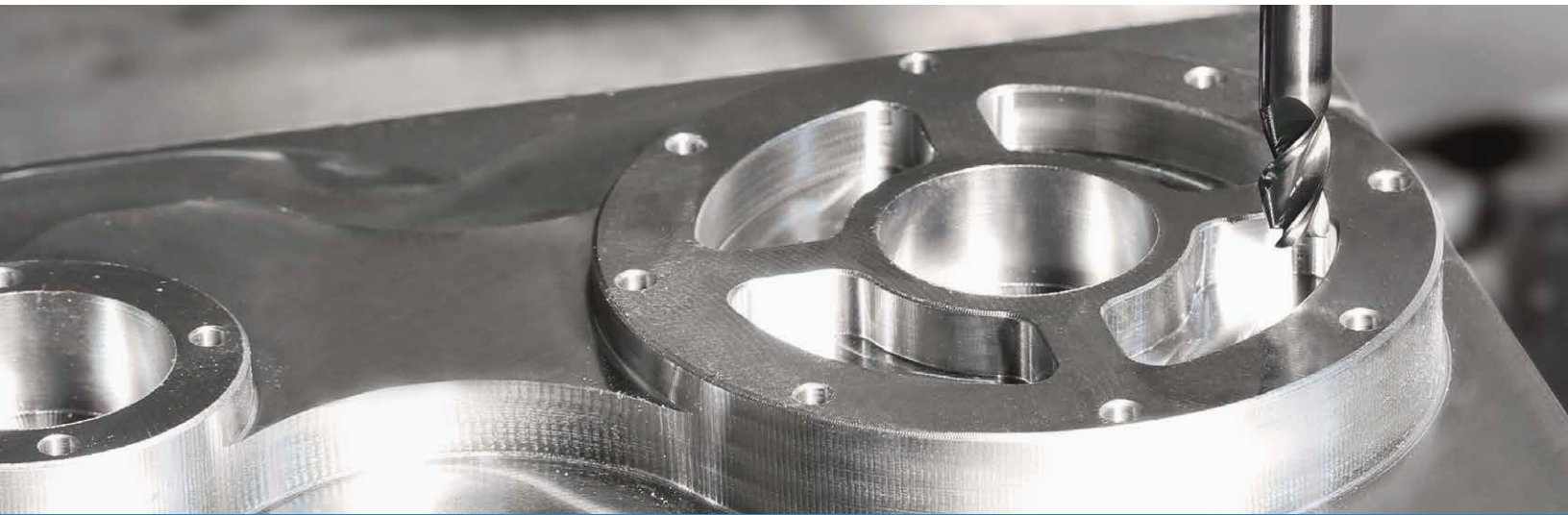




TITAN-AX

High Performance Miniature End Mills



Excellent Chip Evacuation, Long Tool Life, and High Quality Surface Finish

Smoother cutting with better chip evacuation

Deeper pocketing clearance

Ideal for trochoidal milling

Rigid shank diameter construction



TITAN-AX High Performance End Mills

Excellent Chip Evacuation, Long Tool Life, and High Quality Surface Finish
AX™ Performance Coating Technology Extends Tool Life

Kyocera has developed the TITAN-AX™ line of end mills for machining materials used in Medical, Microwave, Aerospace and other miniature component industries. Equipped with optimized flute geometries, 3 flutes, and increased shank diameters for maximum rigidity, these coated end mills are engineered for precision using aggressive machining parameters. Material applications for the TITAN-AX™ include Kovar®, Stainless Steel, Titanium, Carpenter 49 as well as other ferrous materials.

1 TITAN-AX Features

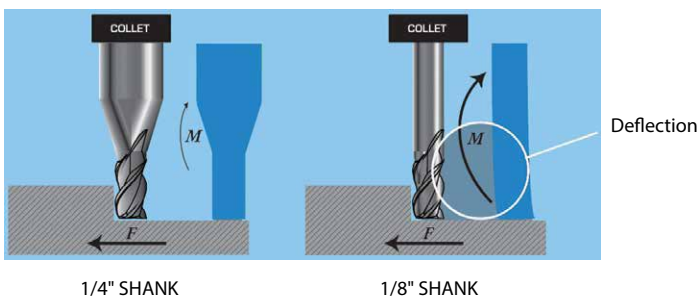
- 3 Flute Optimized Geometry
- Sharp & Corner Radius (Bull Nose)
- AX™ Coating Technology
- Diameter Tolerance $+0 / -.0008"$
- Increased Shank Diameters for Maximum Rigidity
- Long Reach Reduced Neck Design
- Variable Helix

2 TITAN-AX Benefits

- Smoother Cutting with Better Chip Evacuation
- Corner Radii Programmable for 3D Surfacing
- Better Life and Finishes
- Consistent Part Size and Surface Finish
- Better Clamping Rigidity and T.I.R
- Clearance for Deeper Pocketing Applications
- Ideal for Trochoidal Milling Parts

AX™ Performance Coating Technology Extends Tool Life

3 Rigid Shank Diameter Construction



1/4" Diameter shank construction minimizes tool deflection compared to similar cutting diameter on 1/8" shanks. This reduction in deflection from the point of cutting to the collet is due to increased mass. Less deflection means better part consistency, reduced tool breakage, and improved tool life.

