M.A. FORD® APG HP END MILL SECTION

Product Catalog | Vol: 105

ISO 13399 compliant

*Where **high performance** is the **standard**®*

ISO 9001:2015 Certified

www.maford.com

M.A. FORD
High Performance Cutting Tools

*Where **high performance** is the **standard**®*

For over 100 years, M.A. Ford® has been at the cutting edge of tooling design and manufacturing and has developed an enviable global reputation for performance and precision in advanced solid carbide tooling, serving over 60 countries worldwide.

Our innovative cutting geometries, materials and coating technologies are providing effective manufacturing solutions to an expanding and increasingly diverse range of industries from agriculture and construction to aerospace, power generation and automotive, to name but a few.

⚠ **WARNING:** This product can expose you to chemicals including cobalt which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

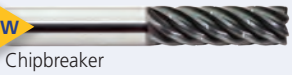
Series Number by Page

HP End Mills		
Series No.	Cat. Pg.	Tech Pg.
135	78	169
135B	84	171
135N	80	169
136	85	173
138	88	173
138B	99	171
138CE	97	173
138N	94	173
156	100	176
157	104	178
158	108	182
177	50	142
177L	55	142
177S	56	142
178	59	146
178N	62	146
179	57	142
179L	58	142
180	63	150
180CB	66	150
180N	67	150
250	68	152
277	21	130
277CB	26	130
277N	29	130
278	33	136
278CB	44	136
278N	46	136
279	32	134/142
334	87	175
380	48	140
380CB	49	140
3MVR	76	164
3MVS	72	164
FHFP	111	113
MFPB	69	154
XFO	70	158
XFO-AL	71	160
XV5CB	17	122
XV7	18	126
XV7CB	20	126

Product Key

Table of Contents

Table des matières | Tabla de contenido

APG End Mills - TuffCut® XV									
Series	Tool Illustration	NOF	Size Range (Inch)	Size Range (Metric)	Length	Corner Type	Helix Angle	Material Group	Page
XV5CB	NEW Chipbreaker	5	3/8″- 3/4″	—		Corner Radius	40°		17
XV7	NEW	7	1/4″- 3/4″	—		Square End Corner Radius	38°		18
XV7CB	NEW  Chipbreaker	7	1/4″- 3/4″	—		Corner Radius	38°		20
APG End Mills - TuffCut® XV Technical Information									115

APG End Mills - TuffCut® XT									
Series	Tool Illustration	NOF	Size Range (Inch)	Size Range (Metric)	Length	Corner Type	Helix Angle	Material Group	Page
277		4	1/8" - 1"	3.0mm - 20.0mm		Square End Corner Radius	38°/41° Variable		21
277CB	NEW Chipbreaker	4	1/8″ - 1″	—		Square End Corner Radius	38°/41° Variable		26
277N	Neck Relief	4	1/8" - 1"	—		Square End Corner Radius	38°/41° Variable		29
279		4	1/8" - 3/4"	3.0mm - 16.0mm		Ball Nose	35° / 38° Variable		32
278		5	1/8" - 1"	—		Square End Corner Radius	40°		33
278CB	NEW Chipbreaker	5	1/4″ - 1″	—		Square End Corner Radius	40°		44
278N	Neck Relief	5	1/4" - 3/4"	3.0mm - 25.0mm		Corner Radius	40°		46
380		9	3/8" - 3/4"	8.0mm - 20.0mm		Corner Radius	37°		48
380CB	NEW Chipbreaker	9	3/8″ - 3/4″	8.0mm - 20.0mm		Corner Radius	37°		49
APG End Mills - TuffCut® XT Technical Information									115

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APG End Mills - TuffCut® XR									
Series	Tool Illustration	NOF	Size Range (Inch)	Size Range (Metric)	Length	Corner Type	Helix Angle	Material Group	Page
177		4	1/16" - 1"	1.5mm - 25.0mm		Square End Corner Radius	35°/38° Variable		50
177L	Neck Relief	4	—	6.0mm - 20.0mm		Corner Radius	35°/38° Variable		55
177S	Neck Relief	4	—	3.0mm - 20.0mm		Square End Corner Radius	35°/38° Variable		56
179		4	1/16" - 1"	1.5mm - 16.0mm		Ball Nose	35°/38° Variable		57
179L	Neck Relief	4	—	3.0mm - 16.0mm		Ball Nose	35°/38° Variable		58
178		5	1/8" - 1"	3.0mm - 25.0mm		Square End Corner Radius	38°		59
178N	Neck Relief	5	1/4" - 1"	—		Corner Radius	38°		62
180		7	1/4" - 1"	6.0mm - 20.0mm		Square End Corner Radius	38°		63
180CB	Chipbreaker	7	1/4" - 1"	—		Square End Corner Radius	38°		66
180N	Neck Relief	7	1/2" - 1"	12.0mm - 20.0mm		Corner Radius	38°		67
APG End Mills - TuffCut® XR Technical Information									115

APG End Mills - TuffCut® 3D									
Series	Tool Illustration	NOF	Size Range (Inch)	Size Range (Metric)	Length	Corner Type	Helix Angle	Material Group	Page
250	NEW	2	—	1.0mm - 16.0mm		Ball Nose	30°		68
MFPB	NEW	Multi	1/4" - 3/4"	6.0mm - 20.0mm		Ball Nose	35°		69
XFO	NEW	Multi	—	6.0mm - 12.0mm		Oval	Variable		70
XFO-AL	NEW	Multi	—	6.0mm - 12.0mm		Oval	Variable		71
APG End Mills - TuffCut® 3D Technical Information									115

APG End Mills - TuffCut® Micro									
Series	Tool Illustration	NOF	Size Range (Inch)	Size Range (Metric)	Length	Corner Type	Helix Angle	Material Group	Page
3MVS	Neck Relief Options	3	1/64" - 1/8"	0.5mm - 3.0mm		Square End Corner Radius	31°/35° Variable		72
3MVR		3	1/64" - 1/8"	0.5mm - 3.0mm		Square End Corner Radius	31°/35° Variable		76
APG End Mills - TuffCut® Micro Technical Information									115

Table of Contents

Table des matières | Tabla de contenido

APG End Mills - TuffCut® AL/X-AL									
Series	Tool Illustration	NOF	Size Range (Inch)	Size Range (Metric)	Length	Corner Type	Helix Angle	Material Group	Page
135		2	3/16" - 1"	3.0mm - 25.0mm		Corner Radius	30°		78
135N	Neck Relief	2	3/16" - 1"	3.0mm - 25.0mm		Square End Corner Radius	30°		80
135B		2	1/8" - 1"	—		Ball Nose	37°		84
136		2	1/8" - 1"	3.0mm - 20.0mm		Square End	45°		85
334		3	1/4" - 1"	—		Corner Radius	45°		87
138		3	1/8" - 1"	3.0mm - 20.0mm		Square End Corner Radius	36°		88
138N	Neck Relief	3	1/8" - 1"	—		Square End Corner Radius	36°		94
138CE		3	1/8" - 3/4"	6.0mm - 16.0mm		Square End	36°		97
138B		3	1/8" - 1"	3.0mm - 16.0mm		Ball Nose	36°		99
APG End Mills - TuffCut® AL/X-AL Technical Information									115

APG End Mills - TuffCut DM®									
Series	Tool Illustration	NOF	Size Range (Inch)	Size Range (Metric)	Length	Corner Type	Helix Angle	Material Group	Page
156	Neck Relief Options	2	1/64" - 1/2"	0.5mm - 12.0mm		Ball Nose	20°		100
157		Multi	1/8" - 5/8"	3.0mm - 25.0mm		Square End Corner Radius	45°		104
158	Neck Relief	4	—	2.0mm - 16.0mm		Corner Radius	35°/38° Variable		108
APG End Mills - TuffCut DM® Technical Information									115

APG End Mills - TuffCut® HF									
Series	Tool Illustration	NOF	Size Range (Inch)	Size Range (Metric)	Length	Corner Type	Helix Angle	Material Group	Page
FHFP	NEW Neck Relief	4/5	—	6.0mm - 16.0mm		Corner Radius	20°		111
APG End Mills - TuffCut® HF Technical Information									113

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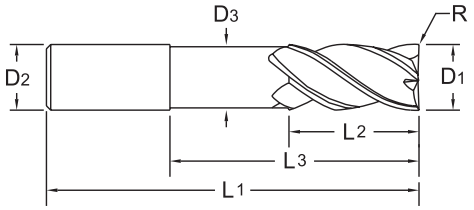
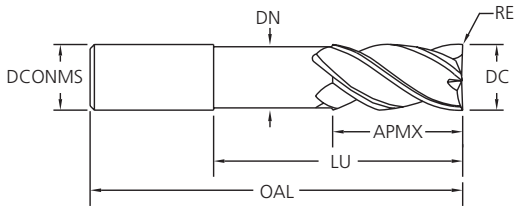
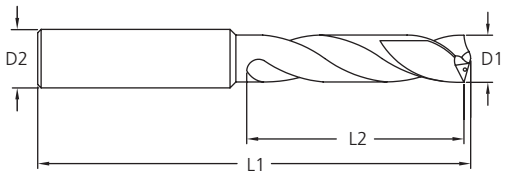
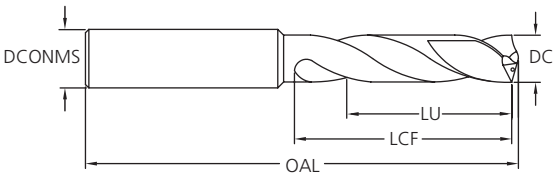
End Mill	Previous Designation		New Designation (ISO 13399)	
Square & Corner Radius				
	Parameter	**Definition**	**Parameter**	**Definition**
	D1	Diameter	DC	Cutting Diameter
	D2	Shank Diameter	DCONMS	Connection Diameter Machine Side
	D3	Neck Diameter	DN	Neck Diameter
	L1	Overall Length	OAL	Overall Length
	L2	Flute Length	APMX	Depth of Cut Maximum
	L3	Neck Length	LU	Usable Length
	R	Corner Radius	RE	Corner Radius
		No. of Flutes	NOF	Flute Count

