.1 x D	787	–	1050	IPT	.0007	.0013	.0017	.0020	.0028	.0035	.0043	.0059	.0071	.0083	.0103	.0112	.0119
	4	0.1 x D	0.1 x D	590	–	984	IPT	.0006	.0012	.0016	.0019	.0025	.0032	.0039	.0053	.0064	.0074	.0091	.0098	.0104
H	1	0.1 x D	0.1 x D	525	–	918	IPT	.0006	.0012	.0016	.0019	.0025	.0032	.0039	.0053	.0064	.0074	.0091	.0098	.0104
	2	0.1 x D	0.1 x D	459	–	787	IPT	.0005	.0009	.0012	.0014	.0019	.0024	.0029	.0040	.0048	.0055	.0067	.0072	.0077
	3	0.1 x D	0.1 x D	394	–	590	IPT	.0004	.0007	.0009	.0011	.0015	.0019	.0023	.0031	.0038	.0044	.0055	.0060	.0064
	4	0.1 x D	0.1 x D	328	–	459	IPT	.0002	.0005	.0006	.0007	.0010	.0013	.0015	.0021	.0025	.0029	.0036	.0039	.0042

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.2 x D	0.2 x D	512	–	682	IPT	.0003	.0006	.0007	.0009	.0012	.0015	.0019	.0026	.0031	.0036	.0045	.0048	.0052
	4	0.2 x D	0.2 x D	384	–	640	IPT	.0003	.0005	.0007	.0008	.0011	.0014	.0017	.0023	.0028	.0032	.0039	.0042	.0045
H	1	0.2 x D	0.2 x D	341	–	597	IPT	.0003	.0005	.0007	.0008	.0011	.0014	.0017	.0023	.0028	.0032	.0039	.0042	.0045
	2	0.2 x D	0.2 x D	298	–	512	IPT	.0002	.0004	.0005	.0006	.0008	.0010	.0013	.0017	.0021	.0024	.0029	.0031	.0033
	3	0.2 x D	0.2 x D	256	–	384	IPT	.0002	.0003	.0004	.0005	.0007	.0008	.0010	.0014	.0016	.0019	.0024	.0026	.0028
	4	0.2 x D	0.2 x D	213	–	298	IPT	.0001	.0002	.0003	.0003	.0004	.0005	.0007	.0009	.0011	.0013	.0016	.0017	.0018

NOTE: Please use the reference table to optimize your cutting speed based on the average cutting angle of the application. See page M159.

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Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.05 x D	0.05 x D	905	–	1207	IPT	.0010	.0019	.0024	.0029	.0040	.0050	.0061	.0085	.0102	.0119	.0148	.0160	.0171
	4	0.05 x D	0.05 x D	679	–	1132	IPT	.0009	.0018	.0022	.0027	.0036	.0046	.0056	.0076	.0091	.0106	.0130	.0140	.0149
H	1	0.05 x D	0.05 x D	604	–	1056	IPT	.0009	.0018	.0022	.0027	.0036	.0046	.0056	.0076	.0091	.0106	.0130	.0140	.0149
	2	0.05 x D	0.05 x D	528	–	905	IPT	.0007	.0013	.0017	.0020	.0027	.0035	.0042	.0057	.0068	.0079	.0096	.0104	.0110
	3	0.05 x D	0.05 x D	453	–	679	IPT	.0005	.0011	.0013	.0016	.0022	.0027	.0033	.0045	.0054	.0063	.0079	.0085	.0091
	4	0.05 x D	0.05 x D	377	–	528	IPT	.0004	.0007	.0009	.0011	.0014	.0018	.0022	.0030	.0036	.0042	.0052	.0056	.0060

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.1 x D	0.1 x D	787	–	1050	IPT	.0007	.0013	.0017	.0020	.0028	.0035	.0043	.0059	.0071	.0083	.0103	.0112	.0119
	4	0.1 x D	0.1 x D	590	–	984	IPT	.0006	.0012	.0016	.0019	.0025	.0032	.0039	.0053	.0064	.0074	.0091	.0098	.0104
H	1	0.1 x D	0.1 x D	525	–	918	IPT	.0006	.0012	.0016	.0019	.0025	.0032	.0039	.0053	.0064	.0074	.0091	.0098	.0104
	2	0.1 x D	0.1 x D	459	–	787	IPT	.0005	.0009	.0012	.0014	.0019	.0024	.0029	.0040	.0048	.0055	.0067	.0072	.0077
	3	0.1 x D	0.1 x D	394	–	590	IPT	.0004	.0007	.0009	.0011	.0015	.0019	.0023	.0031	.0038	.0044	.0055	.0060	.0064
	4	0.1 x D	0.1 x D	328	–	459	IPT	.0002	.0005	.0006	.0007	.0010	.0013	.0015	.0021	.0025	.0029	.0036	.0039	.0042

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.2 x D	0.2 x D	512	–	682	IPT	.0003	.0006	.0007	.0009	.0012	.0015	.0019	.0026	.0031	.0036	.0045	.0048	.0052
	4	0.2 x D	0.2 x D	384	–	640	IPT	.0003	.0005	.0007	.0008	.0011	.0014	.0017	.0023	.0028	.0032	.0039	.0042	.0045
H	1	0.2 x D	0.2 x D	341	–	597	IPT	.0003	.0005	.0007	.0008	.0011	.0014	.0017	.0023	.0028	.0032	.0039	.0042	.0045
	2	0.2 x D	0.2 x D	298	–	512	IPT	.0002	.0004	.0005	.0006	.0008	.0010	.0013	.0017	.0021	.0024	.0029	.0031	.0033
	3	0.2 x D	0.2 x D	256	–	384	IPT	.0002	.0003	.0004	.0005	.0007	.0008	.0010	.0014	.0016	.0019	.0024	.0026	.0028
	4	0.2 x D	0.2 x D	213	–	298	IPT	.0001	.0002	.0003	.0003	.0004	.0005	.0007	.0009	.0011	.0013	.0016	.0017	.0018

NOTE: Please use the reference table to optimize your cutting speed based on the average cutting angle of the application. *See page M159.*

Series 70N1 • Vision Plus

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.05 x D	0.05 x D	905	–	1207	IPT	.0010	.0019	.0024	.0029	.0040	.0050	.0061	.0085	.0102	.0119	.0148	.0160	.0171
	4	0.05 x D	0.05 x D	679	–	1132	IPT	.0009	.0018	.0022	.0027	.0036	.0046	.0056	.0076	.0091	.0106	.0130	.0140	.0149
H	1	0.05 x D	0.05 x D	604	–	1056	IPT	.0009	.0018	.0022	.0027	.0036	.0046	.0056	.0076	.0091	.0106	.0130	.0140	.0149
	2	0.05 x D	0.05 x D	528	–	905	IPT	.0007	.0013	.0017	.0020	.0027	.0035	.0042	.0057	.0068	.0079	.0096	.0104	.0110
	3	0.05 x D	0.05 x D	453	–	679	IPT	.0005	.0011	.0013	.0016	.0022	.0027	.0033	.0045	.0054	.0063	.0079	.0085	.0091
	4	0.05 x D	0.05 x D	377	–	528	IPT	.0004	.0007	.0009	.0011	.0014	.0018	.0022	.0030	.0036	.0042	.0052	.0056	.0060

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.1 x D	0.1 x D	787	–	1050	IPT	.0007	.0013	.0017	.0020	.0028	.0035	.0043	.0059	.0071	.0083	.0103	.0112	.0119
	4	0.1 x D	0.1 x D	590	–	984	IPT	.0006	.0012	.0016	.0019	.0025	.0032	.0039	.0053	.0064	.0074	.0091	.0098	.0104
H	1	0.1 x D	0.1 x D	525	–	918	IPT	.0006	.0012	.0016	.0019	.0025	.0032	.0039	.0053	.0064	.0074	.0091	.0098	.0104
	2	0.1 x D	0.1 x D	459	–	787	IPT	.0005	.0009	.0012	.0014	.0019	.0024	.0029	.0040	.0048	.0055	.0067	.0072	.0077
	3	0.1 x D	0.1 x D	394	–	590	IPT	.0004	.0007	.0009	.0011	.0015	.0019	.0023	.0031	.0038	.0044	.0055	.0060	.0064
	4	0.1 x D	0.1 x D	328	–	459	IPT	.0002	.0005	.0006	.0007	.0010	.0013	.0015	.0021	.0025	.0029	.0036	.0039	.0042

Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing**											
		A		Cutting Speed — vc SFM				D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	18.0	20.0
P	3	0.2 x D	0.2 x D	512	–	682	IPT	.0003	.0006	.0007	.0009	.0012	.0015	.0019	.0026	.0031	.0036	.0045	.0048	.0052
	4	0.2 x D	0.2 x D	384	–	640	IPT	.0003	.0005	.0007	.0008	.0011	.0014	.0017	.0023	.0028	.0032	.0039	.0042	.0045
H	1	0.2 x D	0.2 x D	341	–	597	IPT	.0003	.0005	.0007	.0008	.0011	.0014	.0017	.0023	.0028	.0032	.0039	.0042	.0045
	2	0.2 x D	0.2 x D	298	–	512	IPT	.0002	.0004	.0005	.0006	.0008	.0010	.0013	.0017	.0021	.0024	.0029	.0031	.0033
	3	0.2 x D	0.2 x D	256	–	384	IPT	.0002	.0003	.0004	.0005	.0007	.0008	.0010	.0014	.0016	.0019	.0024	.0026	.0028
	4	0.2 x D	0.2 x D	213	–	298	IPT	.0001	.0002	.0003	.0003	.0004	.0005	.0007	.0009	.0011	.0013	.0016	.0017	.0018

NOTE: Please use the reference table to optimize your cutting speed based on the average cutting angle of the application. See page M159.

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Material Group		Profile Milling A		TiAlN Cutting Speed — vc SFM			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing** D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0
P	3	0.05 x D	0.05 x D	905	–	1207	IPT	.0010	.0019	.0024	.0029	.0040	.0050	.0061	.0085	.0102	.0119	.0148
	4	0.05 x D	0.05 x D	679	–	1132	IPT	.0009	.0018	.0022	.0027	.0036	.0046	.0056	.0076	.0091	.0106	.0130
H	1	0.05 x D	0.05 x D	604	–	1056	IPT	.0009	.0018	.0022	.0027	.0036	.0046	.0056	.0076	.0091	.0106	.0130
	2	0.05 x D	0.05 x D	528	–	905	IPT	.0007	.0013	.0017	.0020	.0027	.0035	.0042	.0057	.0068	.0079	.0096
	3	0.05 x D	0.05 x D	453	–	679	IPT	.0005	.0011	.0013	.0016	.0022	.0027	.0033	.0045	.0054	.0063	.0079
	4	0.05 x D	0.05 x D	377	–	528	IPT	.0004	.0007	.0009	.0011	.0014	.0018	.0022	.0030	.0036	.0042	.0052


Material Group		Profile Milling A		TiAlN Cutting Speed — vc SFM			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing** D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0
P	3	0.1 x D	0.1 x D	787	–	1050	IPT	.0007	.0013	.0017	.0020	.0028	.0035	.0043	.0059	.0071	.0083	.0103
	4	0.1 x D	0.1 x D	590	–	984	IPT	.0006	.0012	.0016	.0019	.0025	.0032	.0039	.0053	.0064	.0074	.0091
H	1	0.1 x D	0.1 x D	525	–	918	IPT	.0006	.0012	.0016	.0019	.0025	.0032	.0039	.0053	.0064	.0074	.0091
	2	0.1 x D	0.1 x D	459	–	787	IPT	.0005	.0009	.0012	.0014	.0019	.0024	.0029	.0040	.0048	.0055	.0067
	3	0.1 x D	0.1 x D	394	–	590	IPT	.0004	.0007	.0009	.0011	.0015	.0019	.0023	.0031	.0038	.0044	.0055
	4	0.1 x D	0.1 x D	328	–	459	IPT	.0002	.0005	.0006	.0007	.0010	.0013	.0015	.0021	.0025	.0029	.0036


Material Group		Profile Milling A		TiAlN Cutting Speed — vc SFM			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing** D1 — Diameter										
		ap	ae	min		max	mm	1.0	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0
P	3	0.2 x D	0.2 x D	512	–	682	IPT	.0003	.0006	.0007	.0009	.0012	.0015	.0019	.0026	.0031	.0036	.0045
	4	0.2 x D	0.2 x D	384	–	640	IPT	.0003	.0005	.0007	.0008	.0011	.0014	.0017	.0023	.0028	.0032	.0039
H	1	0.2 x D	0.2 x D	341	–	597	IPT	.0003	.0005	.0007	.0008	.0011	.0014	.0017	.0023	.0028	.0032	.0039
	2	0.2 x D	0.2 x D	298	–	512	IPT	.0002	.0004	.0005	.0006	.0008	.0010	.0013	.0017	.0021	.0024	.0029
	3	0.2 x D	0.2 x D	256	–	384	IPT	.0002	.0003	.0004	.0005	.0007	.0008	.0010	.0014	.0016	.0019	.0024
	4	0.2 x D	0.2 x D	213	–	298	IPT	.0001	.0002	.0003	.0003	.0004	.0005	.0007	.0009	.0011	.0013	.0016

NOTE: Please use the reference table to optimize your cutting speed based on the average cutting angle of the application. *See page M159.*

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Material Group		Profile Milling A		TiAlN Cutting Speed — vc SFM			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing** D1 — Diameter							
		ap	ae	min		max	mm	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0
P	3	0.05 x D	0.05 x D	905	–	1207	IPT	.0019	.0029	.0040	.0050	.0061	.0085	.0102	.0119
	4	0.05 x D	0.05 x D	679	–	1132	IPT	.0018	.0027	.0036	.0046	.0056	.0076	.0091	.0106
H	1	0.05 x D	0.05 x D	604	–	1056	IPT	.0018	.0027	.0036	.0046	.0056	.0076	.0091	.0106
	2	0.05 x D	0.05 x D	528	–	905	IPT	.0013	.0020	.0027	.0035	.0042	.0057	.0068	.0079
	3	0.05 x D	0.05 x D	453	–	679	IPT	.0011	.0016	.0022	.0027	.0033	.0045	.0054	.0063
	4	0.05 x D	0.05 x D	377	–	528	IPT	.0007	.0011	.0014	.0018	.0022	.0030	.0036	.0042

Material Group		Profile Milling A		TiAlN Cutting Speed — vc SFM			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing** D1 — Diameter							
		ap	ae	min		max	mm	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0
P	3	0.1 x D	0.1 x D	787	–	1050	IPT	.0013	.0020	.0028	.0035	.0043	.0059	.0071	.0083
	4	0.1 x D	0.1 x D	590	–	984	IPT	.0012	.0019	.0025	.0032	.0039	.0053	.0064	.0074
H	1	0.1 x D	0.1 x D	525	–	918	IPT	.0012	.0019	.0025	.0032	.0039	.0053	.0064	.0074
	2	0.1 x D	0.1 x D	459	–	787	IPT	.0009	.0014	.0019	.0024	.0029	.0040	.0048	.0055
	3	0.1 x D	0.1 x D	394	–	590	IPT	.0007	.0011	.0015	.0019	.0023	.0031	.0038	.0044
	4	0.1 x D	0.1 x D	328	–	459	IPT	.0005	.0007	.0010	.0013	.0015	.0021	.0025	.0029

Material Group		Profile Milling A		TiAlN Cutting Speed — vc SFM			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing** D1 — Diameter							
		ap	ae	min		max	mm	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0
P	3	0.2 x D	0.2 x D	512	–	682	IPT	.0006	.0009	.0012	.0015	.0019	.0026	.0031	.0036
	4	0.2 x D	0.2 x D	384	–	640	IPT	.0005	.0008	.0011	.0014	.0017	.0023	.0028	.0032
H	1	0.2 x D	0.2 x D	341	–	597	IPT	.0005	.0008	.0011	.0014	.0017	.0023	.0028	.0032
	2	0.2 x D	0.2 x D	298	–	512	IPT	.0004	.0006	.0008	.0010	.0013	.0017	.0021	.0024
	3	0.2 x D	0.2 x D	256	–	384	IPT	.0003	.0005	.0007	.0008	.0010	.0014	.0016	.0019
	4	0.2 x D	0.2 x D	213	–	298	IPT	.0002	.0003	.0004	.0005	.0007	.0009	.0011	.0013

NOTE: Please use the reference table to optimize your cutting speed based on the average cutting angle of the application. *See page M159.*

Series 422873 • Vision Plus


Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Finishing**					
		A		Cutting Speed — vc SFM				D1 — Diameter				
		ap	ae	min		max	mm	3.0	4.0	5.0	6.0	8.0	10.0
P	3	0.05 x D	0.05 x D	905	–	1207	IPT	.0029	.0040	.0050	.0061	.0085	.0102
	4	0.05 x D	0.05 x D	679	–	1132	IPT	.0027	.0036	.0046	.0056	.0076	.0091
H	1	0.05 x D	0.05 x D	604	–	1056	IPT	.0027	.0036	.0046	.0056	.0076	.0091
	2	0.05 x D	0.05 x D	528	–	905	IPT	.0020	.0027	.0035	.0042	.0057	.0068
	3	0.05 x D	0.05 x D	453	–	679	IPT	.0016	.0022	.0027	.0033	.0045	.0054
	4	0.05 x D	0.05 x D	377	–	528	IPT	.0011	.0014	.0018	.0022	.0030	.0036


Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Semi-Finishing**					
		A		Cutting Speed — vc SFM				D1 — Diameter				
		ap	ae	min		max	mm	3.0	4.0	5.0	6.0	8.0	10.0
P	3	0.1 x D	0.1 x D	787	–	1050	IPT	.0020	.0028	.0035	.0043	.0059	.0071
	4	0.1 x D	0.1 x D	590	–	984	IPT	.0019	.0025	.0032	.0039	.0053	.0064
H	1	0.1 x D	0.1 x D	525	–	918	IPT	.0019	.0025	.0032	.0039	.0053	.0064
	2	0.1 x D	0.1 x D	459	–	787	IPT	.0014	.0019	.0024	.0029	.0040	.0048
	3	0.1 x D	0.1 x D	394	–	590	IPT	.0011	.0015	.0019	.0023	.0031	.0038
	4	0.1 x D	0.1 x D	328	–	459	IPT	.0007	.0010	.0013	.0015	.0021	.0025


Material Group		Profile Milling		TiAlN			Recommended feed per tooth (IPT = inch/th) for 3D milling/profiling (A) — **Roughing**					
		A		Cutting Speed — vc SFM				D1 — Diameter				
		ap	ae	min		max	mm	3.0	4.0	5.0	6.0	8.0	10.0
P	3	0.2 x D	0.2 x D	512	–	682	IPT	.0009	.0012	.0015	.0019	.0026	.0031
	4	0.2 x D	0.2 x D	384	–	640	IPT	.0008	.0011	.0014	.0017	.0023	.0028
H	1	0.2 x D	0.2 x D	341	–	597	IPT	.0008	.0011	.0014	.0017	.0023	.0028
	2	0.2 x D	0.2 x D	298	–	512	IPT	.0006	.0008	.0010	.0013	.0017	.0021
	3	0.2 x D	0.2 x D	256	–	384	IPT	.0005	.0007	.0008	.0010	.0014	.0016
	4	0.2 x D	0.2 x D	213	–	298	IPT	.0003	.0004	.0005	.0007	.0009	.0011

NOTE: Please use the reference table to optimize your cutting speed based on the average cutting angle of the application. *See page M159.*

Calculation Examples

Table of Factor for Speed Calculation Ball Nose

Average Wall Angle	ap/D						
	0.003	0.006	0.010	0.016	0.020	0.025	0.030
0.0°	9.1	6.5	5.0	4.0	3.6	3.2	2.9
3.0°	6.2	4.9	4.0	3.3	3.0	2.8	2.6
5.0°	5.1	4.2	3.5	3.0	2.8	2.5	2.4
8.0°	4.1	3.4	3.0	2.6	2.4	2.3	2.1
10.0°	3.6	3.1	2.7	2.4	2.3	2.1	2.0
15.0°	2.8	2.5	2.2	2.0	1.9	1.8	1.7
20.0°	2.3	2.1	1.9	1.8	1.7	1.6	1.6
30.0°	1.7	1.6	1.5	1.4	1.4	1.3	1.3
40.0°	1.4	1.3	1.3	1.2	1.2	1.2	1.2
50.0°	1.2	1.2	1.1	1.1	1.1	1.1	1.1
55.0°	1.1	1.1	1.1	1.1	1.1	1.0	1.0

*For calculating real cutting speed, use formula: Basic cutting speed * Factor*

Choose the coefficient according to the ap/D and average wall angle.

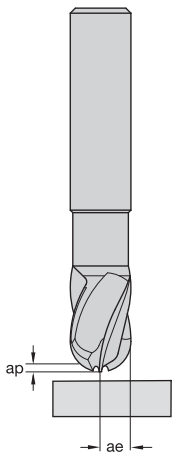
Example 1: For Tool = 3/8" and ap = .008" for average wall angle 0°, ap/D ratio equal .008/.375 = .02. Factor equal 3.6.

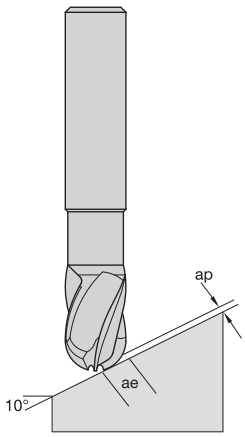
Example 2: For Tool = 5/16" and ap = .004" for average wall angle 10°, ap/D ratio equal .004"/.312 = 0.12. Factor will be between 2.7 and 2.4, choose 2.6.

Keep in mind shank diameter and length effect.

If tool length out of the chuck is more than 2 x D, please decrease feed per tooth by 15% each 1 x D.

Material Group	Basic vc for Factor Calculation		
	Min		Max
P3	160	–	180
P4	140	–	160
H1	100	–	140
H2	70	–	120
H3	60	–	90
H4	50	–	70



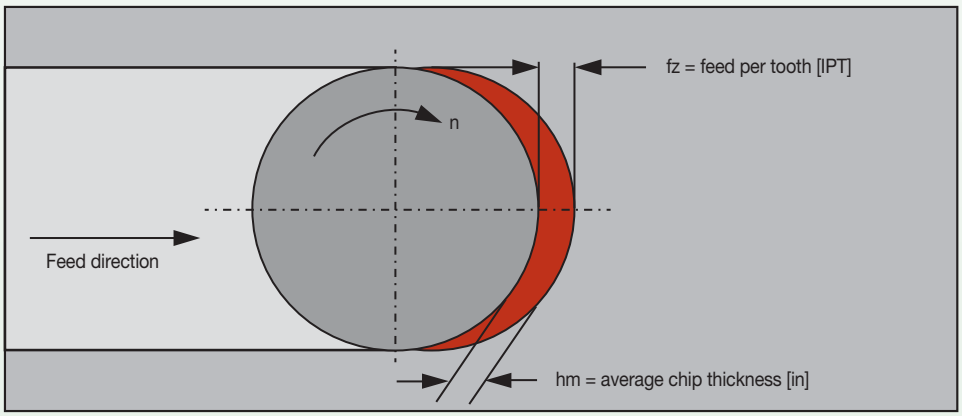


Application example #1 = face milling a flat surface
D = 3/8"
ap = .008"
Average wall angle = 0°
Finishing H2
Starting vc from chart = 300 SFM
ap/D = 0.02
Factor from table = 3.6
vc to program into machine = 300 * 3.6 = 1080 SFM
RPM = 1080* 12/3.14/.375 = 11000 RPM

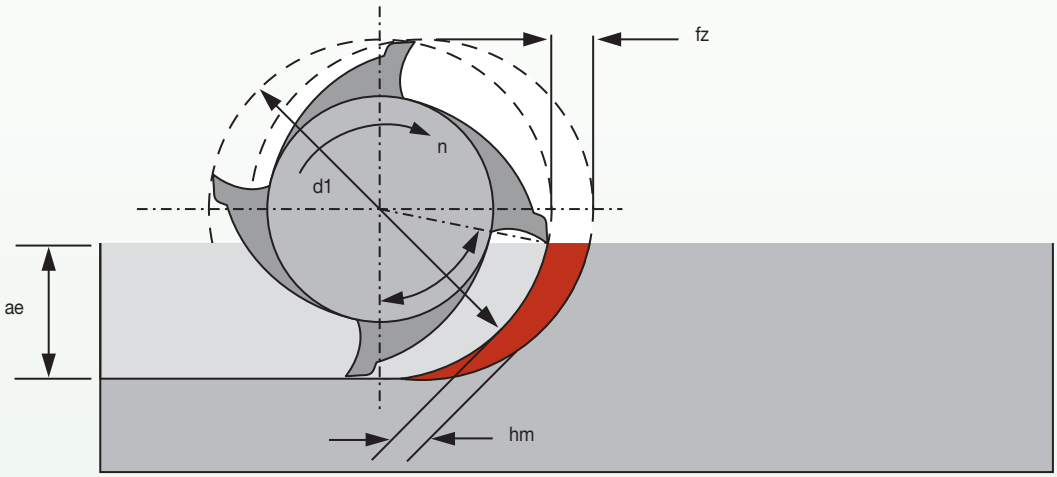
Application example #2 = face milling a 10° average wall angle
D = 5/16"
ap = .004"
Average wall angle = 10°
Finishing H2
Starting vc from chart = 300 SFM
ap/D = 0,1/8 = .012
Factor from table = 2.6
vc to program into machine = 300 * 2.6 = 780 SFM
RPM = 780* 12/3.14/.312 = 9554 RPM

Conventional Slotting

- Full slotting limitations:
  - Usually not more then ap = 1 x D.
  - Conventional and climb milling at the same time.
  - High heat development on the tool and on the workpiece.
  - Difficult chip evacuation.
  - High radial forces.
- This Means:
  - No constant chip thickness.
  - Low MRR.
  - Surface quality from the left to right side are different.
  - Limited tool life.
  - High power and torque requirements for the machine.



ae and Chip Thickness



To calculate average chip thickness:

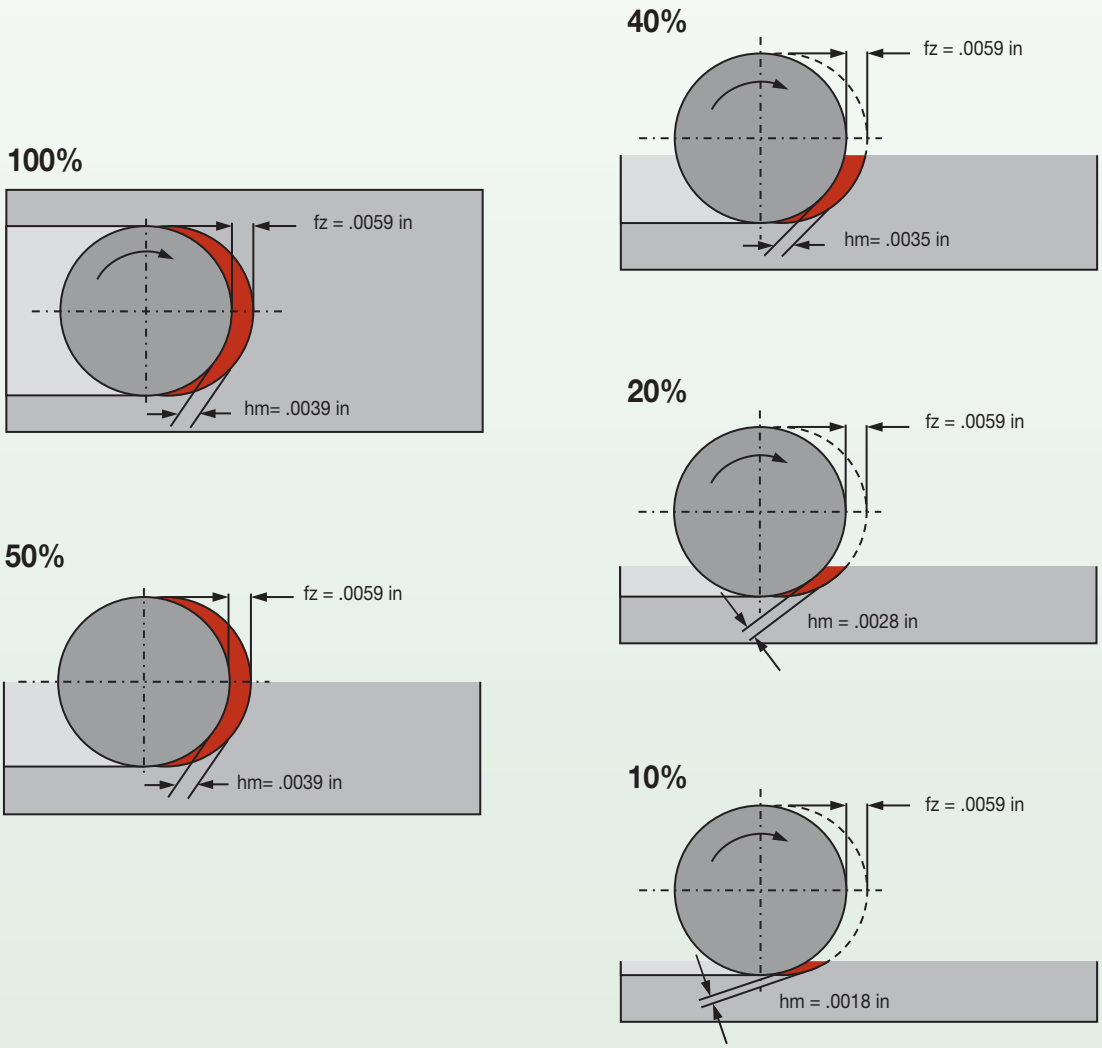
$$hm = fz \bullet \left(\sqrt{\frac{ae}{d1}}\right)$$

Simplified formula for shown application and 90° angles on the tool.
The chip thickness defines the load on the cutting edge.

ae and Chip Thickness

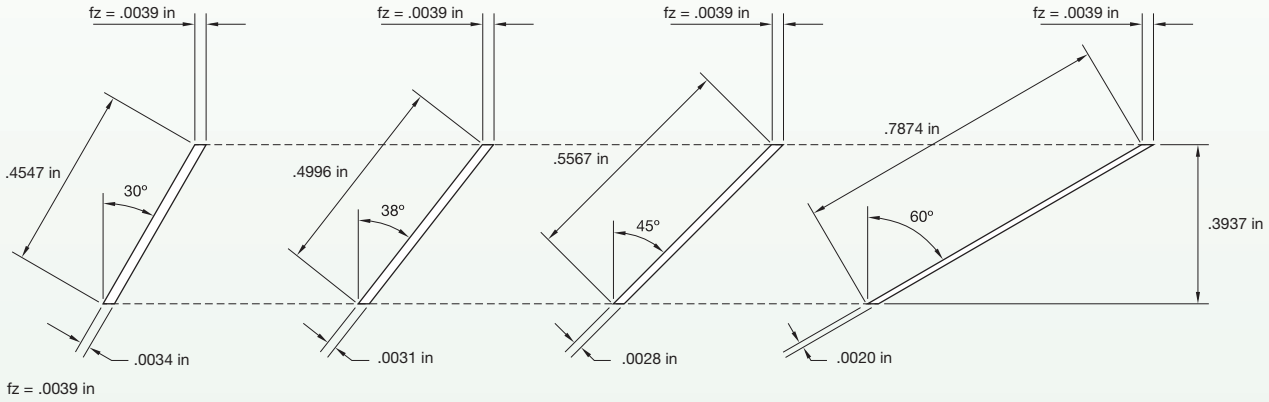
chip thinning effect		
a_e	programmed feed (f_z)	chip thickness (h_m)
100%	.0059 in	.0039 in
50%	.0059 in	.0039 in
40%	.0059 in	.0035 in
20%	.0059 in	.0028 in
10%	.0059 in	.0018 in

The chip thickness needs to be compensated by feed.



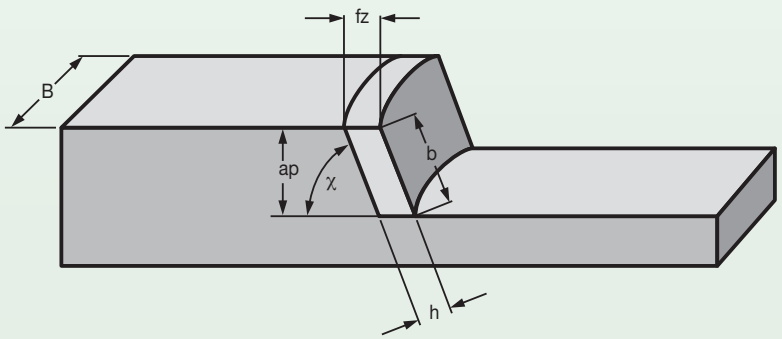
Helix Angle and Chip Thickness

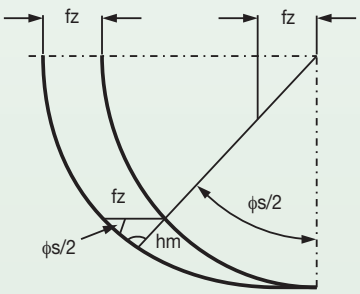
The chip thickness (h) depends on the helix angle of the cutting edge. If the feed fz is constant, the chip thickness gets thinner as helix angle rises. That means with more helix angle, the chip gets thinner — or you can rise feed rate to increase productivity and load to the cutting edge.



Calculation of Chip Thickness

The chip thickness (h) is not constant, but defines the load of the cutting edge. By reducing the load on the cutting edge, machining at higher speeds is possible through the machining parameters. For easier calculation, use an average chip thickness hm. When calculating machining data this way cutting data may be compromised because the workpiece is often a different shape.





$$hm = \frac{360°}{\pi \bullet \phi s} \bullet \frac{ae}{D} \bullet fz \bullet \sin \chi$$

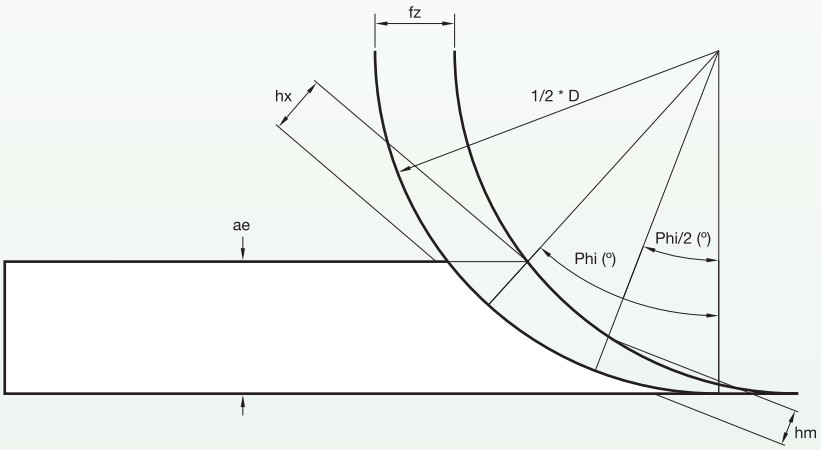
hm [in]	=	average chip thickness
ϕs [°]	=	engagement angle
ae [in]	=	width of engagement
D1 [in]	=	outer diameter tool
fz [IPT]	=	feed per tooth
χ [°]	=	lead angle
λ [°]	=	helix angle *

* Solid End Mills: χ = 90°-λ

NOTE: It makes no difference if the tool is solid or an indexable milling tool.

Differences between hm and hx

In conventional milling, it makes sense to calculate the load to the cutting edge through hm. With reducing the ae to very low values, you can calculate with the maximum chip thickness hx to make sure that the feed per tooth is set up correctly.



Conventional

$hm = 360°/\pi \cdot \phi s \cdot ae/D \cdot fz \cdot \sin x$

hm [in]	=	average chip thickness
fs [°]	=	engagement angle
ae [in]	=	width of engagement
D1 [in]	=	outer diameter tool
fz [IPT]	=	feed per tooth
χ [°]	=	lead angle
λ [°]	=	helix angle *

Smart Machining

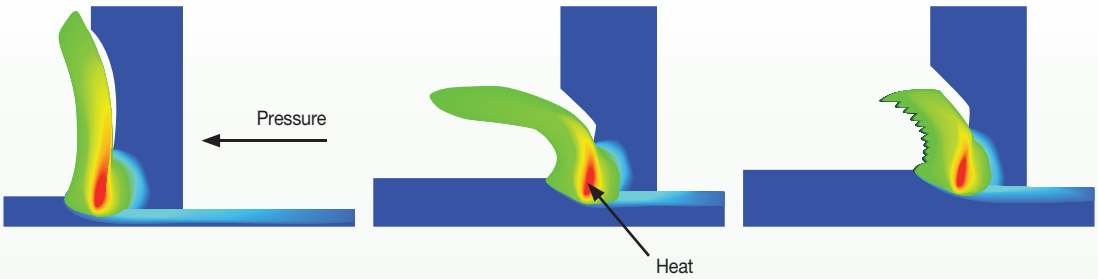
$hx = 360°/\pi \cdot \phi s \cdot 2 \cdot ae/D \cdot fz \cdot \sin x$

hx [in]	=	maximum chip thickness
fs [°]	=	engagement angle
ae [in]	=	width of engagement
D1 [in]	=	outer diameter tool
fz [IPT]	=	feed per tooth
χ [°]	=	lead angle
λ [°]	=	helix angle *

* Solid End Mills: $\chi = 90° - \lambda$

Trochoidal Milling can be performed with solid or indexable milling tools.

Cutting Speed

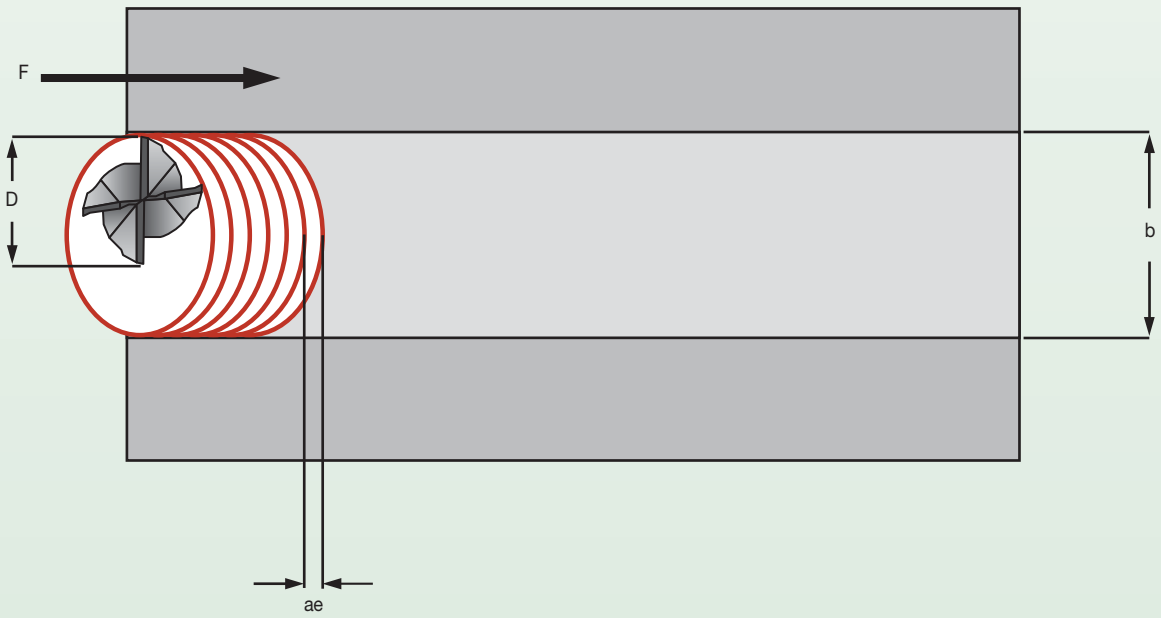


Reduced radial engagement influences the cutting speed, because the heat produced through the cutting process limits the cutting speed.

ae/D	full slot	50% ae	40% ae	30% ae	20% ae	10 % ae	5% ae	4% ae
speed factors	0.9	1	1.1	1.2	1.3	1.4	2.5	3
phi [°]	180	90	78.46	66.42	53.13	36.87	25.84	23.07

Static Trochoidal Milling for a Full Slot

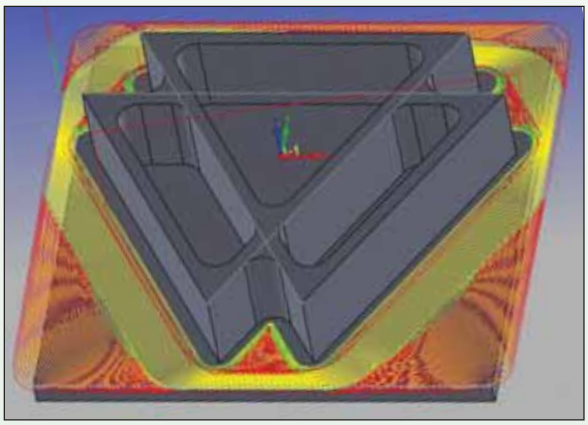
- Use a tool which D < b.
- Program circles in the CNC program (as a cycle).
- After one circle, repeat the same with an offset.
- Optimize by shortening the lane “in the air” to a form like a “D”.

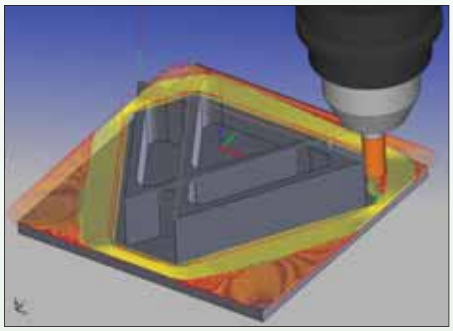


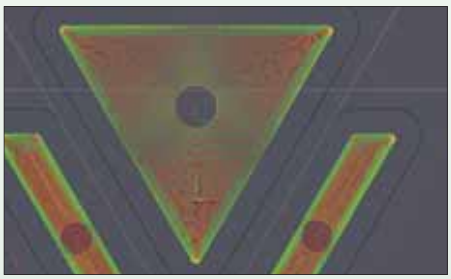
Trochoidal Milling can be performed with solid or indexable milling tools.

Dynamic Trochoidal Milling

- Transfer the basic idea control of chip thickness to dynamic processes.
- Dynamic adaption of feed in relation to ae and wrap angle through an intelligent CAM Software.
- Using helix interpolation, D-lanes, and morphing cycles.







Requirements

Static trochoidal milling
- Dynamic machine.
- CNC Program.
- Modern tool.
- Cutting data for trochoidal machining.

Dynamic trochoidal milling
- Dynamic CNC machine.
- CAD/CAM optimization software.
- Modern tool.
- Cutting data for trochoidal machining.

Benefits

- Constant chip thickness.
- Reduced arc/angle engagement (wrap angle).
- Tremendously reduced load on the cutting edge.
- Reduced temperature during the machining process.
- Higher cutting speed and feed per tooth possible.
- Reduced cycle time and increased tool life.
- Better chip evacuation.
- Better usage of the tool length.
- Less torque and power requirements for the machine.
- Less risk of spindle damages through torque fluctuation and reduced torque peaks caused by conventional milling processes.

VariMill III™ ER

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

VariMill III ER provides the highest metal removal rates and superior surface finish in the most demanding workpiece materials in the aerospace industry. WIDIA-Hanita™ combines its unmatched tooling technology with state-of-the-art surface treatments to deliver the highest quality and productivity you can rely on when it comes down to critical semi-finishing and finishing operations.

- 7-Flute design maximizes Metal Removal Rates (MRR) and surface quality.
- Up to 30% radial engagement allowing for increased productivity.
- Perfectly suited for high-speed machining techniques such as trochoidal and peel milling.
- Central coolant hole on 2 x D tools; chip evacuation during pocketing.
- Available with **SAFE-λOCK**® as standard for increased tool life and anti-pullout.
- Available with all common aerospace radii.

To learn more about our innovations, contact your local Authorized Distributor or visit **widia.com**.

WIDIA™

High-Performance Solid Carbide End Mills •
SAFE-λOCK®

In High-Performance Cutting (HPC), slow microcreeping can cause the cutting tool to be pulled out of the chuck, turning high-quality workpieces to scrap.

SAFE-λOCK®

Be on the safe side with SAFE-λOCK® in High-Performance Cutting (HPC).

- Highly accurate clamping due to positive connection.
- No loss of accuracy.
- No pullout or spinning of the tool.
- No damage to the workpiece or machine.
- Groove on tool shank is directed so the tool will be pulled into the chuck (depending on direction of rotation).

Order Information

WIDIA™ high-performance end mills with shank diameters of 1/2" and larger are available with **SAFE-λOCK®** technology, as a special tool, upon request. Please contact your local customer service location to receive a quote.

Features
- Form-closed clamping.
- High accuracy clamping.
- Helical grooves.

Functions
- No pullout.
- Excellent runout.
- Adjustable clamping length.

Benefits
- Reduce scrap rate.
- Higher tool life.
- No need to change NC program after regrinding.

Example for Highest Metal Removal Rates (MRR)

The VariMill II ER proprietary design with unequal flute spacing and unique core geometry for chatter-free machining enables slotting operations in titanium up to 1 x D.

SAFE-λOCK®
The safety belt for high-performance solid carbide end mills provide form-closed clamping with high accuracy and helical grooves for length adjustment.

WIDIA™ and the Machine Tool Industry (MTI)

Partners from Point to Part

Challenges are always better faced with a partner. Getting the most out of a manufacturing process means a 3-point partnership between the end user, the machine tool builder, and the tooling provider. The right partner works with you every step of the way, from the point of the spindle connection to the completed part.

Let the WIDIA Machine Tool Industry (MTI) specialists be your partners. We'll work with you from pre-planning, time studies, and machine tool selection through setup, runoff, operator training, and process optimization. The MTI team focuses simultaneously on engineering, process and application support, and tool selection. We look at the total solution to get you where you want and need to be in your manufacturing.

We have MTI specialists in more than 60 countries around the world, so there's always someone near you: **W-MTI.Solutions@WIDIA.com**.

Components of a Winning Strategy

Our mission is to build lasting relationships with all of the focused builders, end users, and dealers to provide continuous communications and to ensure we have their mind share. WIDIA is the number one choice of machine tool builders, dealers, and end users globally for total tooling solutions. We provide world class quality, service, and on-time delivery to meet and exceed your expectations

- Trust
- Innovation
- Dedicated Support
- Capability
- Engineered Solutions

Global Manufacturers

Our global organization and network is ensuring a reliable support at the home of the machine tool builder and the final place of installation, and following the machines worldwide.

- Simultaneous engineering support from art to part.
- Seamless transition from the initial investment phase to full production by qualified technical hand-off to local WIDIA™ staff at the end user stage, guaranteeing satisfying continued service and support.
- Starter kits for machine tool equipment.

Global WIDIA MTI

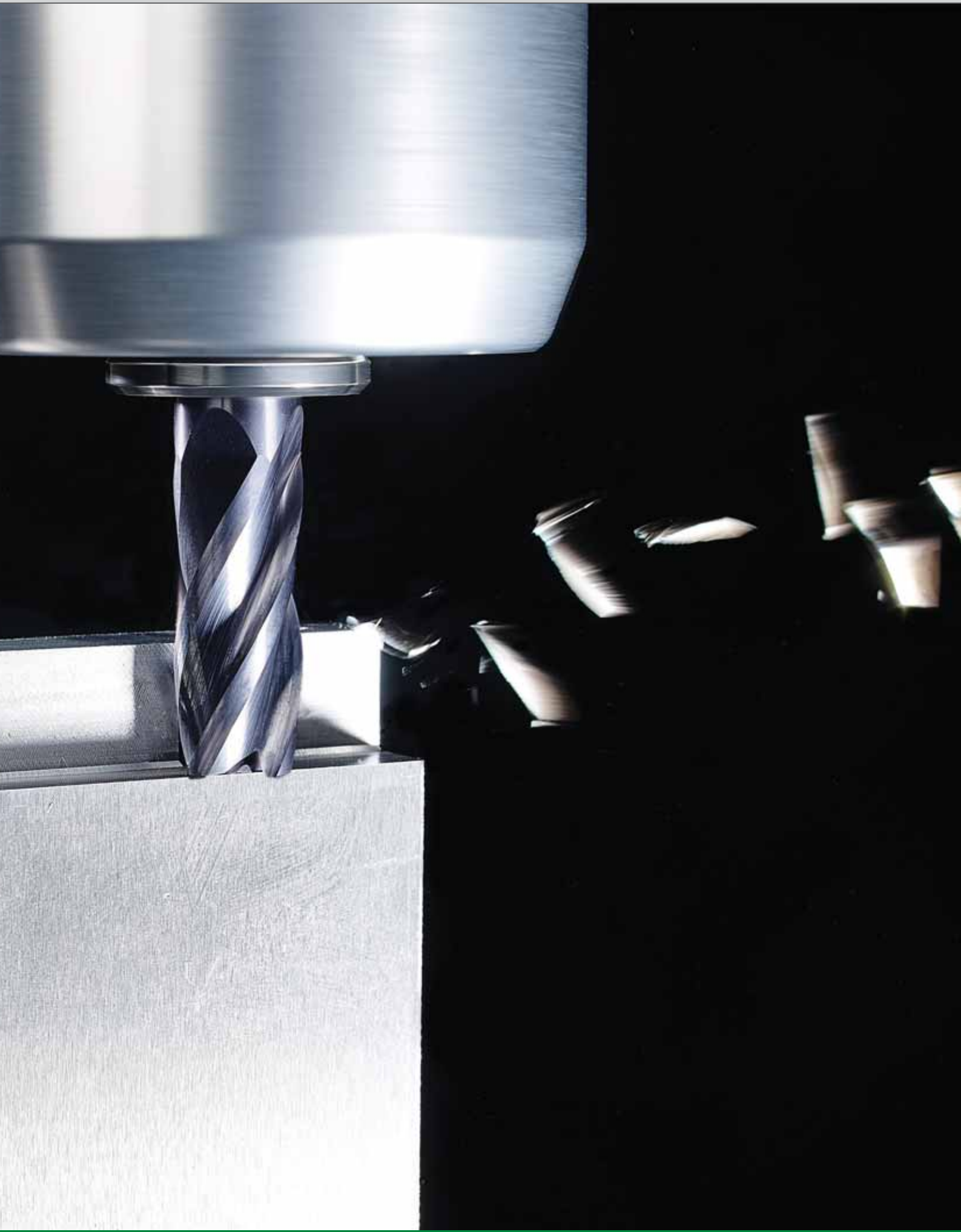
We will provide our customers with a total solution from spindle connection to the part. We include all brands of the WIDIA family of companies to enhance this total solution.

Global Machine Tool Builders

Providing machine tool builders with a long term expertise in the OEM business and an unreached bandwidth of competitive technical solutions, consisting of standard, as well as customized cutting tool technology.

For more information, contact your local WIDIA Authorized Distributor or visit **widia.com/services.**

WIDIA™



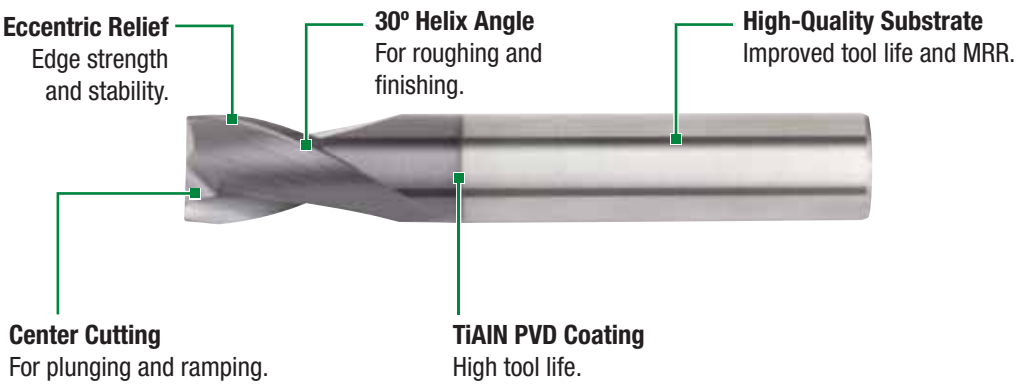
Solid End Milling • General Purpose Solid Carbide End Mills

VariMill GP

VariMill GP offers plunging, slotting, and profiling for a wide range of materials and applications. Designed to provide high metal removal rates and excellent surface conditions at a value price. A wide range of diameters, lengths, and corner styles (such as chamfered, sharp edge, and ball nose) are available from stock.

VariMill GP • 2-Flute

- General purpose tools for a wide range of workpiece materials.
- Roughing and finishing with one tool.
- Various lengths-of-cut and overall lengths with different front end designs available.
- Two flutes for high flexibility in unstable conditions.

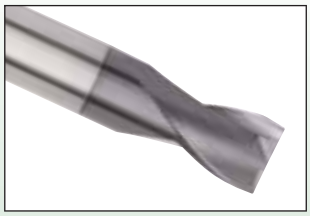


VariMill™ GP

- Increased manufacturing flexibility and reduced tool cost.
- Fewer tool changes and high Metal Removal Rates (MRR).
- No specific tool for roughing and finishing required.
- Eccentric relief for improved edge stability and high tool life.
- Easy and cost-efficient regrinding due to eccentric relief.