Case Study

Guide Rail HRC58-60 Alloy Steel

$V_c = 50$ m/min
 $V_f = 0.04$ mm/rev
D.O.C. = 2.15mm
 $\varnothing 2.00$ mm
Dry (Air)
T0787O118 (3-Flute Stub Length Square End Mill)

Tool Life

TITAN-AX
 $\varnothing 2.00$ mm

25-30 pcs

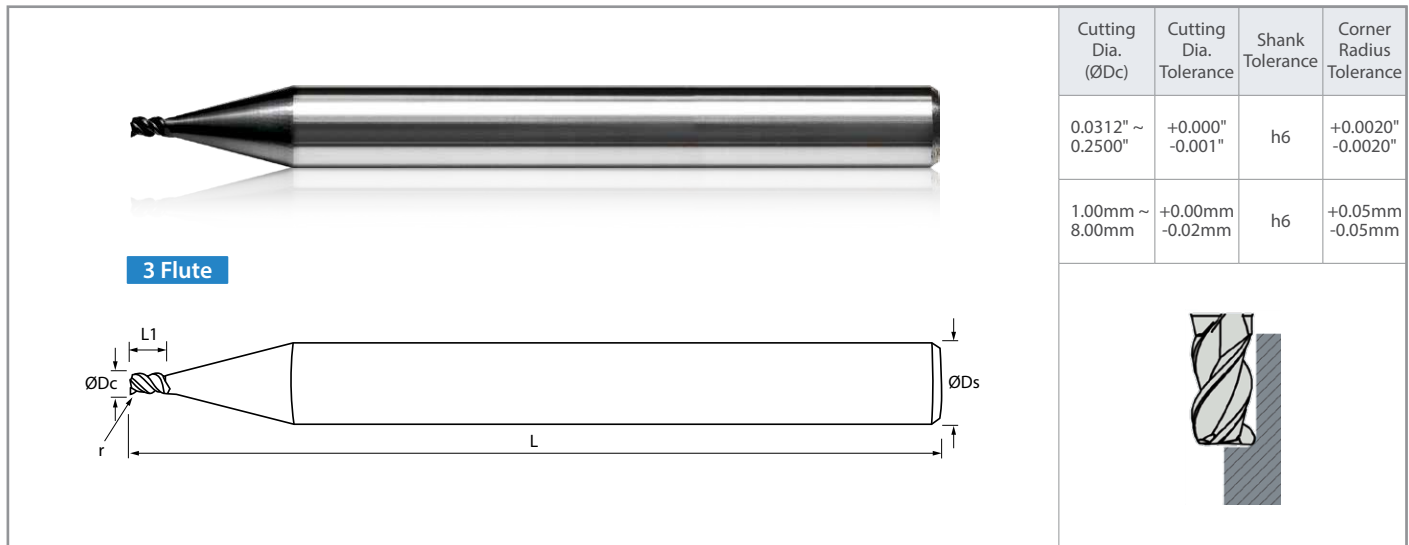
Competitor A
 $\varnothing 2.00$ mm

12-16 pcs

Tool Life
2x

The TITAN-AX doubled the tool life of Competitor A.
Length of slot machined was 82mm.

(User Evaluation)



