

# **Award**<sup>CNC</sup>

**TAPERED END MILLS**

***SUPER SOLID***

***SUB-MICROGRAIN CARBIDE***

***OVER 600 STOCKED STANDARD SIZES***



**Award Cutter Company, Inc. 5577 Crippen Ave. S.W. Grand Rapids, MI 49548**

**Phone: (616) 531-0430/ (616) 531-0431/(616) 532-9985**

**Fax: (616) 531-3240 Toll Free Fax: 888-531-3240**

**Toll Free Phone: 888-531-0430**

**Email: [Awdcutter@aol.com](mailto:Awdcutter@aol.com)**





# **AWARD**

## **Table of Contents**

**Calculating Ball End Diameters..... Pg. 9**

**Large Diameter Multipliers..... Pg. 9**

**Miniature Flat Ends Carbide..... Pg. 10**

**Standard Flat Ends Carbide..... Pg. 11-15**

**Miniature Ball Ends Carbide..... Pg. 16**

**Standard Ball Ends Carbide..... Pg. 17-21**

**Trouble Shooting Guide..... Pg. 22**

**Feeds & Speeds For Carbide..... Pg. 23-24**



**AWARD  
TAPERED  
END  
MILLS**



**THE AWARD CUTTER COMPANY  
WARRANTY AND LIMITATION  
OF LIABILITY**

The Award Cutter Company warrants each new product manufactured and sold by it or one of its authorized dealers only against defects in workmanship and/or materials under normal service, proper installation and use. This warranty is limited to repair or replacement of verified defective products and excludes and all implied warranty or merchantability and all risks and liability whatsoever resulting from any use of said products, including incidental and consequential damages. The provisions of this warranty and limitation of liability shall not be modified in any respect except by written document signed by an officer of The Award Cutter Company.

**IMPORTANT:** Cutting tools can shatter/break under improper or severe use. Wear safety equipment and particularly eye protection at all times in the vicinity of their use.

# Award

**ALL END MILLS ARE END CUTTING**

**ALL END MILLS ARE GUARANTEED**

**ALL TOOLS SUPER SOLID  
SUBMICROGRAIN CARBIDE**

**CONSTANT SPIRAL, FREE CUTTING  
LESS BREAKAGE**

**LONGER CUTTING LIFE**

**FINEST MATERIALS AVAILABLE**

**IMMEDIATE SHIPMENTS**

**ALL TOOLS MFG IN USA**

**OVER 600 SIZES AVAILABLE  
STANDARD FROM STOCK**

MANUFACTURERS OF TAPERED END MILLS • COMPLETE RESHARPENING SERVICE

*Award Cutter Company*

## **AWARD CUTTER COMPANY, INC. SINCE 1959**

Through the years, Award Cutter Company has been a trusted partner of major manufacturers and industrial tool distributors throughout the world in producing tapered end mills of the highest quality.

We have kept pace with industry's ever increasing demand for greater product reliability and complete technology.

Using the very latest technology in the manufacturing process, you can be assured that we are providing industry with a product that out-performs all others.

We wish to extend our sincere thanks to all of our customers, who have enabled us to grow and expand to the point we are today. Some of you have been loyal customers since our beginning in 1959, and for this, we are very grateful. You can be assured that we will continue to provide you with a quality product as well as very personalized service.

Again, we thank you.

Award Cutter Co., Inc.

## AWARD TAPERED END MILL DATA

### SIZES:

Standard sizes are available in a complete range all popular sizes, 1/2 degree through 45 degree in various flute lengths. All standard sizes are right hand cut, right hand spiral. The spiral is constant. Over 600 sizes available standard from stock.

### MATERIAL:

All tapered end mills are produced from a premium grade of super submicrograin carbide to give you the maximum hardness and toughness. This means longer cutting life with less breakage.

### GRINDING:

All flutes are hollow ground with double clearance angles. The flute face is also hollow ground and polished to assure free cutting actions with minimum of heat generation. All tools have end cutting teeth. Special grinding procedures and equipment assures a high degree on concentricity between shank and cutting flutes.

### TOLERANCES:

Taper angles constant to +/- .001 per inch of flute length.  
Tip diameter tolerances are held at +/- .002.  
Shank diameter tolerances are -.0002 to -.0005.



# AWARD TAPERED END MILL DATA

## Calculating Ball End Diameters

P/S Taper Angle	Ball End Multiplier
1/2 deg per side	0.99131
1 deg per side	0.98269
1-1/2 deg per side	0.97415
2 deg per side	0.96568
3 deg per side	0.94896
4 deg per side	0.93251
5 deg per side	0.91633
6 deg per side	0.90053
7 deg per side	0.88472
10 deg per side	0.83909
15 deg per side	0.76732
20 deg per side	0.70020
25 deg per side	0.63707
30 deg per side	0.57735
45 deg per side	0.41421



Formula for calculating a starting tip diameter on a flat end to achieve a specific tangent Ball Diameter:  
 $\text{Ball Diameter} \times \text{Multiplier} = \text{Starting Tip Diameter}$

## Large Diameter Multipliers



P/S Taper Angle	Large Diameter Multiplier
1/2 deg per side	0.01745
1 deg per side	0.03490
1-1/2 deg per side	0.05236
2 deg per side	0.06984
3 deg per side	0.10482
4 deg per side	0.13986
5 deg per side	0.17498
6 deg per side	0.21021
7 deg per side	0.24556
10 deg per side	0.35266
15 deg per side	0.53590
20 deg per side	0.72794
25 deg per side	0.93262
30 deg per side	1.15470
45 deg per side	2.00000

Formula for calculating large diameters:  
 $(\text{Large Diameter Multiplier} \times \text{Flute Length}) + \text{Tip Diameter} = \text{Large Diameter}$

# A

## MINIATURE CARBIDE Flat Ends

Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.	Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>1/2 DEG</b>	M0-0001-CB	1/32	1/4	1/8	2	0.03561	<b>2 DEG</b>	M2-0001-CB	1/32	1/4	1/8	2	0.04871
	M0-0002-CB	1/32	1/2	1/8	2	0.03998		M2-0002-CB	1/32	1/2	1/8	2	0.06617
	M0-0501-CB	3/64	1/4	1/8	2	0.05124		M2-0501-CB	3/64	1/4	1/8	2	0.06434
	M0-0502-CB	3/64	1/2	1/8	2	0.05560		M2-0502-CB	3/64	1/2	1/8	2	0.08180
	M0-002-CB	1/16	1/2	1/8	2	0.07123		M2-002-CB	1/16	1/2	1/8	2	0.09742
	M0-003-CB	1/16	3/4	1/8	2	0.07559		M2-003-CB	1/16	3/4	1/8	2	0.11488
	M0-004-CB	1/16	1	1/8	3	0.07995		M2-004-CB	1/16	1	3/16	3	0.13234
	M0-052-CB	5/64	1/2	1/8	2	0.08685		M2-052-CB	5/64	1/2	1/8	2	0.11305
	M0-053-CB	5/64	3/4	1/8	2	0.09121		M2-053-CB	5/64	3/4	3/16	2	0.13051
M0-054-CB	5/64	1	1/8	3	0.09558	M2-054-CB	5/64	1	3/16	3	0.14797		
<b>1 DEG</b>	M1-0001-CB	1/32	1/4	1/8	2	0.03998	<b>3 DEG</b>	M3-0001-CB	1/32	1/4	1/8	2	0.05746
	M1-0002-CB	1/32	1/2	1/8	2	0.04870		M3-0002-CB	1/32	1/2	1/8	2	0.08366
	M1-0501-CB	3/64	1/4	1/8	2	0.05560		M3-0501-CB	3/64	1/4	1/8	2	0.07308
	M1-0502-CB	3/64	1/2	1/8	2	0.06433		M3-0502-CB	3/64	1/2	1/8	2	0.09929
	M1-002-CB	1/16	1/2	1/8	2	0.07995		M3-002-CB	1/16	1/2	1/8	2	0.11491
	M1-003-CB	1/16	3/4	1/8	2	0.08868		M3-003-CB	1/16	3/4	3/16	2	0.14112
	M1-004-CB	1/16	1	1/8	3	0.09740		M3-004-CB	1/16	1	3/16	3	0.16732
	M1-052-CB	5/64	1/2	1/8	2	0.09558		M3-006-CB	1/16	1 1/2	1/4	3	0.21973
	M1-053-CB	5/64	3/4	1/8	2	0.10430		M3-052-CB	5/64	1/2	3/16	2	0.13054
M1-054-CB	5/64	1	1/8	3	0.11303	M3-053-CB	5/64	3/4	3/16	2	0.15674		
<b>1-1/2 DEG</b>	M15-0001-CB	1/32	1/4	1/8	2	0.04434	<b>5 DEG</b>	M5-0001-CB	1/32	1/4	1/8	2	0.07500
	M15-0002-CB	1/32	1/2	1/8	2	0.05743		M5-0002-CB	1/32	1/2	3/16	2	0.11874
	M15-0501-CB	3/64	1/4	1/8	2	0.05997		M5-0003-CB	1/32	3/4	3/16	2 1/2	0.16249
	M15-0502-CB	3/64	1/2	1/8	2	0.07306		M5-0501-CB	3/64	1/4	1/8	2	0.09062
	M15-002-CB	1/16	1/2	1/8	2	0.08868		M5-0502-CB	3/64	1/2	3/16	2	0.13437
	M15-003-CB	1/16	3/4	1/8	2	0.10177		M5-002-CB	1/16	1/2	1/4	2	0.14999
	M15-004-CB	1/16	1	3/16	3	0.11486		M5-003-CB	1/16	3/4	1/4	2 1/2	0.19374
	M15-052-CB	5/64	1/2	1/8	2	0.10431		M5-004-CB	1/16	1	1/4	3	0.23748
	M15-053-CB	5/64	3/4	1/8	2	0.11740		M5-006-CB	1/16	1 1/2	3/8	3	0.28123
M15-054-CB	5/64	1	3/16	3	0.13049	M5-052-CB	5/64	1/2	3/16	2	0.16562		
							M5-053-CB	5/64	3/4	1/4	2 1/2	0.20936	
							M5-054-CB	5/64	1	3/8	3	0.25311	