Hole Making	Previous Designation		New Designation (ISO 13399)	
Drill				
	Parameter	**Definition**	**Parameter**	**Definition**
	D1	Diameter	DC	Cutting Diameter
	D2	Shank Diameter	DCONMS	Connection Diameter Machine Side
	L1	Overall Length	OAL	Overall Length
	L2	Flute Length	LCF	Length Chip Flute
	L3	Drill Length	LU	Usable Length
				LU = LCF - (1.5 x DC)

Scan QR code to see other tool type ISO 13399 Conversion Keys

TuffCut®

High Performance End Mills

Fraises en bout haute performance | Contadores Verticales de Alta Desempeño

M.A. Ford® TuffCut® End Mills perform better and last significantly longer than competitive products, minimizing process downtime and maximizing productivity and cost efficiency. Included in our product line are high performance end mills developed for specific applications such as stainless steels and high temperature alloys, hardened steel, titanium, composite material, aluminum and softer alloys.

New to our family of high performance end mills are the TuffCut® XV range that includes the series XV5CB, XV7, and XV7CB. The XV's have a thick core design for increased strength, variable pitch for smooth cutting action and reduced harmonics, continuous edge and staggered chipbreaker options for both roughing and finishing applications and are coated with M.A. Ford's newest proprietary coating, ALtima® Q for optimal heat and wear resistance. A 5-flute chipbreaker, non-center cutting (XV5CB), a 7-flute continuous edge, centering cutting (XV7), and a 7-flute staggered chipbreaker, center cutting (XV7CB) round out the offering. Recommended workpiece materials for the XV range are steels, stainless steels, titanium and high temp alloys.

The TuffCut® 3D range is another high performance end mill offering consisting of series 250, series MFPB and series XFO/XFO-AL. The 250 series is a 2-flute ball nose that has high performance geometry. It can be used in roughing and finishing applications, and has a radius tolerance of + 0.010mm for accurate finishing in 3D shapes. The ALtima® Blaze coating makes the 250 series excellent for applications in hardened steels <50HRC, alloy steel, stainless steel and titanium. Finally, the 250 series is offered at an economical price level to reduce tooling costs. Series MFPB is a multiflute parallel ball nose end mill designed for 4 and 5 axis, 3D surfacing applications in aerospace and medical materials. The multi-flute design of MFPB series allows high feed rates in semi-finishing and finishing applications, while the ALtima® Xtreme coating provides excellent heat and wear resistance in tough-to-machine materials. Offered in short and long overall lengths, the MFPB series provides versatility for complex, tough to reach part features.

The XFO and XFO-AL series are designed for optimized cycle times and improved surface finishes in 5-axis finishing operations. Multi-flute for finishing and semi-finishing applications with enhanced edge preparation for increased strength and cutting-edge stabilization, along with a precision radius form tolerance to ensure high accuracy finishing, the XFO family is a welcome addition to the TuffCut® 3D line.

New M.A.Ford High-Feed, Positive end mill Series FHFP, was developed for roughing 3D shapes, long reach applications, & difficult materials.

Benefits of M.A. Ford® End Mill products and support include:

- Thousands of end mills in stock.
- Over 50 different styles of end mills available.
- Aggressive speeds and feeds to maximize metal removal rates.
- Standard, Stub, Long and Extended Reach Lengths are available.
- Solid Carbide Tools are easy to re-sharpen for maximum life.
- ALtima®, ALtima® Plus, ALtima® Blaze, ALtima® Micro, ALtima® Xtreme, ALtima® Q, TiN, TiCN, Fordlube, GemX, Gem+ and CERAedge® coatings are available.
- U.S. Designed and Manufactured.

See page 545 for more information on available coatings.

TuffCut® XT

MADE IN USA

Features:

- Stub, Standard, Long and Extra Long Lengths, as well as Neck Relief Styles available.
- Proprietary Carbide Substrate.
- Improved Geometries.
- Enhanced Corner Protection.
- Industry Standard Corner Radii.
- ALtima® Blaze Coated.
- 4, 5 and 9 Flutes.
- Unique M.A. Ford® Heli-Pitch Geometry.
- Whisper Blend Transition between OD and Neck.
- New Chipbreaker options.

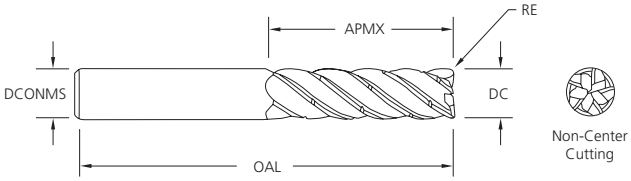
Benefits:

- Higher Feeds over similar End Mills.
- Reduced vibration harmonics.
- Improved Part Finishes.
- Maintains Cutting Edge Strength & Sharpness for Improved Tool Life.
- Slotting at 1X Diameter Deep.
- State-Of-The-Art ALtima® Blaze PVD Coating for Superior Tool Life.
- For Titanium and High Temp Alloy Applications.

	Page
NEW **APG TuffCut® XV**	
Series XV5CB	17
Series XV7	18
Series XV7CB	20
APG TuffCut® XT	
Series 277	21
NEW Series 277CB	26
Series 277N	29
Series 279	32
Series 278	33
NEW Series 278CB	44
Series 278N	46
Series 380	48
NEW Series 380CB	49
APG TuffCut® XR	
Series 177	50
Series 177L	55
Series 177S	56
Series 179	57
Series 179L	58
Series 178	59
Series 178N	62
Series 180	63
Series 180CB	66
Series 180N	67
NEW **APG TuffCut® 3D**	
Series 250	68
Series MFPB	69
Series XFO	70
Series XFO-AL	71
NEW **APG TuffCut® Micro** CORNER RADIUS OPTIONS	
Series 3MVS	72
Series 3MVR	76
APG TuffCut® AL/X-AL	
Series 135	78
Series 135N	80
Series 135B	84
Series 136	85
Series 334	87
Series 138	88
Series 138N	94
Series 138CE	97
Series 138B	99
APG TuffCut® DM	
Series 156	100
Series 157	104
Series 158	108
NEW **APG TuffCut® HF**	
Series FHFP	111
Technical Information	**115**

TuffCut® XV - Series XV5CB

For deep, dynamic milling applications.



- ALtima® Q coating for optimal heat and wear resistance allowing for increased tool life.
- 40° helix, variable pitch geometry for smooth cutting action and reduced harmonics.
- Optimized substrate grade provides increased TRS and toughness.
- Thick core design for increased strength in long ap applications.
- Staggered chipbreaker technology allows for optimal chip management and reduced cutting forces.
- Open end geomertry allows for aggressive entry angles.

ALtima® Q		ALtima® Q Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
XV5CB37534AQ	08090	XV5CB37534AQW	08091	3/8	.3750	3/8	3	1-1/4	.030
XV5CB37544AQ	08094	XV5CB37544AQW	08095	3/8	.3750	3/8	3-1/2	1-5/8	.030
XV5CB50034AQ	08106	XV5CB50034AQW	08107	1/2	.5000	1/2	3-1/2	1-5/8	.030
XV5CB50044AQ	08112	XV5CB50044AQW	08113	1/2	.5000	1/2	4	2-1/8	.030
XV5CB62534AQ	08116	XV5CB62534AQW	08117	5/8	.6250	5/8	4	2-1/8	.030
XV5CB62544AQ	08120	XV5CB62544AQW	08121	5/8	.6250	5/8	5	2-5/8	.030
XV5CB75034AQ	08130	XV5CB75034AQW	08131	3/4	.7500	3/4	5	2-1/2	.030
XV5CB75044AQ	08134	XV5CB75044AQW	08135	3/4	.7500	3/4	6	3-1/8	.030

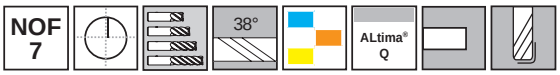
Inch	
DC	Tolerance
3/8 - 3/4	+.0 /-.0025

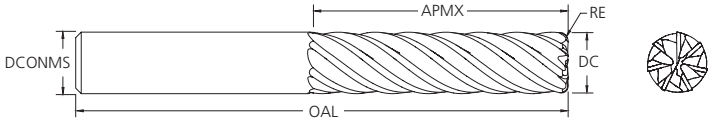
Inch	
DCONMS	Tolerance (h6)
.3750 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7500	+0/-.00051

TECH
Page 122

M.A. Ford follows the ANSI B94.19-1985 specifications when adding a Weldon flat to any inch size end mill. All request for locations not matching these specifications must be sent to customquotes@maford.com

TuffCut® XV - Series XV7





- Center-cutting end geometry for increased ramp angles and improved floor finishes.
- 38° helix, variable pitch geometry for smooth cutting action and reduced harmonics.
- Thick core design for increased strength in tough-to-machine materials.
- Continuous edge and staggered chipbreaker options for both roughing and finishing applications.
- ALtima® Q coating provides optimal heat and wear resistance allowing for increased tool life.