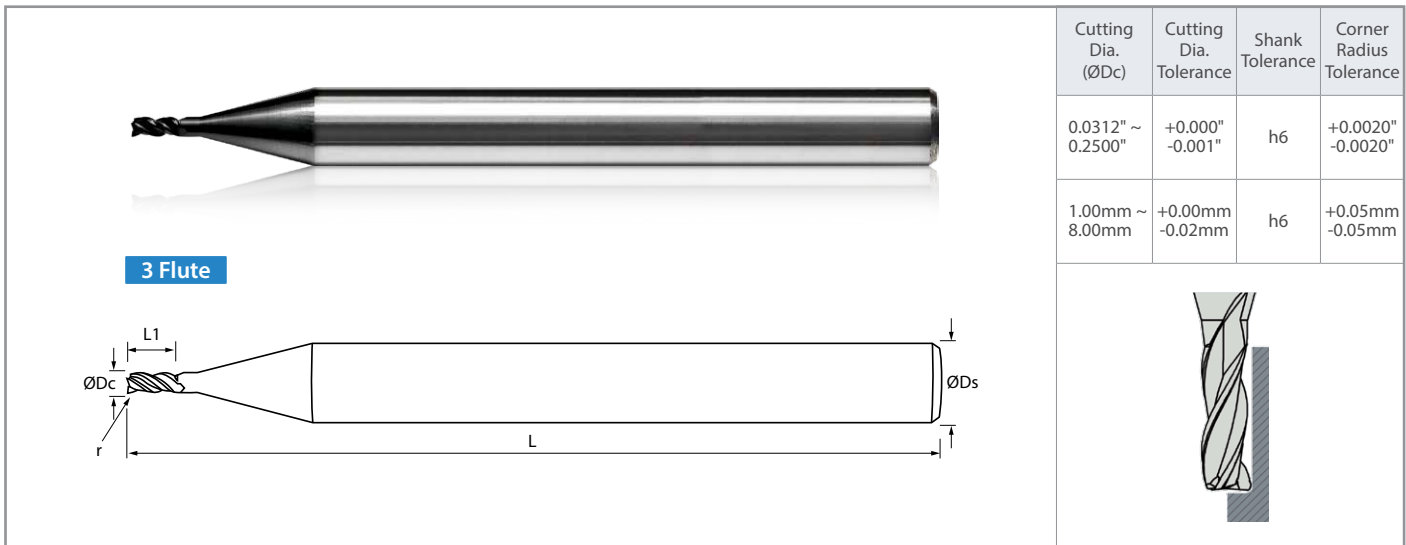
Inch Size Dimensions

Part Number	Stock	Dimensions (in)				
		ØDc	ØDs	L	L1	r
T0312O063CR	●	0.0312 (1/32)	1/4	2 1/2	0.063	0.006
T0469O094CR	●	0.0469 (3/64)			0.094	0.010
T0625O140CR	●	0.0625 (1/16)			0.140	0.010
T0781O140CR	●	0.0781 (5/64)			0.140	0.010
T0938O188CR	●	0.0938 (3/32)			0.188	0.010
T1094O188CR	●	0.1094 (7/64)			0.188	0.010
T1250O250CR	●	0.1250 (1/8)			0.250	0.015
T1562O375CR	●	0.1562 (5/32)			0.375	0.015
T1875O375CR	●	0.1875 (3/16)			0.375	0.015
T2188O375CR	●	0.2188 (7/32)			0.375	0.015
T2500O500CR	●	0.2500 (1/4)			0.500	0.015

Metric Size Dimensions

Part Number	Stock	Dimensions (mm)				
		ØDc	ØDs	L	L1	r
T0394O059CR1	●	1.00	6	63.5	1.5	0.10
T0394O059CR2	●	1.00			1.5	0.20
T0394O059CR3	●	1.00			1.5	0.30
T0591O098CR1	●	1.50			2.5	0.10
T0591O098CR2	●	1.50			2.5	0.20
T0591O098CR3	●	1.50			2.5	0.30
T0591O098CR4	●	1.50			2.5	0.50
T0787O118CR1	●	2.00			3.0	0.20
T0787O118CR2	●	2.00			3.0	0.30
T0787O118CR3	●	2.00			3.0	0.50
T0984O157CR1	●	2.50			4.0	0.20
T0984O157CR2	●	2.50			4.0	0.30
T0984O157CR3	●	2.50			4.0	0.50
T1181O197CR1	●	3.00			5.0	0.20
T1181O197CR2	●	3.00			5.0	0.30
T1181O197CR3	●	3.00			5.0	0.50
T1181O197CR4	●	3.00			5.0	1.00
T1575O236CR1	●	4.00			6.0	0.20
T1575O236CR2	●	4.00			6.0	0.30
T1575O236CR3	●	4.00			6.0	0.50
T1575O236CR4	●	4.00			6.0	1.00
T1969O315CR1	●	5.00			8.0	0.20
T1969O315CR2	●	5.00			8.0	0.30
T1969O315CR3	●	5.00			8.0	0.50
T1969O315CR4	●	5.00			8.0	1.00
T1969O315CR5	●	5.00			8.0	1.50
T2362O354CR1	●	6.00			9.0	0.20
T2362O354CR2	●	6.00			9.0	0.30
T2362O354CR3	●	6.00			9.0	0.50
T2362O354CR4	●	6.00			9.0	1.00
T2362O354CR5	●	6.00			9.0	1.50
T2362O354CR6	●	6.00			9.0	2.00
T3150O472CR1	●	8.00	8	63.5	12.0	0.20
T3150O472CR2	●	8.00			12.0	0.30
T3150O472CR3	●	8.00			12.0	0.50
T3150O472CR4	●	8.00			12.0	1.00
T3150O472CR5	●	8.00			12.0	1.50
T3150O472CR6	●	8.00			12.0	2.00