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAlN



• Four Flutes

# STANDARD CARBIDE

## Flat Ends



Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>1/2 DEG</b>	KK-102-CB	3/32	1/2	1/8	2	0.10248
	KK-103-CB	3/32	3/4	1/8	2	0.10684
	KK-105-CB	3/32	1 1/4	3/16	3	0.11556
	KK-201-CB	1/8	1/4	3/16	2	0.12936
	KK-2015-CB	1/8	3/8	3/16	2	0.13154
	KK-202-CB	1/8	1/2	3/16	2	0.13373
	KK-203-CB	1/8	3/4	3/16	2	0.13809
	KK-204-CB	1/8	1	3/16	3	0.14245
	KK-205-CB	1/8	1 1/4	3/16	3	0.14681
	KK-206-CB	1/8	1 1/2	3/16	3	0.15118
	KK-303-CB	3/16	3/4	1/4	2 1/2	0.20059
	KK-305-CB	3/16	1 1/4	1/4	3	0.20931
	KK-307-CB	3/16	1 3/4	1/4	3 1/2	0.21804
	KK-313-CB	3/16	3 1/4	3/8	5	0.24421
	KK-403-CB	1/4	3/4	3/8	2 1/2	0.26309
	KK-405-CB	1/4	1 1/4	3/8	3	0.27181
	KK-409-CB	1/4	2 1/4	3/8	4	0.28926
	KK-413-CB	1/4	3 1/4	3/8	5	0.30671
	KK-605-CB	3/8	1 1/4	1/2	3	0.39681
	KK-609-CB	3/8	2 1/4	1/2	4	0.41426
	KK-613-CB	3/8	3 1/4	1/2	5	0.43171
	KK-805-CB	1/2	1 1/4	9/16	3	0.52181
	KK-809-CB	1/2	2 1/4	9/16	4	0.53926
	KK-813-CB	1/2	3 1/4	5/8	6	0.55671
KK-1009-CB	5/8	2 1/4	3/4	5	0.66426	
KK-1013-CB	5/8	3 1/4	3/4	6	0.68171	
KK-1017-CB	5/8	4 1/4	3/4	7	0.69916	
KK-1209-CB	3/4	2 1/4	7/8	5	0.78926	
KK-1213-CB	3/4	3 1/4	7/8	6	0.80671	
KK-1217-CB	3/4	4 1/4	7/8	7	0.82416	
KK-1221-CB	3/4	5 1/4	7/8	8	0.84161	

Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>1 DEG</b>	K-102-CB	3/32	1/2	1/8	2	0.11120
	K-103-CB	3/32	3/4	3/16	2 1/2	0.11993
	K-104-CB	3/32	1	3/16	3	0.12865
	K-105-CB	3/32	1 1/4	3/16	3	0.13738
	K-106-CB	3/32	1 1/2	1/4	3 1/2	0.14610
	K-201-CB	1/8	1/4	3/16	2	0.13373
	K-2015-CB	1/8	3/8	3/16	2	0.13809
	K-202-CB	1/8	1/2	3/16	2	0.14245
	K-203-CB	1/8	3/4	1/4	2 1/2	0.15118
	K-204-CB	1/8	1	1/4	3	0.15990
	K-205-CB	1/8	1 1/4	1/4	3	0.16863
	K-206-CB	1/8	1 1/2	1/4	3	0.17735
	K-208-CB	1/8	2	1/4	4	0.19480
	K-303-CB	3/16	3/4	1/4	2 1/2	0.21368
	K-305-CB	3/16	1 1/4	1/4	3	0.23113
	K-307-CB	3/16	1 3/4	1/4	3 1/2	0.24858
	K-308-CB	3/16	2	5/16	4	0.25730
	K-309-CB	3/16	2 1/4	3/8	4	0.26603
	K-310-CB	3/16	2 1/2	3/8	5	0.27475
	K-313-CB	3/16	3 1/4	3/8	5	0.30093
	K-403-CB	1/4	3/4	3/8	2 1/2	0.27618
	K-405-CB	1/4	1 1/4	3/8	3	0.29363
	K-408-CB	1/4	2	3/8	4	0.31980
	K-409-CB	1/4	2 1/4	3/8	4	0.32853
K-413-CB	1/4	3 1/4	3/8	5	0.36343	
K-605-CB	3/8	1 1/4	1/2	3	0.41863	
K-609-CB	3/8	2 1/4	1/2	4	0.45353	
K-613-CB	3/8	3 1/4	1/2	6	0.48843	
K-803-CB	1/2	3/4	5/8	3	0.52618	
K-805-CB	1/2	1 1/4	9/16	4	0.54363	
K-809-CB	1/2	2 1/4	5/8	4	0.57853	
K-813-CB	1/2	3 1/4	5/8	5	0.61343	
K-1009-CB	5/8	2 1/4	3/4	4	0.70353	
K-1013-CB	5/8	3 1/4	3/4	5	0.73843	
K-1017-CB	5/8	4 1/4	7/8	7	0.77333	
K-1209-CB	3/4	2 1/4	7/8	5	0.82853	
K-1213-CB	3/4	3 1/4	7/8	6	0.86343	
K-1217-CB	3/4	4 1/4	1	7	0.89833	
K-1221-CB	3/4	5 1/4	1	8	0.93323	

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAlN



• Four Flutes

**A**

# STANDARD CARBIDE

## Flat Ends

Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
1-1/2	KX-102-CB	3/32	1/2	3/16	2	0.11993
	KX-103-CB	3/32	3/4	3/16	2 1/2	0.13302
	KX-104-CB	3/32	1	1/4	3	0.14611
	KX-105-CB	3/32	1 1/4	3/16	3	0.15920
	KX-106-CB	3/32	1 1/2	1/4	3	0.17229
	KX-154-CB	7/64	1	3/16	3	0.16136
	KX-202-CB	1/8	1/2	3/16	2 1/2	0.15118
	KX-203-CB	1/8	3/4	1/4	2 1/2	0.16427
	KX-204-CB	1/8	1	3/16	3	0.17736
	KX-205-CB	1/8	1 1/4	1/4	3	0.19045
	KX-206-CB	1/8	1 1/2	1/4	3	0.20354
	KX-208-CB	1/8	2	1/4	3 1/2	0.22972
	KX-209-CB	1/8	2 1/4	5/16	4	0.24281
	KX-212-CB	1/8	3	5/16	5	0.28208
	KX-253-CB	5/32	3/4	1/4	2 1/2	0.19552
	KX-254-CB	5/32	1	1/4	3	0.20861
	KX-255-CB	5/32	1 1/4	1/4	3	0.22170
	KX-256-CB	5/32	1 1/2	1/4	3	0.23479
	KX-258-CB	5/32	2	5/16	4	0.26097
	KX-303-CB	3/16	3/4	3/8	2 1/2	0.22677
	KX-304-CB	3/16	1	1/4	3	0.23986
	KX-305-CB	3/16	1 1/4	3/8	3	0.25295
	KX-307-CB	3/16	1 3/4	3/8	3 1/2	0.27913
	KX-309-CB	3/16	2 1/4	3/8	4	0.30531
	KX-313-CB	3/16	3 1/4	3/8	5	0.35767
	KX-403-CB	1/4	3/4	3/8	2 1/2	0.28927
	KX-405-CB	1/4	1 1/4	3/8	3	0.31545
	KX-406-CB	1/4	1 1/2	3/8	3 1/2	0.32854
	KX-409-CB	1/4	2 1/4	3/8	4	0.36781
	KX-413-CB	1/4	3 1/4	1/2	5	0.42017
	KX-605-CB	3/8	1 1/4	1/2	3	0.44045
	KX-609-CB	3/8	2 1/4	1/2	4	0.49281
	KX-613-CB	3/8	3 1/4	9/16	5	0.54517
	KX-805-CB	1/2	1 1/4	5/8	3 1/2	0.56545
	KX-806-CB	1/2	1 1/2	5/8	3 1/2	0.52618
	KX-809-CB	1/2	2 1/4	5/8	4	0.61781
	KX-813-CB	1/2	3 1/4	3/4	5	0.67017
	KX-1009-CB	5/8	2 1/4	3/4	4	0.74281
	KX-1013-CB	5/8	3 1/4	7/8	6	0.79517
	KX-1017-CB	5/8	4 1/4	7/8	7	0.84753
	KX-1209-CB	3/4	2 1/4	7/8	4	0.86781
	KX-1213-CB	3/4	3 1/4	1	6	0.92017

Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
2 DEG	L-102-CB	3/32	1/2	3/16	2	0.12867
	L-103-CB	3/32	3/4	1/4	2 1/2	0.14613
	L-104-CB	3/32	1	1/4	3	0.16359
	L-105-CB	3/32	1 1/4	1/4	3	0.18105
	L-202-CB	1/8	1/2	3/16	2	0.15992
	L-203-CB	1/8	3/4	1/4	2 1/2	0.17738
	L-204-CB	1/8	1	1/4	2 1/2	0.19484
	L-205-CB	1/8	1 1/4	1/4	3	0.21230
	L-206-CB	1/8	1 1/2	1/4	3	0.22976
	L-208-CB	1/8	2	5/16	3 1/2	0.26468
	L-210-CB	1/8	2 1/2	5/16	4	0.29960
	L-303-CB	3/16	3/4	1/4	2 1/2	0.23988
	L-305-CB	3/16	1 1/4	3/8	3	0.27480
	L-307-CB	3/16	1 3/4	3/8	3 1/2	0.30972
	L-309-CB	3/16	2 1/4	1/2	4	0.34464
	L-313-CB	3/16	3 1/4	1/2	5	0.41448
	L-403-CB	1/4	3/4	3/8	2 1/2	0.30238
	L-405-CB	1/4	1 1/4	3/8	3	0.33730
	L-408-CB	1/4	2	1/2	4	0.38968
	L-409-CB	1/4	2 1/4	1/2	4	0.40714
	L-413-CB	1/4	3 1/4	1/2	5	0.47698
	L-605-CB	3/8	1 1/4	1/2	3 1/2	0.46230
	L-609-CB	3/8	2 1/4	9/16	4	0.53214
	L-613-CB	3/8	3 1/4	5/8	5	0.60198
	L-805-CB	1/2	1 1/4	5/8	3 1/2	0.58730
	L-809-CB	1/2	2 1/4	3/4	4	0.65714
	L-813-CB	1/2	3 1/4	3/4	5	0.72698
	L-1009-CB	5/8	2 1/4	7/8	5	0.78214
	L-1013-CB	5/8	3 1/4	7/8	6	0.85198
	L-1017-CB	5/8	4 1/4	1	7	0.92182
	L-1209-CB	3/4	2 1/4	1	5	0.90714
	L-1213-CB	3/4	3 1/4	1	6	0.97698