ALtima® Q		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
XV725000AQ	38175	1/4	.2500	1/4	2	3/8	
XV725002AQ	38176	1/4	.2500	1/4	2	3/8	.015
XV725004AQ	38177	1/4	.2500	1/4	2	3/8	.030
XV725006AQ	38178	1/4	.2500	1/4	2	3/8	.060
XV725020AQ	38179	1/4	.2500	1/4	2-1/2	3/4	
XV725022AQ	38180	1/4	.2500	1/4	2-1/2	3/4	.015
XV725024AQ	38181	1/4	.2500	1/4	2-1/2	3/4	.030
XV725026AQ	38182	1/4	.2500	1/4	2-1/2	3/4	.060
XV737500AQ	38100	3/8	.3750	3/8	2	1/2	
XV737502AQ	38101	3/8	.3750	3/8	2	1/2	.015
XV737504AQ	38102	3/8	.3750	3/8	2	1/2	.030
XV737506AQ	38103	3/8	.3750	3/8	2	1/2	.060
XV737507AQ	38104	3/8	.3750	3/8	2	1/2	.090
XV737510AQ	38105	3/8	.3750	3/8	2-1/2	7/8	
XV737512AQ	38106	3/8	.3750	3/8	2-1/2	7/8	.015
XV737514AQ	38107	3/8	.3750	3/8	2-1/2	7/8	.030
XV737516AQ	38108	3/8	.3750	3/8	2-1/2	7/8	.060
XV737517AQ	38109	3/8	.3750	3/8	2-1/2	7/8	.090
XV737520AQ	38110	3/8	.3750	3/8	3	1-1/4	
XV737522AQ	38111	3/8	.3750	3/8	3	1-1/4	.015
XV737524AQ	38112	3/8	.3750	3/8	3	1-1/4	.030
XV737526AQ	38113	3/8	.3750	3/8	3	1-1/4	.060
XV737527AQ	38114	3/8	.3750	3/8	3	1-1/4	.090
XV750000AQ	38115	1/2	.5000	1/2	2-1/2	5/8	
XV750002AQ	38116	1/2	.5000	1/2	2-1/2	5/8	.015
XV750004AQ	38117	1/2	.5000	1/2	2-1/2	5/8	.030
XV750006AQ	38118	1/2	.5000	1/2	2-1/2	5/8	.060
XV750007AQ	38119	1/2	.5000	1/2	2-1/2	5/8	.090
XV750008AQ	38120	1/2	.5000	1/2	2-1/2	5/8	.120
XV750020AQ	38121	1/2	.5000	1/2	3	1-1/4	
XV750022AQ	38122	1/2	.5000	1/2	3	1-1/4	.015
XV750024AQ	38123	1/2	.5000	1/2	3	1-1/4	.030
XV750026AQ	38124	1/2	.5000	1/2	3	1-1/4	.060
XV750027AQ	38125	1/2	.5000	1/2	3	1-1/4	.090
XV750028AQ	38126	1/2	.5000	1/2	3	1-1/4	.120

M.A. Ford follows the ANSI B94.19-1985 specifications when adding a Weldon flat to any inch size end mill. All request for locations not matching these specifications must be sent to customquotes@maford.com

Inch	
DC	Tolerance
.2363 - .3937	+0/-.0020
.3938 - .7500	+0/-.0025

Inch	
DCONMS	Tolerance (h6)
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7500	+0/-.00051

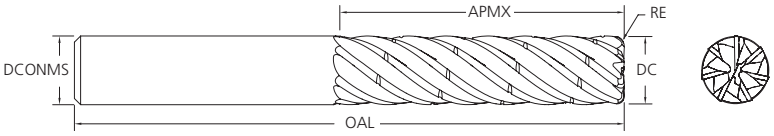
TECH
Page 126

NEW

ALtima® Q		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
XV750030AQ	38127	1/2	.5000	1/2	3-1/2	1-5/8	
XV750032AQ	38128	1/2	.5000	1/2	3-1/2	1-5/8	.015
XV750034AQ	38129	1/2	.5000	1/2	3-1/2	1-5/8	.030
XV750036AQ	38130	1/2	.5000	1/2	3-1/2	1-5/8	.060
XV750037AQ	38131	1/2	.5000	1/2	3-1/2	1-5/8	.090
XV750038AQ	38132	1/2	.5000	1/2	3-1/2	1-5/8	.120
XV750040AQ	38133	1/2	.5000	1/2	4	2-1/8	
XV750042AQ	38134	1/2	.5000	1/2	4	2-1/8	.015
XV750044AQ	38135	1/2	.5000	1/2	4	2-1/8	.030
XV750046AQ	38136	1/2	.5000	1/2	4	2-1/8	.060
XV750047AQ	38137	1/2	.5000	1/2	4	2-1/8	.090
XV750048AQ	38138	1/2	.5000	1/2	4	2-1/8	.120
XV762500AQ	38139	5/8	.6250	5/8	3	3/4	
XV762504AQ	38140	5/8	.6250	5/8	3	3/4	.030
XV762506AQ	38141	5/8	.6250	5/8	3	3/4	.060
XV762508AQ	38142	5/8	.6250	5/8	3	3/4	.120
XV762510AQ	38143	5/8	.6250	5/8	3-1/2	1-3/8	
XV762514AQ	38144	5/8	.6250	5/8	3-1/2	1-3/8	.030
XV762516AQ	38145	5/8	.6250	5/8	3-1/2	1-3/8	.060
XV762518AQ	38146	5/8	.6250	5/8	3-1/2	1-3/8	.120
XV762520AQ	38183	5/8	.6250	5/8	4	1-5/8	
XV762524AQ	38184	5/8	.6250	5/8	4	1-5/8	.030
XV762526AQ	38185	5/8	.6250	5/8	4	1-5/8	.060
XV762528AQ	38186	5/8	.6250	5/8	4	1-5/8	.120
XV762530AQ	38147	5/8	.6250	5/8	4	2-1/8	
XV762534AQ	38148	5/8	.6250	5/8	4	2-1/8	.030
XV762536AQ	38149	5/8	.6250	5/8	4	2-1/8	.060
XV762538AQ	38150	5/8	.6250	5/8	4	2-1/8	.120
XV762540AQ	38151	5/8	.6250	5/8	5	2-5/8	
XV762544AQ	38152	5/8	.6250	5/8	5	2-5/8	.030
XV762546AQ	38153	5/8	.6250	5/8	5	2-5/8	.060
XV762548AQ	38154	5/8	.6250	5/8	5	2-5/8	.120
XV775000AQ	38155	3/4	.7500	3/4	3	1	
XV775004AQ	38156	3/4	.7500	3/4	3	1	.030
XV775006AQ	38157	3/4	.7500	3/4	3	1	.060
XV775007AQ	38158	3/4	.7500	3/4	3	1	.090
XV775008AQ	38159	3/4	.7500	3/4	3	1	.120
XV775020AQ	38160	3/4	.7500	3/4	4	1-5/8	
XV775024AQ	38161	3/4	.7500	3/4	4	1-5/8	.030
XV775026AQ	38162	3/4	.7500	3/4	4	1-5/8	.060
XV775027AQ	38163	3/4	.7500	3/4	4	1-5/8	.090
XV775028AQ	38164	3/4	.7500	3/4	4	1-5/8	.120
XV775030AQ	38165	3/4	.7500	3/4	5	2-3/8	
XV775034AQ	38166	3/4	.7500	3/4	5	2-3/8	.030
XV775036AQ	38167	3/4	.7500	3/4	5	2-3/8	.060
XV775037AQ	38168	3/4	.7500	3/4	5	2-3/8	.090
XV775038AQ	38169	3/4	.7500	3/4	5	2-3/8	.120
XV775050AQ	38170	3/4	.7500	3/4	6	3-1/4	
XV775054AQ	38171	3/4	.7500	3/4	6	3-1/4	.030
XV775056AQ	38172	3/4	.7500	3/4	6	3-1/4	.060
XV775057AQ	38173	3/4	.7500	3/4	6	3-1/4	.090
XV775058AQ	38174	3/4	.7500	3/4	6	3-1/4	.120

TECH
Page 126

TuffCut® XV - Series XV7CB



- Center-cutting end geometry for increased ramp angles and improved floor finishes.
- 38° helix, variable pitch geometry for smooth cutting action and reduced harmonics.
- Thick core design for increased strength in tough-to-machine materials.
- Continuous edge and staggered chipbreaker options for both roughing and finishing applications.
- ALtima® Q coating provides optimal heat and wear resistance allowing for increased tool life.