● : U.S. Stock



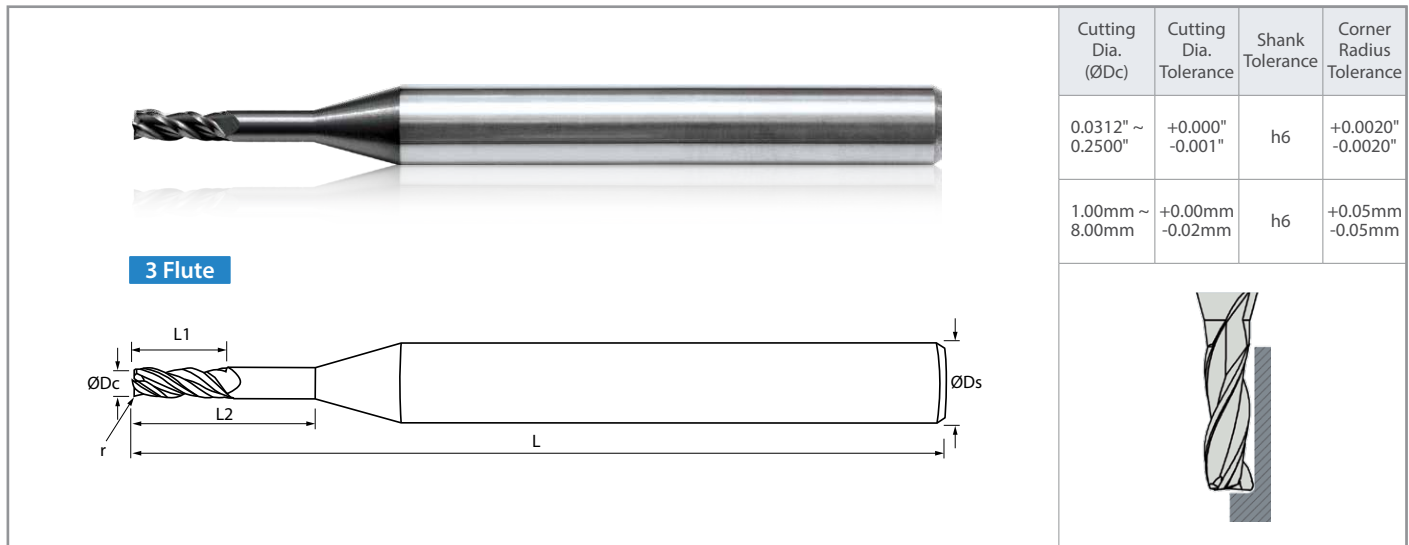
Inch Size Dimensions

Part Number	Stock	Dimensions (in)				
		ØDc	ØDs	L	L1	r
T0312O094CR	●	0.0312 (1/32)	1/4	2 1/2	0.094	0.006
T0469O141CR	●	0.0469 (3/64)			0.141	0.010
T0625O188CR	●	0.0625 (1/16)			0.188	0.010
T0781O234CR	●	0.0781 (5/64)			0.234	0.010
T0938O375CR	●	0.0938 (3/32)			0.375	0.010
T1094O438CR	●	0.1094 (7/64)			0.438	0.010
T1250O500CR	●	0.1250 (1/8)			0.500	0.015
T1562O563CR	●	0.1562 (5/32)			0.563	0.015
T1875O625CR	●	0.1875 (3/16)			0.625	0.015
T2188O625CR	●	0.2188 (7/32)			0.625	0.015
T2500O750CR	●	0.2500 (1/4)			0.750	0.015

Metric Size Dimensions

Part Number	Stock	Dimensions (mm)				
		ØDc	ØDs	L	L1	r
T0394O118CR1	●	1.00	6	63.5	3.0	0.10
T0394O118CR2	●	1.00			3.0	0.20
T0394O118CR3	●	1.00			3.0	0.30
T0591O177CR1	●	1.50			4.5	0.10
T0591O177CR2	●	1.50			4.5	0.20
T0591O177CR3	●	1.50			4.5	0.30
T0591O177CR4	●	1.50			4.5	0.50
T0787O236CR1	●	2.00			6.0	0.20
T0787O236CR2	●	2.00			6.0	0.30
T0787O236CR3	●	2.00			6.0	0.50
T0984O295CR1	●	2.50			7.5	0.20
T0984O295CR2	●	2.50			7.5	0.30
T0984O295CR3	●	2.50			7.5	0.50
T1181O354CR1	●	3.00			9.0	0.20
T1181O354CR2	●	3.00			9.0	0.30
T1181O354CR3	●	3.00			9.0	0.50
T1181O354CR4	●	3.00			9.0	1.00
T1575O472CR1	●	4.00			12.0	0.20
T1575O472CR2	●	4.00			12.0	0.30
T1575O472CR3	●	4.00			12.0	0.50
T1575O472CR4	●	4.00			12.0	1.00
T1969O591CR1	●	5.00			15.0	0.20
T1969O591CR2	●	5.00			15.0	0.30
T1969O591CR3	●	5.00			15.0	0.50
T1969O591CR4	●	5.00			15.0	1.00
T1969O591CR5	●	5.00			15.0	1.50
T2362O709CR1	●	6.00			18.0	0.20
T2362O709CR2	●	6.00			18.0	0.30
T2362O709CR3	●	6.00			18.0	0.50
T2362O709CR4	●	6.00			18.0	1.00
T2362O709CR5	●	6.00			18.0	1.50
T2362O709CR6	●	6.00			18.0	2.00
T3150O945CR1	●	8.00	8	63.5	24.0	0.20
T3150O945CR2	●	8.00			24.0	0.30
T3150O945CR3	●	8.00			24.0	0.50
T3150O945CR4	●	8.00			24.0	1.00
T3150O945CR5	●	8.00			24.0	1.50
T3150O945CR6	●	8.00			24.0	2.00