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAlN



• Four Flutes

# STANDARD CARBIDE

## Flat Ends



Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>3 DEG</b>	M-103-CB	3/32	3/4	3/16	2	0.17237
	M-104-CB	3/32	1	1/4	3	0.19857
	M-105-CB	3/32	1 1/4	1/4	3	0.22478
	M-106-CB	3/32	1 1/2	1/4	3	0.25098
	M-107-CB	3/32	1 3/4	3/8	3 1/2	0.27719
	M-108-CB	3/32	2	5/16	4	0.30339
	M-110-CB	3/32	2 1/2	3/8	4	0.35580
	M-154-CB	7/64	1	1/4	3	0.21382
	M-155-CB	7/64	1 1/4	1/4	3	0.24003
	M-156-CB	7/64	1 1/2	5/16	3	0.26623
	M-158-CB	7/64	2	3/8	4	0.31864
	M-203-CB	1/8	3/4	1/4	2 1/2	0.20362
	M-204-CB	1/8	1	1/4	3	0.22982
	M-205-CB	1/8	1 1/4	3/8	3	0.25603
	M-206-CB	1/8	1 1/2	3/8	3 1/2	0.28223
	M-208-CB	1/8	2	3/8	4	0.33464
	M-209-CB	1/8	2 1/4	3/8	4	0.36085
	M-210-CB	1/8	2 1/2	7/16	4	0.38705
	M-212-CB	1/8	3	1/2	5	0.43946
	M-216-CB	1/8	4	9/16	6	0.54428
	M-253-CB	5/32	3/4	1/4	2 1/2	0.23487
	M-254-CB	5/32	1	3/8	3	0.26107
	M-255-CB	5/32	1 1/4	3/8	3	0.28728
	M-256-CB	5/32	1 1/2	3/8	3	0.31348
	M-257-CB	5/32	1 3/4	3/8	3 1/2	0.33969
	M-258-CB	5/32	2	3/8	4	0.36589
	M-303-CB	3/16	3/4	3/8	2 1/2	0.26612
	M-304-CB	3/16	1	3/8	3	0.29232
	M-305-CB	3/16	1 1/4	3/8	3	0.31853
	M-306-CB	3/16	1 1/2	3/8	3 1/2	0.34473
	M-310-CB	3/16	2 1/2	1/2	4	0.44955
	M-313-CB	3/16	3 1/4	9/16	5	0.52817
	M-316-CB	3/16	4	5/8	6	0.60678
	M-320-CB	3/16	5	3/4	7	0.71160
	M-403-CB	1/4	3/4	3/8	2 1/2	0.32862
	M-404-CB	1/4	1	3/8	3	0.35482
	M-405-CB	1/4	1 1/4	3/8	3	0.37500
	M-408-CB	1/4	2	1/2	4	0.45964
	M-409-CB	1/4	2 1/4	1/2	4	0.48585
	M-413-CB	1/4	3 1/4	5/8	5	0.59067
	M-416-CB	1/4	4	3/4	6	0.66928
	M-420-CB	1/4	5	7/8	7	0.77410

Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>3 DEG</b>	M-504-CB	5/16	1	1/2	3	0.41782
	M-507-CB	5/16	1 3/4	1/2	3 1/2	0.49644
	M-604-CB	3/8	1	1/2	3	0.47982
	M-605-CB	3/8	1 1/4	1/2	3	0.50000
	M-609-CB	3/8	2 1/4	5/8	4	0.61085
	M-613-CB	3/8	3 1/4	3/4	5	0.71567
	M-616-CB	3/8	4	7/8	6	0.79428
	M-620-CB	3/8	5	1	8	0.89910
	M-805-CB	1/2	1 1/4	3/4	4	0.63103
	M-809-CB	1/2	2 1/4	3/4	4	0.73585
	M-813-CB	1/2	3 1/4	7/8	6	0.84067
	M-816-CB	1/2	4	1	7	0.91928
	M-1009-CB	5/8	2 1/4	7/8	5	0.86085
	M-1013-CB	5/8	3 1/4	1	6	0.96567
	M-1209-CB	3/4	2 1/4	1	5	0.98585
	<b>4 DEG</b>	N-0004-CB	1/32	1	3/16	3
N-004-CB		1/16	1	1/4	3	0.20236
N-103-CB		3/32	3/4	1/4	2 1/2	0.19865
N-104-CB		3/32	1	1/4	3	0.23361
N-203-CB		1/8	3/4	1/4	2 1/2	0.22990
N-204-CB		1/8	1	3/8	2 1/2	0.26486
N-206-CB		1/8	1 1/2	3/8	3 1/2	0.33479
N-208-CB		1/8	2	1/2	4	0.40472
N-210-CB		1/8	2 1/2	1/2	5	0.47465
N-303-CB		3/16	3/4	3/8	2 1/2	0.29240
N-305-CB		3/16	1 1/4	3/8	3	0.36233
N-313-CB		3/16	3 1/4	3/4	5	0.64205
N-316-CB		3/16	4	3/4	6	0.74694
N-403-CB		1/4	3/4	3/8	2 1/2	0.35490
N-405-CB		1/4	1 1/4	1/2	3 1/2	0.42483
N-409-CB		1/4	2 1/4	5/8	4	0.56469
N-413-CB	1/4	3 1/4	3/4	5	0.70455	
N-416-CB	1/4	4	7/8	7	0.80944	
N-605-CB	3/8	1 1/4	9/16	3	0.54983	
N-609-CB	3/8	2 1/4	3/4	4	0.68969	
N-613-CB	3/8	3 1/4	7/8	6	0.82955	
N-616-CB	3/8	4	1	7	0.93444	
N-805-CB	1/2	1 1/4	3/4	3 1/2	0.67483	
N-809-CB	1/2	2 1/4	7/8	5	0.81469	
N-813-CB	1/2	3 1/4	1	6	0.95455	

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

• Four Flutes

Other coatings are available including: TiCN and TiAlN

**A**

# STANDARD CARBIDE

## Flat Ends

Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>5 DEG</b>	O-102-CB	3/32	1/2	1/4	2 1/2	0.18124
	O-103-CB	3/32	3/4	1/4	2 1/2	0.22499
	O-104-CB	3/32	1	3/8	3	0.26873
	O-105-CB	3/32	1 1/4	3/8	3	0.31248
	O-106-CB	3/32	1 1/2	3/8	3 1/2	0.35622
	O-108-CB	3/32	2	1/2	4	0.44371
	O-155-CB	7/64	1 1/4	3/8	3	0.32773
	O-203-CB	1/8	3/4	1/4	2 1/2	0.25000
	O-204-CB	1/8	1	3/8	3	0.29998
	O-205-CB	1/8	1 1/4	3/8	3	0.34373
	O-206-CB	1/8	1 1/2	3/8	3 1/2	0.37500
	O-207-CB	1/8	1 3/4	1/2	4	0.43122
	O-208-CB	1/8	2	1/2	4	0.47496
	O-210-CB	1/8	2 1/2	5/8	5	0.56245
	O-212-CB	1/8	3	3/4	5	0.64994
	O-253-CB	5/32	3/4	3/8	2 1/2	0.28749
	O-254-CB	5/32	1	3/8	3	0.33123
	O-255-CB	5/32	1 1/4	3/8	3	0.37498
	O-256-CB	5/32	1 1/2	1/2	3 1/2	0.41872
	O-257-CB	5/32	1 3/4	1/2	4	0.46247
	O-258-CB	5/32	2	1/2	4	0.50000
	O-303-CB	3/16	3/4	3/8	2 1/2	0.31874
	O-304-CB	3/16	1	3/8	3	0.36248
	O-305-CB	3/16	1 1/4	1/2	3	0.40623
	O-306-CB	3/16	1 1/2	1/2	3 1/2	0.44997
	O-307-CB	3/16	1 3/4	1/2	3 1/2	0.49372
	O-308-CB	3/16	2	9/16	4	0.53746
	O-310-CB	3/16	2 1/2	5/8	4	0.62495
	O-312-CB	3/16	3	3/4	5	0.71244
	O-313-CB	3/16	3 1/4	7/8	6	0.75619
	O-316-CB	3/16	4	1	7	0.88742
	O-403-CB	1/4	3/4	1/2	3	0.38124
O-404-CB	1/4	1	1/2	3	0.42498	
O-405-CB	1/4	1 1/4	1/2	3	0.46873	
O-406-CB	1/4	1 1/2	1/2	3 1/2	0.51247	
O-407-CB	1/4	1 3/4	5/8	4	0.55622	
O-408-CB	1/4	2	5/8	4	0.59996	
O-409-CB	1/4	2 1/4	3/4	5	0.64371	
O-410-CB	1/4	2 1/2	3/4	5	0.68745	
O-413-CB	1/4	3 1/4	7/8	6	0.81869	
O-416-CB	1/4	4	1	7	0.94992	
O-504-CB	5/16	1	1/2	3	0.48798	
O-509-CB	5/16	2 1/4	3/4	5	0.70671	

Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>5 DEG</b>	O-604-CB	3/8	1	5/8	3 1/2	0.54998
	O-605-CB	3/8	1 1/4	5/8	4	0.59373
	O-609-CB	3/8	2 1/4	7/8	5	0.76871
	O-613-CB	3/8	3 1/4	1	6	0.94369
	O-805-CB	1/2	1 1/4	3/4	4	0.71873
	O-806-CB	1/2	1 1/2	7/8	4	0.76247
O-809-CB	1/2	2 1/4	1	5	0.89371	
<b>6 DEG</b>	P-004-CB	1/16	1	5/16	3	0.27271
	P-104-CB	3/32	1	5/16	3	0.30396
	P-204-CB	1/8	1	3/8	3	0.33521
<b>7 DEG</b>	R-0003-CB	1/32	3/4	1/4	2 1/2	0.21542
	R-0004-CB	1/32	1	3/8	3	0.27656
	R-001-CB	1/16	1/4	1/4	2	0.12389
	R-002-CB	1/16	1/2	1/4	2	0.18528
	R-003-CB	1/16	3/4	3/8	3	0.24667
	R-004-CB	1/16	1	3/8	3	0.30806
	R-054-CB	5/64	1	3/8	3	0.32356
	R-102-CB	3/32	1/2	1/4	2 1/2	0.21653
	R-104-CB	3/32	1	3/8	3	0.33931
	R-106-CB	3/32	1 1/2	1/2	3 1/2	0.46209
	R-202-CB	1/8	1/2	3/8	2 1/2	0.24778
	R-203-CB	1/8	3/4	3/8	2 1/2	0.30917
	R-204-CB	1/8	1	3/8	3	0.37056
	R-206-CB	1/8	1 1/2	1/2	3 1/2	0.49334
	R-208-CB	1/8	2	5/8	4	0.61612
	R-212-CB	1/8	3	7/8	5	0.86168
	R-253-CB	5/32	3/4	3/8	2 1/2	0.34042
	R-305-CB	3/16	1 1/4	1/2	3 1/2	0.49445
R-403-CB	1/4	3/4	1/2	3	0.43417	
R-404-CB	1/4	1	1/2	3	0.49556	
R-405-CB	1/4	1 1/4	5/8	3 1/2	0.55695	
R-409-CB	1/4	2 1/4	7/8	5	0.80251	
R-605-CB	3/8	1 1/4	3/4	4	0.68195	
R-609-CB	3/8	2 1/4	1	5	0.92751	
R-805-CB	1/2	1 1/4	7/8	4	0.80695	
R-808-CB	1/2	2	1	5	0.99112	