ALtima® Q		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
XV7CB25024AQ	38214	1/4	.2500	1/4	2-1/2	3/4	.030
XV7CB25026AQ	38215	1/4	.2500	1/4	2-1/2	3/4	.060
XV7CB37514AQ	19911	3/8	.3750	3/8	2-1/2	7/8	.030
XV7CB37516AQ	19912	3/8	.3750	3/8	2-1/2	7/8	.060
XV7CB37524AQ	38200	3/8	.3750	3/8	3	1-1/4	.030
XV7CB37526AQ	38201	3/8	.3750	3/8	3	1-1/4	.060
XV7CB50024AQ	19752	1/2	.5000	1/2	3	1-1/4	.030
XV7CB50026AQ	19913	1/2	.5000	1/2	3	1-1/4	.060
XV7CB50034AQ	38202	1/2	.5000	1/2	3-1/2	1-5/8	.030
XV7CB50036AQ	38203	1/2	.5000	1/2	3-1/2	1-5/8	.060
XV7CB50044AQ	38204	1/2	.5000	1/2	4	2-1/8	.030
XV7CB50046AQ	38205	1/2	.5000	1/2	4	2-1/8	.060
XV7CB62514AQ	19914	5/8	.6250	5/8	3-1/2	1-3/8	.030
XV7CB62516AQ	19915	5/8	.6250	5/8	3-1/2	1-3/8	.060
XV7CB62524AQ	38187	5/8	.6250	5/8	4	1-5/8	.030
XV7CB62526AQ	38188	5/8	.6250	5/8	4	1-5/8	.060
XV7CB62534AQ	38206	5/8	.6250	5/8	4	2-1/8	.030
XV7CB62536AQ	38207	5/8	.6250	5/8	4	2-1/8	.060
XV7CB62544AQ	38208	5/8	.6250	5/8	5	2-5/8	.030
XV7CB62546AQ	38209	5/8	.6250	5/8	5	2-5/8	.060
XV7CB75024AQ	19916	3/4	.7500	3/4	4	1-5/8	.030
XV7CB75026AQ	19917	3/4	.7500	3/4	4	1-5/8	.060
XV7CB75034AQ	38210	3/4	.7500	3/4	5	2-3/8	.030
XV7CB75036AQ	38211	3/4	.7500	3/4	5	2-3/8	.060
XV7CB75054AQ	38212	3/4	.7500	3/4	6	3-1/4	.030
XV7CB75056AQ	38213	3/4	.7500	3/4	6	3-1/4	.060

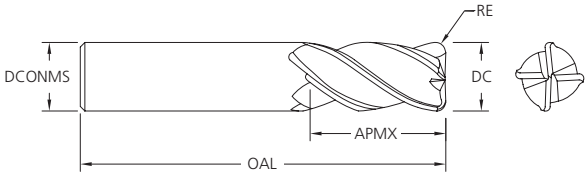
Inch	
DC	Tolerance
.2363 - .3937	+0/-.0020
.3938 - .7500	+0/-.0025

Inch	
DCONMS	Tolerance (h6)
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7500	+0/-.00051

TECH
Page 126

M.A. Ford follows the ANSI B94.19-1985 specifications when adding a Weldon flat to any inch size end mill. All request for locations not matching these specifications must be sent to customquotes@maford.com

TuffCut® XT - Series 277



- Improved geometries.
- Enhanced corner protection.
- Variable helix.

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
277 0300B	27700				3.0	.1181		6.0		57.0		8.0		
277 0300-0.25RB	27701				3.0	.1181		6.0		57.0		8.0		0.25
27712500B	18700			1/8		.1250	1/8		1-1/2		1/8			
27712502B	18701			1/8		.1250	1/8		1-1/2		1/8		.015	
27712510B	18702			1/8		.1250	1/8		1-1/2		3/8			
27712511B	18947			1/8		.1250	1/8		1-1/2		3/8		.010	
27712512B	18703			1/8		.1250	1/8		1-1/2		3/8		.015	
277L1250B	18704			1/8		.1250	1/8		1-1/2		1/2			
277L1252B	18705			1/8		.1250	1/8		1-1/2		1/2		.015	
277 0400B	27702				4.0	.1575		6.0		57.0		11.0		
277 0400-0.25RB	27703				4.0	.1575		6.0		57.0		11.0		0.25
27718700B	18710			3/16		.1875	3/16		2		3/16			
27718702B	18711			3/16		.1875	3/16		2		3/16		.015	
27718704B	18712			3/16		.1875	3/16		2		3/16		.030	
27718710B	18713			3/16		.1875	3/16		2		7/16			
27718711B	18948			3/16		.1875	3/16		2		7/16		.010	
27718712B	18714			3/16		.1875	3/16		2		7/16		.015	
27718714B	18715			3/16		.1875	3/16		2		7/16		.030	
277L1870B	18716			3/16		.1875	3/16		2-1/2		3/4			
277L1872B	18717			3/16		.1875	3/16		2-1/2		3/4		.015	
277L1874B	18718			3/16		.1875	3/16		2-1/2		3/4		.030	
277 0500B	27704				5.0	.1968		6.0		57.0		13.0		

Inch	
DC	Tolerance
1/8 - 1/4	+.000/-.002
>1/4 - 1	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Metric (mm)	
DC	Tolerance (h10)
3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 20.00	+.000/-.084

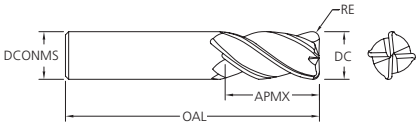
Metric (mm)	
DCONMS	Tolerance (h6)
6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 18.0	+0/-.011
18.01 - 20.0	+0/-.013

Inch	
RE	Tolerance
1/8 - 1	+.0000/-.0016

Metric (mm)	
RE	Tolerance
3.0 - 20.0	+.00/-.04

TECH
Page 130

TuffCut® XT - Series 277 *Continued*



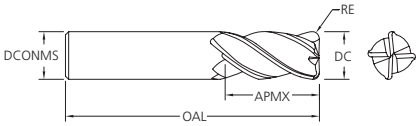
ALtima® Blaze		ALtima® Blaze Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
277 0500-0.25RB	27705				5.0	.1968		6.0		57.0		13.0		0.25
277 0600B	27706				6.0	.2362		6.0		57.0		13.0		
277 0600-0.25RB	27707				6.0	.2362		6.0		57.0		13.0		0.25
27725000B	18725			1/4		.2500	1/4		2		3/8			
27725002B	18726			1/4		.2500	1/4		2		3/8		.015	
27725004B	18727			1/4		.2500	1/4		2		3/8		.030	
27725010B	18728			1/4		.2500	1/4		2-1/2		3/4			
27725011B	18949			1/4		.2500	1/4		2-1/2		3/4		.010	
27725012B	18729			1/4		.2500	1/4		2-1/2		3/4		.015	
27725013B	18950			1/4		.2500	1/4		2-1/2		3/4		.020	
27725014B	18730			1/4		.2500	1/4		2-1/2		3/4		.030	
277L2500B	18731			1/4		.2500	1/4		3		1-1/4			
277L2502B	18732			1/4		.2500	1/4		3		1-1/4		.015	
277L2504B	18733			1/4		.2500	1/4		3		1-1/4		.030	
277X2500B	18734			1/4		.2500	1/4		4		1-3/4			
277X2502B	18735			1/4		.2500	1/4		4		1-3/4		.015	
277X2504B	18736			1/4		.2500	1/4		4		1-3/4		.030	
27731200B	18740			5/16		.3125	5/16		2		7/16			
27731202B	18741			5/16		.3125	5/16		2		7/16		.015	
27731204B	18742			5/16		.3125	5/16		2		7/16		.030	
27731206B	18743			5/16		.3125	5/16		2		7/16		.060	
27731210B	18744			5/16		.3125	5/16		2-1/2		13/16			
27731212B	18745			5/16		.3125	5/16		2-1/2		13/16		.015	
27731214B	18746			5/16		.3125	5/16		2-1/2		13/16		.030	
27731216B	18747			5/16		.3125	5/16		2-1/2		13/16		.060	
277L3120B	18748			5/16		.3125	5/16		3		1-1/4			
277L3122B	18749			5/16		.3125	5/16		3		1-1/4		.015	
277L3124B	18750			5/16		.3125	5/16		3		1-1/4		.030	
277L3126B	18751			5/16		.3125	5/16		3		1-1/4		.060	
277X3120B	18752			5/16		.3125	5/16		4		1-3/4			
277X3122B	18753			5/16		.3125	5/16		4		1-3/4		.015	
277X3124B	18754			5/16		.3125	5/16		4		1-3/4		.030	
277X3126B	18755			5/16		.3125	5/16		4		1-3/4		.060	
277 0800B	27708				8.0	.3150		8.0		63.0		19.0		
277 0800-0.80RB	27709				8.0	.3150		8.0		63.0		19.0		0.80
27737500B	18759			3/8		.3750	3/8		2		1/2			