I2C Series

- Wide range of lengths-of-cut — short, regular, long, and extra long.
- Steel, stainless steel, and cast iron.
- Corner chamfer for increased tool life.
- Center cut.



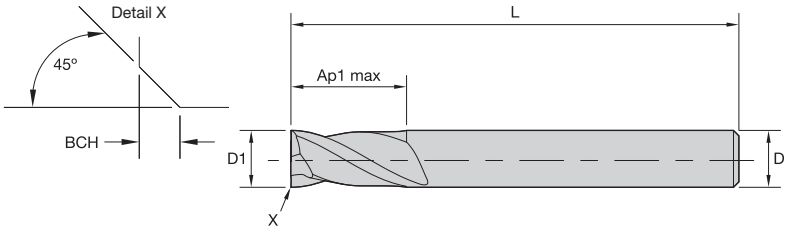
I2S Series

- Wide range of lengths-of-cut — short, regular, long, and extra long.
- Steel, stainless steel, and cast iron.
- Center cut.

I2B Series

- Wide range of lengths-of-cut — short, regular, long, and extra long.
- Steel, stainless steel, and cast iron.
- Center cut ball nose.

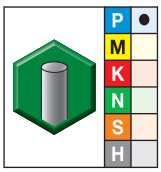
- Center cutting.
- Chamfered corners.
- Standard items listed. Additional styles and coatings made-to-order.

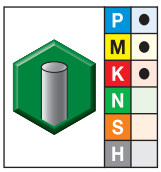


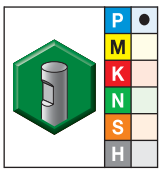
End Mill Tolerances

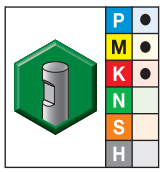
D1	tolerance e8	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series I2C • VariMill GP







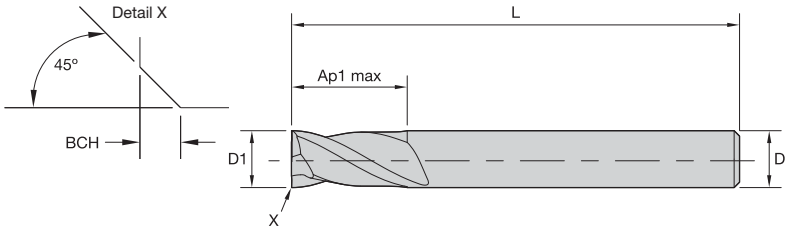


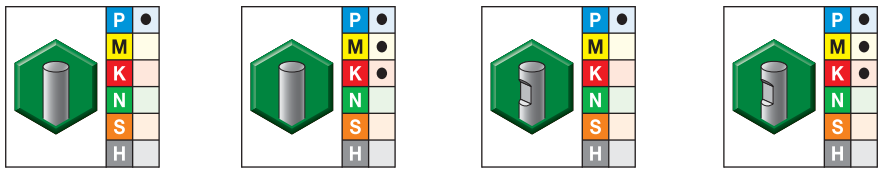
● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN						
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
5877923	I2C0125T025S	5873898	I2C0125T025S	–		–		1/8	1/8	1/4	1 1/2	.010
5877924	I2C0125T050R	5873899	I2C0125T050R	–		–		1/8	1/8	1/2	1 1/2	.010
5877925	I2C0125T075L	5873900	I2C0125T075L	–		–		1/8	1/8	3/4	2 1/4	.010
5877926	I2C0125T075X	5873901	I2C0125T075X	–		–		1/8	1/8	3/4	3	.010
5877927	I2C0141T056R	5873902	I2C0141T056R	–		–		9/64	3/16	9/16	2	.010
5877928	I2C0156T031R	5873903	I2C0156T031R	–		–		5/32	3/16	5/16	2	.010
5877929	I2C0156T056L	5873904	I2C0156T056L	–		–		5/32	3/16	9/16	2	.010
5877930	I2C0172T062R	5873905	I2C0172T062R	–		–		11/64	3/16	5/8	2	.010
	–	5873906	I2C0188T031S	–		–		3/16	3/16	5/16	1 1/2	.010
5877931	I2C0188T062R	5873907	I2C0188T062R	–		–		3/16	3/16	5/8	2	.010
5877932	I2C0188T075L	5873908	I2C0188T075L	–		–		3/16	3/16	3/4	2 1/2	.010
5877933	I2C0188T112X	5873909	I2C0188T112X	–		–		3/16	3/16	1 1/8	3	.010
5877934	I2C0219T043R	5873910	I2C0219T043R	–		–		7/32	1/4	7/16	2	.016
5877935	I2C0219T062L	5873911	I2C0219T062L	–		–		7/32	1/4	5/8	2 1/2	.016
5877936	I2C0250T050S	5873912	I2C0250T050S	–		–		1/4	1/4	1/2	2	.016
5877937	I2C0250T075R	5873913	I2C0250T075R	–		–		1/4	1/4	3/4	2 1/2	.016
5877938	I2C0250T112R	5873914	I2C0250T112L	–		–		1/4	1/4	1 1/8	3	.016
5877939	I2C0250T125L		–	–		–		1/4	1/4	1 1/4	3 1/2	.016
5877940	I2C0250T150X	5873915	I2C0250T150X	–		–		1/4	1/4	1 1/2	4	.016
5877951	I2C0281T075R	5873916	I2C0281T075R	–		–		9/32	5/16	3/4	2 1/2	.016
5878021	I2C0312T050S	5873986	I2C0312T050S	–		–		5/16	5/16	1/2	2	.016
5877952	I2C0312T081R	5873917	I2C0312T081R	–		–		5/16	5/16	13/16	2 1/2	.016
5877953	I2C0312T112L	5873918	I2C0312T112L	–		–		5/16	5/16	1 1/8	3	.016
5877954	I2C0312T162X	5873919	I2C0312T162X	–		–		5/16	5/16	1 5/8	4	.016

(continued)

(Series I2C • VariMill GP — continued)



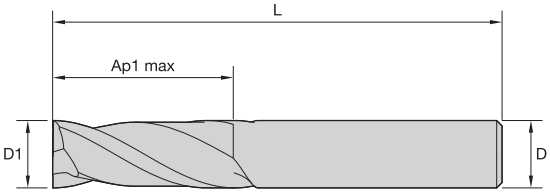


● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN						
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
5877955	I2C0344T100R	5873920	I2C0344T100R		–		–	11/32	3/8	1	2 1/2	.020
5877956	I2C0375T062S	5873921	I2C0375T062S		–		–	3/8	3/8	5/8	2	.020
5877957	I2C0375T100R	5873922	I2C0375T100R		–		–	3/8	3/8	1	2 1/2	.020
5877958	I2C0375T112R	5873923	I2C0375T112R		–		–	3/8	3/8	1 1/8	3	.020
5877959	I2C0375T175L	5873924	I2C0375T175L		–		–	3/8	3/8	1 3/4	4	.020
5877960	I2C0375T300X	5873925	I2C0375T300X		–		–	3/8	3/8	3	6	.020
5877961	I2C0406T100R	5873926	I2C0406T100R		–		–	13/32	7/16	1	2 3/4	.020
5877962	I2C0437T062S	5873927	I2C0437T062S		–		–	7/16	7/16	5/8	2 1/2	.020
5877963	I2C0437T100R	5873928	I2C0437T100R		–		–	7/16	7/16	1	2 1/2	.020
5877964	I2C0437T200L	5873929	I2C0437T200L		–		–	7/16	7/16	2	4	.020
5877965	I2C0437T300X	5873930	I2C0437T300X		–		–	7/16	7/16	3	6	.020
5877967	I2C0469T100R	5873931	I2C0469T100R		–		–	15/32	1/2	1	3	.020
5877968	I2C0500T062S	5873932	I2C0500T062S		–		–	1/2	1/2	5/8	2 1/2	.020
5877969	I2C0500T100R	5873933	I2C0500T100R	5878002	I2C0500W100R	5873966	I2C0500W100R	1/2	1/2	1	3	.020
5877970	I2C0500T200L	5873934	I2C0500T200L	5878003	I2C0500W200L	5873967	I2C0500W200L	1/2	1/2	2	4	.020
5877971	I2C0500T300X	5873935	I2C0500T300X	5878004	I2C0500W300X	5873968	I2C0500W300X	1/2	1/2	3	6	.020
5877972	I2C0562T075R	5873936	I2C0562T075R	5878005	I2C0562W075R	5873969	I2C0562W075R	9/16	9/16	3/4	3	.020
5877973	I2C0562T125L	5873937	I2C0562T125L	5878006	I2C0562W125L	5873971	I2C0562W125L	9/16	9/16	1 1/4	3 1/2	.020
5877974	I2C0562T225X	5873938	I2C0562T225X	5878007	I2C0562W225X	5873972	I2C0562W225X	9/16	9/16	2 1/4	5	.020
5877975	I2C0625T075S	5873939	I2C0625T075S		–		–	5/8	5/8	3/4	3	.020
5877976	I2C0625T125R	5873940	I2C0625T125R	5878008	I2C0625W125R	5873973	I2C0625W125R	5/8	5/8	1 1/4	3 1/2	.020
5877977	I2C0625T225R	5873951	I2C0625T225R	5878009	I2C0625W225R	5873974	I2C0625W225R	5/8	5/8	2 1/4	5	.020
5877978	I2C0625T300L	5873952	I2C0625T300L	5878010	I2C0625W300L	5873975	I2C0625W300L	5/8	5/8	3	6	.020
5877979	I2C0625T400X	5873953	I2C0625T400X	5878011	I2C0625W400X	5873976	I2C0625W400X	5/8	5/8	4	7	.020
5877980	I2C0687T137R	5873954	I2C0687T137R	5878012	I2C0687W137R	5873977	I2C0687W137R	11/16	3/4	1 3/8	4	.020
5877991	I2C0750T100S	5873955	I2C0750T100S		–		–	3/4	3/4	1	3	.020
5877992	I2C0750T150R	5873956	I2C0750T150R		–		–	3/4	3/4	1 1/2	4	.020
5877993	I2C0750T225R	5873957	I2C0750T225R	5878013	I2C0750W225R	5873978	I2C0750W225R	3/4	3/4	2 1/4	5	.020
5877994	I2C0750T300L	5873958	I2C0750T300L	5878014	I2C0750W300L	5873979	I2C0750W300L	3/4	3/4	3	6	.020
5877995	I2C0750T400X	5873959	I2C0750T400X	5878015	I2C0750W400X	5873980	I2C0750W400X	3/4	3/4	4	7	.020
5877996	I2C0875T150R	5873960	I2C0875T150R	5878016	I2C0875W150R	5873981	I2C0875W150R	7/8	7/8	1 1/2	4	.020
5877997	I2C0875T225L	5873961	I2C0875T225L	5878017	I2C0875W225L	5873982	I2C0875W225L	7/8	7/8	2 1/4	5	.020
5877998	I2C1000T150S	5873962	I2C1000T150S		–		–	1	1	1 1/2	4	.020
5877999	I2C1000T225R	5873963	I2C1000T225R	5878018	I2C1000W225R	5873983	I2C1000W225R	1	1	2 1/4	5	.020
5878000	I2C1000T300L	5873964	I2C1000T300L	5878019	I2C1000W300L	5873984	I2C1000W300L	1	1	3	6	.020
5878001	I2C1000T400X	5873965	I2C1000T400X	5878020	I2C1000W400X	5873985	I2C1000W400X	1	1	4	7	.020

NOTE: For application data, please see pages N11–N12.

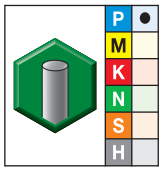
- Center cutting.
- Sharp corners.
- Standard items listed. Additional styles and coatings made-to-order.

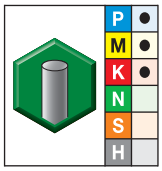


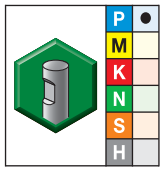
End Mill Tolerances

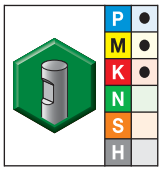
D1	tolerance e8	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series I2S • VariMill GP







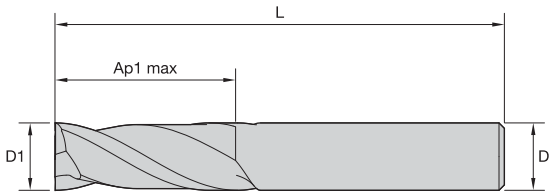


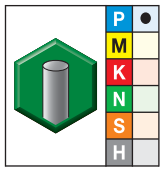
● first choice
○ alternate choice

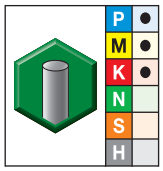
grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN					
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
5873648	I2S0016T003R	5872793	I2S0016T003R	–		–		1/64	1/8	1/32	1 1/2
5873649	I2S0031T007R	5872794	I2S0031T007R	–		–		1/32	1/8	5/64	1 1/2
5873661	I2S0062T012R	5872796	I2S0062T012R	–		–		1/16	1/8	1/8	1 1/2
5873650	I2S0062T018L	5872795	I2S0062T018L	–		–		1/16	1/8	3/16	1 1/2
5873662	I2S0062T050X	5872797	I2S0062T050X	–		–		1/16	1/8	1/2	2
5873663	I2S0078T018R	5872798	I2S0078T018R	–		–		5/64	1/8	3/16	1 1/2
5873664	I2S0094T018S	5872799	I2S0094T018S	–		–		3/32	1/8	3/16	1 1/2
5873665	I2S0094T037R	5872800	I2S0094T037R	–		–		3/32	1/8	3/8	1 1/2
5873666	I2S0094T062L	5872841	I2S0094T062L	–		–		3/32	1/8	5/8	2
	–	5872843	I2S0109T037R	–		–		7/64	1/8	3/8	1 1/2
5873667	I2S0125T025S	5872844	I2S0125T025S	–		–		1/8	1/8	1/4	1 1/2
5873669	I2S0125T050R	5872845	I2S0125T050R	–		–		1/8	1/8	1/2	1 1/2
5873670	I2S0125T075L	5872846	I2S0125T075L	–		–		1/8	1/8	3/4	2 1/4
5873671	I2S0125T075X	5872847	I2S0125T075X	–		–		1/8	1/8	3/4	3
5873672	I2S0141T056R	5872848	I2S0141T056R	–		–		9/64	3/16	9/16	2
5873673	I2S0156T031R	5872849	I2S0156T031R	–		–		5/32	3/16	5/16	2
5873674	I2S0156T056L	5872850	I2S0156T056L	–		–		5/32	3/16	9/16	2
5873675	I2S0172T062R	5872851	I2S0172T062R	–		–		11/64	3/16	5/8	2
	–	5872852	I2S0188T031S	–		–		3/16	3/16	5/16	1 1/2
5873676	I2S0188T062R	5872853	I2S0188T062R	–		–		3/16	3/16	5/8	2
5873677	I2S0188T075L	5872854	I2S0188T075L	–		–		3/16	3/16	3/4	2 1/2
5873678	I2S0188T112X	5872855	I2S0188T112X	–		–		3/16	3/16	1 1/8	3
5873679	I2S0219T043R	5872856	I2S0219T043R	–		–		7/32	1/4	7/16	2
5873680	I2S0219T062L	5872857	I2S0219T062L	–		–		7/32	1/4	5/8	2 1/2

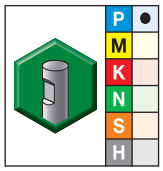
(continued)

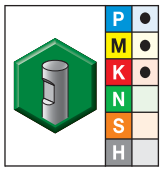
(Series I2S • VariMill GP — continued)









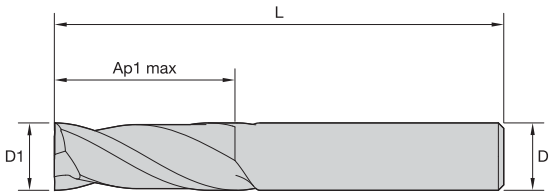


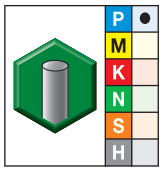
● first choice
○ alternate choice

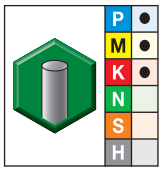
grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN					
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
5873681	I2S0250T050S	5872858	I2S0250T050S	–		–		1/4	1/4	1/2	2
5873682	I2S0250T075R	5872859	I2S0250T075R	–		–		1/4	1/4	3/4	2 1/2
5873683	I2S0250T112R	5872860	I2S0250T112R	–		–		1/4	1/4	1 1/8	3
5873684	I2S0250T125L		–	–		–		1/4	1/4	1 1/4	3 1/2
5873685	I2S0250T150X	5872861	I2S0250T150X	–		–		1/4	1/4	1 1/2	4
5873686	I2S0281T075R	5872862	I2S0281T075R	–		–		9/32	5/16	3/4	2 1/2
5873755	I2S0312T050S	5872941	I2S0312T050S	–		–		5/16	5/16	1/2	2
5873687	I2S0312T081R	5872863	I2S0312T081R	–		–		5/16	5/16	13/16	2 1/2
5873688	I2S0312T112L	5872864	I2S0312T112L	–		–		5/16	5/16	1 1/8	3
5873689	I2S0312T162X	5872865	I2S0312T162X	–		–		5/16	5/16	1 5/8	4
5873690	I2S0344T100R	5872866	I2S0344T100R	–		–		11/32	3/8	1	2 1/2
5873691	I2S0375T062S	5872867	I2S0375T062S	–		–		3/8	3/8	5/8	2
5873692	I2S0375T100R	5872868	I2S0375T100R	–		–		3/8	3/8	1	2 1/2
5873693	I2S0375T112R	5872869	I2S0375T112R	–		–		3/8	3/8	1 1/8	3
5873694	I2S0375T175L	5872870	I2S0375T175L	–		–		3/8	3/8	1 3/4	4
5873695	I2S0375T300X	5872881	I2S0375T300X	–		–		3/8	3/8	3	6
5873696	I2S0406T100R	5872882	I2S0406T100R	–		–		13/32	7/16	1	2 3/4
5873697	I2S0437T062S	5872883	I2S0437T062S	–		–		7/16	7/16	5/8	2 1/2
5873698	I2S0437T100R	5872884	I2S0437T100R	–		–		7/16	7/16	1	2 1/2
5873699	I2S0437T200L	5872885	I2S0437T200L	–		–		7/16	7/16	2	4
5873700	I2S0437T300X	5872886	I2S0437T300X	–		–		7/16	7/16	3	6
5873711	I2S0469T100R	5872887	I2S0469T100R	–		–		15/32	1/2	1	3
5873712	I2S0500T062S	5872888	I2S0500T062S	–		–		1/2	1/2	5/8	2 1/2
5873713	I2S0500T100R	5872889	I2S0500T100R	5873736	I2S0500W100R	5872922	I2S0500W100R	1/2	1/2	1	3
5873714	I2S0500T200L	5872890	I2S0500T200L	5873737	I2S0500W200L	5872923	I2S0500W200L	1/2	1/2	2	4
5873715	I2S0500T300X	5872891	I2S0500T300X	5873738	I2S0500W300X	5872924	I2S0500W300X	1/2	1/2	3	6
5873716	I2S0562T075R	5872892	I2S0562T075R	5873739	I2S0562W075R	5872925	I2S0562W075R	9/16	9/16	3/4	3
5873717	I2S0562T125L	5872893	I2S0562T125L	5873740	I2S0562W125L	5872926	I2S0562W125L	9/16	9/16	1 1/4	3 1/2
5873718	I2S0562T225X	5872894	I2S0562T225X	5873741	I2S0562W225X	5872927	I2S0562W225X	9/16	9/16	2 1/4	5
5873719	I2S0625T075S	5872895	I2S0625T075S		–		–	5/8	5/8	3/4	3
5873720	I2S0625T125R	5872896	I2S0625T125R	5873742	I2S0625W125R	5872928	I2S0625W125R	5/8	5/8	1 1/4	3 1/2
5873721	I2S0625T225R	5872897	I2S0625T225R	5873743	I2S0625W225R	5872929	I2S0625W225R	5/8	5/8	2 1/4	5
5873722	I2S0625T300L	5872898	I2S0625T300L	5873744	I2S0625W300L	5872930	I2S0625W300L	5/8	5/8	3	6
5873723	I2S0625T400X	5872899	I2S0625T400X	5873745	I2S0625W400X	5872931	I2S0625W400X	5/8	5/8	4	7
5873724	I2S0687T137R	5872900	I2S0687T137R	5873746	I2S0687W137R	5872932	I2S0687W137R	11/16	3/4	1 3/8	4
5873725	I2S0750T100S	5872901	I2S0750T100S		–		–	3/4	3/4	1	3

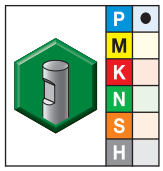
(continued)

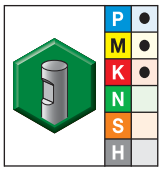
(Series I2S • VariMill GP — continued)









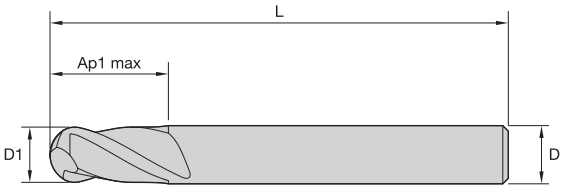


● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN					
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
5873726	I2S0750T150R	5872902	I2S0750T150R	–		–		3/4	3/4	1 1/2	4
5873727	I2S0750T225R	5872903	I2S0750T225R	5873747	I2S0750W225R	5872933	I2S0750W225R	3/4	3/4	2 1/4	5
5873728	I2S0750T300L	5872904	I2S0750T300L	5873748	I2S0750W300L	5872934	I2S0750W300L	3/4	3/4	3	6
5873729	I2S0750T400X	5872905	I2S0750T400X	5873749	I2S0750W400X	5872935	I2S0750W400X	3/4	3/4	4	7
5873730	I2S0875T150R	5872906	I2S0875T150R	5873750	I2S0875W150R	5872936	I2S0875W150R	7/8	7/8	1 1/2	4
5873731	I2S0875T225L	5872907	I2S0875T225L	5873751	I2S0875W225L	5872937	I2S0875W225L	7/8	7/8	2 1/4	5
5873732	I2S1000T150S	5872908	I2S1000T150S	–		–		1	1	1 1/2	4
5873733	I2S1000T225R	5872909	I2S1000T225R	5873752	I2S1000W225R	5872938	I2S1000W225R	1	1	2 1/4	5
5873734	I2S1000T300L	5872910	I2S1000T300L	5873753	I2S1000W300L	5872939	I2S1000W300L	1	1	3	6
5873735	I2S1000T400X	5872921	I2S1000T400X	5873754	I2S1000W400X	5872940	I2S1000W400X	1	1	4	7

NOTE: For application data, please see pages N11–N12.

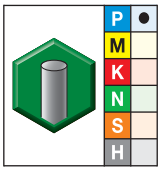
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.

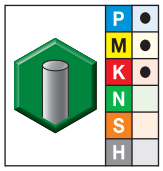


End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series I2B • VariMill GP



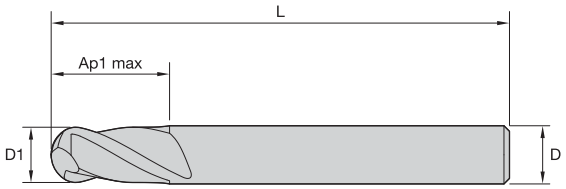


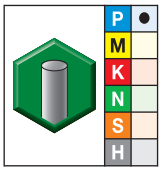
● first choice
○ alternate choice

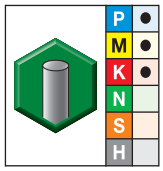
grade UNCOATED		grade TiAlN TiAlN					
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
5878223	I2B0031T007R	5878172	I2B0031T007R	1/32	1/8	5/64	1 1/2
–		5878174	I2B0046T018R	3/64	1/8	3/16	1 1/2
5878224	I2B0062T018R	5878173	I2B0062T018R	1/16	1/8	3/16	1 1/2
–		5878175	I2B0078T018R	5/64	1/8	3/16	1 1/2
–		5878176	I2B0093T018R	3/32	1/8	3/16	1 1/2
5878225	I2B0093T037L	5878177	I2B0093T037L	3/32	1/8	3/8	1 1/2
–		5878178	I2B0109T037R	7/64	1/8	3/8	1 1/2
5878226	I2B0125T025S	5878179	I2B0125T025S	1/8	1/8	1/4	1 1/2
5878227	I2B0125T050R	5878180	I2B0125T050R	1/8	1/8	1/2	1 1/2
–		5878181	I2B0125T075L	1/8	1/8	3/4	2 1/4
–		5878182	I2B0125T075X	1/8	1/8	3/4	3
–		5878183	I2B0156T031R	5/32	3/16	5/16	2
–		5878184	I2B0156T056L	5/32	3/16	9/16	2
–		5878185	I2B0187T031S	3/16	3/16	5/16	1 1/2
5878228	I2B0187T062R	5878186	I2B0187T062R	3/16	3/16	5/8	2
–		5878187	I2B0187T075L	3/16	3/16	3/4	2 1/2
–		5878188	I2B0187T100X	3/16	3/16	1	4
–		5878189	I2B0218T062R	7/32	1/4	5/8	2 1/2
–		5878190	I2B0250T050S	1/4	1/4	1/2	2
5878229	I2B0250T075R	5878191	I2B0250T075R	1/4	1/4	3/4	2 1/2
–		5878192	I2B0250T112R	1/4	1/4	1 1/8	3
–		5878193	I2B0250T150L	1/4	1/4	1 1/2	4
–		5878194	I2B0250T150X	1/4	1/4	1 1/2	6
–		5878195	I2B0312T050S	5/16	5/16	1/2	2

(continued)

(Series I2B • VariMill GP— continued)







● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN					
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
5878230	I2B0312T081R	5878196	I2B0312T081R	5/16	5/16	13/16	2 1/2
–		5878197	I2B0312T112L	5/16	5/16	1 1/8	3
–		5878198	I2B0312T150X	5/16	5/16	1 1/2	6
–		5878199	I2B0375T062S	3/8	3/8	5/8	2
5878241	I2B0375T087R	5878200	I2B0375T087R	3/8	3/8	7/8	2 1/2
–		5878201	I2B0375T112R	3/8	3/8	1 1/8	3
–		5878202	I2B0375T175L	3/8	3/8	1 3/4	4
–		5878203	I2B0375T300X	3/8	3/8	3	6
–		5878204	I2B0406T100R	13/32	7/16	1	2 1/2
–		5878205	I2B0437T100R	7/16	7/16	1	2 1/2
–		5878206	I2B0500T062S	1/2	1/2	5/8	2 1/2
5878242	I2B0500T100R	5878207	I2B0500T100R	1/2	1/2	1	3
–		5878208	I2B0500T150X	1/2	1/2	1 1/2	6
5878243	I2B0500T200L	5878209	I2B0500T200L	1/2	1/2	2	4
–		5878210	I2B0500T300L	1/2	1/2	3	6
–		5878211	I2B0625T125R	5/8	5/8	1 1/4	3 1/2
5878244	I2B0625T225L	5878212	I2B0625T225L	5/8	5/8	2 1/4	5
–		5878213	I2B0625T300X	5/8	5/8	3	6
–		5878214	I2B0750T100S	3/4	3/4	1	3
5878245	I2B0750T150R	5878215	I2B0750T150R	3/4	3/4	1 1/2	4
–		5878216	I2B0750T200X	3/4	3/4	2	6
–		5878217	I2B0750T225L	3/4	3/4	2 1/4	5
–		5878218	I2B0750T300X	3/4	3/4	3	6
5878246	I2B0875T150R	5878219	I2B0875T150R	7/8	7/8	1 1/2	4
–		5878220	I2B1000T150R	1	1	1 1/2	4
5878247	I2B1000T300L	5878221	I2B1000T300L	1	1	3	6

NOTE: For application data, please see pages N13–N14.