● : U.S. Stock



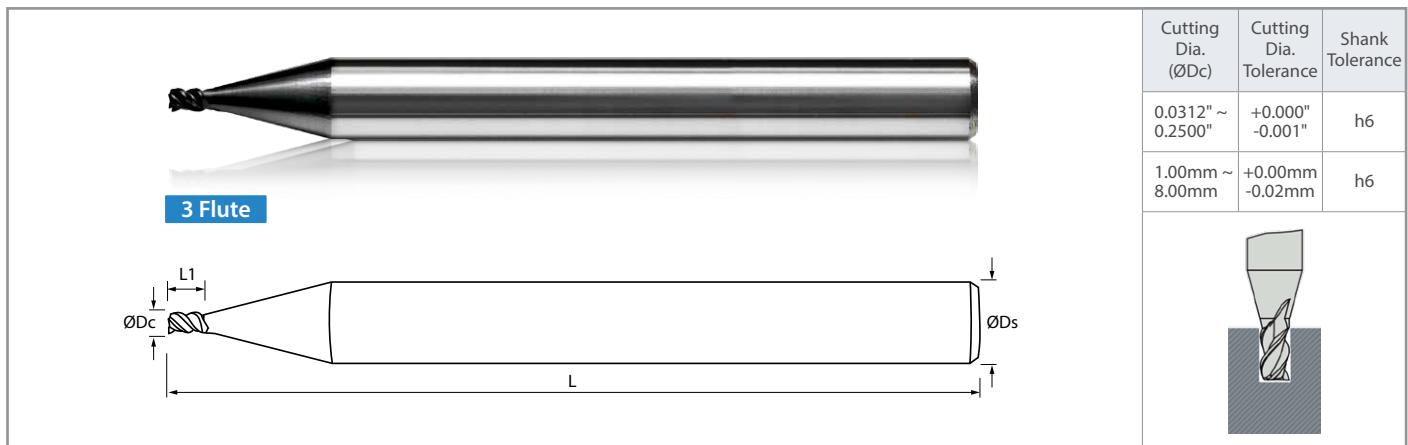
Inch Size Dimensions

Part Number	Stock	Dimensions (in)					
		ØDc	ØDs	L	L1	L2	r
T0312O094ERC	●	0.0312 (1/32)	1/4	2 1/2	0.094	0.155	0.006
T0469O141ERC	●	0.0469 (3/64)			0.141	0.230	0.010
T0625O188ERC	●	0.0625 (1/16)			0.188	0.312	0.010
T0781O234ERC	●	0.0781 (5/64)			0.234	0.390	0.010
T0938O375ERC	●	0.0938 (3/32)			0.375	0.465	0.010
T1094O438ERC	●	0.1094 (7/64)			0.438	0.545	0.010
T1250O500ERC	●	0.1250 (1/8)			0.500	0.625	0.015
T1562O563ERC	●	0.1562 (5/32)			0.563	0.781	0.015
T1875O625ERC	●	0.1875 (3/16)			0.625	0.938	0.015
T2188O625ERC	●	0.2188 (7/32)			0.625	1.093	0.015
T2500O750ERC	●	0.2500 (1/4)			0.750	1.250	0.015

Metric Size Dimensions

Part Number	Stock	Dimensions (mm)					
		ØDc	ØDs	L	L1	L2	r
T0394O118ECR1	●	1.00	6	75	3.0	10	0.10
T0394O118ECR2	●	1.00			3.0	10	0.20
T0394O118ECR3	●	1.00			3.0	10	0.30
T0591O177ECR1	●	1.50			4.5	15	0.10
T0591O177ECR2	●	1.50			4.5	15	0.20
T0591O177ECR3	●	1.50			4.5	15	0.30
T0591O177ECR4	●	1.50			4.5	15	0.50
T0787O236ECR1	●	2.00			6.0	20	0.20
T0787O236ECR2	●	2.00			6.0	20	0.30
T0787O236ECR3	●	2.00			6.0	20	0.50
T0984O295ECR1	●	2.50			7.5	25	0.20
T0984O295ECR2	●	2.50			7.5	25	0.30
T0984O295ECR3	●	2.50			7.5	25	0.50
T1181O354ECR1	●	3.00			9.0	30	0.20
T1181O354ECR2	●	3.00			9.0	30	0.30
T1181O354ECR3	●	3.00			9.0	30	0.50
T1181O354ECR4	●	3.00			9.0	30	1.00
T1575O472ECR1	●	4.00			12.0	30	0.20
T1575O472ECR2	●	4.00			12.0	30	0.30
T1575O472ECR3	●	4.00			12.0	30	0.50
T1575O472ECR4	●	4.00			12.0	30	1.00
T1969O591ECR1	●	5.00			15.0	40	0.20
T1969O591ECR2	●	5.00			15.0	40	0.30
T1969O591ECR3	●	5.00			15.0	40	0.50
T1969O591ECR4	●	5.00			15.0	40	1.00
T1969O591ECR5	●	5.00			15.0	40	1.50
T2362O709ECR1	●	6.00			18.0	45	0.20
T2362O709ECR2	●	6.00			18.0	45	0.30
T2362O709ECR3	●	6.00			18.0	45	0.50
T2362O709ECR4	●	6.00			18.0	45	1.00
T2362O709ECR5	●	6.00			18.0	45	1.50
T2362O709ECR6	●	6.00			18.0	45	2.00
T3150O945ECR1	●	8.00	8	100	24.0	50	0.20
T3150O945ECR2	●	8.00			24.0	50	0.30
T3150O945ECR3	●	8.00			24.0	50	0.50
T3150O945ECR4	●	8.00			24.0	50	1.00
T3150O945ECR5	●	8.00			24.0	50	1.50
T3150O945ECR6	●	8.00			24.0	50	2.00