TECH
Page 130

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
27737502B	18760			3/8		.3750	3/8		2		1/2		.015	
27737504B	18761			3/8		.3750	3/8		2		1/2		.030	
27737506B	18762			3/8		.3750	3/8		2		1/2		.060	
27737510B	18763			3/8		.3750	3/8		2-1/2		7/8			
27737511B	18951			3/8		.3750	3/8		2-1/2		7/8		.010	
27737512B	18764			3/8		.3750	3/8		2-1/2		7/8		.015	
27737513B	18952			3/8		.3750	3/8		2-1/2		7/8		.020	
27737514B	18765			3/8		.3750	3/8		2-1/2		7/8		.030	
27737516B	18766			3/8		.3750	3/8		2-1/2		7/8		.060	
27737520B	14498			3/8		.3750	3/8		3		1-1/4			
27737522B	14499			3/8		.3750	3/8		3		1-1/4		.015	
27737524B	14500			3/8		.3750	3/8		3		1-1/4		.030	
27737526B	14503			3/8		.3750	3/8		3		1-1/4		.060	
277L3750B	18767			3/8		.3750	3/8		4		1-1/2			
277L3752B	18768			3/8		.3750	3/8		4		1-1/2		.015	
277L3754B	18769			3/8		.3750	3/8		4		1-1/2		.030	
277L3756B	18770			3/8		.3750	3/8		4		1-1/2		.060	
277X3750B	18771			3/8		.3750	3/8		4		2-1/2			
277X3752B	18772			3/8		.3750	3/8		4		2-1/2		.015	
277X3754B	18773			3/8		.3750	3/8		4		2-1/2		.030	
277X3756B	18774			3/8		.3750	3/8		4		2-1/2		.060	
277 1000B	27710				10.0	.3937		10.0		72.0		22.0		
277 1000-0.80RB	27711				10.0	.3937		10.0		72.0		22.0		0.80
27743700B	18778			7/16		.4375	7/16		2-1/2		1/2			
27743702B	18779			7/16		.4375	7/16		2-1/2		1/2		.015	
27743704B	18780			7/16		.4375	7/16		2-1/2		1/2		.030	
27743710B	18781			7/16		.4375	7/16		2-3/4		1			
27743712B	18782			7/16		.4375	7/16		2-3/4		1		.015	
27743714B	18783			7/16		.4375	7/16		2-3/4		1		.030	
277L4370B	18784			7/16		.4375	7/16		4		2			
277L4372B	18785			7/16		.4375	7/16		4		2		.015	
277L4374B	18786			7/16		.4375	7/16		4		2		.030	
277 1200B	27712				12.0	.4724		12.0		83.0		26.0		
277 1200-0.80RB	27713				12.0	.4724		12.0		83.0		26.0		0.80
277 1200-3.00RB	27714				12.0	.4724		12.0		83.0		26.0		3.00
27750000B	18787	27750000BW	13269	1/2		.5000	1/2		2-1/2		5/8			
27750002B	18788	27750002BW	13270	1/2		.5000	1/2		2-1/2		5/8		.015	
27750004B	18789	27750004BW	13271	1/2		.5000	1/2		2-1/2		5/8		.030	
27750006B	18790	27750006BW	13272	1/2		.5000	1/2		2-1/2		5/8		.060	
27750010B	18791	27750010BW	13273	1/2		.5000	1/2		3		1			
27750011B	18953			1/2		.5000	1/2		3		1		.010	
27750012B	18792	27750012BW	13274	1/2		.5000	1/2		3		1		.015	
27750013B	18954			1/2		.5000	1/2		3		1		.020	

TECH
Page 130

TuffCut® XT - Series 277 *Continued*



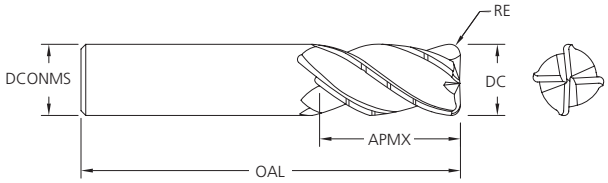
ALtima® Blaze		ALtima® Blaze Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
27750014B	18793	27750014BW	13275	1/2		.5000	1/2		3		1		.030	
27750015B	18811	27750015BW	13276	1/2		.5000	1/2		3		1		.045	
27750016B	18794	27750016BW	13277	1/2		.5000	1/2		3		1		.060	
27750017B	18795	27750017BW	13278	1/2		.5000	1/2		3		1		.090	
27750018B	18796	27750018BW	13279	1/2		.5000	1/2		3		1		.120	
27750020B	18797	27750020BW	13280	1/2		.5000	1/2		3		1-1/4			
27750021B	18955			1/2		.5000	1/2		3		1-1/4		.010	
27750022B	18798	27750022BW	13281	1/2		.5000	1/2		3		1-1/4		.015	
27750023B	18956			1/2		.5000	1/2		3		1-1/4		.020	
27750024B	18799	27750024BW	13282	1/2		.5000	1/2		3		1-1/4		.030	
27750026B	18800	27750026BW	13283	1/2		.5000	1/2		3		1-1/4		.060	
27750027B	18801	27750027BW	13284	1/2		.5000	1/2		3		1-1/4		.090	
27750028B	18802	27750028BW	13285	1/2		.5000	1/2		3		1-1/4		.120	
277L5000B	18803	277L5000BW	13286	1/2		.5000	1/2		4		2			
277L5002B	18804	277L5002BW	13287	1/2		.5000	1/2		4		2		.015	
277L5004B	18805	277L5004BW	13288	1/2		.5000	1/2		4		2		.030	
277L5006B	18806	277L5006BW	13289	1/2		.5000	1/2		4		2		.060	
277X5000B	18807	277X5000BW	13290	1/2		.5000	1/2		5		3			
277X5002B	18808	277X5002BW	13291	1/2		.5000	1/2		5		3		.015	
277X5004B	18809	277X5004BW	13292	1/2		.5000	1/2		5		3		.030	
277X5006B	18810	277X5006BW	13293	1/2		.5000	1/2		5		3		.060	
27762500B	18814	27762500BW	13294	5/8		.6250	5/8		3		3/4			
27762502B	18815	27762502BW	13295	5/8		.6250	5/8		3		3/4		.015	
27762504B	18816	27762504BW	13296	5/8		.6250	5/8		3		3/4		.030	
27762506B	18817	27762506BW	13297	5/8		.6250	5/8		3		3/4		.060	
27762510B	18818	27762510BW	13298	5/8		.6250	5/8		3-1/2		1-1/4			
27762512B	18819	27762512BW	13299	5/8		.6250	5/8		3-1/2		1-1/4		.015	
27762514B	18820	27762514BW	14141	5/8		.6250	5/8		3-1/2		1-1/4		.030	
27762516B	18821	27762516BW	14142	5/8		.6250	5/8		3-1/2		1-1/4		.060	
27762517B	18822	27762517BW	14143	5/8		.6250	5/8		3-1/2		1-1/4		.090	
27762518B	18823	27762518BW	14144	5/8		.6250	5/8		3-1/2		1-1/4		.120	
277L6250B	18824	277L6250BW	14145	5/8		.6250	5/8		5		2-1/4			
277L6252B	18825	277L6252BW	14146	5/8		.6250	5/8		5		2-1/4		.015	
277L6254B	18826	277L6254BW	14147	5/8		.6250	5/8		5		2-1/4		.030	
277L6256B	18827	277L6256BW	14148	5/8		.6250	5/8		5		2-1/4		.060	
277X6250B	18828	277X6250BW	14149	5/8		.6250	5/8		6		3			
277X6252B	18829	277X6252BW	14150	5/8		.6250	5/8		6		3		.015	
277X6254B	18830	277X6254BW	14151	5/8		.6250	5/8		6		3		.030	