Series I2C..S I2S..S I2C..R I2S..R • TiALN • VariMill GP



Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.															
		A		B	Cutting Speed — vc SFM				D1 — Diameter														
		ap	ae	ap	min		max	frac.	1/64	1/32	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
								dec.	.0156	.0313	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	0.5 X D	490	–	660	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	0.5 X D	490	–	660	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	0.5 X D	460	–	620	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	0.5 X D	390	–	520	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	0.5 X D	300	–	490	IPT	.0001	.0002	.0003	.0004	.0005	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
M	1	Ap1 max	0.1 x D	0.5 X D	300	–	380	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	0.5 X D	200	–	260	IPT	.0001	.0001	.0003	.0004	.0004	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
K	1	Ap1 max	0.1 x D	0.5 X D	390	–	490	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	0.5 X D	360	–	460	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series I2C..S I2S..S I2C..R I2S..R • Uncoated • VariMill GP



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.															
		A		B	Cutting Speed — vc SFM				D1 — Diameter														
		ap	ae	ap	min		max	frac.	1/64	1/32	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
								dec.	.0156	.0313	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	0.5 X D	390	–	520	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	1.25 x D	0.1 x D	0.5 X D	390	–	520	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	1.25 x D	0.1 x D	0.5 X D	370	–	500	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

■ Series I2C..L I2S..L I2C..X I2S..X • TiAlN • VariMill GP

Material Group		Side Milling (A)		TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A).											
		A		Cutting Speed — vc SFM				D1 — Diameter										
							frac.	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	490	–	660	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	490	–	660	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	460	–	620	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	390	–	520	IPT	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	300	–	490	IPT	.0003	.0004	.0005	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
M	1	Ap1 max	0.1 x D	300	–	380	IPT	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	200	–	260	IPT	.0003	.0004	.0004	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
K	1	Ap1 max	0.1 x D	390	–	490	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	360	–	460	IPT	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045

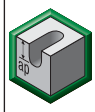
NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

■ Series I2C..L I2S..L I2C..X I2S..X • Uncoated • VariMill GP

Material Group		Side Milling (A)		uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A).											
		A		Cutting Speed — vc SFM				D1 — Diameter										
							frac.	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	390	–	520	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	390	–	520	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	370	–	500	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series I2B..S I2B..R • TiAlN • VariMill GP


Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.															
		A		B	Cutting Speed — vc SFM				D1 — Diameter														
		ap	ae	ap	min		max	frac.	1/64	1/32	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
								dec.	.0156	.0313	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	0.5 x D	490	–	660	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	0.5 x D	490	–	660	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	0.5 x D	460	–	620	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	0.5 x D	390	–	520	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	0.5 x D	300	–	490	IPT	.0001	.0002	.0003	.0004	.0005	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
M	1	Ap1 max	0.1 x D	0.5 x D	300	–	380	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	0.5 x D	200	–	260	IPT	.0001	.0001	.0003	.0004	.0004	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
K	1	Ap1 max	0.1 x D	0.5 x D	390	–	490	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	0.5 x D	360	–	460	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series I2B..S I2B..R • Uncoated • VariMill GP



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.															
		A		B	Cutting Speed — vc SFM				D1 — Diameter														
		ap	ae	ap	min		max	frac.	1/64	1/32	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
								dec.	.0156	.0313	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	0.5 x D	390	–	520	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	1.25 x D	0.1 x D	0.5 x D	390	–	520	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	1.25 x D	0.1 x D	0.5 x D	370	–	500	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series I2B..L I2B..X • TiAlN • VariMill GP

Material Group		Side Milling (A)		TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A).									
		A		Cutting Speed — vc SFM				D1 — Diameter								
							frac.	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	490	–	660	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	490	–	660	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	460	–	620	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	390	–	520	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	300	–	490	IPT	.0005	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
M	1	Ap1 max	0.1 x D	300	–	380	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	200	–	260	IPT	.0004	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
K	1	Ap1 max	0.1 x D	390	–	490	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	360	–	460	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series I2B..L I2B..X • Uncoated • VariMill GP

Material Group		Side Milling (A)		uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A).									
		A		Cutting Speed — vc SFM				D1 — Diameter								
							frac.	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	390	–	520	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	1.25 x D	0.1 x D	390	–	520	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	1.25 x D	0.1 x D	370	–	500	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Tooling Systems

ERICKSON™

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

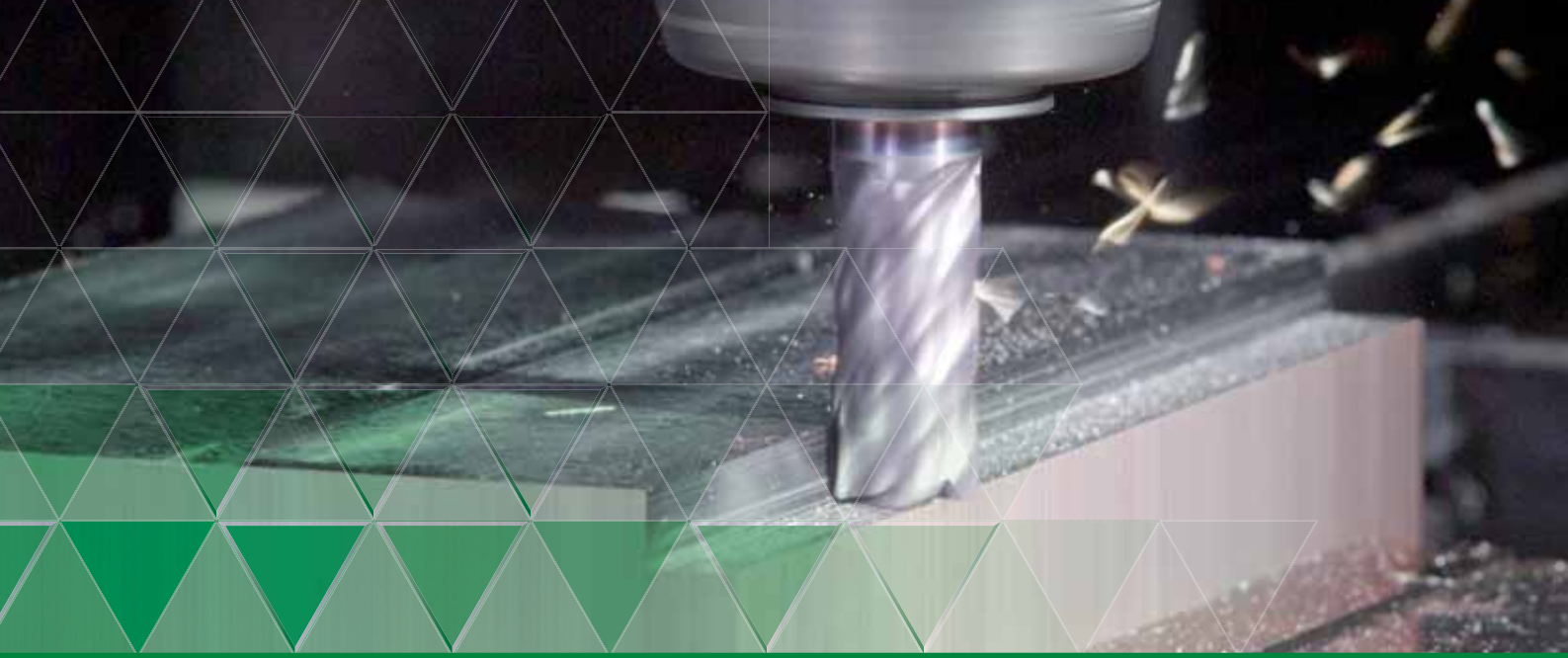
ERICKSON™ Toolholders

WIDIA™ proudly offers premium quality ERICKSON toolholder products, so you can be sure that you're buying the best the industry has to offer. The entire portfolio — including steep taper, HSK, straight shank extensions, collets, sleeves, and accompanying products — offers high productivity, increased accuracy, and application flexibility.

Designed for both manual and automatic tool changing, ERICKSON interfaces are ideally suited for most machine tools and feature a compact and rigid construction guaranteed to handle high torque and deliver optimal metal removal rates.

To learn more about our innovations, contact your local Authorized Distributor or visit **widia.com**.

WIDIA™



Solid Carbide End Mills

WIDIA™ offers a complete line of 3-flute general-purpose solid carbide end mill tools

General purpose offers plunging, slotting, and profiling for a wide range of materials and applications. Designed to provide high Metal Removal Rates (MRR) and excellent surface conditions at economic pricing. For a complete line of comprehensive tools, visit **widia.com**.

NOVO KNOWS ART TO PART TO PROFIT

Being as productive and profitable as possible is your fundamental goal. With the addition of NOVO™ to your team, your goal can be achieved. NOVO possesses powerful digital tools that link together process planning, inventory availability and purchase, cost-per-part management, and productivity improvements.

NOVO can ensure you have the right tools on your machines, in the right sequence. This results in flawless execution that accelerates every job, and maximizes every shift.

01	THE DIGITAL SOURCE FOR DELIVERING SMART MACHINING SOLUTIONS widia.com/novo	NOVO™

WIDIA-Hanita™ Means Quality

WIDIA-Hanita™ solid carbide end mill products have a strong history of providing revolutionary and innovative solutions for your most extreme solid end milling challenges.

EXTREME **CHALLENGES.** EXTREME **RESULTS.**

As an industry-leading manufacturer of carbide round tools, WIDIA-Hanita™ offers a complete portfolio of precision-engineered products with solutions for a wide range of workpiece materials at **widia.com**.

The VariMill™ line offers superior performance high-speed machining.

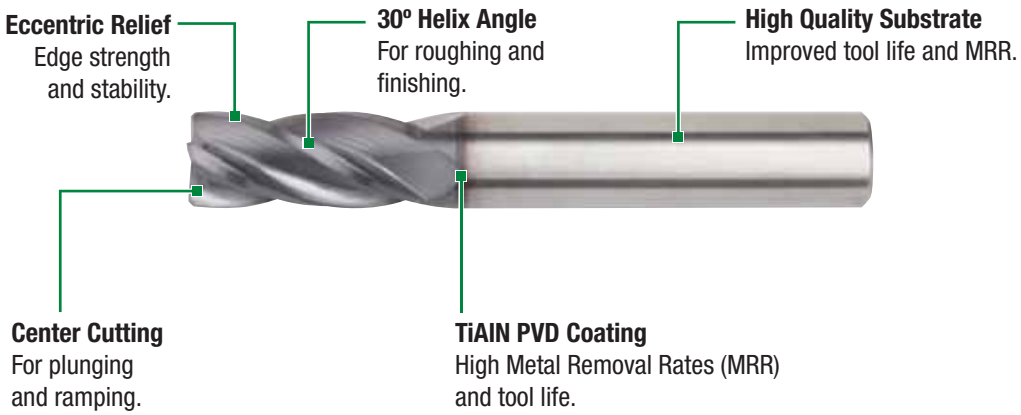
- The versatile 2- and 4-flute general-purpose line, VariMill™ GP, is ideal for a wide range of materials.
- The 4-flute VariMill I™ offers plunging, slotting, and profiling at the highest possible feed rates for a wide range of materials.
- The 5-flute VariMill II™ end mills are the proven leader in the field of high-performance, chatter-free machining.
- The 5-flute VariMill II™ ER end mills are specifically designed for machining high-performance aerospace materials.
- The 7-flute VariMill III™ ER high-performance tool has true finishing capabilities for walls and floors.

VariMill GP

VariMill GP offers plunging, slotting, and profiling for a wide range of materials and applications. Designed to provide high metal removal rates and excellent surface conditions at a value price. A wide range of diameters, lengths, and corner styles (such as chamfered, sharp edge, and ball nose) are available from stock.

VariMill GP • 4-Flute

- General purpose tools for a wide range of workpiece materials.
- Roughing and finishing with one tool.
- Various lengths-of-cut and overall lengths with different front-end designs available.
- Four flutes for high Metal Removal Rates (MRR) and tool life.



VariMill™ GP

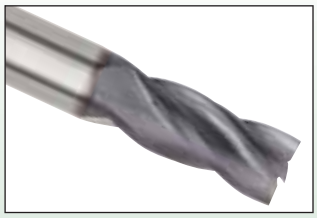
- Increased manufacturing flexibility and reduced tooling cost.
- Less tool changes and high Metal Removal Rates (MRR).
- One tool required for roughing and finishing.
- Eccentric relief for improved edge stability and high tool life.
- Easy and cost-efficient regrinding due to eccentric relief.

I4C Series

- Wide range of lengths-of-cut — short, regular, long, and extra long.
- Steel, stainless steel, and cast iron.
- Corner chamfer for improved tool life.
- Center cut.

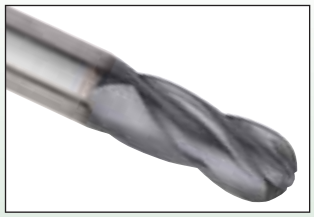
I4S Series

- Wide range of lengths-of-cut — short, regular, long, and extra long.
- Steel, stainless steel, and cast iron.

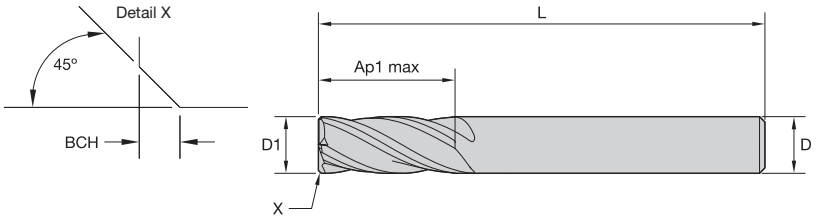


I4B Series

- Wide range of lengths-of-cut — short, regular, long, and extra long.
- Steel, stainless steel, and cast iron.
- Center cut ball nose.



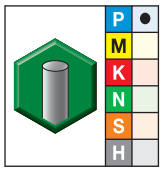
- Center cutting.
- Chamfered corners.
- Standard items listed. Additional styles and coatings made-to-order.

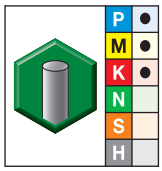


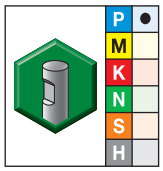
End Mill Tolerances

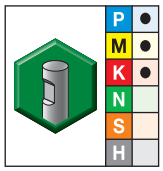
D1	tolerance e8	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series I4C • VariMill GP







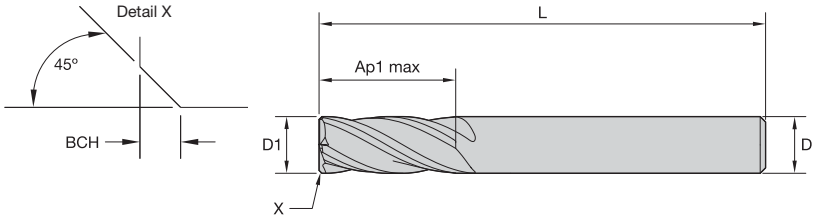


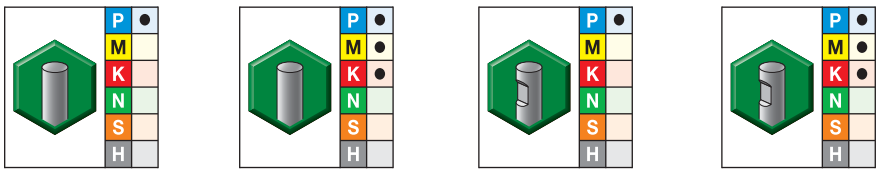
● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN						
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
	–	5825747	I4C0125T025S		–		–	1/8	1/8	1/4	1 1/2	.010
5825840	I4C0125T050R	5825748	I4C0125T050R		–		–	1/8	1/8	1/2	1 1/2	.010
	–	5825749	I4C0125T075L		–		–	1/8	1/8	3/4	2 1/4	.010
5825851	I4C0125T100X	5825751	I4C0125T100X		–		–	1/8	1/8	1	3	.010
	–	5825752	I4C0140T056R		–		–	9/64	3/16	9/16	2	.010
	–	5825753	I4C0156T056R		–		–	5/32	3/16	9/16	2	.010
5825852	I4C0187T062R	5825754	I4C0187T062R		–		–	3/16	3/16	5/8	2	.010
	–	5825756	I4C0187T075L		–		–	3/16	3/16	3/4	2 1/2	.010
	–	5825755	I4C0187T075S		–		–	3/16	3/16	3/4	1 1/2	.010
	–	5825757	I4C0187T112L		–		–	3/16	3/16	1 1/8	3	.010
	–	5825758	I4C0187T112X		–		–	3/16	3/16	1 1/8	3 1/4	.010
5825853	I4C0187T112X		–		–		–	3/16	3/16	1 1/2	3	.010
	–	5825759	I4C0203T062R		–		–	13/64	1/4	5/8	2 1/2	.016
	–	5825760	I4C0218T043R		–		–	7/32	1/4	7/16	2	.016
	–	5825761	I4C0218T062L		–		–	7/32	1/4	5/8	2 1/2	.016
	–	5825762	I4C0234T075R		–		–	15/64	1/4	3/4	2 1/2	.016
5825854	I4C0250T050S	5825764	I4C0250T050S		–		–	1/4	1/4	1/2	2	.016
5825855	I4C0250T075R	5825765	I4C0250T075R		–		–	1/4	1/4	3/4	2 1/2	.016
5825856	I4C0250T112L	5825766	I4C0250T112L		–		–	1/4	1/4	1 1/8	3	.016
5825857	I4C0250T150X	5825767	I4C0250T150X		–		–	1/4	1/4	1 1/2	4	.016
	–	5825768	I4C0265T075R		–		–	17/64	5/16	3/4	2 1/2	.016
	–	5825769	I4C0281T075R		–		–	9/32	5/16	3/4	2 1/2	.016
	–	5825770	I4C0296T081R		–		–	19/64	5/16	13/16	2 1/2	.016
5825858	I4C0312T050S	5825771	I4C0312T050S		–		–	5/16	5/16	1/2	2	.016

(continued)

(Series I4C • VariMill GP — continued)



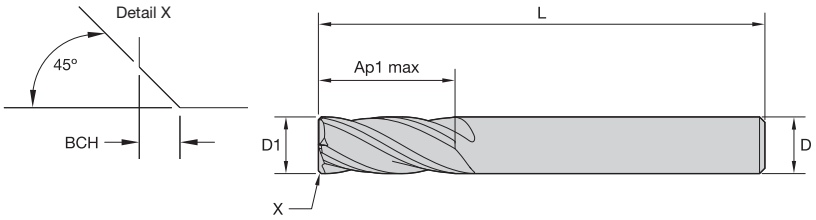


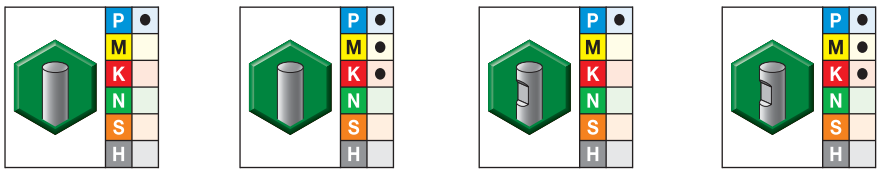
● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN						
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
5825859	I4C0312T081R	5825772	I4C0312T081R	–		–		5/16	5/16	13/16	2 1/2	.016
5825860	I4C0312T112L	5825773	I4C0312T112L	–		–		5/16	5/16	1 1/8	3	.016
5825861	I4C0312T162X	5825774	I4C0312T162X	–		–		5/16	5/16	1 5/8	4	.016
–		5825775	I4C0328T100R	–		–		21/64	3/8	1	2 1/2	.020
–		5825776	I4C0343T100R	–		–		11/32	3/8	1	2 1/2	.020
–		5825777	I4C0359T100R	–		–		23/64	3/8	1	2 1/2	.020
5825862	I4C0375T062S	5825778	I4C0375T062S	–		–		3/8	3/8	5/8	2	.020
5825863	I4C0375T100R	5825779	I4C0375T100R	–		–		3/8	3/8	1	2 1/2	.020
5825864	I4C0375T112L	5825780	I4C0375T112L	–		–		3/8	3/8	1 1/8	3	.020
5825865	I4C0375T175X	5825781	I4C0375T175X	–		–		3/8	3/8	1 3/4	4	.020
–		5825782	I4C0390T100R	–		–		25/64	7/16	1	2 3/4	.020
–		5825783	I4C0406T100R	–		–		13/32	7/16	1	2 3/4	.020
–		5825784	I4C0421T100R	–		–		27/64	7/16	1	2 3/4	.020
–		5825786	I4C0437T100R	–		–		7/16	7/16	1	2 3/4	.020
5825866	I4C0437T100S	5825785	I4C0437T100S	–		–		7/16	7/16	1	2 1/2	.020
5825867	I4C0437T200L	5825787	I4C0437T200L	–		–		7/16	7/16	2	4	.020
5825868	I4C0437T300X	5825788	I4C0437T300X	–		–		7/16	7/16	3	6	.020
–		5825789	I4C0453T100R	–		–		29/64	1/2	1	3	.020
–		5825790	I4C0468T100R	–		–		15/32	1/2	1	3	.020
–		5825791	I4C0484T100R	–		–		31/64	1/2	1	3	.020
5825869	I4C0500T062S	5825792	I4C0500T062S	5825484	I4C0500W062S	5825461	I4C0500W062S	1/2	1/2	5/8	2 1/2	.020
5825870	I4C0500T100R	5825793	I4C0500T100R	5825485	I4C0500W100R	5825462	I4C0500W100R	1/2	1/2	1	3	.020
5825871	I4C0500T200L	5825794	I4C0500T200L	5825486	I4C0500W200L	5825463	I4C0500W200L	1/2	1/2	2	4	.020
5825872	I4C0500T300X	5825795	I4C0500T300X	–		5825464	I4C0500W300X	1/2	1/2	3	6	.020
5825873	I4C0562T075R	5825796	I4C0562T075R	–		5825465	I4C0562W075R	9/16	9/16	3/4	3	.020
5825874	I4C0562T125L	5825797	I4C0562T125L	5825487	I4C0562W125L	5825466	I4C0562W125L	9/16	9/16	1 1/4	3 1/2	.020
5825875	I4C0562T225X	5825798	I4C0562T225X	–		5825467	I4C0562W225X	9/16	9/16	2 1/4	5	.020
5825876	I4C0625T075S	5825799	I4C0625T075S	–		5825469	I4C0625W075S	5/8	5/8	3/4	3	.020
5825877	I4C0625T125R	5825800	I4C0625T125R	5825488	I4C0625W125R	5825470	I4C0625W125R	5/8	5/8	1 1/4	3 1/2	.020
5825878	I4C0625T225L	5825821	I4C0625T225L	5825489	I4C0625W225L	5825471	I4C0625W225L	5/8	5/8	2 1/4	5	.020
5825879	I4C0625T400X	5825822	I4C0625T400X	–		5825472	I4C0625W400X	5/8	5/8	4	7	.020
–		5825823	I4C0687T137R	–		–		11/16	3/4	1 3/8	4	.020
5825880	I4C0750T100S	5825824	I4C0750T100S	–		5825473	I4C0750W100S	3/4	3/4	1	3	.020
5825881	I4C0750T150R	5825825	I4C0750T150R	5825490	I4C0750W150R	5825474	I4C0750W150R	3/4	3/4	1 1/2	4	.020
5825882	I4C0750T225R	5825826	I4C0750T225R	5825491	I4C0750W225R	5825475	I4C0750W225R	3/4	3/4	2 1/4	5	.020
5825883	I4C0750T300L	5825827	I4C0750T300L	5825492	I4C0750W300L	5825476	I4C0750W300L	3/4	3/4	3	6	.020

(continued)

(Series I4C • VariMill GP — continued)



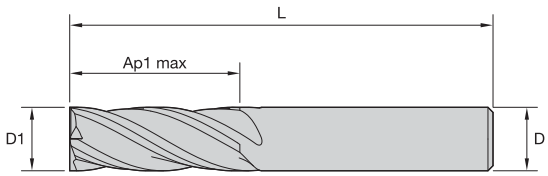


● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN						
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH
5825884	I4C0750T400X	5825828	I4C0750T400X	–		5825477	I4C0750W400X	3/4	3/4	4	7	.020
	–	5825829	I4C0812T150R	–		–		13/16	7/8	1 1/2	4	.020
5825885	I4C0875T150R	5825830	I4C0875T150R	5825493	I4C0875W150R	5825478	I4C0875W150R	7/8	7/8	1 1/2	4	.020
5825886	I4C0875T225L	5825831	I4C0875T225L	5825494	I4C0875W225L	5825479	I4C0875W225L	7/8	7/8	2 1/4	5	.020
5825887	I4C1000T150S	5825832	I4C1000T150S	–		5825480	I4C1000W150S	1	1	1 1/2	4	.020
5825888	I4C1000T225R	5825833	I4C1000T225R	5825495	I4C1000W225R	5825481	I4C1000W225R	1	1	2 1/4	5	.020
5825889	I4C1000T300L	5825834	I4C1000T300L	5825496	I4C1000W300L	5825482	I4C1000W300L	1	1	3	6	.020
5825890	I4C1000T400X	5825835	I4C1000T400X	–		5825483	I4C1000W400X	1	1	4	7	.020
5825891	I4C1250T200R	5825836	I4C1250T200R	–		–		1 1/4	1 1/4	2	4 1/2	.020

NOTE: For application data, please see pages N28–N29.