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAIN



• Four Flutes

# STANDARD CARBIDE

## Flat Ends



Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>10 DEG</b>	T-0002-CB	1/32	1/2	1/4	2 1/2	0.20758
	T-0003-CB	1/32	3/4	3/8	2 1/2	0.29575
	T-002-CB	1/16	1/2	3/8	2 1/2	0.23883
	T-003-CB	1/16	3/4	3/8	2 1/2	0.32700
	T-004-CB	1/16	1	1/2	3	0.41516
	T-005-CB	1/16	1 1/4	1/2	3 1/2	0.50333
	T-102-CB	3/32	1/2	3/8	2 1/2	0.27008
	T-102A-CB	3/32	1/2	1/4	2 1/2	0.27008
	T-103-CB	3/32	3/4	3/8	2 1/2	0.35825
	T-106-CB	3/32	1 1/2	5/8	3 1/2	0.62274
	T-203-CB	1/8	3/4	3/8	2 1/2	0.38950
	T-204-CB	1/8	1	1/2	3	0.47766
	T-205-CB	1/8	1 1/4	5/8	3	0.56583
	T-206-CB	1/8	1 1/2	3/4	3 1/2	0.65399
	T-254-CB	5/32	1	1/2	3	0.50000
	T-258-CB	5/32	2	7/8	4	0.86132
	T-303-CB	3/16	3/4	1/2	3	0.45199
	T-305-CB	3/16	1 1/4	5/8	3 1/2	0.62500
	T-309-CB	3/16	2 1/4	1	5	0.98099
	T-403-CB	1/4	3/4	5/8	3	0.51450
	T-404-CB	1/4	1	5/8	3	0.60266
	T-405-CB	1/4	1 1/4	3/4	3 1/2	0.69083
	T-408-CB	1/4	2	1	5	0.95532
	T-605-CB	3/8	1 1/4	7/8	3 1/2	0.81583
T-805-CB	1/2	1 1/4	1	3 1/2	0.94083	
<b>15 DEG</b>	V-0001-CB	1/32	1/4	1/4	2	0.16523
	V-0003-CB	1/32	3/4	1/2	2 1/2	0.43318
	V-001-CB	1/16	1/4	1/4	2	0.19648
	V-003-CB	1/16	3/4	1/2	2 1/2	0.46443
	V-101-CB	3/32	1/4	1/4	2	0.22773
	V-102-CB	3/32	1/2	3/8	2 1/2	0.36170
	V-103-CB	3/32	3/4	1/2	3	0.49568
	V-104-CB	3/32	1	3/4	3	0.62965
	V-106-CB	3/32	1 1/2	1	4	0.89760
	V-202-CB	1/8	1/2	1/2	3	0.39295
	V-203-CB	1/8	3/4	9/16	3	0.52693
	V-204-CB	1/8	1	3/4	3	0.66090
	V-206-CB	1/8	1 1/2	1	4	0.92885
	V-304-CB	3/16	1	3/4	3	0.72340
	V-304A-CB	3/16	1	1/2	3	0.72340
	V-305-CB	3/16	1 1/4	7/8	3 1/2	0.85738
	V-404-CB	1/4	1	3/4	3	0.78590
	V-404A-CB	1/4	1	1/2	3	0.78590
	V-405-CB	1/4	1 1/4	1	4	0.91988

Taper Per Side	Tool No.	Tip Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>15 DEG</b>	V-405A-CB	1/4	1 1/4	1/2	3 1/2	0.91988
	V-504-CB	5/16	1	7/8	3 1/2	0.84890
	V-606-CB	• 3/8	1 1/2	3/4	4	1.17885
	V-805-CB	• 1/2	1 1/4	3/4	3 1/2	1.16988
<b>20 DEG</b>	W-0001-CB	1/32	1/4	1/4	2	0.21324
	W-001-CB	1/16	1/4	1/4	2	0.24449
	W-002-CB	1/16	1/2	1/2	2 1/2	0.42647
	W-102-CB	3/32	1/2	1/2	2 1/2	0.45772
	W-103-CB	3/32	3/4	3/4	3	0.63971
	W-202-CB	1/8	1/2	1/2	2 1/2	0.48897
	W-204-CB	• 1/8	1	1/2	3 1/2	0.85294
	W-304-CB	• 3/16	1	1/2	3 1/2	0.91594
W-404-CB	• 1/4	1	1/2	3 1/2	0.97794	
<b>25 DEG</b>	X-001-CB	1/16	1/4	3/8	2 1/2	0.35118
	X-002-CB	1/16	1/2	3/8	2 1/2	0.63985
	X-101-CB	3/32	1/4	3/8	2 1/2	0.38268
	X-103-CB	3/32	3/4	1/2	3	0.79322
	X-201-CB	1/8	1/4	1/2	2 1/2	0.41368
	X-202-CB	• 1/8	1/2	1/2	2 1/2	0.70235
	X-204-CB	• 1/8	1	1/2	3	1.05762
	<b>30 DEG</b>	Z-001-CB	1/16	1/4	3/8	2 1/2
Z-002-CB		1/16	1/2	3/8	2 1/2	0.63985
Z-101-CB		3/32	1/4	3/8	2 1/2	0.38243
Z-103-CB		3/32	3/4	1/2	2 3/4	0.95978
Z-201-CB		1/8	1/4	1/2	2 1/2	0.41368
Z-202-CB		• 1/8	1/2	1/2	2 1/2	0.70235
Z-204-CB		• 1/8	1	1/2	3 1/8	1.27970
Z-404-CB		• 1/4	1	3/4	3	1.40470
<b>45 DEG</b>	45-2015-CB	• 1/8	5/16	1/2	2 1/2	0.75000
	45-202-CB	• 1/8	1/2	1/2	2 5/8	1.12500

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAlN



• Four Flutes



**A**

# MINIATURE CARBIDE

## Ball Ends

Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.	Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>1/2 DEG</b>	BM0-0001-CB	1/32	1/4	1/8	2	0.03561	<b>2 DEG</b>	BM2-0001-CB	1/32	1/4	1/8	2	0.04871
	BM0-0002-CB	1/32	1/2	1/8	2	0.03998		BM2-0002-CB	1/32	1/2	1/8	2	0.06617
	BM0-0501-CB	3/64	1/4	1/8	2	0.05124		BM2-0501-CB	3/64	1/4	1/8	2	0.06434
	BM0-0502-CB	3/64	1/2	1/8	2	0.05560		BM2-0502-CB	3/64	1/2	1/8	2	0.08180
	BM0-002-CB	1/16	1/2	1/8	2	0.07123		BM2-002-CB	1/16	1/2	1/8	2	0.09742
	BM0-003-CB	1/16	3/4	1/8	2	0.07559		BM2-003-CB	1/16	3/4	1/8	2	0.11488
	BM0-004-CB	1/16	1	1/8	3	0.07995		BM2-004-CB	1/16	1	3/16	3	0.13234
	BM0-052-CB	5/64	1/2	1/8	2	0.08685		BM2-052-CB	5/64	1/2	1/8	2	0.11305
	BM0-053-CB	5/64	3/4	1/8	2	0.09121		BM2-053-CB	5/64	3/4	3/16	2	0.13051
BM0-054-CB	5/64	1	1/8	3	0.09558	BM2-054-CB	5/64	1	3/16	3	0.14797		
<b>1 DEG</b>	BM1-0001-CB	1/32	1/4	1/8	2	0.03998	<b>3 DEG</b>	BM3-0001-CB	1/32	1/4	1/8	2	0.05746
	BM1-0002-CB	1/32	1/2	1/8	2	0.04870		BM3-0002-CB	1/32	1/2	1/8	2	0.08366
	BM1-0501-CB	3/64	1/4	1/8	2	0.05560		BM3-0501-CB	3/64	1/4	1/8	2	0.07308
	BM1-0502-CB	3/64	1/2	1/8	2	0.06433		BM3-0502-CB	3/64	1/2	1/8	2	0.09929
	BM1-002-CB	1/16	1/2	1/8	2	0.07995		BM3-002-CB	1/16	1/2	1/8	2	0.11491
	BM1-003-CB	1/16	3/4	1/8	2	0.08868		BM3-003-CB	1/16	3/4	3/16	2	0.14112
	BM1-004-CB	1/16	1	1/8	3	0.09740		BM3-004-CB	1/16	1	3/16	3	0.16732
	BM1-052-CB	5/64	1/2	1/8	2	0.09558		BM3-006-CB	1/16	1 1/2	1/4	3	0.21973
	BM1-053-CB	5/64	3/4	1/8	2	0.10430		BM3-052-CB	5/64	1/2	3/16	2	0.13054
BM1-054-CB	5/64	1	1/8	3	0.11303	BM3-053-CB	5/64	3/4	3/16	2	0.15674		
<b>1-1/2 DEG</b>	BM15-0001-CB	1/32	1/4	1/8	2	0.04434	<b>5 DEG</b>	BM5-0001-CB	1/32	1/4	1/8	2	0.07500
	BM15-0002-CB	1/32	1/2	1/8	2	0.05743		BM5-0002-CB	1/32	1/2	3/16	2	0.11874
	BM15-0501-CB	3/64	1/4	1/8	2	0.05997		BM5-0003-CB	1/32	3/4	3/16	2 1/2	0.16249
	BM15-0502-CB	3/64	1/2	1/8	2	0.07306		BM5-0501-CB	3/64	1/4	1/8	2	0.09062
	BM15-002-CB	1/16	1/2	1/8	2	0.08868		BM5-0502-CB	3/64	1/2	3/16	2	0.13437
	BM15-003-CB	1/16	3/4	1/8	2	0.10177		BM5-002-CB	1/16	1/2	1/4	2	0.14999
	BM15-004-CB	1/16	1	3/16	3	0.11486		BM5-003-CB	1/16	3/4	1/4	2 1/2	0.19374
	BM15-052-CB	5/64	1/2	1/8	2	0.10431		BM5-004-CB	1/16	1	1/4	3	0.23748
	BM15-053-CB	5/64	3/4	1/8	2	0.11740		BM5-006-CB	1/16	1 1/2	3/8	3	0.28123
BM15-054-CB	5/64	1	3/16	3	0.13049	BM5-052-CB	5/64	1/2	3/16	2	0.16562		
							BM5-053-CB	5/64	3/4	1/4	2 1/2	0.20936	
							BM5-054-CB	5/64	1	3/8	3	0.25311	

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAlN



• Four Flutes



# STANDARD CARBIDE

## Ball Ends



Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>1/2 DEG</b>	BKK-102-CB	3/32	1/2	1/8	2	0.10248
	BKK-103-CB	3/32	3/4	1/8	2	0.10684
	BKK-105-CB	3/32	1 1/4	3/16	3	0.11556
	BKK-201-CB	1/8	1/4	3/16	2	0.12936
	BKK-2015-CB	1/8	3/8	3/16	2	0.13154
	BKK-202-CB	1/8	1/2	3/16	2	0.13373
	BKK-203-CB	1/8	3/4	3/16	2	0.13809
	BKK-204-CB	1/8	1	3/16	3	0.14245
	BKK-205-CB	1/8	1 1/4	3/16	3	0.14681
	BKK-206-CB	1/8	1 1/2	3/16	3	0.15118
	BKK-303-CB	3/16	3/4	1/4	2 1/2	0.20059
	BKK-305-CB	3/16	1 1/4	1/4	3	0.20931
	BKK-307-CB	3/16	1 3/4	1/4	3 1/2	0.21804
	BKK-313-CB	3/16	3 1/4	3/8	5	0.24421
	BKK-403-CB	1/4	3/4	3/8	2 1/2	0.26309
	BKK-405-CB	1/4	1 1/4	3/8	3	0.27181
	BKK-409-CB	1/4	2 1/4	3/8	4	0.28926
	BKK-413-CB	1/4	3 1/4	3/8	5	0.30671
	BKK-605-CB	3/8	1 1/4	1/2	3	0.39681
	BKK-609-CB	3/8	2 1/4	1/2	4	0.41426
	BKK-613-CB	3/8	3 1/4	1/2	5	0.43171
	BKK-805-CB	1/2	1 1/4	9/16	3	0.52181
	BKK-809-CB	1/2	2 1/4	9/16	4	0.53926
	BKK-813-CB	1/2	3 1/4	5/8	6	0.55671
	BKK-1009-CB	5/8	2 1/4	3/4	5	0.66426
	BKK-1013-CB	5/8	3 1/4	3/4	6	0.68171
	BKK-1017-CB	5/8	4 1/4	3/4	7	0.69916
	BKK-1209-CB	3/4	2 1/4	7/8	5	0.78926
BKK-1213-CB	3/4	3 1/4	7/8	6	0.80671	
BKK-1217-CB	3/4	4 1/4	7/8	7	0.82416	
BKK-1221-CB	3/4	5 1/4	7/8	8	0.84161	

Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>1 DEG</b>	BK-102-CB	3/32	1/2	1/8	2	0.11120
	BK-103-CB	3/32	3/4	3/16	2 1/2	0.11993
	BK-104-CB	3/32	1	3/16	3	0.12865
	BK-105-CB	3/32	1 1/4	3/16	3	0.13738
	BK-106-CB	3/32	1 1/2	1/4	3 1/2	0.14610
	BK-201-CB	1/8	1/4	3/16	2	0.13373
	BK-2015-CB	1/8	3/8	3/16	2	0.13809
	BK-202-CB	1/8	1/2	3/16	2	0.14245
	BK-203-CB	1/8	3/4	1/4	2 1/2	0.15118
	BK-204-CB	1/8	1	1/4	3	0.15990
	BK-205-CB	1/8	1 1/4	1/4	3	0.16863
	BK-206-CB	1/8	1 1/2	1/4	3	0.17735
	BK-208-CB	1/8	2	1/4	4	0.19480
	BK-303-CB	3/16	3/4	1/4	2 1/2	0.21368
	BK-305-CB	3/16	1 1/4	1/4	3	0.23113
	BK-307-CB	3/16	1 3/4	1/4	3 1/2	0.24858
	BK-308-CB	3/16	2	5/16	4	0.25730
	BK-309-CB	3/16	2 1/4	3/8	4	0.26603
	BK-310-CB	3/16	2 1/2	3/8	5	0.27475
	BK-313-CB	3/16	3 1/4	3/8	5	0.30093
	BK-403-CB	1/4	3/4	3/8	2 1/2	0.27618
	BK-405-CB	1/4	1 1/4	3/8	3	0.29363
	BK-408-CB	1/4	2	3/8	4	0.31980
	BK-409-CB	1/4	2 1/4	3/8	4	0.32853
	BK-413-CB	1/4	3 1/4	3/8	5	0.36343
	BK-605-CB	3/8	1 1/4	1/2	3	0.41863
	BK-609-CB	3/8	2 1/4	1/2	4	0.45353
	BK-613-CB	3/8	3 1/4	1/2	6	0.48843
BK-803-CB	1/2	3/4	5/8	3	0.52618	
BK-805-CB	1/2	1 1/4	9/16	4	0.54363	
BK-809-CB	1/2	2 1/4	5/8	4	0.57853	
BK-813-CB	1/2	3 1/4	5/8	5	0.61343	
BK-1009-CB	5/8	2 1/4	3/4	4	0.70353	
BK-1013-CB	5/8	3 1/4	3/4	5	0.73843	
BK-1017-CB	5/8	4 1/4	7/8	7	0.77333	
BK-1209-CB	3/4	2 1/4	7/8	5	0.82853	
BK-1213-CB	3/4	3 1/4	7/8	6	0.86343	
BK-1217-CB	3/4	4 1/4	1	7	0.89833	
BK-1221-CB	3/4	5 1/4	1	8	0.93323	

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAlN



• Four Flutes

**A**

# STANDARD CARBIDE

## Ball Ends

Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>1-1/2 DEG</b>	BKX-102-CB	3/32	1/2	3/16	2	0.11993
	BKX-103-CB	3/32	3/4	3/16	2 1/2	0.13302
	BKX-104-CB	3/32	1	1/4	3	0.14611
	BKX-105-CB	3/32	1 1/4	3/16	3	0.15920
	BKX-106-CB	3/32	1 1/2	1/4	3	0.17229
	BKX-154-CB	7/64	1	3/16	3	0.16136
	BKX-202-CB	1/8	1/2	3/16	2 1/2	0.15118
	BKX-203-CB	1/8	3/4	1/4	2 1/2	0.16427
	BKX-204-CB	1/8	1	3/16	3	0.17736
	BKX-205-CB	1/8	1 1/4	1/4	3	0.19045
	BKX-206-CB	1/8	1 1/2	1/4	3	0.20354
	BKX-208-CB	1/8	2	1/4	3 1/2	0.22972
	BKX-209-CB	1/8	2 1/4	5/16	4	0.24281
	BKX-212-CB	1/8	3	5/16	5	0.28208
	BKX-253-CB	5/32	3/4	1/4	2 1/2	0.19552
	BKX-254-CB	5/32	1	1/4	3	0.20861
	BKX-255-CB	5/32	1 1/4	1/4	3	0.22170
	BKX-256-CB	5/32	1 1/2	1/4	3	0.23479
	BKX-258-CB	5/32	2	5/16	4	0.26097
	BKX-303-CB	3/16	3/4	3/8	2 1/2	0.22677
	BKX-304-CB	3/16	1	1/4	3	0.23986
	BKX-305-CB	3/16	1 1/4	3/8	3	0.25295
	BKX-307-CB	3/16	1 3/4	3/8	3 1/2	0.27913
	BKX-309-CB	3/16	2 1/4	3/8	4	0.30531
	BKX-313-CB	3/16	3 1/4	3/8	5	0.35767
	BKX-403-CB	1/4	3/4	3/8	2 1/2	0.28927
	BKX-405-CB	1/4	1 1/4	3/8	3	0.31545
	BKX-406-CB	1/4	1 1/2	3/8	3 1/2	0.32854
	BKX-409-CB	1/4	2 1/4	3/8	4	0.36781
	BKX-413-CB	1/4	3 1/4	1/2	5	0.42017
	BKX-605-CB	3/8	1 1/4	1/2	3	0.44045
	BKX-609-CB	3/8	2 1/4	1/2	4	0.49281
BKX-613-CB	3/8	3 1/4	9/16	5	0.54517	
BKX-805-CB	1/2	1 1/4	5/8	3 1/2	0.56545	
BKX-806-CB	1/2	1/2	5/8	3 1/2	0.52618	
BKX-809-CB	1/2	2 1/4	5/8	4	0.61781	
BKX-813-CB	1/2	3 1/4	3/4	5	0.67017	
BKX-1009-CB	5/8	2 1/4	3/4	4	0.74281	
BKX-1013-CB	5/8	3 1/4	7/8	6	0.79517	
BKX-1017-CB	5/8	4 1/4	7/8	7	0.84753	
BKX-1209-CB	3/4	2 1/4	7/8	4	0.86781	
BKX-1213-CB	3/4	3 1/4	1	6	0.92017	

Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>2 DEG</b>	BL-102-CB	3/32	1/2	3/16	2	0.12867
	BL-103-CB	3/32	3/4	1/4	2 1/2	0.14613
	BL-104-CB	3/32	1	1/4	3	0.16359
	BL-105-CB	3/32	1 1/4	1/4	3	0.18105
	BL-202-CB	1/8	1/2	3/16	2	0.15992
	BL-203-CB	1/8	3/4	1/4	2 1/2	0.17738
	BL-204-CB	1/8	1	1/4	2 1/2	0.19484
	BL-205-CB	1/8	1 1/4	1/4	3	0.21230
	BL-206-CB	1/8	1 1/2	1/4	3	0.22976
	BL-208-CB	1/8	2	5/16	3 1/2	0.26468
	BL-210-CB	1/8	2 1/2	5/16	4	0.29960
	BL-303-CB	3/16	3/4	1/4	2 1/2	0.23988
	BL-305-CB	3/16	1 1/4	3/8	3	0.27480
	BL-307-CB	3/16	1 3/4	3/8	3 1/2	0.30972
	BL-309-CB	3/16	2 1/4	1/2	4	0.34464
	BL-313-CB	3/16	3 1/4	1/2	5	0.41448
	BL-403-CB	1/4	3/4	3/8	2 1/2	0.30238
	BL-405-CB	1/4	1 1/4	3/8	3	0.33730
	BL-408-CB	1/4	2	1/2	4	0.38968
	BL-409-CB	1/4	2 1/4	1/2	4	0.40714
	BL-413-CB	1/4	3 1/4	1/2	5	0.47698
	BL-605-CB	3/8	1 1/4	1/2	3 1/2	0.46230
	BL-609-CB	3/8	2 1/4	9/16	4	0.53214
	BL-613-CB	3/8	3 1/4	5/8	5	0.60198
	BL-805-CB	1/2	1 1/4	5/8	3 1/2	0.58730
	BL-809-CB	1/2	2 1/4	3/4	4	0.65714
	BL-813-CB	1/2	3 1/4	3/4	5	0.72698
	BL-1009-CB	5/8	2 1/4	7/8	5	0.78214
	BL-1013-CB	5/8	3 1/4	7/8	6	0.85198
	BL-1017-CB	5/8	4 1/4	1	7	0.92182
	BL-1209-CB	3/4	2 1/4	1	5	0.90714
	BL-1213-CB	3/4	3 1/4	1	6	0.97698