TECH
Page 130

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
277X6256B	18831	277X6256BW	14152	5/8		.6250	5/8		6		3		.060	
277 1600B	27715				16.0	.6299		16.0		92.0		32.0		
277 1600-0.80RB	27716				16.0	.6299		16.0		92.0		32.0		0.80
27775000B	18832	27775000BW	14153	3/4		.7500	3/4		3		1			
27775002B	18833	27775002BW	14154	3/4		.7500	3/4		3		1		.015	
27775004B	18834	27775004BW	14155	3/4		.7500	3/4		3		1		.030	
27775006B	18835	27775006BW	14156	3/4		.7500	3/4		3		1		.060	
27775010B	18836	27775010BW	14157	3/4		.7500	3/4		4		1-5/8			
27775012B	18837	27775012BW	14158	3/4		.7500	3/4		4		1-5/8		.015	
27775014B	18838	27775014BW	14159	3/4		.7500	3/4		4		1-5/8		.030	
27775016B	18839	27775016BW	14160	3/4		.7500	3/4		4		1-5/8		.060	
27775017B	18840	27775017BW	14161	3/4		.7500	3/4		4		1-5/8		.090	
27775018B	18841	27775018BW	14162	3/4		.7500	3/4		4		1-5/8		.120	
27775019B	18842	27775019BW	14163	3/4		.7500	3/4		4		1-5/8		.190	
27775020B	18843	27775020BW	14164	3/4		.7500	3/4		4		1-5/8		.250	
277L7500B	18844	277L7500BW	14165	3/4		.7500	3/4		5		2-1/4			
277L7502B	18845	277L7502BW	14166	3/4		.7500	3/4		5		2-1/4		.015	
277L7504B	18846	277L7504BW	14167	3/4		.7500	3/4		5		2-1/4		.030	
277L7506B	18847	277L7506BW	14168	3/4		.7500	3/4		5		2-1/4		.060	
277X7500B	18848	277X7500BW	14169	3/4		.7500	3/4		6		3			
277X7502B	18849	277X7502BW	14170	3/4		.7500	3/4		6		3		.015	
277X7504B	18850	277X7504BW	14171	3/4		.7500	3/4		6		3		.030	
277X7506B	18851	277X7506BW	14172	3/4		.7500	3/4		6		3		.060	
277XX750B	18852	277XX750BW	14173	3/4		.7500	3/4		7		4-1/8			
277XX754B	18853	277XX754BW	14174	3/4		.7500	3/4		7		4-1/8		.030	
277XX756B	18854	277XX756BW	14175	3/4		.7500	3/4		7		4-1/8		.060	
277 2000B	27717				20.0	.7874		20.0		104.0		38.0		
277 2000-0.80RB	27718				20.0	.7874		20.0		104.0		38.0		0.80
27710010B	18859	27710010BW	14176	1		1.0000	1		4		1-1/2			
27710012B	18860	27710012BW	14177	1		1.0000	1		4		1-1/2		.015	
27710014B	18861	27710014BW	14178	1		1.0000	1		4		1-1/2		.030	
27710016B	18862	27710016BW	14179	1		1.0000	1		4		1-1/2		.060	
27710017B	18863	27710017BW	14180	1		1.0000	1		4		1-1/2		.090	
27710018B	18864	27710018BW	14181	1		1.0000	1		4		1-1/2		.120	
27710019B	18865	27710019BW	14182	1		1.0000	1		4		1-1/2		.190	
27710020B	18866	27710020BW	14183	1		1.0000	1		4		1-1/2		.250	
277L1000B	18867	277L1000BW	14184	1		1.0000	1		5		2-1/4			
277L1002B	18868	277L1002BW	14185	1		1.0000	1		5		2-1/4		.015	
277L1004B	18869	277L1004BW	14186	1		1.0000	1		5		2-1/4		.030	
277L1006B	18870	277L1006BW	14187	1		1.0000	1		5		2-1/4		.060	
277X1000B	18871	277X1000BW	14188	1		1.0000	1		6		3			
277X1002B	18872	277X1002BW	14189	1		1.0000	1		6		3		.015	
277X1004B	18873	277X1004BW	14190	1		1.0000	1		6		3		.030	
277X1006B	18874	277X1006BW	14191	1		1.0000	1		6		3		.060	
277XX100B	18875	277XX100BW	14192	1		1.0000	1		7		4-1/8			
277XX104B	18876	277XX104BW	14193	1		1.0000	1		7		4-1/8		.030	
277XX106B	18877	277XX106BW	14194	1		1.0000	1		7		4-1/8		.060	

TECH
Page 130

TuffCut® XT - Series 277CB



- Staggered chipbreaker technology.
- Enhanced corner protection.
- Variable helix.

ALtima® Blaze		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
277LCB1250B	27953	1/8	.1250	1/8	1-1/2	1/2	
277LCB1252B	27954	1/8	.1250	1/8	1-1/2	1/2	.015
277LCB1870B	27955	3/16	.1875	3/16	2-1/2	3/4	
277LCB1872B	27956	3/16	.1875	3/16	2-1/2	3/4	.015
277LCB1874B	27957	3/16	.1875	3/16	2-1/2	3/4	.030
277LCB2500B	27958	1/4	.2500	1/4	3	1-1/4	
277LCB2502B	27959	1/4	.2500	1/4	3	1-1/4	.015
277LCB2504B	27960	1/4	.2500	1/4	3	1-1/4	.030
277XCB2500B	27961	1/4	.2500	1/4	4	1-3/4	
277XCB2502B	27962	1/4	.2500	1/4	4	1-3/4	.015
277XCB2504B	27963	1/4	.2500	1/4	4	1-3/4	.030
277LCB3120B	27964	5/16	.3125	5/16	3	1-1/4	
277LCB3122B	27965	5/16	.3125	5/16	3	1-1/4	.015
277LCB3124B	27966	5/16	.3125	5/16	3	1-1/4	.030
277LCB3126B	27967	5/16	.3125	5/16	3	1-1/4	.060
277XCB3120B	27968	5/16	.3125	5/16	4	1-3/4	
277XCB3122B	27969	5/16	.3125	5/16	4	1-3/4	.015
277XCB3124B	27970	5/16	.3125	5/16	4	1-3/4	.030
277XCB3126B	27971	5/16	.3125	5/16	4	1-3/4	.060
277CB37510B	27972	3/8	.3750	3/8	2-1/2	7/8	
277CB37511B	27973	3/8	.3750	3/8	2-1/2	7/8	.010
277CB37512B	27974	3/8	.3750	3/8	2-1/2	7/8	.015
277CB37513B	27975	3/8	.3750	3/8	2-1/2	7/8	.020
277CB37514B	27976	3/8	.3750	3/8	2-1/2	7/8	.030
277CB37516B	27988	3/8	.3750	3/8	2-1/2	7/8	.060
277LCB3750B	27977	3/8	.3750	3/8	4	1-1/2	
277LCB3752B	27978	3/8	.3750	3/8	4	1-1/2	.015
277LCB3754B	27979	3/8	.3750	3/8	4	1-1/2	.030

Inch	
DC	Tolerance
1/8 - 1/4	+.000/-.002
>1/4 - 1	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Inch	
RE	Tolerance
1/8 - 1	+.0000/-.0016

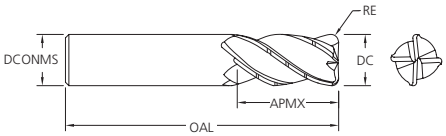
TECH
Page 130

NEW

ALtima® Blaze		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
277LCB3756B	27980	3/8	.3750	3/8	4	1-1/2	.060
277XCB3750B	27981	3/8	.3750	3/8	4	2-1/2	
277XCB3752B	27982	3/8	.3750	3/8	4	2-1/2	.015
277XCB3754B	27983	3/8	.3750	3/8	4	2-1/2	.030
277XCB3756B	27984	3/8	.3750	3/8	4	2-1/2	.060
277LCB4370B	27985	7/16	.4375	7/16	4	2	
277LCB4372B	27986	7/16	.4375	7/16	4	2	.015
277LCB4374B	27987	7/16	.4375	7/16	4	2	.030
277CB50020B	27993	1/2	.5000	1/2	3	1-1/4	
277CB50021B	27994	1/2	.5000	1/2	3	1-1/4	.010
277CB50022B	27995	1/2	.5000	1/2	3	1-1/4	.015
277CB50023B	27996	1/2	.5000	1/2	3	1-1/4	.020
277CB50024B	27997	1/2	.5000	1/2	3	1-1/4	.030
277CB50026B	27989	1/2	.5000	1/2	3	1-1/4	.060
277LCB5000B	27998	1/2	.5000	1/2	4	2	
277LCB5002B	27999	1/2	.5000	1/2	4	2	.015
277LCB5004B	28000	1/2	.5000	1/2	4	2	.030
277LCB5006B	28002	1/2	.5000	1/2	4	2	.060
277XCB5000B	28003	1/2	.5000	1/2	5	3	
277XCB5002B	28004	1/2	.5000	1/2	5	3	.015
277XCB5004B	28005	1/2	.5000	1/2	5	3	.030
277XCB5006B	28007	1/2	.5000	1/2	5	3	.060
277CB62510B	28008	5/8	.6250	5/8	3-1/2	1-1/4	
277CB62512B	28009	5/8	.6250	5/8	3-1/2	1-1/4	.015
277CB62514B	28010	5/8	.6250	5/8	3-1/2	1-1/4	.030
277CB62516B	27990	5/8	.6250	5/8	3-1/2	1-1/4	.060
277LCB6250B	28012	5/8	.6250	5/8	5	2-1/4	
277LCB6252B	28013	5/8	.6250	5/8	5	2-1/4	.015
277LCB6254B	28014	5/8	.6250	5/8	5	2-1/4	.030
277LCB6256B	28015	5/8	.6250	5/8	5	2-1/4	.060
277XCB6250B	28017	5/8	.6250	5/8	6	3	
277XCB6252B	28018	5/8	.6250	5/8	6	3	.015
277XCB6254B	28019	5/8	.6250	5/8	6	3	.030
277XCB6256B	28020	5/8	.6250	5/8	6	3	.060
277CB75010B	28022	3/4	.7500	3/4	4	1-5/8	
277CB75012B	28023	3/4	.7500	3/4	4	1-5/8	.015
277CB75014B	28024	3/4	.7500	3/4	4	1-5/8	.030
277CB75016B	27991	3/4	.7500	3/4	4	1-5/8	.060
277LCB7500B	28025	3/4	.7500	3/4	5	2-1/4	
277LCB7502B	28027	3/4	.7500	3/4	5	2-1/4	.015