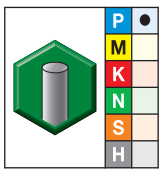
- Center cutting.
- Sharp corners.
- Standard items listed. Additional styles and coatings made-to-order.

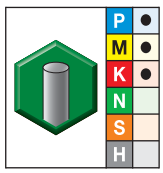


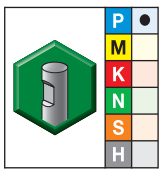
End Mill Tolerances

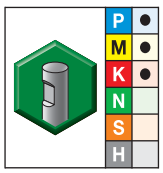
D1	tolerance e8	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series I4S • VariMill GP







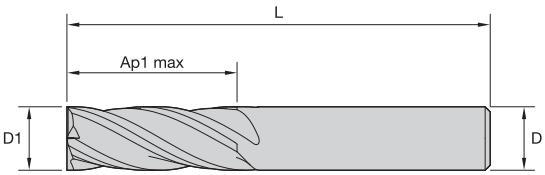


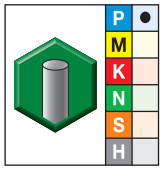
● first choice
○ alternate choice

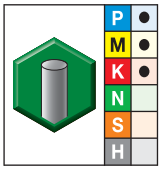
grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN					
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
	–	5879053	I4S0016T003R		–		–	1/64	1/8	1/32	1 1/2
	–	5879054	I4S0031T008R		–		–	1/32	1/8	5/64	1 1/2
5879198	I4S0062T010R	5879055	I4S0062T011R		–		–	1/16	1/8	7/64	1 1/2
5879199	I4S0078T019R	5879056	I4S0078T018R		–		–	5/64	1/8	3/16	1 1/2
5879200	I4S0094T037R	5879057	I4S0093T037R		–		–	3/32	1/8	3/8	1 1/2
	–	5879058	I4S0093T062L		–		–	3/32	1/8	5/8	2
	–	5879059	I4S0109T037R		–		–	7/64	1/8	3/8	1 1/2
	–	5879060	I4S0125T025S		–		–	1/8	1/8	1/4	1 1/2
5879201	I4S0125T050R	5879131	I4S0125T050R		–		–	1/8	1/8	1/2	1 1/2
	–	5879132	I4S0125T075L		–		–	1/8	1/8	3/4	2 1/4
5879202	I4S0125T100X	5879133	I4S0125T100X		–		–	1/8	1/8	1	3
	–	5879134	I4S0140T056R		–		–	9/64	3/16	9/16	2
	–	5879135	I4S0156T056R		–		–	5/32	3/16	9/16	2
5879203	I4S0187T062R	5879136	I4S0187T062R		–		–	3/16	3/16	5/8	2
	–	5879137	I4S0187T075S		–		–	3/16	3/16	3/4	1 1/2
	–	5879138	I4S0187T075L		–		–	3/16	3/16	3/4	2 1/2
5879204	I4S0187T112L	5879139	I4S0187T112L		–		–	3/16	3/16	1 1/8	3
	–	5879140	I4S0187T112X		–		–	3/16	3/16	1 1/8	3 1/4
	–	5879141	I4S0203T062R		–		–	13/64	1/4	5/8	2 1/2
	–	5879142	I4S0218T043R		–		–	7/32	1/4	7/16	2
	–	5879143	I4S0218T062L		–		–	7/32	1/4	5/8	2 1/2
	–	5879144	I4S0234T075R		–		–	15/64	1/4	3/4	2 1/2
5879205	I4S0250T050S	5879145	I4S0250T050S		–		–	1/4	1/4	1/2	2
5879206	I4S0250T075R	5879146	I4S0250T075R		–		–	1/4	1/4	3/4	2 1/2

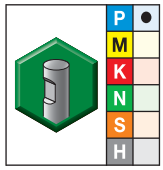
(continued)

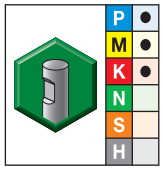
(Series I4S • VariMill GP — continued)









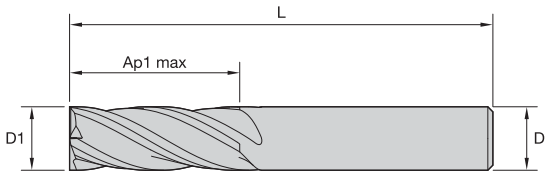


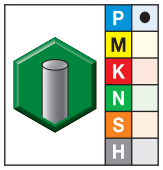
● first choice
○ alternate choice

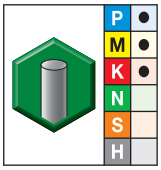
grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN					
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
5879207	I4S0250T112L	5879147	I4S0250T112L	–		–		1/4	1/4	1 1/8	3
5879208	I4S0250T150X	5879148	I4S0250T150X	–		–		1/4	1/4	1 1/2	4
	–	5879149	I4S0265T075R	–		–		17/64	5/16	3/4	2 1/2
	–	5879150	I4S0281T075R	–		–		9/32	5/16	3/4	2 1/2
	–	5879151	I4S0296T081R	–		–		19/64	5/16	13/16	2 1/2
5879209	I4S0312T050S	5879152	I4S0312T050S	–		–		5/16	5/16	1/2	2
5879210	I4S0312T081R	5879153	I4S0312T081R	–		–		5/16	5/16	13/16	2 1/2
5879211	I4S0312T112L	5879154	I4S0312T112L	–		–		5/16	5/16	1 1/8	3
5879212	I4S0312T162X	5879155	I4S0312T162X	–		–		5/16	5/16	1 5/8	4
	–	5879156	I4S0328T100R	–		–		21/64	3/8	1	2 1/2
	–	5879157	I4S0343T100R	–		–		11/32	3/8	1	2 1/2
	–	5879158	I4S0359T100R	–		–		23/64	3/8	1	2 1/2
5879213	I4S0375T062S	5879159	I4S0375T062S	–		–		3/8	3/8	5/8	2
5879214	I4S0375T100R	5879160	I4S0375T100R	–		–		3/8	3/8	1	2 1/2
5879215	I4S0375T112L	5879161	I4S0375T112L	–		–		3/8	3/8	1 1/8	3
5879216	I4S0375T175X	5879162	I4S0375T175X	–		–		3/8	3/8	1 3/4	4
	–	5879163	I4S0390T100R	–		–		25/64	7/16	1	2 3/4
	–	5879164	I4S0406T100R	–		–		13/32	7/16	1	2 3/4
	–	5879165	I4S0421T100R	–		–		27/64	7/16	1	2 3/4
5879217	I4S0437T100S	5879166	I4S0437T100S	–		–		7/16	7/16	1	2 1/2
	–	5879167	I4S0437T100R	–		–		7/16	7/16	1	2 3/4
5879218	I4S0437T200L	5879168	I4S0437T200L	–		–		7/16	7/16	2	4
5879219	I4S0437T300X	5879169	I4S0437T300X	–		–		7/16	7/16	3	6
	–	5879170	I4S0453T100R	–		–		29/64	1/2	1	3
	–	5879171	I4S0468T100R	–		–		15/32	1/2	1	3
	–	5879172	I4S0484T100R	–		–		31/64	1/2	1	3
5879220	I4S0500T062S	5879173	I4S0500T062S	5879568	I4S0500W062S	5879526	I4S0500W062S	1/2	1/2	5/8	2 1/2
5879221	I4S0500T100R	5879174	I4S0500T100R	5879569	I4S0500W100R	5879527	I4S0500W100R	1/2	1/2	1	3
5879222	I4S0500T200L	5879175	I4S0500T200L	5879570	I4S0500W200L	5879528	I4S0500W200L	1/2	1/2	2	4
5879223	I4S0500T300X	5879176	I4S0500T300X		–	5879529	I4S0500W300X	1/2	1/2	3	6
5879224	I4S0562T075R	5879177	I4S0562T075R		–	5879530	I4S0562W075R	9/16	9/16	3/4	3
5879225	I4S0562T125L	5879178	I4S0562T125L	5879571	I4S0562W125L	5879551	I4S0562W125L	9/16	9/16	1 1/4	3 1/2
5879226	I4S0562T225X	5879179	I4S0562T225X		–	5879552	I4S0562W225X	9/16	9/16	2 1/4	5
5879227	I4S0625T075S	5879180	I4S0625T075S		–	5879553	I4S0625W075S	5/8	5/8	3/4	3
5879228	I4S0625T125R	5879181	I4S0625T125R	5879572	I4S0625W125R	5879554	I4S0625W125R	5/8	5/8	1 1/4	3 1/2
5879229	I4S0625T225L	5879182	I4S0625T225L	5879573	I4S0625W225L	5879555	I4S0625W225L	5/8	5/8	2 1/4	5

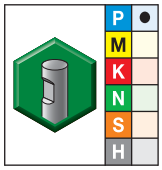
(continued)

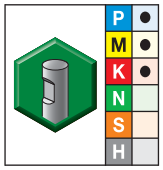
(Series I4S • VariMill GP — continued)









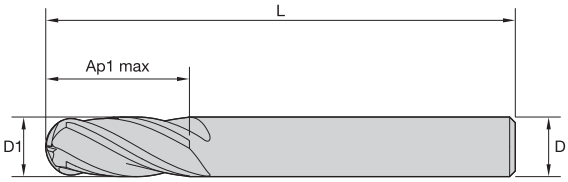


● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN		grade UNCOATED		grade TiAlN TiAlN					
order #	catalog #	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L
5879230	I4S0625T400X	5879183	I4S0625T400X		–	5879556	I4S0625W400X	5/8	5/8	4	7
	–	5879184	I4S0687T137R		–		–	11/16	3/4	1 3/8	4
5879241	I4S0750T100S	5879185	I4S0750T100S		–	5879557	I4S0750W100S	3/4	3/4	1	3
5879242	I4S0750T150R	5879186	I4S0750T150R	5879574	I4S0750W150R	5879558	I4S0750W150R	3/4	3/4	1 1/2	4
5879243	I4S0750T225R	5879187	I4S0750T225R	5879575	I4S0750W225R	5879559	I4S0750W225R	3/4	3/4	2 1/4	5
5879244	I4S0750T300L	5879188	I4S0750T300L	5879576	I4S0750W300L	5879560	I4S0750W300L	3/4	3/4	3	6
5879245	I4S0750T400X	5879189	I4S0750T400X		–	5879561	I4S0750W400X	3/4	3/4	4	7
	–	5879190	I4S0812T150R		–		–	13/16	7/8	1 1/2	4
5879246	I4S0875T150R	5879191	I4S0875T150R	5879577	I4S0875W150R	5879562	I4S0875W150R	7/8	7/8	1 1/2	4
5879247	I4S0875T225L	5879192	I4S0875T225L	5879578	I4S0875W225L	5879563	I4S0875W225L	7/8	7/8	2 1/4	5
5879248	I4S1000T150S	5879193	I4S1000T150S		–	5879564	I4S1000W150S	1	1	1 1/2	4
5879249	I4S1000T225R	5879194	I4S1000T225R	5879579	I4S1000W225R	5879565	I4S1000W225R	1	1	2 1/4	5
5879250	I4S1000T300L	5879195	I4S1000T300L	5879580	I4S1000W300L	5879566	I4S1000W300L	1	1	3	6
5879261	I4S1000T400X	5879196	I4S1000T400X		–	5879567	I4S1000W400X	1	1	4	7
5879262	I4S1250T200R	5879197	I4S1250T200R		–		–	1 1/4	1 1/4	2	4 1/2

NOTE: For application data, please see pages N28–N29.

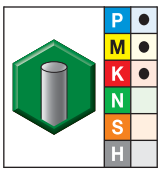
- Center cutting.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
All	+.000/-.002	≤ 1/8"	0/.00024
		> 1/8–1/4"	0/.00031
		> 1/4–3/8"	0/.00035
		> 3/8–23/32"	0/.00043
		> 23/32–1 3/16"	0/.00051

Series I4B • VariMill GP

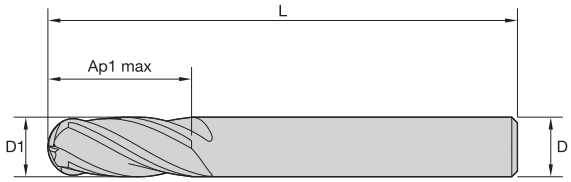


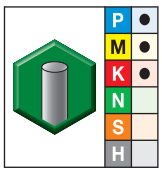
● first choice
○ alternate choice

grade TiAlN TiAlN					
order #	catalog #	D1	D	length of cut Ap1 max	length L
5825624	I4B0031T008R	1/32	1/8	5/64	1 1/2
5825625	I4B0047T012R	3/64	1/8	1/8	1 1/2
5825626	I4B0062T019R	1/16	1/8	3/16	1 1/2
5825627	I4B0078T019R	5/64	1/8	3/16	1 1/2
5825628	I4B0094T019R	3/32	1/8	3/16	1 1/2
5825643	I4B0094T037L	3/32	1/8	3/8	1 1/2
5825645	I4B0109T037R	7/64	1/8	3/8	1 1/2
5825646	I4B0125T025S	1/8	1/8	1/4	1 1/2
5825647	I4B0125T050R	1/8	1/8	1/2	1 1/2
5825648	I4B0125T075L	1/8	1/8	3/4	2 1/4
5825649	I4B0125T075X	1/8	1/8	3/4	3
5825650	I4B0141T056R	9/64	3/16	9/16	2
5825651	I4B0156T031R	5/32	3/16	5/16	2
5825652	I4B0156T056L	5/32	3/16	9/16	2
5825653	I4B0172T062R	11/64	3/16	5/8	2
5825654	I4B0187T031S	3/16	3/16	5/16	1 1/2
5825655	I4B0187T062R	3/16	3/16	5/8	2
5825656	I4B0187T075L	3/16	3/16	3/4	2 1/2
5825657	I4B0187T100X	3/16	3/16	1	4
5825658	I4B0203T062R	13/64	1/4	5/8	2 1/2
5825659	I4B0219T062R	7/32	1/4	5/8	2 1/2
5825660	I4B0234T075R	15/64	1/4	3/4	2 1/2
5825661	I4B0250T050S	1/4	1/4	1/2	2
5825663	I4B0250T075R	1/4	1/4	3/4	2 1/2

(continued)

(Series I4B • VariMill GP — continued)



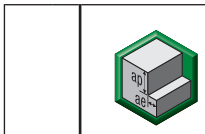
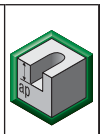


● first choice
○ alternate choice

order #	catalog #	grade TiAlN TiAlN	D1	D	length of cut Ap1 max	length L
5825664	I4B0250T112R		1/4	1/4	1 1/8	3
5825665	I4B0250T150L		1/4	1/4	1 1/2	4
5825666	I4B0250T150X		1/4	1/4	1 1/2	6
5825667	I4B0266T075R		17/64	5/16	3/4	2 1/2
5825668	I4B0281T075R		9/32	5/16	3/4	2 1/2
5825669	I4B0312T050S		5/16	5/16	1/2	2
5825670	I4B0312T081R		5/16	5/16	13/16	2 1/2
5825681	I4B0312T112L		5/16	5/16	1 1/8	3
5825682	I4B0312T162X		5/16	5/16	1 5/8	4
5825683	I4B0344T100R		11/32	3/8	1	2 1/2
5825684	I4B0375T100S		3/8	3/8	1	2 1/2
5825685	I4B0375T100L		3/8	3/8	1	4
5825686	I4B0375T112R		3/8	3/8	1 1/8	3
5825687	I4B0375T150X		3/8	3/8	1 1/2	6
5825688	I4B0437T100R		7/16	1/2	1	2 1/2
5825689	I4B0500T100S		1/2	1/2	1	3
5825690	I4B0500T100R		1/2	1/2	1	4
5825691	I4B0500T150X		1/2	1/2	1 1/2	6
5825693	I4B0500T200L		1/2	1/2	2	4 1/2
5825692	I4B0500T200R		1/2	1/2	2	4
5825694	I4B0500T300X		1/2	1/2	3	6
5825695	I4B0562T125R		9/16	9/16	1 1/4	3 1/2
5825696	I4B0625T075S		5/8	5/8	3/4	3
5825697	I4B0625T125R		5/8	5/8	1 1/4	3 1/2
5825698	I4B0625T225L		5/8	5/8	2 1/4	5
5825699	I4B0625T300X		5/8	5/8	3	6
5825700	I4B0750T100R		3/4	3/4	1	3
5825711	I4B0750T150L		3/4	3/4	1 1/2	4
5825712	I4B0750T300X		3/4	3/4	3	6
5825713	I4B0875T150R		7/8	7/8	1 1/2	4
5825714	I4B1000T150R		1	1	1 1/2	4
5825715	I4B1000T225L		1	1	2 1/4	5

NOTE: For application data, please see page N30.

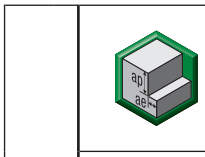
Series I4C..S I4S..S I4C..R I4S..R • TiAlN • VariMill GP


Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.															
		A		B	Cutting Speed — vc SFM				D1 — Diameter														
		ap	ae	ap	min	–	max	frac.	1/64	1/32	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
								dec.	.0156	.0313	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	0.5 x D	490	–	660	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	0.5 x D	490	–	660	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	0.5 x D	460	–	620	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	0.5 x D	390	–	520	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	0.5 x D	300	–	490	IPT	.0001	.0002	.0003	.0004	.0005	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
M	1	Ap1 max	0.1 x D	0.5 x D	300	–	380	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	0.5 x D	200	–	260	IPT	.0001	.0001	.0003	.0004	.0004	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
K	1	Ap1 max	0.1 x D	0.5 x D	390	–	490	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	0.5 x D	360	–	460	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

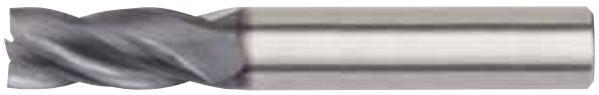
Series I4C..S I4S..S I4C..R I4S..R • Uncoated • VariMill GP



Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.												
		A		B	Cutting Speed — vc SFM				D1 — Diameter											
		ap	ae	ap	min	–	max	frac.	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
								dec.	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	0.5 x D	390	–	520	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	1.25 x D	0.1 x D	0.5 x D	390	–	520	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	1.25 x D	0.1 x D	0.5 x D	370	–	500	IPT	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series I4C..L I4S..L I4C..X I4S..X • TiAlN • VariMill GP



Material Group		Side Milling (A)		TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A).									
		A		Cutting Speed — vc SFM				D1 — Diameter								
							frac.	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	490	–	660	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	490	–	660	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	460	–	620	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	390	–	520	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	300	–	490	IPT	.0005	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
M	1	Ap1 max	0.1 x D	300	–	380	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	200	–	260	IPT	.0004	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
K	1	Ap1 max	0.1 x D	390	–	490	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	360	–	460	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045

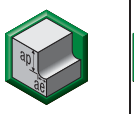
NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

Series I4C..L I4S..L I4C..X I4S..X • Uncoated • VariMill GP

Material Group		Side Milling (A)		uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A).									
		A		Cutting Speed — vc SFM				D1 — Diameter								
							frac.	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
		ap	ae	min		max	dec.	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	390	–	520	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	390	–	520	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	370	–	500	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

■ Series I4B..S I4B..R • TiAlN • VariMill GP



Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.														
		A		B	Cutting Speed — vc SFM				D1 — Diameter													
		ap	ae	ap	min		max	frac.	1/64	1/32	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
								dec.	.0156	.0313	.0625	.0781	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	0.5 x D	490	–	660	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	0.5 x D	490	–	660	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	0.5 x D	460	–	620	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	0.5 x D	390	–	520	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	0.5 x D	300	–	490	IPT	.0001	.0002	.0003	.0004	.0005	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
M	1	Ap1 max	0.1 x D	0.5 x D	300	–	380	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	0.5 x D	200	–	260	IPT	.0001	.0001	.0003	.0004	.0004	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
K	1	Ap1 max	0.1 x D	0.5 x D	390	–	490	IPT	.0001	.0002	.0004	.0005	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	0.5 x D	360	–	460	IPT	.0001	.0002	.0004	.0004	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

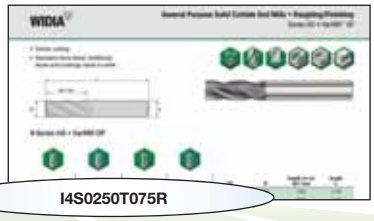
■ Series I4B..L I4B..X • TiAlN • VariMill GP


Material Group		Side Milling (A)		TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A).									
		A		Cutting Speed — vc SFM				D1 — Diameter								
		ap	ae	min		max	frac.	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
							dec.	.0938	.1250	.1875	.2500	.3125	.3750	.5000	.6250	.7500	1.0000
P	0	Ap1 max	0.1 x D	490	–	660	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	1	Ap1 max	0.1 x D	490	–	660	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	460	–	620	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	3	Ap1 max	0.1 x D	390	–	520	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	4	Ap1 max	0.1 x D	300	–	490	IPT	.0005	.0007	.0010	.0014	.0017	.0020	.0026	.0030	.0034	.0039
M	1	Ap1 max	0.1 x D	300	–	380	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045
	2	Ap1 max	0.1 x D	200	–	260	IPT	.0004	.0006	.0009	.0012	.0016	.0018	.0023	.0027	.0031	.0036
K	1	Ap1 max	0.1 x D	390	–	490	IPT	.0007	.0009	.0013	.0018	.0023	.0027	.0034	.0039	.0044	.0049
	2	Ap1 max	0.1 x D	360	–	460	IPT	.0005	.0007	.0011	.0015	.0020	.0023	.0029	.0034	.0039	.0045

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.

How Do Catalog Numbers Work?

Each character in our catalog number signifies a specific trait of that product. Use the following key columns and corresponding images to easily identify which attributes apply.



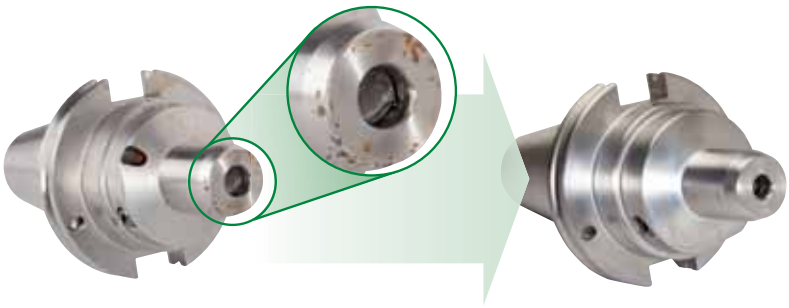
I	4	S	0250	T	075	R
Standard	Flutes	End Mill Style	Diameter Inch	Shank Style	Ap1 max Inch	Length
Inch	**2** = 2 Flutes **4** = 4 Flutes	**S** = Sharp Edge **C** = Chamfer **B** = Ball Nose		**T** = Plain Shank **W** = Weldon® Shank		**S** = Stub **R** = Regular **L** = Long **X** = Extra Long

WIDIA™ Repair Services

WIDIA tooling products are produced to the highest specifications and manufactured from premium materials. However, like all mechanical devices, they wear and require repair.

- Milling cutters
- Boring bars — standard, tunable, and de-vibe
- Indexable drills
- Line boring bars
- Feed-out heads
- Motion tools
- Standard indexable tooling
- Eccentric toolholders
- Floating toolholders
- Hydraulic chucks
- KM™ clamping units (manual and spring packs)
- KM-LOC™ and KM-LOC II™ clamping units

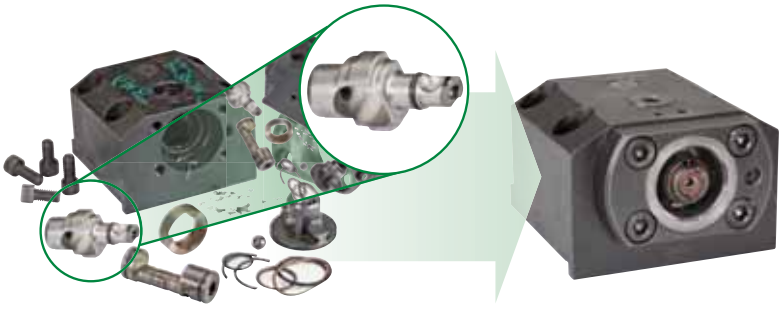
Hydraulic Chucks



Damaged WIDIA Tools

Repaired WIDIA Tools

KM-LOC™



Damaged WIDIA Tools

Repaired WIDIA Tools

Tools Are Valuable. Protect Them and Get the Most from Your Investment.

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

- Live/driven tooling
- Milling chucks
- Right-angle heads
- Tapping holders (excluding tap adapters)
- Integral tapping tools (excluding tap adapters)
- Tuned tooling units

When your WIDIA™ advanced tooling products need to be serviced, the WIDIA Service and Repair Department has the highly trained staff to provide expert assistance.

For about half the cost of a new WIDIA tool purchase, your existing damaged WIDIA tools can be repaired to like-new condition. In certain circumstances, it is not cost effective to repair some tooling. Contact the WIDIA Service and Repair Department with any questions about your requirements.

For more information, contact your local WIDIA Authorized Distributor or visit **widia.com/services**.

WIDIA™

WIDIA
HANITA

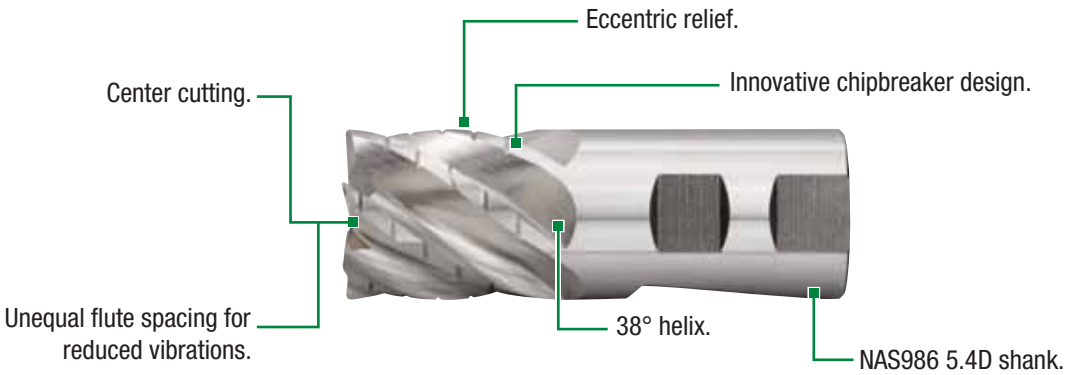
Solid End Milling • High-Performance High-Speed Steel (HSS-E/PM)

High-Speed Steel ER Rougher

HSS ER ROUGHER

The next generation of premium cobalt HSS roughers are designed specifically for titanium and stainless steels. They are engineered with an Eccentric Relief (ER) grind to provide a stronger cutting edge that requires less torque to operate. The unique proprietary chipbreaker geometry will break and control the chip, enabling higher metal removal rates and greater productivity. The HSS rougher offers the best-in-class performance for difficult-to-machine workpiece materials.