● : U.S. Stock

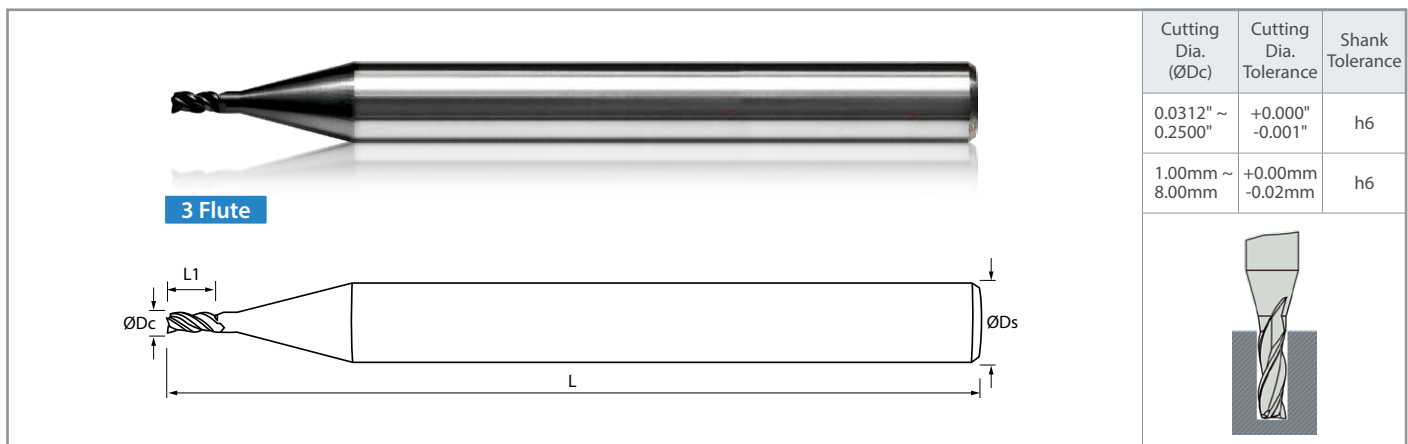


Inch Size Dimensions

Part Number	Stock	Dimensions (in)			
		ØDc	ØDs	L	L1
T0312O063	●	0.0312 (1/32)	1/4	2 1/2	0.063
T0469O094	●	0.0469 (3/64)			0.094
T0625O140	●	0.0625 (1/16)			0.140
T0781O140	●	0.0781 (5/64)			0.140
T0938O188	●	0.0938 (3/32)			0.188
T1094O188	●	0.1094 (7/64)			0.188
T1250O250	●	0.1250 (1/8)			0.250
T1562O375	●	0.1562 (5/32)			0.375
T1875O375	●	0.1875 (3/16)			0.375
T2188O375	●	0.2188 (7/32)			0.375
T2500O500	●	0.2500 (1/4)			0.500

Metric Size Dimensions

Part Number	Stock	Dimensions (mm)			
		ØDc	ØDs	L	L1
T0394O059	●	1.00	6	63.5	1.5
T0591O098	●	1.50			2.5
T0787O118	●	2.00			3.0
T0984O157	●	2.50			4.0
T1181O197	●	3.00			5.0
T1575O236	●	4.00			6.0
T1969O315	●	5.00			8.0
T2362O354	●	6.00			9.0
T3150O472	●	8.00			12.0



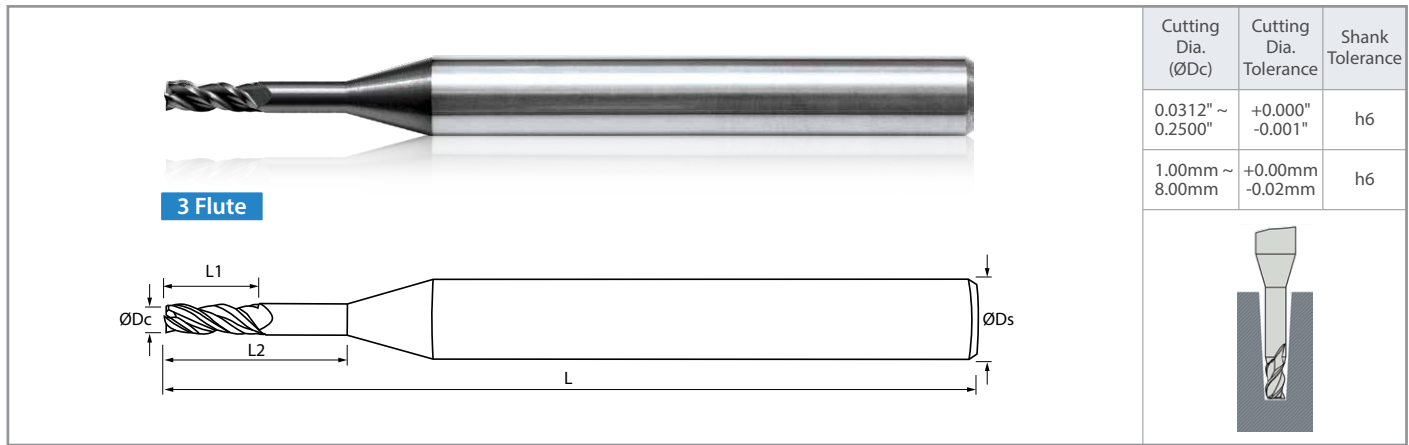
Inch Size Dimensions

Part Number	Stock	Dimensions (in)			
		ØDc	ØDs	L	L1
T0312O094	●	0.0312 (1/32)	1/4	2 1/2	0.094
T0469O141	●	0.0469 (3/64)			0.141
T0625O188	●	0.0625 (1/16)			0.188
T0781O234	●	0.0781 (5/64)			0.234
T0938O375	●	0.0938 (3/32)			0.375
T1094O438	●	0.1094 (7/64)			0.438
T1250O500	●	0.1250 (1/8)			0.500
T1562O563	●	0.1562 (5/32)			0.563
T1875O625	●	0.1875 (3/16)			0.625
T2188O625	●	0.2188 (7/32)			0.625
T2500O750	●	0.2500 (1/4)			0.750