TECH
Page 130

TuffCut® XT - Series 277CB *Continued*

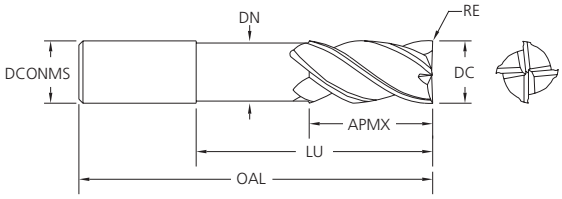


NEW

ALtima® Blaze		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
277LCB7504B	28028	3/4	.7500	3/4	5	2-1/4	.030
277LCB7506B	28029	3/4	.7500	3/4	5	2-1/4	.060
277XCB7500B	28030	3/4	.7500	3/4	6	3	
277XCB7502B	28032	3/4	.7500	3/4	6	3	.015
277XCB7504B	28033	3/4	.7500	3/4	6	3	.030
277XCB7506B	28034	3/4	.7500	3/4	6	3	.060
277XXCB750B	28035	3/4	.7500	3/4	7	4-1/8	
277XXCB754B	28037	3/4	.7500	3/4	7	4-1/8	.030
277XXCB756B	28038	3/4	.7500	3/4	7	4-1/8	.060
277CB10010B	28039	1	1.0000	1	4	1-1/2	
277CB10012B	28040	1	1.0000	1	4	1-1/2	.015
277CB10014B	28042	1	1.0000	1	4	1-1/2	.030
277CB10016B	27992	1	1.0000	1	4	1-1/2	.060
277LCB1000B	28043	1	1.0000	1	5	2-1/4	
277LCB1002B	28044	1	1.0000	1	5	2-1/4	.015
277LCB1004B	28045	1	1.0000	1	5	2-1/4	.030
277LCB1006B	28047	1	1.0000	1	5	2-1/4	.060
277XCB1000B	28048	1	1.0000	1	6	3	
277XCB1002B	28049	1	1.0000	1	6	3	.015
277XCB1004B	28050	1	1.0000	1	6	3	.030
277XCB1006B	28052	1	1.0000	1	6	3	.060
277XXCB100B	28053	1	1.0000	1	7	4-1/8	
277XXCB104B	28054	1	1.0000	1	7	4-1/8	.030
277XXCB106B	28055	1	1.0000	1	7	4-1/8	.060

TECH
Page 130

TuffCut® XT - Series 277N



- Improved geometries.
- Enhanced corner protection.
- Variable helix.

ALtima® Blaze		DC		DCONMS	DN	OAL	APMX	LU	RE	Reach
										LU/DC
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch	Inch	
27712500N3B	27720	1/8	.1250	1/8	.115	3	3/16	3/8		3
27712502N3B	27721	1/8	.1250	1/8	.115	3	3/16	3/8	.015	3
27712500N5B	27722	1/8	.1250	1/8	.115	3	3/16	5/8		5
27712502N5B	27723	1/8	.1250	1/8	.115	3	3/16	5/8	.015	5
27718700N3B	27724	3/16	.1875	3/16	.177	3	1/4	9/16		3
27718702N3B	27725	3/16	.1875	3/16	.177	3	1/4	9/16	.015	3
27718704N3B	27726	3/16	.1875	3/16	.177	3	1/4	9/16	.030	3
27718700N5B	27727	3/16	.1875	3/16	.177	3	1/4	15/16		5
27718702N5B	27728	3/16	.1875	3/16	.177	3	1/4	15/16	.015	5
27718704N5B	27729	3/16	.1875	3/16	.177	3	1/4	15/16	.030	5
27725000N3B	27730	1/4	.2500	1/4	.240	3	3/8	3/4		3
27725002N3B	27731	1/4	.2500	1/4	.240	3	3/8	3/4	.015	3
27725004N3B	27732	1/4	.2500	1/4	.240	3	3/8	3/4	.030	3
27725006N3B	27733	1/4	.2500	1/4	.240	3	3/8	3/4	.060	3
27725000N5B	27734	1/4	.2500	1/4	.240	4	3/8	1-1/4		5
27725002N5B	27735	1/4	.2500	1/4	.240	4	3/8	1-1/4	.015	5
27725004N5B	27736	1/4	.2500	1/4	.240	4	3/8	1-1/4	.030	5
27725006N5B	27737	1/4	.2500	1/4	.240	4	3/8	1-1/4	.060	5
27731200N3B	27738	5/16	.3125	5/16	.300	3	7/16	15/16		3
27731202N3B	27739	5/16	.3125	5/16	.300	3	7/16	15/16	.015	3
27731204N3B	27740	5/16	.3125	5/16	.300	3	7/16	15/16	.030	3
27737500N3B	27741	3/8	.3750	3/8	.360	3	1/2	1-1/8		3
27737502N3B	27742	3/8	.3750	3/8	.360	3	1/2	1-1/8	.015	3
27737504N3B	27743	3/8	.3750	3/8	.360	3	1/2	1-1/8	.030	3
27737506N3B	27744	3/8	.3750	3/8	.360	3	1/2	1-1/8	.060	3
27737500N4B	27745	3/8	.3750	3/8	.360	4	1/2	1-1/2		4
27737502N4B	27746	3/8	.3750	3/8	.360	4	1/2	1-1/2	.015	4
27737504N4B	27747	3/8	.3750	3/8	.360	4	1/2	1-1/2	.030	4
27737506N4B	27748	3/8	.3750	3/8	.360	4	1/2	1-1/2	.060	4
27737500N5B	27749	3/8	.3750	3/8	.360	4	1/2	1-7/8		5

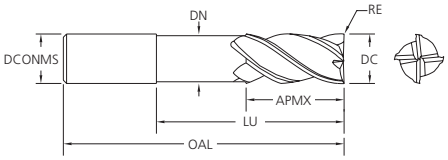
Inch	
DC	Tolerance
1/8 - 1/4	+.000/-.002
>1/4 - 1	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Inch	
RE	Tolerance
1/8 - 1	+.0000/-.0016

TECH
Page 130

TuffCut® XT - Series 277N *Continued*



ALtima® Blaze		DC		DCONMS	DN	OAL	APMX	LU	RE	Reach
										LU/DC
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch	Inch	
27737502N5B	27750	3/8	.3750	3/8	.360	4	1/2	1-7/8	.015	5
27737504N5B	27751	3/8	.3750	3/8	.360	4	1/2	1-7/8	.030	5
27737506N5B	27752	3/8	.3750	3/8	.360	4	1/2	1-7/8	.060	5
27750000N3B	27753	1/2	.5000	1/2	.480	4	5/8	1-1/2		3
27750002N3B	27754	1/2	.5000	1/2	.480	4	5/8	1-1/2	.015	3
27750004N3B	27755	1/2	.5000	1/2	.480	4	5/8	1-1/2	.030	3
27750006N3B	27756	1/2	.5000	1/2	.480	4	5/8	1-1/2	.060	3
27750007N3B	27757	1/2	.5000	1/2	.480	4	5/8	1-1/2	.090	3
27750008N3B	27758	1/2	.5000	1/2	.480	4	5/8	1-1/2	.120	3
27750000N4B	27759	1/2	.5000	1/2	.480	5	5/8	2		4
27750002N4B	27760	1/2	.5000	1/2	.480	5	5/8	2	.015	4
27750004N4B	27761	1/2	.5000	1/2	.480	5	5/8	2	.030	4
27750006N4B	27762	1/2	.5000	1/2	.480	5	5/8	2	.060	4
27750007N4B	27763	1/2	.5000	1/2	.480	5	5/8	2	.090	4
27750008N4B	27764	1/2	.5000	1/2	.480	5	5/8	2	.120	4
27750000N5B	27765	1/2	.5000	1/2	.480	6	5/8	2-1/2		5
27750002N5B	27766	1/2	.5000	1/2	.480	6	5/8	2-1/2	.015	5
27750004N5B	27767	1/2	.5000	1/2	.480	6	5/8	2-1/2	.030	5
27750006N5B	27768	1/2	.5000	1/2	.480	6	5/8	2-1/2	.060	5
27750007N5B	27769	1/2	.5000	1/2	.480	6	5/8	2-1/2	.090	5
27750008N5B	27770	1/2	.5000	1/2	.480	6	5/8	2-1/2	.120	5
27762500N3B	27771	5/8	.6250	5/8	.600	5	3/4	1-7/8		3
27762504N3B	27772	5/8	.6250	5/8	.600	5	3/4	1-7/8	.030	3
27762506N3B	27773	5/8	.6250	5/8	.600	5	3/4	1-7/8	.060	3
27762507N3B	27774	5/8	.6250	5/8	.600	5	3/4	1-7/8	.090	3
27762508N3B	27775	5/8	.6250	5/8	.600	5	3/4	1-7/8	.120	3
27762500N4B	27776	5/8	.6250	5/8	.600	5	3/4	2-1/2		4
27762504N4B	27777	5/8	.6250	5/8	.600	5	3/4	2-1/2	.030	4
27762506N4B	27778	5/8	.6250	5/8	.600	5	3/4	2-1/2	.060	4
27762507N4B	27779	5/8	.6250	5/8	.600	5	3/4	2-1/2	.090	4
27762508N4B	27780	5/8	.6250	5/8	.600	5	3/4	2-1/2	.120	4
27762500N5B	27781	5/8	.6250	5/8	.600	6	3/4	3-1/8		5
27762504N5B	27782	5/8	.6250	5/8	.600	6	3/4	3-1/8	.030	5
27762506N5B	27783	5/8	.6250	5/8	.600	6	3/4	3-1/8	.060	5
27762507N5B	27784	5/8	.6250	5/8	.600	6	3/4	3-1/8	.090	5
27762508N5B	27785	5/8	.6250	5/8	.600	6	3/4	3-1/8	.120	5
27775000N3B	27786	3/4	.7500	3/4	.720	5	1	2-1/4		3
27775004N3B	27787	3/4	.7500	3/4	.720	5	1	2-1/4	.030	3