- 6-flute design with proprietary chipbreaker providing superior chip control.
- Eccentric relief geometry provides a stronger cutting edge resulting in longer tool life.
- NAS986 5.4D shank adds the flexibility of dual clamping.
- Higher metal removal rates enable productivity with lower tool costs.



High-Speed Steel ER Rougher

- Achieve outstanding tool life results due to unequal flute spacing and eccentric relief reinforcing the cutting edge.
- Benefit from proprietary chipbreaker pattern for improved chip formation.
- Apply at highest feed rates in full slotting, ramping, and side milling due to proprietary core design.

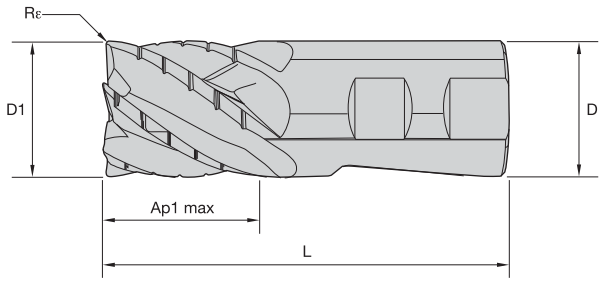
620E Series

- Highest metal removal rates and tool life in:
  — Titanium
  — Stainless steels
- Corner radii.
- Various lengths-of-cut.

Application Example
Roughing a forged landing gear link.
Gantry-type vertical milling machine.

Workpiece material:	Titanium 6Al-4V
Tool:	D = 1 1/2"
Cutting data:	ap = 3"
	ae = 1/4"
	vc = 60 SFM
	fz = .006 IPT
Result:	20% higher cutting speed and more than 70% higher feed per tooth. 110% higher tool life compared to previous competitive tool.

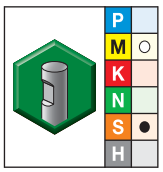
- Center cutting.
- Premium cobalt HSS.
- Eccentric relief grind with chipbreaker.
- Optimized geometry for titanium machining.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+0.002/-0.0	All	h6

Series 620E • HSS ER Roughers



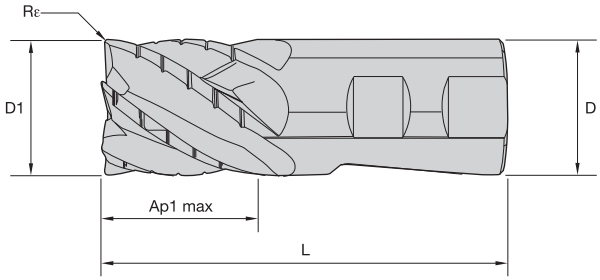
● first choice
○ alternate choice

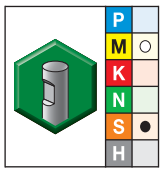
grade UNCOATED

order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
5329387	620E32009CW	1 1/4	1 1/4	2	4 1/2	.060
5599913	620E32009EW	1 1/4	1 1/4	2	4 1/2	.120
5329388	623E32009CW	1 1/4	1 1/4	3	5 1/2	.060
5599914	623E32009EW	1 1/4	1 1/4	3	5 1/2	.120
5329389	621E32009CW	1 1/4	1 1/4	4	6 1/2	.060
5599915	621E32009EW	1 1/4	1 1/4	4	6 1/2	.120
5329550	620E38009CW	1 1/2	1 1/4	2	4 1/2	.060
5599916	620E38009EW	1 1/2	1 1/4	2	4 1/2	.120
5329551	623E38009CW	1 1/2	1 1/4	3	5 1/2	.060
5599917	623E38009EW	1 1/2	1 1/4	3	5 1/2	.120
5329552	621E38009CW	1 1/2	1 1/4	4	6 1/2	.060
5599918	621E38009EW	1 1/2	1 1/4	4	6 1/2	.120
5329553	620E3800ACW	1 1/2	1 1/2	2	5 1/4	.060
5599919	620E3800AEW	1 1/2	1 1/2	2	5 1/4	.120
5329554	623E3800ACW	1 1/2	1 1/2	3	6 1/4	.060
5599970	623E3800AEW	1 1/2	1 1/2	3	6 1/4	.120

(continued)

(Series 620E • HSS ER Roughers — continued)





● first choice
○ alternate choice

grade UNCOATED						
order #	catalog #	D1	D	length of cut Ap1 max	length L	Rε
5329555	621E3800ACW	1 1/2	1 1/2	4	7 1/4	.060
5599971	621E3800AEW	1 1/2	1 1/2	4	7 1/4	.120
5329556	625E51022CW	2	2	2	5 3/4	.060
5599972	625E51022EW	2	2	2	5 3/4	.120
5329557	625E51032CW	2	2	3	6 3/4	.060
5599973	625E51032EW	2	2	3	6 3/4	.120
5329558	625E51042CW	2	2	4	7 3/4	.060
5599974	625E51042EW	2	2	4	7 3/4	.120
5329559	625E51062CW	2	2	6	9 3/4	.060
5599975	625E51062EW	2	2	6	9 3/4	.120

Series 620E • HSS ER Roughers

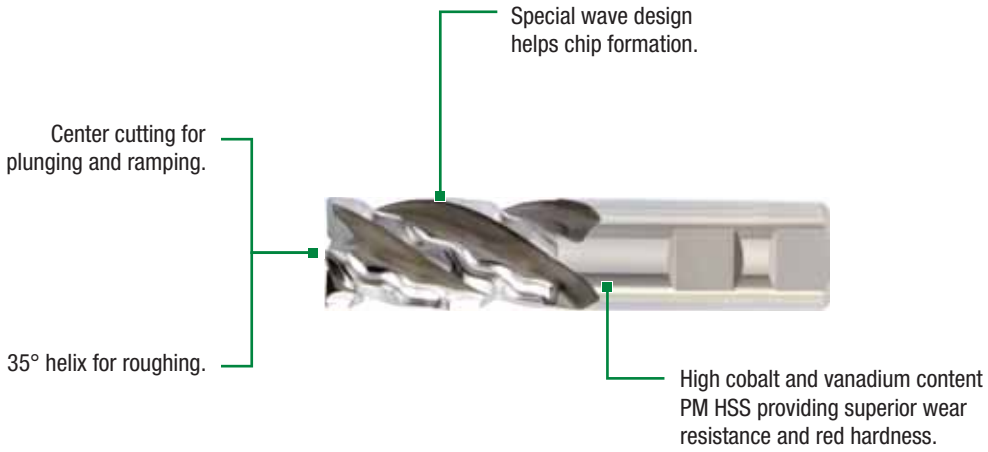
Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT=inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.			
		A		B	Cutting Speed — vc SFM				D1 — Diameter		
								frac.	1 1/4	1 1/2	2
		ap	ae	ap	min		max	dec.	1.2500	1.5000	2.0000
M	1	1.5 x D	0.5 x D	1 x D	40	–	60	IPT	.0052	.0053	.0053
	2	1.5 x D	0.5 x D	1 x D	40	–	60	IPT	.0042	.0042	.0043
S	4	1.5 x D	0.5 x D	1 x D	16	–	50	IPT	.0038	.0039	.0039

NOTE: Side milling applications — for longest length tools, reduce ae by 30%.
Slot milling applications — for longest length tools, reduce ap by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

WavCut

WavCut tools for machining titanium are best suited for applications in aerospace and energy, providing high Metal Removal Rates (MRR) and increased tool life. The special wave design of these 4- and 6-fluted end mills require less horsepower during roughing and semi-finishing, and provide excellent chip formation. Since chips evacuate easily, WavCut tools do not recut chips thus increasing tool life. Also, the edges change the radial cutting edge position without changing the diameter.

- Center cutting offering excellent performance in roughing applications, especially in titanium.
- Capable of deep-slotting cuts for high Metal Removal Rates (MRR).
- Special wave design for excellent chip formation and evacuation preventing re-cutting of chips.



WavCut™ Series

- Benefit from reliable and trouble-free machining results using HSS WavCut cutter.
- Drastically reduce the risk of re-cutting chips, especially with vertical machines having multiple spindles.
- Increase stock removal rates over regular roughing tools due to reduced horsepower consumption.

620W Series

- 4-flute 35° helix for slotting.
- 6-flute 35° helix, for slotting, and in certain cases, pocketing and profiling.
- Center cutting, chamfered corner, uncoated.

Other featured HSS Series

- Sophisticated roughing profiles capable of dealing with chip formation issues.
- High cobalt and vanadium content PM HSS providing superior wear resistance and red hardness.
- High-performance finishers with specific geometries for different workpiece materials.

6A0R Series

- 3-flute, 45° helix.
- Coarse cord style roughing profile.
- Non-ferrous materials.

6ANR Series

- 3-flute, 45° helix.
- Extended neck for long-reach applications.
- Coarse cord style roughing profile.
- Non-ferrous materials.

6T0R Series

- 4-, 5-, and 6-flute, 35° helix.
- Fine cord style roughing profile.
- High-temp alloys and titanium.

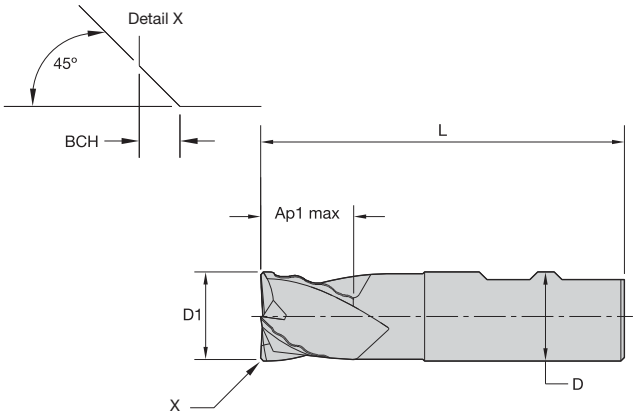
6TNR Series

- 4-, 5-, and 6-flute, 35° helix.
- Extended neck for long-reach applications.
- Fine cord style roughing profile.
- High-temp alloys and titanium.

3405/3407 Series

- Center Cutting.
- NAS Type 986 46 + 66 compliant.
- 4 and 6 flute, 35° helix.
- High-temp alloys and titanium.

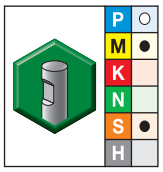
- Center cutting.
- NAS 986 5.2W Shank.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance h6 + / -
All	+0.004/-0.0	All	-0.0002/-0.0005

Series 620W • WavCut I



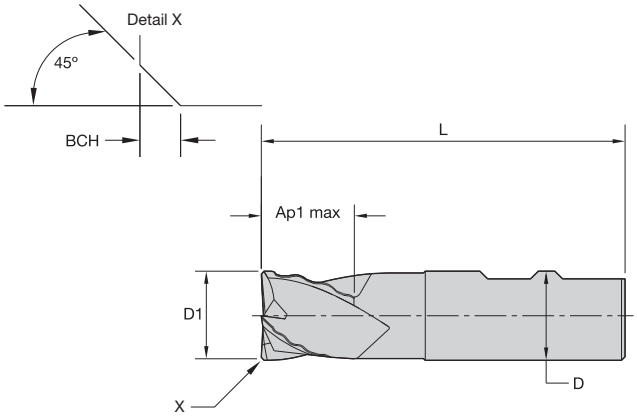
grade UNCOATED

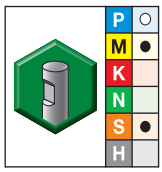
● first choice
○ alternate choice

order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH	ZU
2709800	620W19077	3/4	3/4	1 5/8	3 7/8	.039	4
2709403	623W19077	3/4	3/4	2 1/4	4 1/2	.039	4
2709627	621W19077	3/4	3/4	3	5 1/4	.039	4
2709772	620W25088	1	1	2	4 1/2	.039	6
2709779	620W25078	1	1	2	4 1/2	.039	4
2709389	623W25078	1	1	3	5 1/2	.039	4
3032729	623W25088	1	1	3	5 1/2	.039	6
2709613	621W25078	1	1	4	6 1/2	.039	4
2709606	621W25088	1	1	4	6 1/2	.039	6
2709494	622W25078	1	1	6	8 1/2	.039	4
2709755	620W32079	1 1/4	1 1/4	2	4 1/2	.039	4
2709747	620W32089	1 1/4	1 1/4	2	4 1/2	.039	6
2709375	623W32089	1 1/4	1 1/4	3	5 1/2	.039	6
2709591	621W32079	1 1/4	1 1/4	4	6 1/2	.039	4
2709583	621W32089	1 1/4	1 1/4	4	6 1/2	.039	6
2709487	622W32089	1 1/4	1 1/4	6	8 1/2	.039	6
2709723	620W38079	1 1/2	1 1/4	2	4 1/2	.039	4
2709715	620W38089	1 1/2	1 1/4	2	4 1/2	.039	6
2709361	623W38089	1 1/2	1 1/4	3	5 1/2	.039	6
2709562	621W38089	1 1/2	1 1/4	4	6 1/2	.039	6

(continued)

(Series 620W • WavCut I — continued)





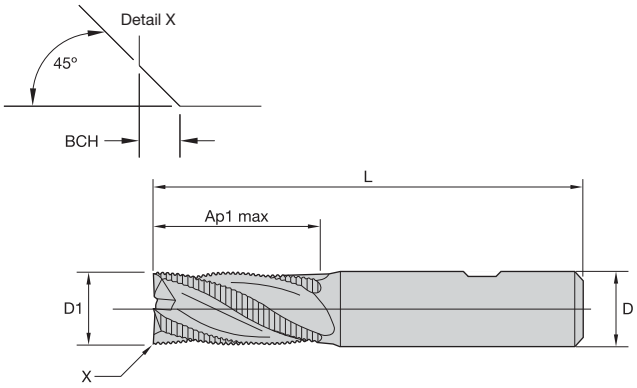
● first choice
○ alternate choice

grade UNCOATED

order #	catalog #	D1	D	length of cut Ap1 max	length L	BCH	ZU
2709569	**621W38079**	1 1/2	1 1/4	4	6 1/2	.039	4
2709473	**622W38089**	1 1/2	1 1/4	4	8 1/2	.039	6
2709233	**625W51722**	2	2	2	5 3/4	.039	6
2709219	**625W51732**	2	2	3	6 3/4	.039	6
2709206	**625W51742**	2	2	4	7 3/4	.039	6
2709200	**625W51762**	2	2	6	9 3/4	.039	6
2709191	**625W51782**	2	2	8	11 3/4	.039	6

NOTE: For application data, please see page O16.

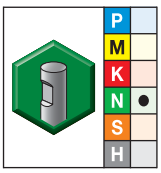
- Center cutting.
- Chamfered profile.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance
All	+0.0047/-0.0047	All	-0.0002/-0.0005

Series 6A0R

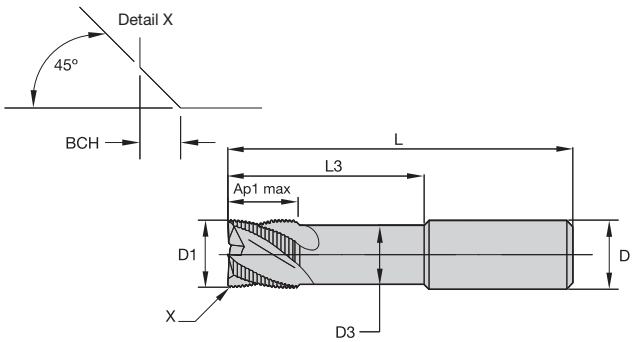


● first choice
○ alternate choice

order #	catalog #	grade TiCN TiCN	D1	D	length of cut Ap1 max	length L	BCH
2840160	TC6A0R13005		1/2	1/2	1 1/4	3 1/4	.014
2840121	TC6A1R13005		1/2	1/2	2	4	.014
2840146	TC6A0R19007		3/4	3/4	1 5/8	3 7/8	.014
2840087	TC6A3R19007		3/4	3/4	2 1/4	4 1/2	.014
2840108	TC6A1R19007		3/4	3/4	3	5 1/4	.014
2840138	TC6A0R25008		1	1	2	4 1/2	.020
1839782	TC6A3R25008		1	1	3	5 1/2	.020
2840103	TC6A1R25008		1	1	4	6 1/2	.020
2840132	TC6A0R32009		1 1/4	1 1/4	2	4 1/2	.020
2840073	TC6A3R32009		1 1/4	1 1/4	3	5 1/2	.020
2840099	TC6A1R32009		1 1/4	1 1/4	4	6 1/2	.020

NOTE: For application data, please see page O17.

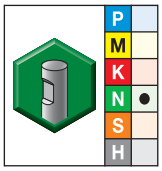
- Center cutting.
- Chamfered profile.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance
All	+0.0047/-0.0047	All	-0.0002/-0.0005

Series 6ANR

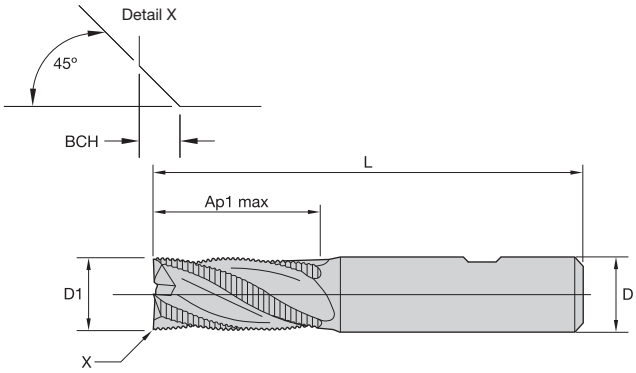


● first choice
○ alternate choice

order #	catalog #	grade TiCN TiCN	D1	D	D3	length of cut Ap1 max	L3	length L	BCH
2840040	TC6ANR13005		1/2	1/2	.470	1 1/4	2	4	.014
2840034	TC6ANR13015		1/2	1/2	.470	1 1/4	3	5	.014
2840028	TC6ANR13025		1/2	1/2	.470	1 1/4	4	6	.014
2840007	TC6ANR19007		3/4	3/4	.705	1 5/8	4	6 1/4	.014
2840000	TC6ANR19017		3/4	3/4	.705	1 5/8	6	8 1/4	.014
2839994	TC6ANR25008		1	1	.940	2	4	6 1/2	.020
1907409	TC6ANR25018		1	1	.940	2	6	8 1/2	.020
2839981	TC6ANR32009		1 1/4	1 1/4	1.175	2	4	6 1/2	.020
2839975	TC6ANR32019		1 1/4	1 1/4	1.175	2	6	8 1/2	.020
2839969	TC6ANR32029		1 1/4	1 1/4	1.175	2	8	10 1/2	.020

NOTE: For application data, please see page O17.

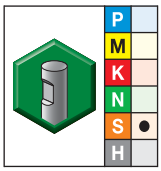
- Center cutting.
- Chamfered profile.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance
All	+0.0047/-0.0047	All	-0.0002/-0.0005

Series 6T0R • Series 6T0R 6T1R 6T3R

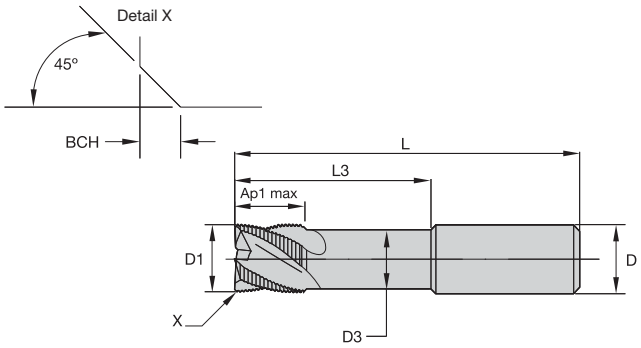


● first choice
○ alternate choice

order #	catalog #	grade TiAlN TiAlN	D1	D	length of cut Ap1 max	length L	BCH	ZU
2836219	TF6T0R13005		1/2	1/2	1 1/4	3 1/4	.035	4
2836188	TF6T1R13005		1/2	1/2	2	4	.035	4
2836212	TF6T0R16006		5/8	5/8	1 5/8	3 3/4	.047	4
2836182	TF6T1R16006		5/8	5/8	2 1/2	4 5/8	.047	4
2836206	TF6T0R19007		3/4	3/4	1 5/8	3 7/8	.047	4
2836151	TF6T3R19007		3/4	3/4	2 1/4	4 1/2	.047	4
2836176	TF6T1R19007		3/4	3/4	3	5 1/4	.047	4
2836204	TF6T0R25008		1	1	2	4 1/2	.059	5
2836145	TF6T3R25008		1	1	3	5 1/2	.059	5
2836169	TF6T1R25008		1	1	4	6 1/2	.059	5
2836199	TF6T0R32009		1 1/4	1 1/4	2	4 1/2	.059	6
2836138	TF6T3R32009		1 1/4	1 1/4	3	5 1/2	.059	6
2836163	TF6T1R32009		1 1/4	1 1/4	4	6 1/2	.059	6
2836193	TF6T0R38009		1 1/2	1 1/4	2	4 1/2	.059	6
2836132	TF6T3R38009		1 1/2	1 1/4	3	5 1/2	.059	6
2836157	TF6T1R38009		1 1/2	1 1/4	4	6 1/2	.059	6

NOTE: For application data, please see page O18.

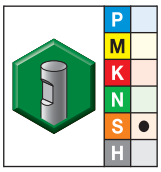
- Center cutting.
- Chamfered profile.
- Standard items listed. Additional styles and coatings made-to-order.



End Mill Tolerances

D1	tolerance	D	tolerance
All	+0.0047/-0.0047	All	-0.0002/-0.0005

Series 6TNR

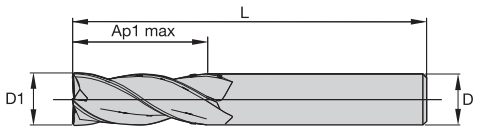


● first choice
○ alternate choice

grade TiAlN TiAlN									
order #	catalog #	D1	D	D3	length of cut Ap1 max	L3	length L	BCH	ZU
2836090	TF6TNR16006	5/8	5/8	.588	1 5/8	3	5 1/8	.047	4
2836087	TF6TNR16016	5/8	5/8	.588	1 5/8	4	6 1/8	.047	4
2836081	TF6TNR19007	3/4	3/4	.705	1 5/8	4	6 1/4	.047	4
2836075	TF6TNR19017	3/4	3/4	.705	1 5/8	6	8 1/4	.047	4
2836068	TF6TNR25008	1	1	.940	2	4	6 1/2	.059	5
2836063	TF6TNR25018	1	1	.940	2	6	8 1/2	.059	5
2836059	TF6TNR32009	1 1/4	1 1/4	1.175	2	4	6 1/2	.059	6
2836054	TF6TNR32019	1 1/4	1 1/4	1.175	2	6	8 1/2	.059	6
2836048	TF6TNR32029	1 1/4	1 1/4	1.175	2	8	10 1/2	.059	6

NOTE: For application data, please see page O18.

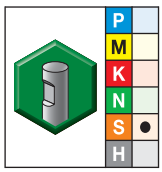
- Center cutting.
- NAS Type 986 46 + 66 compliant.
- Standard items listed. Additional styles and coatings made-to-order.

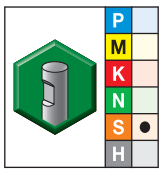


End Mill Tolerances

D1	tolerance	D	tolerance
All	+.002/-0.0	All	-0.0002/-0.0005

Series 3405 3415 3425 3435 3455 3407 3417 3427 3437 3457



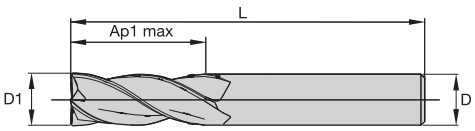


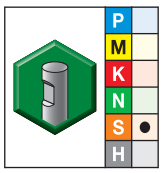
● first choice
○ alternate choice

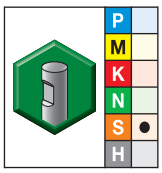
grade UNCOATED		grade TiAlN TiAlN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	ZU
2866066	341510004		–	3/8	3/8	1 1/2	3 1/4	4
2866063	341513005	2838292	TF341513005	1/2	1/2	2	4	4
2866027	342513005		–	1/2	1/2	3	5	4
2866099	340516006		–	5/8	5/8	1 5/8	3 3/4	4
	–	2838285	TF341516006	5/8	5/8	2 1/2	4 5/8	4
2865994	343519007	2838241	TF343519007	3/4	3/4	2 1/4	4 1/2	4
	–	2838218	TF343719007	3/4	3/4	2 1/4	4 1/2	6
2866057	341519007	2838277	TF341519007	3/4	3/4	3	5 1/4	4
	–	2838260	TF341719007	3/4	3/4	3	5 1/4	6
2866021	342519007		–	3/4	3/4	4	6 1/4	4
2866009	342719007		–	3/4	3/4	4	6 1/4	6
2866090	340525008		–	1	1	2	4 1/2	4
2865990	343525008	2838234	TF343525008	1	1	3	5 1/2	4
2865982	343725008	2838212	TF343725008	1	1	3	5 1/2	6
2866036	341725008	2838254	TF341725008	1	1	4	6 1/2	6
2866051	341525008	2838273	TF341525008	1	1	4	6 1/2	4
2866018	342525008		–	1	1	6	8 1/2	4
2866006	342725008		–	1	1	6	8 1/2	6
2866072	340732009		–	1 1/4	1 1/4	2	4 1/2	6
2865988	343532009	2838227	TF343532009	1 1/4	1 1/4	3	5 1/2	4
2865978	343732009	2838205	TF343732009	1 1/4	1 1/4	3	5 1/2	6
	–	2838265	TF341532009	1 1/4	1 1/4	4	6 1/2	4
2866033	341732009	2838248	TF341732009	1 1/4	1 1/4	4	6 1/2	6
2866015	342532009		–	1 1/4	1 1/4	6	8 1/2	4

(continued)

(Series 3405 3415 3425 3435 3455 3407 3417 3427 3437 3457 — continued)







● first choice
○ alternate choice

grade UNCOATED		grade TiAlN TiAlN						
order #	catalog #	order #	catalog #	D1	D	length of cut Ap1 max	length L	ZU
2866003	342732009		–	1 1/4	1 1/4	6	8 1/2	6
2865999	342738009		–	1 1/2	1 1/4	6	8 1/2	6
2865975	343738009		–	1 1/2	1 1/2	3	5 1/2	6
2866030	341738009		–	1 1/2	1 1/2	4	6 1/2	6
2865960	345751020		–	2	2	2	5 3/4	6
2865958	345751030		–	2	2	3	6 3/4	6
2865955	345751040	2838177	TF345751040	2	2	4	7 3/4	6
2865969	345551040	2838193	TF345551040	2	2	4	7 3/4	4
2865951	345751060	2838170	TF345751060	2	2	6	9 3/4	6
2865948	345751080		–	2	2	8	11 3/4	6
2865963	345551080		–	2	2	8	11 3/4	4

NOTE: For application data, please see page O18.