Metric Size Dimensions

Part Number	Stock	Dimensions (mm)			
		ØDc	ØDs	L	L1
T0394O118	●	1.00	6	63.5	3.0
T0591O177	●	1.50			4.5
T0787O236	●	2.00			6.0
T0984O295	●	2.50			7.5
T1181O354	●	3.00			9.0
T1575O472	●	4.00			12.0
T1969O591	●	5.00			15.0
T2362O709	●	6.00			18.0
T3150O945	●	8.00			24.0

● : U.S. Stock



Inch Size Dimensions

Part Number	Stock	Dimensions (in)				
		ØDc	ØDs	L	L1	L2
T0312O063ER	●	0.0312 (1/32)	1/4	2 1/2	0.063	0.155
T0469O094ER	●	0.0469 (3/64)			0.094	0.230
T0625O140ER	●	0.0625 (1/16)			0.140	0.312
T0781O140ER	●	0.0781 (5/64)			0.140	0.390
T0938O188ER	●	0.0938 (3/32)			0.188	0.465
T1094O188ER	●	0.1094 (7/64)			0.188	0.545
T1250O250ER	●	0.1250 (1/8)			0.250	0.625
T1562O375ER	●	0.1562 (5/32)			0.375	0.781
T1875O375ER	●	0.1875 (3/16)			0.375	0.938
T2188O375ER	●	0.2188 (7/32)			0.375	1.093
T2500O500ER	●	0.2500 (1/4)			0.500	1.250

Metric Size Dimensions

Part Number	Stock	Dimensions (mm)				
		ØDc	ØDs	L	L1	L2
T0394O118ER	●	1.00	6	75	3.0	10
T0591O177ER	●	1.50			4.5	15
T0787O236ER	●	2.00			6.0	20
T0984O295ER	●	2.50			7.5	25
T1181O354ER	●	3.00			9.0	30
T1575O472ER	●	4.00			12.0	30
T1969O591ER	●	5.00			15.0	40
T2362O709ER	●	6.00			18.0	45
T3150O945ER	●	8.00			24.0	50

● : U.S. Stock

Recommended Cutting Conditions

Workpiece Material	Material Hardness/Types	AX Coated Recommended Cutting Speed (sfm)	Cutting Dia. ØD (in)	Cutting Dia. ØD (mm)	Application Feed Rate (ipt)		
					Roughing Ap = 1.0 (100%) x Ø Ae = 0.30 (30%) x Ø	Finishing Ap = 1.0 (100%) x Ø Ae = 0.10 (10%) x Ø	Slotting Ap = 0.5 (50%) x Ø Ae = 1.0 (100%) x Ø
Carbon Steel <30 HRc	12L14 A36 1018 1028 1050	425 - 525 - 625	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00019 - 0.00038	0.00023 - 0.00046	0.00013 - 0.00026
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00038 - 0.00057	0.00046 - 0.00069	0.00026 - 0.00039
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00057 - 0.00076	0.00069 - 0.00092	0.00039 - 0.00052
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00076 - 0.00095	0.00092 - 0.00115	0.00052 - 0.00065
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00095 - 0.00114	0.00115 - 0.00138	0.00065 - 0.00078
			Ø0.3125	Ø8.00	0.00148 - 0.00156	0.00180 - 0.00188	0.00100 - 0.00108
Alloy Steel 30 - 40 HRc	4130 4140 4150 8620	360 - 395 - 435	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00014 - 0.00028	0.00019 - 0.00038	0.00009 - 0.00018
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00028 - 0.00042	0.00038 - 0.00057	0.00018 - 0.00027
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00042 - 0.00056	0.00057 - 0.00076	0.00027 - 0.00036
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00056 - 0.00070	0.00076 - 0.00095	0.00036 - 0.00045
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00070 - 0.00084	0.00095 - 0.00114	0.00045 - 0.00054
			Ø0.3125	Ø8.00	0.00106 - 0.00118	0.00148 - 0.00156	0.00072 - 0.00080
Hardened Steel	48 HRc - 55HRc	225 - 250 - 275	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00010 - 0.00020	0.00015 - 0.00030	0.00008 - 0.00016
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00020 - 0.00030	0.00030 - 0.00045	0.00016 - 0.00024
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00030 - 0.00040	0.00045 - 0.00060	0.00024 - 0.00032
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00040 - 0.00050	0.00060 - 0.00075	0.00032 - 0.00040
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00050 - 0.00060	0.00075 - 0.00090	0.00040 - 0.00048
			Ø0.3125	Ø8.00	0.00076 - 0.00084	0.00116 - 0.00124	0.00060 - 0.00068
Tool Steel	56HRc - 68HRc	120 - 130 - 140	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00008 - 0.00016	0.00012 - 0.00024	0.00006 - 0.00012
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00016 - 0.00024	0.00024 - 0.00036	0.00012 - 0.00018
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00024 - 0.00032	0.00036 - 0.00048	0.00018 - 0.00024
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00032 - 0.00040	0.00048 - 0.00060	0.00024 - 0.00030
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00040 - 0.00048	0.00060 - 0.00072	0.00030 - 0.00036
			Ø0.3125	Ø8.00	0.00060 - 0.00068	0.00092 - 0.00100	0.00044 - 0.00052

** Above recommendations are suggested starting parameters. Cutting speeds and feeds may vary according to machining application, setup, and tool runout.