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAlN



• Four Flutes

# STANDARD CARBIDE

## Ball Ends



Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>3 DEG</b>	BM-103-CB	3/32	3/4	3/16	2	0.17237
	BM-104-CB	3/32	1	1/4	3	0.19857
	BM-105-CB	3/32	1 1/4	1/4	3	0.22478
	BM-106-CB	3/32	1 1/2	1/4	3	0.25098
	BM-107-CB	3/32	1 3/4	3/8	3 1/2	0.27719
	BM-108-CB	3/32	2	5/16	4	0.30339
	BM-110-CB	3/32	2 1/2	3/8	4	0.35580
	BM-154-CB	7/64	1	1/4	3	0.21382
	BM-155-CB	7/64	1 1/4	1/4	3	0.24003
	BM-156-CB	7/64	1 1/2	5/16	3	0.26623
	BM-158-CB	7/64	2	3/8	4	0.31864
	BM-203-CB	1/8	3/4	1/4	2 1/2	0.20362
	BM-204-CB	1/8	1	1/4	3	0.22982
	BM-205-CB	1/8	1 1/4	3/8	3	0.25603
	BM-206-CB	1/8	1 1/2	3/8	3 1/2	0.28223
	BM-208-CB	1/8	2	3/8	4	0.33464
	BM-209-CB	1/8	2 1/4	3/8	4	0.36085
	BM-210-CB	1/8	2 1/2	7/16	4	0.38705
	BM-212-CB	1/8	3	1/2	5	0.43946
	BM-216-CB	1/8	4	9/16	6	0.54428
	BM-253-CB	5/32	3/4	1/4	2 1/2	0.23487
	BM-254-CB	5/32	1	3/8	3	0.26107
	BM-255-CB	5/32	1 1/4	1/4	3	0.28728
	BM-256-CB	5/32	1 1/2	5/16	3	0.31348
	BM-257-CB	5/32	1 3/4	3/8	3 1/2	0.33969
	BM-258-CB	5/32	2	3/8	4	0.36589
	BM-303-CB	3/16	3/4	3/8	2 1/2	0.26612
	BM-304-CB	3/16	1	3/8	3	0.29232
	BM-305-CB	3/16	1 1/4	3/8	3	0.31853
	BM-306-CB	3/16	1 1/2	3/8	3 1/2	0.34473
	BM-310-CB	3/16	2 1/2	1/2	4	0.44955
	BM-313-CB	3/16	3 1/4	9/16	5	0.52817
	BM-316-CB	3/16	4	5/8	6	0.60678
	BM-320-CB	3/16	5	3/4	7	0.71160
	BM-403-CB	1/4	3/4	3/8	2 1/2	0.32862
	BM-404-CB	1/4	1	3/8	3	0.35482
	BM-405-CB	1/4	1 1/4	3/8	3	0.37500
	BM-408-CB	1/4	2	1/2	4	0.45964
	BM-409-CB	1/4	2 1/4	1/2	4	0.48585
	BM-413-CB	1/4	3 1/4	5/8	5	0.59067
	BM-416-CB	1/4	4	3/4	6	0.66928
	BM-420-CB	1/4	5	7/8	7	0.77410

Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>3 DEG</b>	BM-504-CB	5/16	1	1/2	3	0.41782
	BM-507-CB	5/16	1 3/4	1/2	3 1/2	0.49644
	BM-604-CB	3/8	1	1/2	3	0.47982
	BM-605-CB	3/8	1 1/4	1/2	3	0.50000
	BM-609-CB	3/8	2 1/4	5/8	4	0.61085
	BM-613-CB	3/8	3 1/4	3/4	5	0.71567
	BM-616-CB	3/8	4	7/8	6	0.79428
	BM-620-CB	3/8	5	1	8	0.89910
	BM-805-CB	1/2	1 1/4	3/4	4	0.63103
	BM-809-CB	1/2	2 1/4	3/4	4	0.73585
	BM-813-CB	1/2	3 1/4	7/8	6	0.84067
	BM-816-CB	1/2	4	1	7	0.91928
	BM-1009-CB	5/8	2 1/4	7/8	5	0.86085
	BM-1013-CB	5/8	3 1/4	1	6	0.96567
	BM-1209-CB	3/4	2 1/4	1	5	0.98585
	<b>4 DEG</b>	BN-0004-CB	1/32	1	3/16	3
BN-004-CB		1/16	1	3/16	3	0.20236
BN-103-CB		3/32	3/4	1/4	2 1/2	0.19865
BN-104-CB		3/32	1	1/4	3	0.23361
BN-203-CB		1/8	3/4	1/4	2 1/2	0.22990
BN-204-CB		1/8	1	3/8	2 1/2	0.26486
BN-206-CB		1/8	1 1/2	1/2	3 1/2	0.33479
BN-208-CB		1/8	2	1/2	4	0.40472
BN-210-CB		1/8	2 1/2	1/2	5	0.47465
BN-303-CB		3/16	3/4	3/8	2 1/2	0.29240
BN-305-CB		3/16	1 1/4	3/8	3	0.36233
BN-313-CB		3/16	3 1/4	3/4	5	0.64205
BN-316-CB		3/16	4	3/4	6	0.74694
BN-403-CB		1/4	3/4	3/8	2 1/2	0.35490
BN-405-CB		1/4	1 1/4	1/2	3 1/2	0.42483
BN-409-CB		1/4	2 1/4	5/8	4	0.56469
BN-413-CB	1/4	3 1/4	3/4	5	0.70455	
BN-416-CB	1/4	4	7/8	7	0.80944	
BN-605-CB	3/8	1 1/4	9/16	3	0.54983	
BN-609-CB	3/8	2 1/4	3/4	4	0.68969	
BN-613-CB	3/8	3 1/4	7/8	6	0.82955	
BN-616-CB	3/8	4	1	7	0.93444	
BN-805-CB	1/4	1 1/4	3/4	3 1/2	0.67483	
BN-809-CB	1/4	2 1/4	7/8	5	0.81469	
BN-813-CB	1/4	3 1/4	1	6	0.95455	

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

• Four Flutes

Other coatings are available including: TiCN and TiAlN

**A**

# STANDARD CARBIDE

## Ball Ends

Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>5 DEG</b>	BO-102-CB	3/32	1/2	1/4	2 1/2	0.18124
	BO-103-CB	3/32	3/4	1/4	2 1/2	0.22499
	BO-104-CB	3/32	1	3/8	3	0.26873
	BO-105-CB	3/32	1 1/4	3/8	3	0.31248
	BO-106-CB	3/32	1 1/2	3/8	3 1/2	0.35622
	BO-108-CB	3/32	2	1/2	4	0.44371
	BO-155-CB	7/64	1 1/4	3/8	3	0.32773
	BO-203-CB	1/8	3/4	1/4	2 1/2	0.25000
	BO-204-CB	1/8	1	3/8	3	0.29998
	BO-205-CB	1/8	1 1/4	3/8	3	0.34373
	BO-206-CB	1/8	1 1/2	3/8	3 1/2	0.37500
	BO-207-CB	1/8	1 3/4	1/2	4	0.43122
	BO-208-CB	1/8	2	1/2	4	0.47496
	BO-210-CB	1/8	2 1/2	5/8	5	0.56245
	BO-212-CB	1/8	3	3/4	5	0.64994
	BO-253-CB	5/32	3/4	3/8	2 1/2	0.28749
	BO-254-CB	5/32	1	3/8	3	0.33123
	BO-255-CB	5/32	1 1/4	3/8	3	0.37498
	BO-256-CB	5/32	1 1/2	1/2	3 1/2	0.41872
	BO-257-CB	5/32	1 3/4	1/2	4	0.46247
	BO-258-CB	5/32	2	1/2	4	0.50000
	BO-303-CB	3/16	3/4	3/8	2 1/2	0.31874
	BO-304-CB	3/16	1	3/8	3	0.36248
	BO-305-CB	3/16	1 1/4	1/2	3	0.40623
	BO-306-CB	3/16	1 1/2	1/2	3 1/2	0.44997
	BO-307-CB	3/16	1 3/4	1/2	3 1/2	0.49372
	BO-308-CB	3/16	2	9/16	4	0.53746
	BO-310-CB	3/16	2 1/2	5/8	4	0.62495
	BO-312-CB	3/16	3	3/4	5	0.71244
	BO-313-CB	3/16	3 1/4	7/8	6	0.75619
	BO-316-CB	3/16	4	1	7	0.88742
	BO-403-CB	1/4	3/4	1/2	3	0.38124
BO-404-CB	1/4	1	1/2	3	0.42498	
BO-405-CB	1/4	1 1/4	1/2	3	0.46873	
BO-406-CB	1/4	1 1/2	1/2	3 1/2	0.51247	
BO-407-CB	1/4	1 3/4	5/8	4	0.55622	
BO-408-CB	1/4	2	5/8	4	0.59996	
BO-409-CB	1/4	2 1/4	3/4	5	0.64371	
BO-410-CB	1/4	2 1/2	3/4	5	0.68745	
BO-413-CB	1/4	3 1/4	7/8	6	0.81869	
BO-416-CB	1/4	4	1	7	0.94992	
BO-504-CB	5/16	1	1/2	3	0.48798	
BO-509-CB	5/16	2 1/4	3/4	5	0.70671	

Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.	
<b>5 DEG</b>	BO-604-CB	3/8	1	5/8	3 1/2	0.54998	
	BO-605-CB	3/8	1 1/4	5/8	4	0.59373	
	BO-609-CB	3/8	2 1/4	7/8	5	0.76871	
	BO-613-CB	3/8	3 1/4	1	6	0.94369	
	BO-805-CB	1/2	1 1/4	3/4	4	0.71873	
	BO-806-CB	1/2	1 1/2	7/8	4	0.76247	
	BO-809-CB	1/2	2 1/4	1	5	0.89371	
	<b>6 DEG</b>	BP-004-CB	1/16	1	5/16	3	0.27271
		BP-104-CB	3/32	1	5/16	3	0.30396
BP-204-CB		1/8	1	3/8	3	0.33521	
<b>7 DEG</b>	BR-0003-CB	1/32	3/4	1/4	2 1/2	0.21542	
	BR-0004-CB	1/32	1	3/8	3	0.27656	
	BR-001-CB	1/16	1/4	1/4	2	0.12389	
	BR-002-CB	1/16	1/2	1/4	2	0.18528	
	BR-003-CB	1/16	3/4	3/8	3	0.24667	
	BR-004-CB	1/16	1	3/8	3	0.30806	
	BR-054-CB	5/64	1	3/8	3	0.32356	
	BR-102-CB	3/32	1/2	1/4	2 1/2	0.21653	
	BR-104-CB	3/32	1	3/8	3	0.33931	
	BR-106-CB	3/32	1 1/2	1/2	3 1/2	0.46209	
	BR-202-CB	1/8	1/2	3/8	2 1/2	0.24778	
	BR-203-CB	1/8	3/4	3/8	2 1/2	0.30917	
	BR-204-CB	1/8	1	3/8	3	0.37056	
	BR-206-CB	1/8	1 1/2	1/2	3 1/2	0.49334	
	BR-208-CB	1/8	2	5/8	4	0.61612	
	BR-212-CB	1/8	3	7/8	5	0.86168	
	BR-253-CB	5/32	3/4	3/8	2 1/2	0.34042	
	BR-305-CB	3/16	1 1/4	1/2	3 1/2	0.49445	
	BR-403-CB	1/4	3/4	1/2	3	0.43417	
	BR-404-CB	1/4	1	1/2	3	0.49556	
BR-405-CB	1/4	1 1/4	5/8	3 1/2	0.55695		
BR-409-CB	1/4	2 1/4	7/8	5	0.80251		
BR-605-CB	3/8	1 1/4	3/4	4	0.68195		
BR-609-CB	3/8	2 1/4	1	5	0.92751		
BR-805-CB	1/2	1 1/4	7/8	4	0.80695		
BR-808-CB	1/2	2	1	5	0.99112		