Series 620W • WavCut I

Material Group		Side Milling (A) and Slotting (B)			uncoated			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.					
		A		B	Cutting Speed — vc SFM				D1 — Diameter				
								frac.	3/4	1	1 1/4	1 1/2	2
		ap	ae	ap	min		max	dec.	.7500	1.0000	1.2500	1.5000	2.0000
P	5	1.5 x D	0.4 x D	1 x D	30	–	50	IPT	.0030	.0040	.0045	.0050	.0055
M	1	1.5 x D	0.4 x D	1 x D	30	–	50	IPT	.0040	.0045	.0050	.0055	.0060
	2	1.5 x D	0.4 x D	1 x D	30	–	40	IPT	.0035	.0040	.0045	.0050	.0055
S	4	1.5 x D	0.4 x D	0.75 x D	50	–	70	IPT	.0033	.0040	.0050	.0055	.0060

NOTE: Side milling applications — For longest length tools, reduce ae by 30%.
Slot milling applications — For longest length tools, reduce ap by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

Series 6A0R

Material Group		Side Milling (A) and Slotting (B)			uncoated			TiCN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.				
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter			
											frac.	1/2	3/4	1	1 1/4
		ap	ae	ap	min		max	min		max	dec.	.5000	.7500	1.0000	1.2500
N	1	1.25 x D	0.5 x D	1 x D	1050	–	1750	1500	–	2500	IPT	.0055	.0075	.0085	.0100
	2	1.25 x D	0.5 x D	1 x D	840	–	1400	1200	–	2000	IPT	.0050	.0068	.0077	.0090

NOTE: Side milling applications — For longest length tools, reduce ae by 30%.
Slot milling applications — For longest length tools, reduce ap by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

Series 6ANR

Material Group		Side Milling (A) and Slotting (B)			TiCN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.				
		A		B	Cutting Speed — vc SFM				D1 — Diameter			
								frac.	1/2	3/4	1	1 1/4
		ap	ae	ap	min		max	dec.	.5000	.7500	1.0000	1.2500
N	1	1 x D	0.3 x D	0.75 x D	1500	–	2500	IPT	.0055	.0075	.0085	.0100
	2	1 x D	0.3 x D	0.5 x D	1200	–	2000	IPT	.0050	.0068	.0077	.0090

NOTE: Side milling applications — For longest length tools, reduce ae by 30%.
Slot milling applications — For longest length tools, reduce ap by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

Series 6T0R



Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.						
		A		B	Cutting Speed — vc SFM				D1 — Diameter					
								frac.	1/2	5/8	3/4	1	1 1/4	1 1/2
		ap	ae	ap	min		max	dec.	.5000	.6250	.7500	1.0000	1.2500	1.5000
S	3	1.25 x D	0.5 x D	1 x D	50	–	90	IPT	.0028	.0033	.0036	.0040	.0050	.0060
	4	1.25 x D	0.3 x D	0.5 x D	50	–	90	IPT	.0026	.0030	.0033	.0036	.0045	.0055

NOTE: Side milling applications — For longest length tools, reduce ae by 30%.
Slot milling applications — For longest length tools, reduce ap by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

Application Data • Series 6TNR

Series 6TNR



Material Group		Side Milling (A) and Slotting (B)			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.				
		A		B	Cutting Speed — vc SFM				D1 — Diameter			
								frac.	5/8	3/4	1	1 1/4
		ap	ae	ap	min		max	dec.	.6250	.7500	1.0000	1.2500
S	3	0.75 x D	0.4 x D	0.5 x D	50	–	90	IPT	.0033	.0036	.0040	.0050
	4	0.75 x D	0.3 x D	0.3 x D	50	–	90	IPT	.0030	.0033	.0036	.0045

NOTE: Side milling applications — For longest length tools, reduce ae by 30%.
Slot milling applications — For longest length tools, reduce ap by 30%.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

Application Data • Series 3405 3415 3425 3435 3455 3407 3417 3427 3437 3457

Series 3405 3415 3425 3435 3455 3407 3417 3427 3437 3457



Material Group		Side Milling (A) and Slotting (B)			uncoated			TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.								
		A		B	Cutting Speed — vc SFM			Cutting Speed — vc SFM				D1 — Diameter							
											frac.	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
		ap	ae	ap	min		max	min		max	dec.	.3750	.5000	.6250	.7500	1.0000	1.2500	1.5000	2.0000
S	3	1.5 x D	0.1 x D	0.5 x D	50	–	80	50	–	90	IPT	.0020	.0025	.0029	.0032	.0038	.0042	.0045	.0048
	4	1.5 x D	0.1 x D	0.4 x D	40	–	60	50	–	90	IPT	.0018	.0023	.0026	.0029	.0035	.0038	.0041	.0044

NOTE: Side milling applications — For longest reach (L3) tools, reduce ae by 30%.
Slot milling applications — For longest reach (L3) tools, reduce ap by 30%.
For cutting aluminum with high silicon, coating is recommended.
Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on diameters >1/2".

Solid Carbide-Tipped End Mills

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

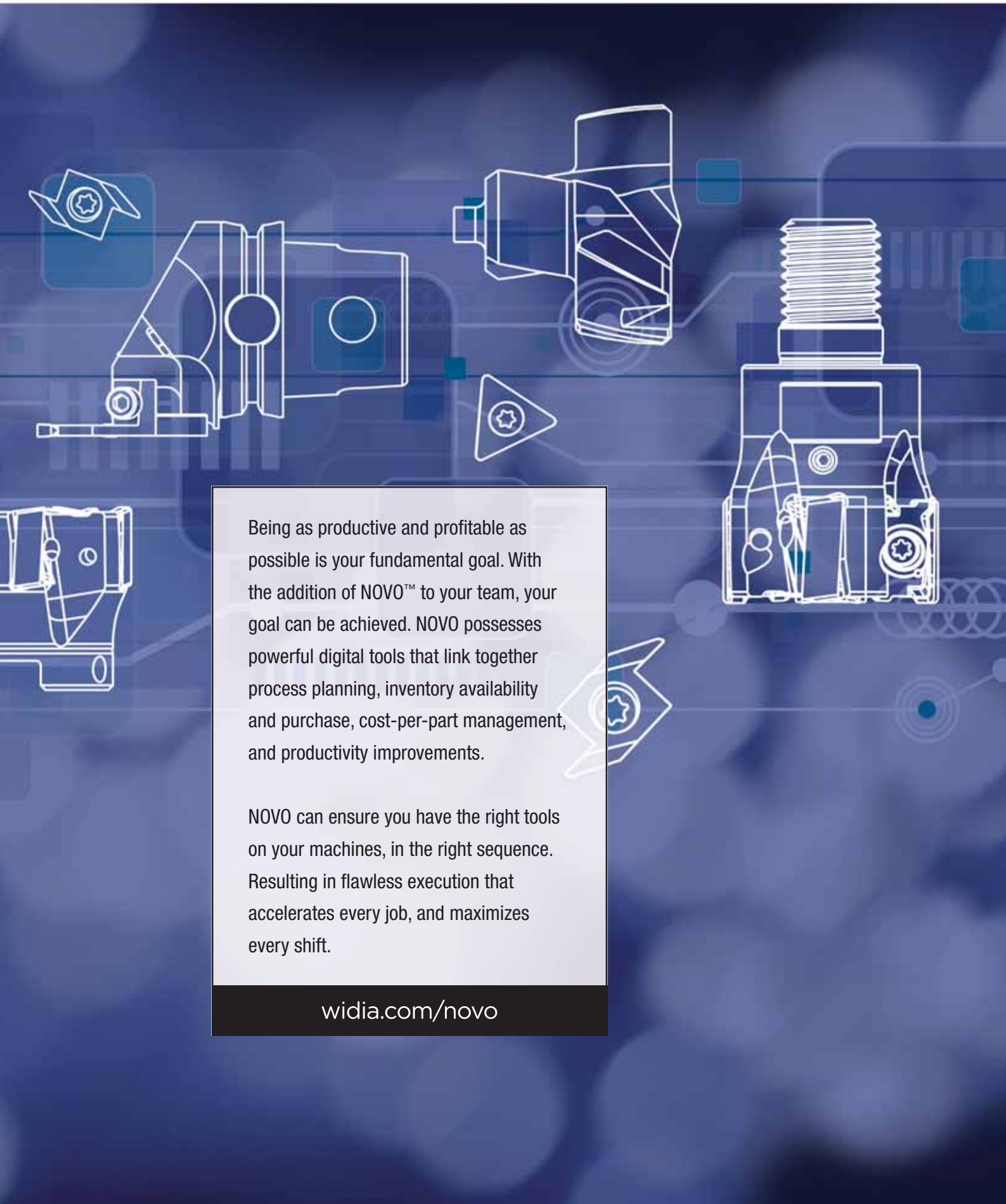
WIDIA-Hanita™ carbide-tipped end mills can provide unique advantages over solid tools, especially in large diameter sizes. They can be run at the same high cutting speeds of solid carbide but are usually less costly because of their steel body. The tougher body also absorbs shock, which enables it to perform well in conventional machines with less-than-rigid setups. Our in-house brazing capabilities and expertise provide our customers with flexibility in using carbide-tipped cutting edges on many styles, geometries, and sizes of standard and custom solution tooling.

- Available up to a diameter of 9.84" (250mm).
- Continuous edge carbide diameter of up to 11.81" (300mm).
- Center cutting geometries available.
- Maximum helix angle is 45°.
- Available in multiple spindle connections.
- Outstanding custom solutions capabilities.

To learn more about our innovations, contact your local Authorized Distributor or visit **widia.com**.

WIDIA™

NOVO KNOWS
ART TO PART TO PROFIT



Being as productive and profitable as possible is your fundamental goal. With the addition of NOVO™ to your team, your goal can be achieved. NOVO possesses powerful digital tools that link together process planning, inventory availability and purchase, cost-per-part management, and productivity improvements.

NOVO can ensure you have the right tools on your machines, in the right sequence. Resulting in flawless execution that accelerates every job, and maximizes every shift.

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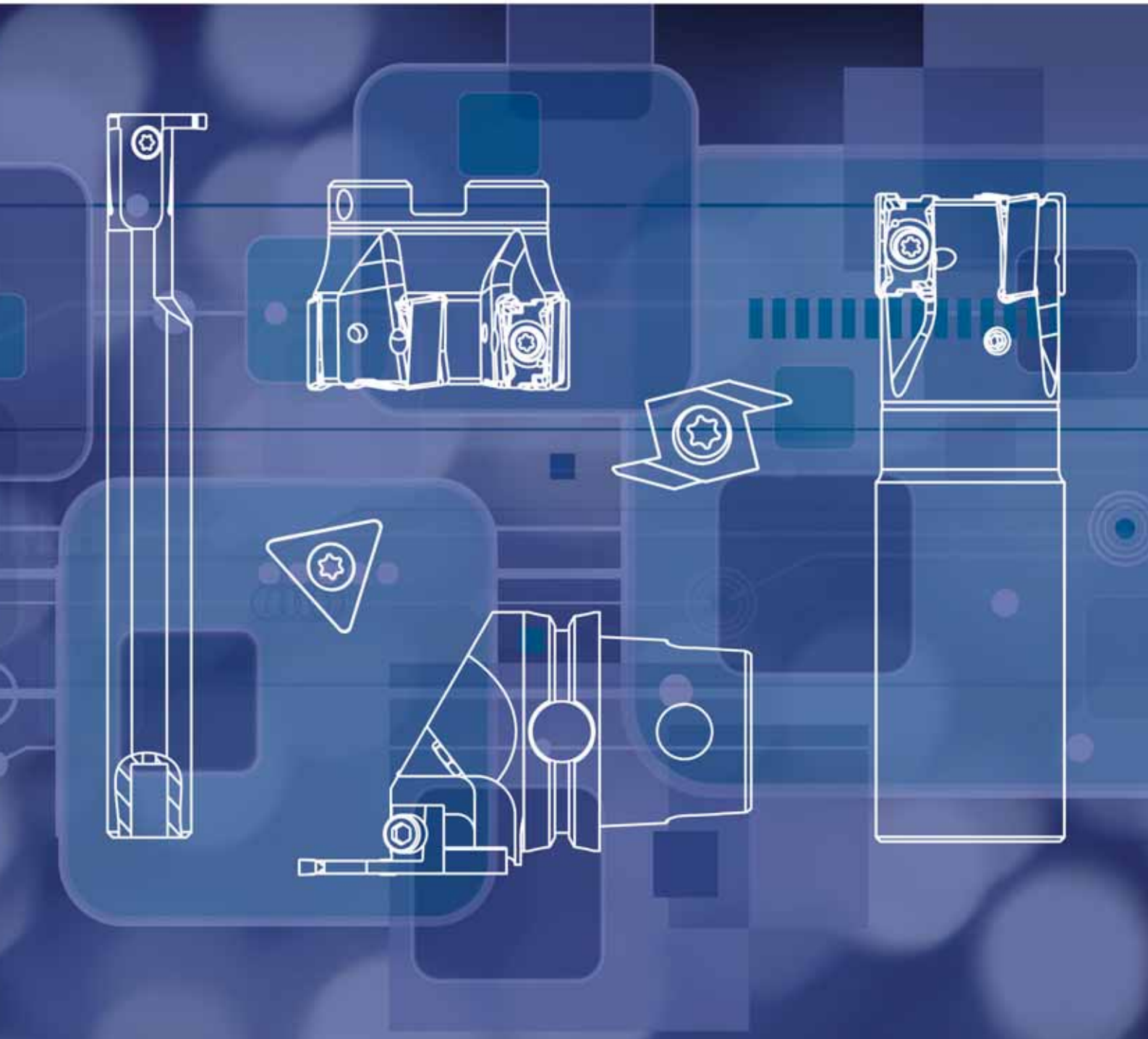
WIDIA™



01

THE DIGITAL SOURCE FOR DELIVERING
SMART MACHINING SOLUTIONS

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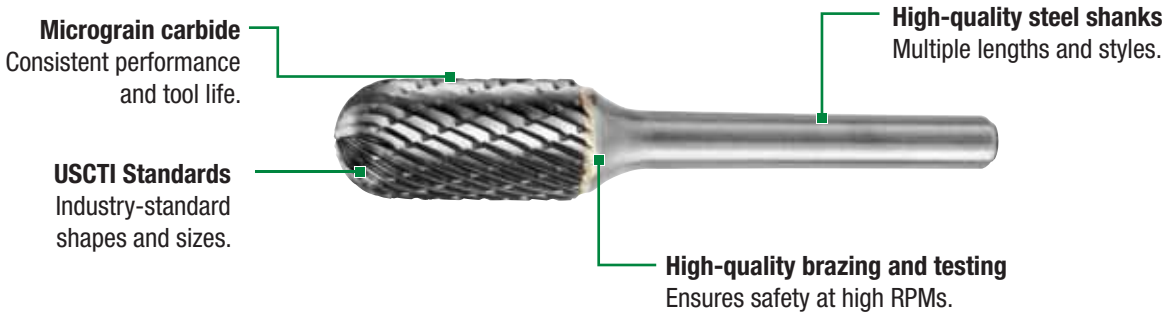
NOVO™

Solid End Milling • Burs

Carbide Burs

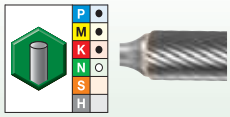
WIDIA™ carbide burs are manufactured in compliance with USCTI standards and are the highest quality in the industry, delivering excellent performance and safety. Our unique manufacturing process ensures exceptional tool life with the reliability to operate safely at high speeds. WIDIA burs offer a comprehensive portfolio of sizes and shapes for all applications and workpiece materials.

- Complete selection of shapes and cut styles for all materials and applications.
- Solid shank and brazed-on steel styles.
- Highest quality materials and construction deliver exceptional tool life.
- Wide array of sizes and shank lengths.
- Available in multiple size and style kits.
- Use of industry-standard USCTI codes for easy identification.



Standard Cut Styles

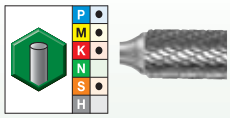
Standard Cut (Right-Hand Spiral)



The WIDIA™ standard (right-hand spiral) cut produces a smooth finish for general-purpose use on steel, cast iron, and other ferrous and non-ferrous materials.

Most WIDIA carbide burs are available in the right-hand spiral design.

Master Cut (Double Cut)



The WIDIA exclusive **master cut**, with its chisel-type cutting edge, is a machine-ground tool built to exacting tolerances of concentricity, size, and shape. This accuracy, when combined with precision grinders, results in smooth-running, fast metal removal, and fine finishes. The right- and left-hand helical flutes combine to produce a chisel-type cutting tooth. This results in faster penetration and stock removal with minimal bounce or chatter.

The master cut design also produces an easy-to-handle granular-type chip in most metals, as opposed to the conventional sliver-type chips.

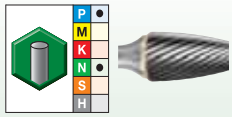
Throughout its life, the master cut gives faster stock removal and less operator fatigue, and maintains a good finish on the widest possible variety of workpiece materials.

Aluminum Cut

The WIDIA **aluminum cut** burs are outstanding on soft or non-ferrous type materials. Use the aluminum cut design on aluminum, magnesium, brass, lead, and most plastics.

Special Cut Styles

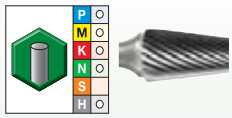
Coarse Cut



Coarse cut burs are favored for applications in softer materials such as brass, lead, annealed low-carbon steels, and some aluminum alloys. The combination of fewer flutes with greater depths provides the chip clearance necessary for these materials.

Available as specials.

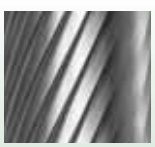
Fine Cut RHS



The WIDIA **fine cut right-hand spiral** is used in applications where stock removal is light and workpiece finish is critical. A greater number of flutes reduces chip load and provides excellent control in deburring small, intricate areas.

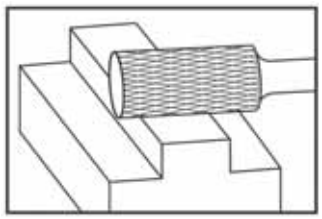
Available as specials.

How to select a Bur

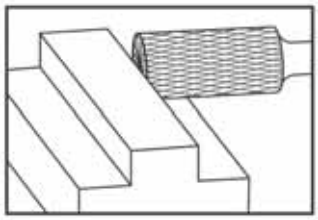
Applications	Material	Cut	
Efficient stock removal — deburring, finishing, and cleaning.	Ferrous metals Non-ferrous metals	Double Master Cut	
Heavy stock removal — deburring, milling, cleaning, and machining.	Non-ferrous metal: aluminum alloys Plastics	Aluminum Cut	
Medium stock removal — deburring, milling, cleaning, and finishing.	Non-ferrous metal: aluminum alloys Plastics Hard rubber	Coarse Cut Special Cut Style	
Medium stock removal — deburring, milling, cleaning, and finishing.	Non-Hardened steel >45 HRC Hardened steel >45 HRC: stainless steel High-temperature resistant metals: nickel, cobalt, titanium Non-ferrous light metals: brass, copper, and zinc	Single Cut	
Light stock removal — fine deburring and fine finishing.	Hardened steel >45 HRC	Fine Cut Special Cut Style	

Bur Shapes

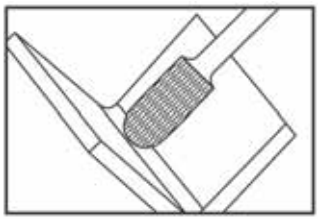
A Shape



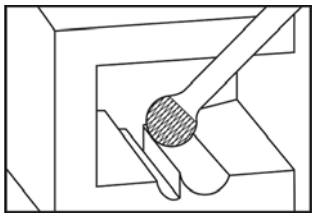
B Shape



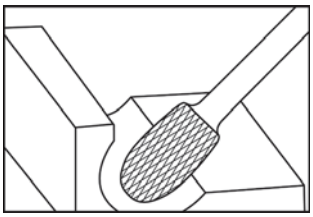
C Shape



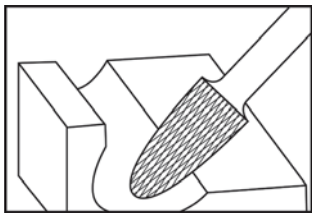
D Shape



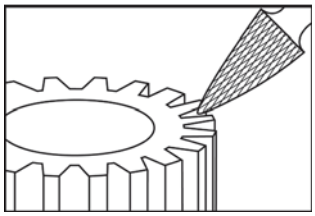
E Shape



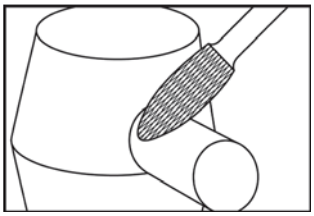
F Shape



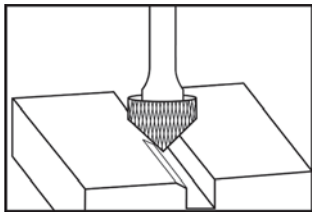
G Shape



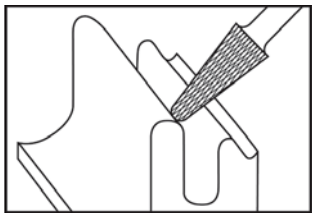
H Shape



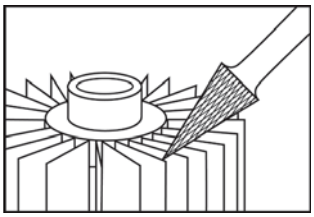
K Shape



L Shape



M Shape



Shank Styles

A Shank
1/8" solid carbide shank

B Shank
1/8" hardened steel shank

C Shank
1/4" hardened steel shank

D Shank
1/8" solid carbide shank

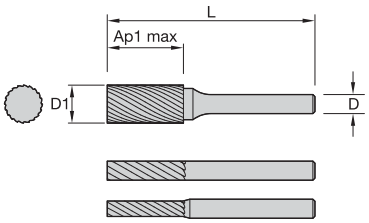
Bur Cutting Speeds

Bur Diameter Inch	Recommended Cutting Speed (RPM)	Maximum Cutting Speed (RPM)
1/16	60,000–90,000	100,000
1/8	40,000–70,000	90,000
3/16	35,000–60,000	80,000
1/4	30,000–50,000	70,000
5/16	20,000–40,000	68,000
3/8	20,000–40,000	66,000
7/16	15,000–40,000	58,000
1/2	15,000–40,000	50,000
5/8	12,000–25,000	40,000
3/4	10,000–20,000	33,000
1	7,500–20,000	25,000
1-1/8	7,000–13,000	20,000
1-1/2	5,000–10,000	17,000
1-3/4	4,500–9,000	14,000
2	4,000–8,000	12,500

- Cylindrical shape.
- No end cut.
- Shank styles A, B, and C — see page P5 for shank style definitions.

Single Cut

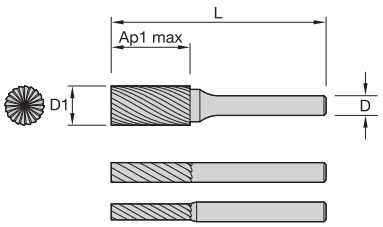
Master Cut



Series SA Cylindrical

	Single Cut		Master Cut						
USCTI Number	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style
SA-41	2736627	M40200	2735826	M41200	1/16	1/8	1/4	1 1/2	A
SA-42	2736622	M40201	2735821	M41201	3/32	1/8	7/16	1 1/2	A
SA-43	2736616	M40202	2735816	M41202	1/8	1/8	9/16	1 1/2	A
SA-43L2	2736613	M40203	2735811	M41203	1/8	1/8	9/16	2	A
SA-43L3	2736608	M40204	2735806	M41204	1/8	1/8	9/16	3	A
SA-11	2736603	M40205	2735801	M41205	1/8	1/4	1/2	2	C
SA-52	2736598	M40206	2735796	M41206	5/32	1/8	1/2	1 1/2	A
SA-53	–		2735792	M41207	3/16	1/8	1/2	1 1/2	A
SA-14	2736589	M40208	2735787	M41208	3/16	1/4	5/8	2	C
SA-51	2736583	M40209	2735782	M41209	1/4	1/8	3/16	1 7/16	B
SA-51-2	2736578	M40210	2735777	M41210	1/4	1/8	1/2	1 3/4	B
SA-1L6	2736569	M40212	2735767	M41212	1/4	1/4	5/8	6 5/8	C
SA-1	2736574	M40211	2735772	M41211	1/4	1/4	5/8	2	C
SA-2	2736564	M40213	2735763	M41213	5/16	1/4	3/4	2 1/2	C
SA-3	1293725	M40214	3063092	M41214	3/8	1/4	3/4	2 1/2	C
SA-3L6	–		2735752	M41215	3/8	1/4	3/4	6 3/4	C
SA-4	2736549	M40216	2735747	M41216	7/16	1/4	1	2 3/4	C
SA-5	2736544	M40217	2735742	M41217	1/2	1/4	1	2 3/4	C
SA-5L6	–		2735737	M41218	1/2	1/4	1	7	C
SA-6	2736534	M40219	2735732	M41219	5/8	1/4	1	2 3/4	C
SA-7	3046342	M40220	2735727	M41220	3/4	1/4	1	2 3/4	C
SA-9	2736525	M40221	2735722	M41221	1	1/4	1	2 3/4	C

- Cylindrical shape.
- With end cut.
- Shank styles A and C — see page P5 for shank style definitions.




Single Cut

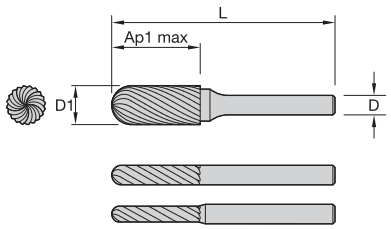

Master Cut


Aluminum Cut

Series SB Cylindrical with End Cut

	Single Cut		Master Cut		Aluminum Cut						
USCTI Number	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style
SB-41	2736483	M40247	–		–		1/16	1/8	1/4	1 1/2	A
SB-42	2736480	M40248	–		–		3/32	1/8	7/16	1 1/2	A
SB-43	1750953	M40249	–		–		1/8	1/8	9/16	1 1/2	A
SB-11	–		2735677	M41250	–		1/8	1/4	1/2	2	C
SB-14	2736465	M40251	2735672	M41251	–		3/16	1/4	5/8	2	C
SB-51	2736459	M40252	2735666	M41252	–		1/4	1/8	3/16	1 7/16	A
SB-51-2	–		2735662	M41253	–		1/4	1/8	1/2	1 3/4	A
SB-1	2736449	M40254	2735657	M41254	2736311	M40527	1/4	1/4	5/8	2	C
SB-2	2736446	M40255	3055771	M41255	–		5/16	1/4	3/4	2 1/2	C
SB-3	2736441	M40256	2735646	M41256	2736307	M40528	3/8	1/4	3/4	2 1/2	C
SB-4	–		3050640	M41257	–		7/16	1/4	1	2 3/4	C
SB-5	2736436	M40258	2735636	M41258	2736300	M40529	1/2	1/4	1	2 3/4	C
SB-6	–		2735631	M41259	2736296	M40530	5/8	1/4	1	2 3/4	C
SB-7	–		2735626	M41260	2736291	M40531	3/4	1/4	1	2 3/4	C

- Cylindrical shape.
- Ball nose end cut.
- Shank styles A, B, and C — see page P5 for shank style definitions.