Recommended Cutting Conditions (Continued)

Workpiece Material	Material Hardness/Types	AX Coated Recommended Cutting Speed (sfm)	Cutting Dia. ØD (in)	Cutting Dia. ØD (mm)	Application Feed Rate (ipt)		
					Roughing Ap = 1.0 (100%) x Ø Ae = 0.30 (30%) x Ø	Finishing Ap = 1.0 (100%) x Ø Ae = 0.10 (10%) x Ø	Slotting Ap = 0.5 (50%) x Ø Ae = 1.0 (100%) x Ø
Stainless Steel	303 304 316 321	245 - 275 - 305	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00014 - 0.00028	0.00019 - 0.00038	0.00009 - 0.00018
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00028 - 0.00042	0.00038 - 0.00057	0.00018 - 0.00027
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00042 - 0.00056	0.00057 - 0.00076	0.00027 - 0.00036
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00056 - 0.00070	0.00076 - 0.00095	0.00036 - 0.00045
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00070 - 0.00084	0.00095 - 0.00114	0.00045 - 0.00054
			Ø0.3125	Ø8.00	0.00106 - 0.00118	0.00148 - 0.00156	0.00072 - 0.00080
Stainless Steel	15-5PH 17-4PH 13-8 400 Series	175 - 200 - 225	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00013 - 0.00026	0.00018 - 0.00036	0.00008 - 0.00016
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00026 - 0.00039	0.00036 - 0.00054	0.00016 - 0.00024
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00039 - 0.00052	0.00054 - 0.00072	0.00024 - 0.00032
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00052 - 0.00065	0.00072 - 0.00090	0.00032 - 0.00040
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00065 - 0.00078	0.00090 - 0.00108	0.00040 - 0.00048
			Ø0.3125	Ø8.00	0.00100 - 0.00108	0.00140 - 0.00148	0.00060 - 0.00068
Cast Iron	-	450 - 550 - 650	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00019 - 0.00038	0.00023 - 0.00046	0.00013 - 0.00026
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00038 - 0.00057	0.00046 - 0.00069	0.00026 - 0.00039
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00057 - 0.00076	0.00069 - 0.00092	0.00039 - 0.00052
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00076 - 0.00095	0.00092 - 0.00115	0.00052 - 0.00065
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00095 - 0.00114	0.00115 - 0.00138	0.00065 - 0.00078
			Ø0.3125	Ø8.00	0.00148 - 0.00156	0.00180 - 0.00188	0.00100 - 0.00108
Copper Alloy	Bronze	470 - 500 - 530	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00019 - 0.00038	0.00023 - 0.00046	0.00013 - 0.00026
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00038 - 0.00057	0.00046 - 0.00069	0.00026 - 0.00039
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00057 - 0.00076	0.00069 - 0.00092	0.00039 - 0.00052
	Brass	395 - 435 - 475	Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00076 - 0.00095	0.00092 - 0.00115	0.00052 - 0.00065
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00095 - 0.00114	0.00115 - 0.00138	0.00065 - 0.00078
			Ø0.3125	Ø8.00	0.00148 - 0.00156	0.00180 - 0.00188	0.00100 - 0.00108
Heat-Resistant Alloy	Hastelloy Inconel Monel Promet Waspaloy	145 - 165 - 185	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00010 - 0.00020	0.00015 - 0.00030	0.00008 - 0.00016
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00020 - 0.00030	0.00030 - 0.00045	0.00016 - 0.00024
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00030 - 0.00040	0.00045 - 0.00060	0.00024 - 0.00032
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00040 - 0.00050	0.00060 - 0.00075	0.00032 - 0.00040
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00050 - 0.00060	0.00075 - 0.00090	0.00040 - 0.00048
			Ø0.3125	Ø8.00	0.00076 - 0.00084	0.00116 - 0.00124	0.00060 - 0.00068
Titanium Alloy	-	180 - 200 - 220	Ø0.0312 - Ø0.0781	Ø1.00 - Ø2.00	0.00010 - 0.00020	0.00015 - 0.00030	0.00008 - 0.00016
			Ø0.0781 - Ø0.1250	Ø2.00 - Ø3.00	0.00020 - 0.00030	0.00030 - 0.00045	0.00016 - 0.00024
			Ø0.1250 - Ø0.1562	Ø3.00 - Ø4.00	0.00030 - 0.00040	0.00045 - 0.00060	0.00024 - 0.00032
			Ø0.1562 - Ø0.1967	Ø4.00 - Ø5.00	0.00040 - 0.00050	0.00060 - 0.00075	0.00032 - 0.00040
			Ø0.1967 - Ø0.2500	Ø5.00 - Ø6.00	0.00050 - 0.00060	0.00075 - 0.00090	0.00040 - 0.00048
			Ø0.3125	Ø8.00	0.00076 - 0.00084	0.00116 - 0.00124	0.00060 - 0.00068

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