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAIN

• Four Flutes



# STANDARD CARBIDE

## Ball Ends



Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.	Taper Per Side	Tool No.	Ball Dia.	Flt. Lgth	Shk Dia.	OAL	Large Dia.
<b>10 DEG</b>	BT-0002-CB	1/32	1/2	1/4	2 1/2	0.20758	<b>15 DEG</b>	BV-0001-CB	1/32	1/4	1/4	2	0.16523
	BT-0003-CB	1/32	3/4	3/8	2 1/2	0.29575		BV-0003-CB	1/32	3/4	1/2	2 1/2	0.43318
	BT-002-CB	1/16	1/2	3/8	2 1/2	0.23883		BV-001-CB	1/16	1/4	1/4	2	0.19648
	BT-003-CB	1/16	3/4	3/8	2 1/2	0.32700		BV-003-CB	1/16	3/4	1/2	2 1/2	0.46443
	BT-004-CB	1/16	1	1/2	3	0.41516		BV-101-CB	3/32	1/4	1/4	2	0.22773
	BT-005-CB	1/16	1 1/4	1/2	3 1/2	0.50333		BV-102-CB	3/32	1/2	3/8	2 1/2	0.36170
	BT-102-CB	3/32	1/2	3/8	2 1/2	0.27008		BV-103-CB	3/32	3/4	1/2	3	0.49568
	BT-102A-CB	3/32	1/2	1/4	2 1/2	0.27008		BV-104-CB	3/32	1	3/4	3	0.62965
	BT-103-CB	3/32	3/4	3/8	2 1/2	0.35825		BV-106-CB	3/32	1 1/2	1	4	0.89760
	BT-106-CB	3/32	1 1/2	5/8	3 1/2	0.62274		BV-202-CB	1/8	1/2	1/2	3	0.39295
	BT-203-CB	1/8	3/4	3/8	2 1/2	0.38950		BV-203-CB	1/8	3/4	9/16	3	0.52693
	BT-204-CB	1/8	1	1/2	3	0.47766		BV-204-CB	1/8	1	3/4	3	0.66090
	BT-205-CB	1/8	1 1/4	5/8	3	0.56583		BV-206-CB	1/8	1 1/2	1	4	0.92885
	BT-206-CB	1/8	1 1/2	3/4	3 1/2	0.65399		BV-304-CB	3/16	1	3/4	3	0.72340
	BT-254-CB	5/32	1	1/2	3	0.50000		BV-304A-CB	3/16	1	1/2	3	0.72340
	BT-258-CB	5/32	2	7/8	4	0.86132		BV-305-CB	3/16	1 1/4	7/8	3 1/2	0.85738
	BT-303-CB	3/16	3/4	1/2	3	0.45199		BV-404-CB	1/4	1	3/4	3	0.78590
	BT-305-CB	3/16	1 1/4	5/8	3 1/2	0.62500		BV-404A-CB	1/4	1	1/2	3	0.78590
	BT-309-CB	3/16	2 1/4	1	5	0.98099		BV-405-CB	1/4	1 1/4	1	4	0.91988
	BT-403-CB	1/4	3/4	5/8	3	0.51450							
BT-404-CB	1/4	1	5/8	3	0.60266								
BT-405-CB	1/4	1 1/4	3/4	3 1/2	0.69083								
BT-408-CB	1/4	2	1	5	0.95532								
BT-605-CB	3/8	1 1/4	7/8	3 1/2	0.81583								
BT-805-CB	1/2	1 1/4	1	3 1/2	0.94083								
<b>15 DEG</b>	BV-0001-CB	1/32	1/4	1/4	2	0.16523	<b>20 DEG</b>	BW-0001-CB	1/32	1/4	1/4	2	0.21324
	BV-0003-CB	1/32	3/4	1/2	2 1/2	0.43318		BW-001-CB	1/16	1/4	1/4	2	0.24449
	BV-001-CB	1/16	1/4	1/4	2	0.19648		BW-002-CB	1/16	1/2	1/2	2 1/2	0.42647
	BV-003-CB	1/16	3/4	1/2	2 1/2	0.46443		BW-102-CB	3/32	1/2	1/2	2 1/2	0.45772
	BV-101-CB	3/32	1/4	1/4	2	0.22773		BW-103-CB	3/32	3/4	3/4	3	0.63971
	BV-102-CB	3/32	1/2	3/8	2 1/2	0.36170		BW-202-CB	1/8	1/2	1/2	2 1/2	0.48897
	BV-103-CB	3/32	3/4	1/2	3	0.49568		BW-204-CB	1/8	1	1/2	3 1/2	0.85294
	BV-104-CB	3/32	1	3/4	3	0.62965		BW-304-CB	3/16	1	1/2	3 1/2	0.91594
	BV-106-CB	3/32	1 1/2	1	4	0.89760		BW-404-CB	1/4	1	1/2	3 1/2	0.97794
	BV-202-CB	1/8	1/2	1/2	3	0.39295		<b>25 DEG</b>	BX-001-CB	1/16	1/4	3/8	2 1/2
BV-203-CB	1/8	3/4	9/16	3	0.52693	BX-002-CB	1/16		1/2	3/8	2 1/2	0.63985	
BV-204-CB	1/8	1	3/4	3	0.66090	BX-101-CB	3/32		1/4	3/8	2 1/2	0.38268	
BV-206-CB	1/8	1 1/2	1	4	0.92885	BX-103-CB	3/32		3/4	1/2	3	0.79322	
BV-304-CB	3/16	1	3/4	3	0.72340	BX-201-CB	1/8		1/4	1/2	2 1/2	0.41368	
BV-304A-CB	3/16	1	1/2	3	0.72340	BX-202-CB	1/8		1/2	1/2	2 1/2	0.70235	
BV-305-CB	3/16	1 1/4	7/8	3 1/2	0.85738	BX-204-CB	1/8		1	1/2	3	1.05762	
BV-404-CB	1/4	1	3/4	3	0.78590	<b>30 DEG</b>	BZ-001-CB		1/16	1/4	3/8	2 1/2	0.35118
BV-404A-CB	1/4	1	1/2	3	0.78590		BZ-002-CB		1/16	1/2	3/8	2 1/2	0.63985
BV-405-CB	1/4	1 1/4	1	4	0.91988		BZ-101-CB		3/32	1/4	3/8	2 1/2	0.38243
							BZ-103-CB	3/32	3/4	1/2	2 3/4	0.95978	
							BZ-201-CB	1/8	1/4	1/2	2 1/2	0.41368	
							BZ-202-CB	1/8	1/2	1/2	2 1/2	0.70235	
							BZ-204-CB	1/8	1	1/2	3 1/8	1.27970	
							BZ-404-CB	1/4	1	3/4	3	1.40470	
							<b>45 DEG</b>	B45-2015-CB	1/8	0.312	1/2	2 1/2	0.75000
								B45-202-CB	1/8	1/2	1/2	2 5/8	1.12500

ALL SIZES ARE AVAILABLE  
CALL FOR AVAILABILITY 1-888-531-0430

Other coatings are available including: TiCN and TiAlN



• Four Flutes

# A

## Trouble Shooting Guide For Problems With End Mills

Problem/ Cause	Solution
<b>Chip Packing</b> Cut too heavy Not enough chip clearance Not enough coolant	<ul style="list-style-type: none"> <li>• Decrease width and depth of cut</li> <li>• Use end mill with less flutes</li> <li>• Use higher coolant pressure and reposition nozzle to point of cut or use air pressure</li> </ul>
<b>Chipped Cutting Edge</b> Feed rate too heavy Feed too heavy on first cut Lack of rigidity (machine & holder) Lack of rigidity (tool) Tool cutting corner too sharp	<ul style="list-style-type: none"> <li>• Reduce feed rate</li> <li>• Reduce feed rate on first cut</li> <li>• Use better machine or tool holder or change parameters</li> <li>• Use shorter tool, hold shank deeper, try climb milling</li> <li>• Decrease primary relief and cutting angle, reduce radial width-of cut</li> </ul>
<b>Excessive Wear</b> Speed is too fast Hard work material Improper feed and speed (too slow) Improper helix angle Primary relief angle is too large Recutting chips	<ul style="list-style-type: none"> <li>• Decrease spindle speed, use another coolant</li> <li>• Use coatings (TiN, TiCN, TiAlN, TiAlN+, etc.)</li> <li>• Increase feed and speed</li> <li>• Change to correct helix angle</li> <li>• Change to smaller relief angle</li> <li>• Change feed &amp; speed, Change chip size or clear chips with more coolant or air pressure</li> </ul>
<b>No Dimensional Accuracy</b> Cut is too heavy Lack of accuracy (machine & holder) Rigidity is not enough (machine & holder) Too few flutes	<ul style="list-style-type: none"> <li>• Decrease width and depth of cut</li> <li>• Repair machine or holder</li> <li>• Change machine or holder or change parameters</li> <li>• Use mult flute end mills, use end mill with higher rigidity</li> </ul>
<b>Reduced Tool Life</b> Cutting friction is too much Hard work material Improper helix & relief angle	<ul style="list-style-type: none"> <li>• Regrind at earlier stage</li> <li>• Use coatings (TiN, TiCN, TiAlN, TiAlN+, etc.)</li> <li>• Change to correct helix angle and primary relief</li> </ul>
<b>Rough Surface Finish</b> Feed rate too heavy Cutting speed is too slow Wear is too much No end tooth concavity Recutting chips	<ul style="list-style-type: none"> <li>• Reduce feed rate</li> <li>• Increase RPM</li> <li>• Regrind at earlier stage</li> <li>• Grind concave angle on bottom of teeth</li> <li>• Change feed &amp; speed, change chip size or clear chips with coolant or air pressure</li> </ul>
<b>Side Wall Taper in Work Piece</b> Feed rate too heavy Overhang of tool is too much Too few flutes	<ul style="list-style-type: none"> <li>• Reduce feed rate</li> <li>• Hold shank deeper, use shorter end mill</li> <li>• Use mult flute end mills, use end mill with higher rigidity</li> </ul>
<b>Squeal and Chattering</b> Feed and speed too fast Lack of rigidity (machine & holder) Poor set up Cut is too heavy Overhang of tool is too much Lack of relief	<ul style="list-style-type: none"> <li>• Correct feed and speed</li> <li>• Use better machine or tool holder or change parameter</li> <li>• Improve clamping rigidity</li> <li>• Decrease width and depth of cut</li> <li>• Hold shank deeper, use shorter end mill</li> <li>• Decrease relief angle, make margin; hone primary with oil stone</li> </ul>
<b>Tool Breakage</b> Feed is too heavy Cut is too heavy Overhang of tool is too much Wear is too much	<ul style="list-style-type: none"> <li>• Reduce feed rate</li> <li>• Decrease width and depth-of-cut</li> <li>• Hold shank deeper, use shorter end mill</li> <li>• Regrind at earlier stage</li> </ul>
<b>Work Piece Burrs</b> Wear on primary relief is too much Incorrect feed and speed Improper helix angle	<ul style="list-style-type: none"> <li>• Regrind at earlier stage</li> <li>• Correct cutting parameters</li> <li>• Change to correct cutting angle</li> </ul>