Single Cut

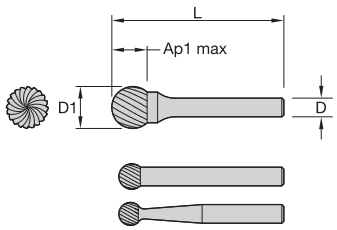

Master Cut


Aluminum Cut

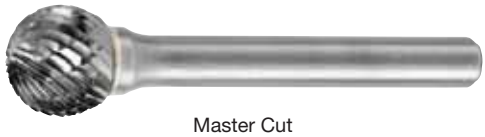
Series SC Cylindrical Ball Nose

	Single Cut		Master Cut		Aluminum Cut						
USCTI Number	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style
SC-41	3046343	M40284	2735611	M41284	–		3/32	1/8	7/16	1 1/2	A
SC-42	2736406	M40285	2735606	M41285	–		1/8	1/8	9/16	1 1/2	A
SC-42L2	2736401	M40286	2735600	M41286	–		1/8	1/8	9/16	2	A
SC-42L3	2736397	M40287	2735596	M41287	–		1/8	1/8	9/16	3	A
SC-11	2736392	M40288	2735591	M41288	–		1/8	1/4	1/2	2	A
SC-52	2736387	M40289	1568786	M41289	–		5/32	1/8	1/2	1 1/2	A
SC-53	3050059	M40290	2735581	M41290	–		3/16	1/8	1/2	1 1/2	A
SC14	2736379	M40291	2735576	M41291	–		3/16	1/4	5/8	2	A
SC-51	3056826	M40292	2735571	M41292	–		1/4	1/8	1/2	1 3/4	B
SC-1	2736369	M40293	2735566	M41293	2736287	M40532	1/4	1/4	5/8	2	A
SC-1L6	3043496	M40294	2735561	M41294	–		1/4	1/4	5/8	6 5/8	C
SC-2	2736358	M40295	2735556	M41295	–		5/16	1/4	3/4	2 1/2	A
SC-3	2736353	M40296	2735551	M41296	2736281	M40533	3/8	1/4	3/4	2 1/2	A
SC-3L6	2736349	M40297	2735546	M41297	–		3/8	1/4	3/4	6 3/4	C
SC-4	–		3050641	M41298	–		7/16	1/4	1	2 3/4	A
SC-5L6	2736334	M40300	2735526	M41300	–		1/2	1/4	1	7	C
SC-5	2736339	M40299	2735531	M41299	2736276	M40534	1/2	1/4	1	2 3/4	A
SC-6	2736329	M40301	2735521	M41301	2736272	M40535	5/8	1/4	1	2 3/4	A
SC-7	2736324	M40302	2735516	M41302	2736265	M40536	3/4	1/4	1	2 3/4	C

- Ball shape.
- Shank styles A, B, and C — see page P5 for shank style definitions.




Single Cut

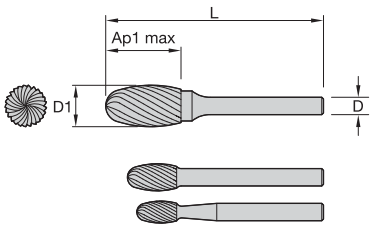

Master Cut


Aluminum Cut

Series SD BALL

	Single Cut		Master Cut		Aluminum Cut						
USCTI Number	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style
—	2730676	M40322	–		–		1/16	1/8	1/16	1 1/2	A
SD-41	2730671	M40323	2729967	M41323	–		3/32	1/8	3/32	1 1/2	A
SD-42L2	3044078	M40325	–		–		1/8	1/8	1/8	2	A
SD-42L3	2730659	M40326	2729951	M41326	–		1/8	1/8	1/8	3	A
SD-42	–		2729963	M41324	–		1/8	1/8	1/8	1 1/2	A
SD-11	3043497	M40327	2729946	M41327	–		1/8	1/4	1/8	2	C
SD-53	2730649	M40328	2729942	M41328	–		3/16	1/8	3/16	1 1/2	A
SD-14	2730644	M40329	2729936	M41329	–		3/16	1/4	3/16	2	C
SD-42L2	–		1752141	M41325	–		1/8	1/8	1/8	2	A
SD-51	2730639	M40330	2729930	M41330	–		1/4	1/8	1/4	1 3/4	B
SD-1L6	2730629	M40332	2729920	M41332	–		1/4	1/4	1/4	6 1/4	C
SD-1	2730634	M40331	2729926	M41331	2730077	M40537	1/4	1/4	1/4	2	C
SD-2	2730624	M40333	2729914	M41333	–		5/16	1/4	5/16	2 1/32	C
SD-3L6	2730614	M40335	2729906	M41335	–		3/8	1/4	3/8	6 3/8	C
SD-3	2730619	M40334	2729910	M41334	2730072	M40538	3/8	1/4	3/8	2 5/64	C
SD-4	2730609	M40336	2729901	M41336	–		7/16	1/4	7/16	2 9/64	C
SD-5	–		2729895	M41337	2730067	M40539	1/2	1/4	1/2	2 13/16	C
SD-5L6	2730598	M40338	3046344	M41338	–		1/2	1/4	1/2	6 1/2	C
SD-5	2730603	M40337	–		–		1/2	1/4	1/2	2 13/64	C
SD-6	2730593	M40339	2729885	M41339	2730063	M40540	5/8	1/4	5/8	2 5/16	C
SD-7	2730588	M40340	–		–		3/4	1/4	3/4	4 7/16	C
SD-7	–		2729880	M41340	–		3/4	1/4	3/4	2 7/16	C
SD-9	2730583	M40341	2729873	M41341	–		1	1/4	1	2 11/16	C

- Egg shape.
- Shank styles A, B, and C — see page P5 for shank style definitions.




Single Cut

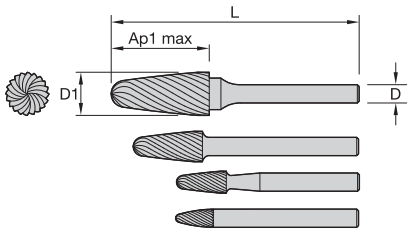

Master Cut

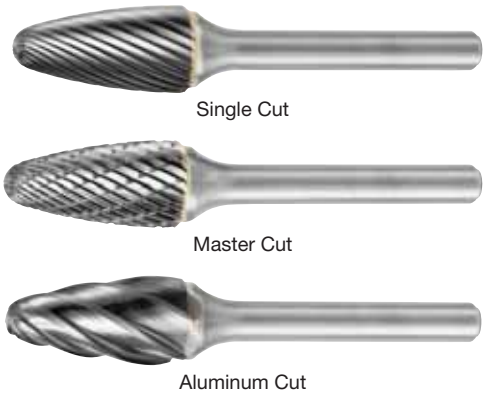

Aluminum Cut

Series SE EGG

	Single Cut		Master Cut		Aluminum Cut						
USCTI Number	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style
SE-41	**2730561**	**M40360**	**2729835**	**M41360**	–		1/8	1/8	7/32	1 1/2	A
SE-53	–		**2729830**	**M41361**	–		3/16	1/8	9/32	1 1/2	A
SE-51	**2730551**	**M40362**	**2729825**	**M41362**	–		1/4	1/8	3/8	1 5/8	B
SE-1	**2730544**	**M40363**	**2729820**	**M41363**	–		1/4	1/4	3/8	2	C
SE-3	–		–		**2730058**	**M40541**	3/8	1/4	5/8	2 3/4	C
SE-3	**2730542**	**M40364**	**2729814**	**M41364**	–		3/8	1/4	5/8	2 3/8	C
SE-5	**2730536**	**M40365**	**2729808**	**M41365**	**2730053**	**M40542**	1/2	1/4	7/8	2 5/8	C
SE-6	–		**2729803**	**M41366**	**2730048**	**M40543**	5/8	1/4	1	2 3/4	C
SE-7	–		**2729797**	**M41367**	–		3/4	1/4	1	2 3/4	C

- Round nose tree shape.
- Shank styles A, B, and C — see page P5 for shank style definitions.

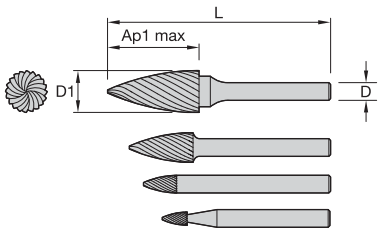




Series SF Round Nose Tree

	Single Cut		Master Cut		Aluminum Cut						
USCTI Number	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style
SF-41	2730511	M40379	2729782	M41379	–		1/8	1/8	1/4	1 1/2	A
SF-42	2730506	M40380	2729778	M41380	–		1/8	1/8	1/2	1 1/2	A
SF-53	2730501	M40381	3051757	M41381	–		3/16	1/8	1/2	1 1/2	A
SF-51	2730495	M40382	2729768	M41382	–		1/4	1/8	1/2	1 3/4	B
SF-1	2730491	M40383	1750297	M41383	2730042	M40544	1/4	1/4	5/8	2	C
SF-1L6	2730486	M40384	2729756	M41384	–		1/4	1/4	5/8	6	C
SF-3	2730481	M40385	2729751	M41385	2730037	M40545	3/8	1/4	3/4	2 1/2	C
SF-3L6	2730477	M40386	2729746	M41386	–		3/8	1/4	3/4	6 3/4	C
SF-4	2730472	M40387	2729741	M41387	–		7/16	1/4	1	2 3/4	C
SF-13	2730467	M40388	2729736	M41388	–		1/2	1/4	3/4	2 1/2	C
SF-5	2730461	M40389	2729731	M41389	2730032	M40546	1/2	1/4	1	2 3/4	C
SF-5L6	2730456	M40390	2729726	M41390	–		1/2	1/4	1	7	C
SF-6	2730451	M40391	2729721	M41391	2730027	M40547	5/8	1/4	1	2 3/4	C
SF-7	–		2729716	M41392	–		3/4	1/4	1	2 3/4	C
SF-15	–		2729711	M41393	–		3/4	1/4	1 1/2	3 1/4	C
SF-14	–		2729706	M41394	–		3/4	1/4	1 1/4	3	C

- Pointed tree shape.
- Shank styles A, B, and C — see page P5 for shank style definitions.



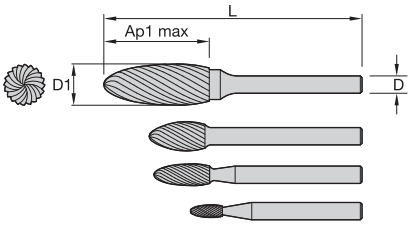

Single Cut


Master Cut

Series SG Pointed Tree

	Single Cut		Master Cut						
USCTI Number	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style
SG-41	2730399	19M40414-SAV	2729675	M41414	1/8	1/8	1/4	1 1/2	A
SG-42	2730395	M40415	2729669	M41415	1/8	1/8	5/16	1 1/2	A
SG-43	3054754	M40416	2729664	M41416	1/8	1/8	3/8	1 1/2	A
SG-44	2730385	M40417	2729660	M41417	1/8	1/8	1/2	1 1/2	A
SG-53	2730380	M40418	2729656	M41418	3/16	1/8	1/2	1 1/2	A
SG-51	2730375	M40419	2729651	M41419	1/4	1/8	1/2	1 3/4	B
SG-1	2730371	M40420	2729646	M41420	1/4	1/4	5/8	2	C
SG-2	–		2729641	M41421	5/16	1/4	3/4	2 1/2	C
SG-3	2730360	M40422	2729636	M41422	3/8	1/4	3/4	2 1/2	C
SG-13	2730355	M40423	2729631	M41423	1/2	1/4	3/4	2 1/2	C
SG-5	2730350	M40424	2729626	M41424	1/2	1/4	1	2 3/4	C
SG-6	2730345	M40425	2729621	M41425	5/8	1/4	1	2 3/4	C

- Flame shape.
- Shank styles A and C — see page P5 for shank style definitions.



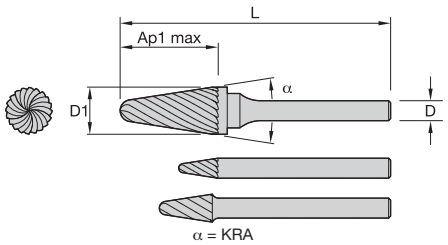

Single Cut

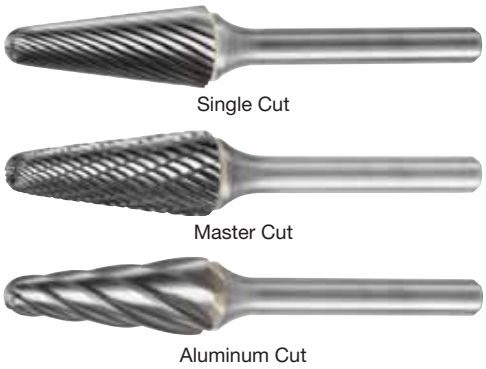

Master Cut

Series SH Flame

	Single Cut		Master Cut						
USCTI Number	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style
SH-41	**2730325**	**M40446**	**2729586**	**M41446**	1/8	1/8	1/4	1 1/2	A
SH-53	**2730320**	**M40447**	**2729581**	**M41447**	3/16	1/8	3/8	1 1/2	A
SH-2	**2730315**	**M40448**	**2729575**	**M41448**	5/16	1/4	3/4	2 1/2	C
SH-5	**2730310**	**M40449**	**2729570**	**M41449**	1/2	1/4	1 1/4	3	C
SH-6	**2730305**	**M40450**	**2729566**	**M41450**	5/8	1/4	1 7/16	3 3/16	C
SH-7	–		**2729559**	**M41451**	3/4	1/4	1 5/8	3 3/8	C

- Included angle shape.
- Shank styles A and C — see page P5 for shank style definitions.

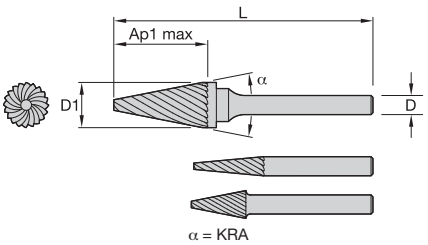




Series SL Included Angle

	Single Cut		Master Cut		Aluminum Cut							
USCTI Number	order #	catalog #	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style	KRA
SL-41	**2730295**	**M40461**	**3046345**	**M41461**	–		1/8	1/8	3/8	1 1/2	A	8
SL-42	**2730290**	**M40462**	**2729539**	**M41462**	–		1/8	1/8	1/2	1 1/2	A	8
SL-53	**2730285**	**M40463**	**3052817**	**M41463**	–		3/16	1/8	1/2	1 1/2	A	14
SL-1	**2730280**	**M40464**	**2729529**	**M41464**	–		1/4	1/4	5/8	2	C	14
SL-1L6	**3046916**	**M40465**	**2729523**	**M41465**	–		1/4	1/4	5/8	6 5/8	C	14
SL-2	**2730270**	**M40466**	**1752788**	**M41466**	–		5/16	1/4	7/8	2 3/4	C	14
SL-3	**2730264**	**M40467**	**2729513**	**M41467**	**2730022**	**M40548**	3/8	1/4	1 1/16	2 15/16	C	14
SL-3L6	**2730259**	**M40468**	**2729508**	**M41468**	–		3/8	1/4	1 1/16	7 3/16	C	14
SL-4	**2730254**	**M40469**	**2729503**	**M41469**	**2730017**	**M40549**	1/2	1/4	1 1/8	3	C	14
SL-4L6	**2730249**	**M40470**	**2729498**	**M41470**	–		1/2	1/4	1 1/8	7 1/4	C	14
SL-6	**2730244**	**M40471**	**2729493**	**M41471**	**2730012**	**M40550**	5/8	1/4	1 5/16	3 3/16	C	14
SL-7	**2730239**	**M40472**	**2729488**	**M41472**	–		3/4	1/4	1 1/2	3 3/8	C	14

- Pointed cone shape.
- Shank styles A, B, and C — see page P5 for shank style definitions.



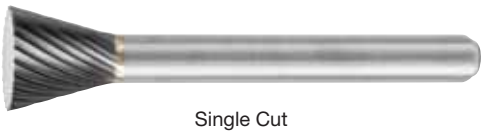

Single Cut


Master Cut

Series SM Pointed Cone

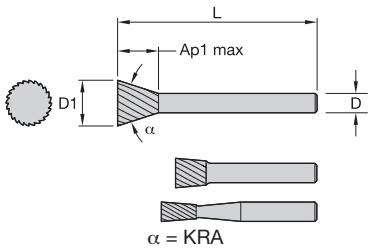
	Single Cut		Master Cut							
USCTI Number	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style	KRA
SM-41	**2730206**	**M40485**	**2729447**	**M41485**	1/8	1/8	3/8	1 1/2	A	12
SM-42	**2730202**	**M40486**	**2729443**	**M41486**	1/8	1/8	7/16	1 1/2	A	14
SM-43	**2730196**	**M40487**	**2729438**	**M41487**	1/8	1/8	5/8	1 1/2	A	7
SM-53	**2730191**	**M40488**	**2729433**	**M41488**	3/16	1/8	1/2	1 1/2	A	16
SM-51	**2730185**	**M40489**	**3050060**	**M41489**	1/4	1/8	1/2	1 7/8	B	22
SM-1	**2730179**	**M40490**	**2729423**	**M41490**	1/4	1/4	1/2	2	C	22
SM-2	**2730174**	**M40491**	**2729418**	**M41491**	1/4	1/4	3/4	2	C	14
SM-3	**2730169**	**M40492**	**2729413**	**M41492**	1/4	1/4	1	2	C	10
SM-4	**2730164**	**M40493**	**2729407**	**M41493**	3/8	1/4	5/8	2 1/2	C	28
SM-5	**2730159**	**M40494**	**2729402**	**M41494**	1/2	1/4	7/8	2 3/4	C	28
SM-6	**2730154**	**M40495**	**2729397**	**M41495**	5/8	1/4	1	2 7/8	C	31

- Inverted taper shape.
- Shank styles A and C — see page P5 for shank style definitions.



Single Cut

Master Cut



Series SN Inverted Taper

	Single Cut		Master Cut							
USCTI Number	order #	catalog #	order #	catalog #	D1	D	Ap1 max	length L	shank style	KRA
SN-41	**2730119**	**M40509**	–		3/32	1/8	3/16	1 1/2	A	10
SN-42	–		**2729371**	**M41510**	1/8	1/8	3/16	1 1/2	A	10
SN-51	–		**3051758**	**M41512**	1/4	1/8	1/4	1 1/2	A	10
SN-1	**2730100**	**M40513**	**2729356**	**M41513**	1/4	1/4	5/16	2	C	10
SN-4	**2730095**	**M40515**	–		1/2	1/4	1/2	2 1/4	C	28
SN-3	–		**2729351**	**M41514**	1/2	1/4	1/2	2 1/4	C	16

- Fine master-cut style.
- Cylindrical shape.
- Series IGT has no end cut.
- Series IGT-EC has end cut.
- Solid carbide construction.

Master Cut

Series IGT Internal Grinding Tool

Master Cut					
order #	catalog #	D1	D	Ap1 max	length L
2735469	M42006	1/16	1/8	1/8	1 1/2
2735464	M42007	5/64	1/8	5/32	1 1/2
2735459	M42008	3/32	1/8	5/32	1 1/2
2735454	M42009	7/64	1/8	3/16	1 1/2
2735449	M42010	1/8	1/8	3/16	1 1/2
2735411	M42019	9/64	3/16	7/32	2
2735406	M42020	5/32	3/16	7/32	2
2735401	M42021	11/64	3/16	1/4	2
2735396	M42022	3/16	3/16	1/4	2
2735443	M42012	7/32	1/4	9/32	2
2735439	M42013	15/64	1/4	5/16	2
2735432	M42014	1/4	1/4	5/16	2
2735427	M42015	9/32	1/4	11/32	2 1/2
2735423	M42016	5/16	1/4	11/32	2 1/2
2735417	M42018	3/8	1/4	3/8	2 1/2

Series IGT-EC Internal Grinding Tool

Master Cut

Series IGT-EC Internal Grinding Tool

Master Cut					
order #	catalog #	D1	D	Ap1 max	length L
2735391	M42023	1/16	1/8	1/8	1 1/2
2735386	M42024	5/64	1/8	5/32	1 1/2
2735381	M42025	3/32	1/8	5/32	1 1/2
2735376	M42026	7/64	1/8	3/16	1 1/2
2735371	M42027	1/8	1/8	3/16	1 1/2
2735326	M42036	9/64	3/16	7/32	2
2735320	M42037	5/32	3/16	7/32	2
2735316	M42038	11/64	3/16	1/4	2
2735310	M42039	3/16	3/16	1/4	2
2735366	M42028	13/64	1/4	9/32	2
2735361	M42029	7/32	1/4	9/32	2
2735357	M42030	15/64	1/4	5/16	2
2735352	M42031	1/4	1/4	5/16	2
2735346	M42032	9/32	1/4	11/32	2 1/2
2735341	M42033	5/16	1/4	11/32	2 1/2
2735336	M42034	11/32	1/4	3/8	2 1/2
2735331	M42035	3/8	1/4	3/8	2 1/2

- Shank styles A, B, and C — see page P5 for shank style definitions.
- Assortment of bur styles for multiple applications.
- Most popular inch sizes.

Series Bur Sets

order number	catalog number	D1	D	quantity	shank style	cut style	includes
2736246	**M40588**	1/8	1/8	9	A	Master	SA-42, SA-43, SC-41, SC-42, SD-42, SE-41, SF-42, SG-42, SM-43
2736236	**M40591**	1/4	1/8	9	B	Master	SA-51, SB-51, SC-51, SD-51, SE-51, SF-51, SG-51, SM-51, SN-51
2736227	**M40593**	1/4	1/4	8	C	Master	SA-1, SC-1, SD-1, SE-1, SF-1, SG-1, SL-1, SM-2
2736221	**M40594**	1/2	1/4	8	C	Master	SA-5, SC-5, SD-5, SE-5, SF-5, SG-5, SL-4, SM-5

- Solid carbide construction.
- Multiple flute, 30° left-hand spiral, right-hand cut with diamond cut flutes.
- Straight shank.
- Four end cut styles
  —Series CRTF-N E — no end cut
  —Series CRTF-B E — bur end cut
  —Series CRTF-CC — end mill end cut
  —Series CRTF-DP — drill-point end cut

Master Cut

Series CRTF-BE

Master Cut					
order #	catalog #	D1	D	Ap1 max	length L
2737550	M34820	1/16	1/8	3/16	1 1/2
2737545	M34821	1/8	1/8	1/2	1 1/2
2894631	M34822	3/16	3/16	5/8	2
2737540	M34830	3/16	1/4	5/8	2
2737535	M34831	1/4	1/4	3/4	2
2737530	M34832	1/4	1/4	3/4	2 1/2
2737521	M34841	3/8	3/8	1	2 1/2
3045679	M34842	1/2	1/2	1	3

- Solid carbide construction.
- Multiple flute, 30° left-hand spiral, right-hand cut with diamond cut flutes.
- Straight shank.

Master Cut

Series CRTF-CC

Master Cut					
order #	catalog #	D1	D	Ap1 max	length L
2737593	M34792	1/16	1/8	3/16	1 1/2
2737583	M34800	1/8	1/8	1/2	1 1/2
2737573	M34802	1/4	1/4	3/4	2
2737564	M34810	5/16	5/16	1	2 1/2
2737558	M34811	3/8	3/8	1	2 1/2
2737555	M34812	1/2	1/2	1	3

- Solid carbide construction.
- Multiple flute, 30° left-hand spiral, right-hand cut with diamond cut flutes.
- Straight shank.

Master Cut

Series CRTF-DP

Master Cut					
order #	catalog #	D1	D	Ap1 max	length L
2737511	**M34850**	1/16	1/8	3/16	1 1/2
2737506	**M34851**	1/8	1/8	1/2	1 1/2
2737497	**M34860**	1/4	1/4	3/4	2
2737492	**M34861**	1/4	1/4	1	3
2737482	**M34870**	3/8	3/8	1	2 1/2
2737478	**M34871**	1/2	1/2	1	3

Series CRTF-NE

- Solid carbide construction.
- Multiple flute, 30° left-hand spiral, right-hand cut with diamond cut flutes.
- Straight shank.

Master Cut

Series CRTF-NE

Master Cut					
order #	catalog #	D1	D	Ap1 max	length L
2737455	**M34882**	1/4	1/4	3/4	2
2737449	**M34890**	1/4	1/4	1	3
2978031	**M34892**	3/8	3/8	1	2 1/2
2737438	**M34900**	1/2	1/2	1	3

Good for You, Better for the Environment!

The WIDIA™ Carbide Recycling Program can turn accumulated scrap carbide tooling in your shop into cash.

Carbide Recycling

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

We pay cash for used carbide tooling, including coated or non-coated carbide inserts, drills, end mills, reamers, and taps, regardless of brand.

It's good for the environment and a responsible way to dispose of scrap carbide.

Our carbide recycling program features:

- Easy-to-use web portal that shows what your scrap carbide is worth before sending it to us.
- Online forms that make it easy to ship scrap carbide to WIDIA.
- Green Box™ containers for safe, convenient shipping of scrap carbide to WIDIA.
- Cash payment for used carbide tooling.

For more information, contact your local WIDIA Authorized Distributor or visit **widia.com/services**.

WIDIA™

On the Web

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HydroForce™ HT Chuck

EXTREME **CHALLENGES.**
EXTREME **RESULTS.**

HydroForce™ HT Chuck High Torque for High Metal Removal Rates (MRR) and Superior Surface Finish

- HydroForce gives you an unmatched combination of accuracy and clamping forces.
- Compact and stable design.
- Advanced hydraulic clamping with lowest runout and superior vibration dampening.
- Balanced quality to lower vibration, especially at high speeds.
- Focused and flexible product offering.

WIDIA™