# FEEDS & SPEEDS FOR CARBIDE

# A

Recommendations For Surface Feet Per Minute & Feed Per Tooth\*

## "UNDER" 32 HRC Hard Grade Materials

MATERIAL	SFM	1/8"	3/16"	1/4"	3/8"	1/2"	5/8"	3/4"	1"
<b>NON-FERROUS MATERIALS</b>									
Aluminum Alloys: 2024-T4/T6, 2014, 6061-T6/T651, 7075-T6	800-2000	0.001	0.002	0.003	0.004	0.005	0.006	0.008	0.010
Magnesium: Die-Cast, Extruded	800-1500	0.001	0.0015	0.002	0.003	0.004	0.006	0.008	0.009
Copper: Yellow Brass, High Lead Brass, Red Brass	800-1000	0.001	0.0012	0.002	0.0025	0.003	0.004	0.004	0.005
Copper Alloys: Aluminum/Bronze, Low Silicon Bronze	800-1000	0.001	0.0012	0.002	0.0025	0.003	0.004	0.004	0.005
Plastics: Acrylics, Phenolics, Polysulfone, G10, G11	200-500	0.001	0.002	0.003	0.004	0.006	0.008	0.010	0.012
Carbon, Graphites: Carbon, Graphites	200-500	0.002	0.003	0.004	0.006	0.008	0.009	0.010	0.012
<b>STAINLESS STEELS</b>									
Precipitation: 13/8, 15/5, AM-350/355	80-250	0.0003	0.0005	0.001	0.001	0.002	0.003	0.004	0.005
Austenitic: 200 Series, 302, 303, 304L, 316L	100-350	0.0002	0.0003	0.0005	0.001	0.002	0.0025	0.0035	0.0045
Martensitic: 403, 410, 416	80-250	0.0002	0.0003	0.0005	0.001	0.0015	0.0025	0.003	0.004
<b>HIGH TEMP. ALLOYS</b>									
Cobalt Base: Stellite, HS-21, Haynes 25/188, X-40, L-605	50-90	0.0003	0.0004	0.0006	0.0008	0.0012	0.0015	0.002	0.0025
Nickel Base: Inconel 600/625, Nichel 200-270, Invar, Monel 400-405, K-Monel, PermaNechel 300, Incoly 600-800, Mar-M-246/247	50-95	0.0004	0.0005	0.0008	0.001	0.002	0.0025	0.003	0.004
Iron Base: N-155, Timken 16-26-6, Incoloy 800-802, Multimet	70-125	0.0004	0.0005	0.001	0.0015	0.002	0.0025	0.003	0.004
<b>STEELS</b>									
High Strength Steels: 4140, 4340, 6150, 52100, H11, H13	100-160	0.0004	0.0006	0.001	0.0015	0.002	0.0025	0.003	0.004
High Alloy Steels-Mold & Die:A-2/6/10, p20, 01, 02, 06	100-160	0.0004	0.0006	0.001	0.0015	0.0015	0.0025	0.003	0.004
Medium Alloy Steels: 200, 250, 300	100-350	0.0005	0.0005	0.001	0.002	0.0025	0.0035	0.004	0.005
Low Alloy Steels-Maraging: 10XX, 11XX, 13XX	100-350	0.0005	0.0007	0.0012	0.002	0.003	0.004	0.005	0.006
<b>CAST IRONS</b>									
Ductile Iron: Ductile Cast Iron	120-350	0.0005	0.0008	0.0015	0.002	0.0022	0.003	0.004	0.006
Cast Iron: Gray Cast Iron	120-350	0.0005	0.001	0.002	0.003	0.004	0.005	0.006	0.008
<b>TITANIUM</b>									
Titanium Alloys: Commercially Pure, 6AL-4V, ASTM 1/2/3, 6AL-25N-4Zr-2Mo-Si	100-250	0.0003	0.0004	0.0005	0.001	0.0015	0.0025	0.003	0.004

\*These are base-line recommendations. Adjust feed and speed according to individual circumstances.

RPM = SFM X 3.82/Tool Diameter Feed (in IPM's) = RPM X FPT X # of Flutes



# A

# FEEDS & SPEEDS FOR CARBIDE

Recommendations For Surface Feet Per Minute & Feed Per Tooth\*

## "OVER" 32 HRc Hard Grade Materials

MATERIAL	SFM	1/8"	3/16"	1/4"	3/8"	1/2"	5/8"	3/4"	1"
<b>NON-FERROUS MATERIALS</b>									
Aluminum Alloys: 440, 356, 380, C6130	500-1000	0.001	0.0015	0.002	0.003	0.004	0.005	0.006	0.008
Copper: Naval Brass, High Silicon Bronze, A17, C-17200	800-1000	0.001	0.0015	0.002	0.0025	0.003	0.004	0.0045	0.005
Copper Alloys: Nickel, Silver, Beryllium Copper, Oxygen-Free Copper	800-1000	0.001	0.0015	0.002	0.0025	0.003	0.004	0.004	0.005
Plastics: Polycarbonate	200-500	0.001	0.002	0.003	0.004	0.006	0.008	0.010	0.012
<b>STAINLESS STEELS</b>									
Precipitation: 17/4, 17/7, AF-17, Custom 450/635, 15/7Mo	90-125	0.0003	0.0005	0.001	0.001	0.002	0.003	0.004	0.005
Austenitic: 304, 310, 314, 316, 321, 330, 347, 348	90-150	0.0002	0.0003	0.0005	0.001	0.002	0.0025	0.0035	0.004
Martensitic: 420, 430F, 440C, 446	90-170	0.0002	0.0003	0.0005	0.001	0.0015	0.0025	0.0025	0.004
<b>HIGH TEMP. ALLOYS</b>									
Cobalt Base: Air-Resist 13/213/215, Haynes 21/36, Howmet 3, HS 6/51, Nasa Co-W-Re, Mar-M-302, MP-159	50-80	0.0003	0.0004	0.0006	0.0008	0.0012	0.0015	0.002	0.0025
Nickel Base: Hastelloy-C/B/G/X, Inconel 718, Waspaloy, M252, Rene 41-95, Nimonic 75-80, Astroloy, Udimet 500-700	50-80	0.0004	0.0005	0.0008	0.001	0.002	0.0025	0.003	0.004
Iron Base: A286, Haynes 556, Discoloy, V-57	70-110	0.0004	0.0005	0.001	0.0015	0.002	0.0025	0.003	0.004
<b>STEELS</b>									
High Strength Steels: 4140, 4340M, EDT-150, HP9-430, 11-10, 300M, D6Ac, H11, H13, Armor Plate	80-140	0.0004	0.0006	0.001	0.0015	0.0015	0.0025	0.003	0.004
High Alloy Steels-Mold & Die:Hy-Tugg, Stressproof, Armor Plate	80-140	0.0004	0.0006	0.001	0.0015	0.0015	0.0025	0.003	0.004
Medium Alloy Steels: 200, 250, 300	80-140	0.0005	0.0005	0.001	0.002	0.0025	0.0035	0.004	0.005
Low Alloy Steels-Maraging: 23XX, 31XX	100-120	0.0005	0.0007	0.0012	0.002	0.003	0.004	0.005	0.006
<b>CAST IRONS</b>									
Ductile Iron: Ductile Cast Iron	80-140	0.0005	0.0008	0.0015	0.002	0.0022	0.003	0.004	0.006
Cast Iron: Malleable, Chilled	80-140	0.0005	0.001	0.002	0.003	0.004	0.005	0.006	0.008
<b>TITANIUM</b>									
Titanium Alloys: 5Al-2 1/2-Sn-Eli 8AlMo-1V	80-180	0.0003	0.0004	0.0005	0.001	0.0015	0.0025	0.003	0.004

\*These are base-line recommendations. Adjust feed and speed according to individual circumstances.

$$\text{RPM} = \text{SFM} \times 3.82 / \text{Tool Diameter} \quad \text{Feed (in IPM's)} = \text{RPM} \times \text{FPT} \times \# \text{ of Flutes}$$



# Award

**TAPERED END MILLS™**

**SUPERIOR SERVICE SINCE 1959**

**HIGHLY ACCURATE-TOOL AFTER TOOL**

**LATEST MANUFACTURING TECHNOLOGY**

**KNOWN WORLDWIDE FOR PRODUCT  
RELIABILITY**

**FEWER CHANGES, LASTS MANY TIMES  
LONGER THAN ORDINARY SOLID  
MICROGRAIN CARBIDE END MILLS**

**MANUFACTURED FROM SUPERIOR  
SUBMICROGRAIN CARBIDE**

**OVER 600 STOCKED STANDARD SIZES**

# METRIC CONVERSION TABLE

## LINEAR MEASURE

1 kilometer = 0.6214 mile	1 mile = 1.609 kilometers
39.37 inches	1 yard = 0.9144 meter
1 meter = 3.2808 feet	1 foot = 0.3048 meter
1.0936 yards	1 foot = 304.8 millimeters
1 centimeter = 0.3937 inch	1 inch = 2.54 centimeters
1 millimeter = 0.03937 inch	1 inch = 25.4 millimeters
1 micrometer ( $\mu\text{m}$ )	1 microinch = 0.025 $\mu\text{m}$
(0.001 millimeter) = 0.00004 inch	

## SQUARE MEASURE

1 square kilometer = 0.3861 square mile = 247.1 acres
1 hectare = 2.471 acres = 107,640 square feet
1 are = 0.0247 acre = 1076.4 square feet
1 square meter = 10.764 square feet = 1.196 square yards
1 square centimeter = 0.155 square inch
1 square millimeter = 0.00155 square inch
1 square mile = 2.5899 square kilometer
1 acre = 0.4047 hectare = 40.47 ares
1 square yard = 0.0929 square meter = 929 square centimeters
1 square inch = 6.452 square centimeters = 645.2 square millimeters

## CUBIC MEASURE

1 cubic meter = 35.31 cubic feet = 1.308 cubic yards
1 cubic meter = 264.2 US gallons = 219.969 Imperial gallons
1 cubic centimeter = 0.062 cubic inch
1 liter (cubic decimeter) = 0.0353 cubic foot = 61.023 cubic inches
1 liter = 0.2642 US gallons = 1.0567 US quarts = 0.2200 Imperial gallons
1 cubic yard = 0.7646 cubic meter
1 cubic foot = 0.02832 cubic meter = 28.317 liters
1 cubic inch = 16.38706 cubic centimeters
1 Imperial gallon = 4.546 liters
1 Imperial quart = 1.136 liters
1 US gallon = 3.785 liters
1 US quart = 0.946 liter

## WEIGHT

1 metric ton = 0.9842 ton (of 2240 pounds) = 2204.6 pounds
1 kilogram = 2.2046 pounds = 35.274 ounces avoirdupois
1 gram = 0.03215 ounces troy = 0.03527 ounces avoirdupois
1 gram = 15.432 grains
1 ton (of 2240 pounds) = 1.016 metric tons = 1016 kilograms
1 pound = 0.4536 kilograms = 453.6 grams
1 ounce avoirdupois = 28.35 grams
1 ounce troy = 31.103 grams
1 grain = 0.0648 gram
1 kilogram per square millimeter = 1422.32 pounds per sq. in.
1 kilogram per square centimeter = 14.2232 pounds per sq. in.
1 kilogram/meter = 7.233 foot/pounds
1 pound per square inch = 0.0703 kilogram per square centimeter
1 calorie (kilogram calorie) = 3.968 Btu (British Thermal Units)
1 international table calorie = 4.1868 joules
1 kilojoules = 0.948 Btu
1 kilo pound (kp) = 1 kilogram-force