TECH
Page 130

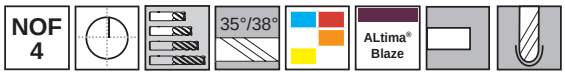
ALtima® Blaze		DC		DCONMS	DN	OAL	APMX	LU	RE	Reach
										LU/DC
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch	Inch	
27775006N3B	27788	3/4	.7500	3/4	.720	5	1	2-1/4	.060	3
27775007N3B	27789	3/4	.7500	3/4	.720	5	1	2-1/4	.090	3
27775008N3B	27790	3/4	.7500	3/4	.720	5	1	2-1/4	.120	3
27775009N3B	27791	3/4	.7500	3/4	.720	5	1	2-1/4	.190	3
27775012N3B	27792	3/4	.7500	3/4	.720	5	1	2-1/4	.250	3
27775000N4B	27793	3/4	.7500	3/4	.720	6	1	3		4
27775004N4B	27794	3/4	.7500	3/4	.720	6	1	3	.030	4
27775006N4B	27795	3/4	.7500	3/4	.720	6	1	3	.060	4
27775007N4B	27796	3/4	.7500	3/4	.720	6	1	3	.090	4
27775008N4B	27797	3/4	.7500	3/4	.720	6	1	3	.120	4
27775009N4B	27798	3/4	.7500	3/4	.720	6	1	3	.190	4
27775012N4B	27799	3/4	.7500	3/4	.720	6	1	3	.250	4
27775000N5B	27800	3/4	.7500	3/4	.720	6	1	3-3/4		5
27775004N5B	27801	3/4	.7500	3/4	.720	6	1	3-3/4	.030	5
27775006N5B	27802	3/4	.7500	3/4	.720	6	1	3-3/4	.060	5
27775007N5B	27803	3/4	.7500	3/4	.720	6	1	3-3/4	.090	5
27775008N5B	27804	3/4	.7500	3/4	.720	6	1	3-3/4	.120	5
27775009N5B	27805	3/4	.7500	3/4	.720	6	1	3-3/4	.190	5
27775012N5B	27806	3/4	.7500	3/4	.720	6	1	3-3/4	.250	5
27710000N3B	27807	1	1.0000	1	.960	6	1-1/4	3		3
27710004N3B	27808	1	1.0000	1	.960	6	1-1/4	3	.030	3
27710006N3B	27809	1	1.0000	1	.960	6	1-1/4	3	.060	3
27710007N3B	27810	1	1.0000	1	.960	6	1-1/4	3	.090	3
27710008N3B	27811	1	1.0000	1	.960	6	1-1/4	3	.120	3
27710009N3B	27812	1	1.0000	1	.960	6	1-1/4	3	.190	3
27710012N3B	27813	1	1.0000	1	.960	6	1-1/4	3	.250	3
27710000N4B	27814	1	1.0000	1	.960	6	1-1/4	4		4
27710004N4B	27815	1	1.0000	1	.960	6	1-1/4	4	.030	4
27710006N4B	27816	1	1.0000	1	.960	6	1-1/4	4	.060	4
27710007N4B	27817	1	1.0000	1	.960	6	1-1/4	4	.090	4
27710008N4B	27818	1	1.0000	1	.960	6	1-1/4	4	.120	4
27710009N4B	27819	1	1.0000	1	.960	6	1-1/4	4	.190	4
27710012N4B	27821	1	1.0000	1	.960	6	1-1/4	4	.250	4
27710000N5B	27823	1	1.0000	1	.960	7	1-1/4	5		5
27710004N5B	27825	1	1.0000	1	.960	7	1-1/4	5	.030	5
27710006N5B	27827	1	1.0000	1	.960	7	1-1/4	5	.060	5
27710007N5B	27829	1	1.0000	1	.960	7	1-1/4	5	.090	5
27710008N5B	27831	1	1.0000	1	.960	7	1-1/4	5	.120	5
27710009N5B	27833	1	1.0000	1	.960	7	1-1/4	5	.190	5
27710012N5B	27835	1	1.0000	1	.960	7	1-1/4	5	.250	5

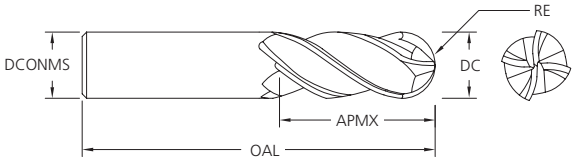
TuffCut® XT - Series 277 Sets

ALtima® Blaze			
Tool No.	EDP	Diameter in Sets	End
27700000B	27699	1/8", 1/4", 3/8", 1/2"	Sq. End
27700002B	27698	1/8", 1/4", 3/8", 1/2"	.015 R

TECH
Page 130

TuffCut® XT - Series 279





- ALtima® Blaze coated.
- Enhanced cutting edge quality.
- Variable helix and flute spacing for improved machining harmonics.

ALtima® Blaze		DC			DCONMS		OAL		APMX	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
279M0300B	27938		3	.1181		6		57		8
27912500B	27910	1/8		.1250	1/8		1-1/2		1/4	
27912510B	27912	1/8		.1250	1/8		1-1/2		3/8	
279M0400B	27940		4	.1575		6		57		11
27918700B	27914	3/16		.1875	3/16		2		3/8	
27918710B	27916	3/16		.1875	3/16		2		5/8	
279M0500B	27942		5	.1968		6		57		13
279M0600B	27944		6	.2362		6		57		13
27925000B	27918	1/4		.2500	1/4		2		3/8	
27925010B	27920	1/4		.2500	1/4		2-1/2		3/4	
27931200B	27922	5/16		.3125	5/16		2		1/2	
27931210B	27924	5/16		.3125	5/16		2-1/2		13/16	
279M0800B	27946		8	.3150		8		63		19
27937500B	27926	3/8		.3750	3/8		2		1/2	
27937510B	27928	3/8		.3750	3/8		2-1/2		7/8	
279M1000B	27948		10	.3937		10		72		22
27943700B	27929	7/16		.4375	7/16		2-1/2		1/2	
27943710B	27931	7/16		.4375	7/16		2-3/4		1	
279M1200B	27950		12	.4724		12		83		26
27950000B	27930	1/2		.5000	1/2		2-1/2		5/8	
27950010B	27932	1/2		.5000	1/2		3		1-1/4	
27962510B	27934	5/8		.6250	5/8		3-1/2		1-1/4	
279M1600B	27952		16	.6299		16		92		32
27975010B	27936	3/4		.7500	3/4		4		1-1/2	

Inch	
DC	Tolerance
1/8 - 1/4	+.000/-.002
>1/4 - 3/4	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7500	+0/-.00051

Metric (mm)	
DC	Tolerance (h10)
3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 16.00	+.000/-.070

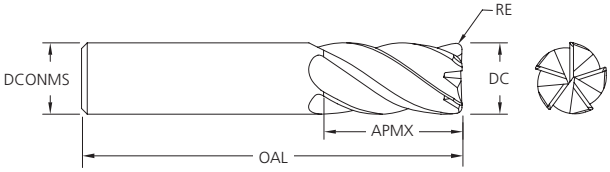
Metric (mm)	
DCONMS	Tolerance (h6)
3	+0/-0.006
3.01 - 6.0	+0/-0.008
6.01 - 10.0	+0/-0.009
10.01 - 16.0	+0/-0.011

Inch	
RE	Tolerance
1/8 - 3/4	+.0/-.001

Metric (mm)	
RE	Tolerance
3.0 - 16.0	+.0/-.025

TECH
Page 134/142

TuffCut® XT - Series 278



- Improved geometries.
- Enhanced corner protection.

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
27812500B	36992			1/8	.1250	1/8	1-1/2	1/4	
27812502B	97002			1/8	.1250	1/8	1-1/2	1/4	.015
27812504B	97003			1/8	.1250	1/8	1-1/2	1/4	.030
27812510B	36993			1/8	.1250	1/8	1-1/2	3/8	
27812520B	97005			1/8	.1250	1/8	1-1/2	1/2	
27812521B	18957			1/8	.1250	1/8	1-1/2	1/2	.010
27812522B	97006			1/8	.1250	1/8	1-1/2	1/2	.015
27812524B	97007			1/8	.1250	1/8	1-1/2	1/2	.030
27812530B	97009			1/8	.1250	1/8	2-1/2	3/4	
27812532B	97010			1/8	.1250	1/8	2-1/2	3/4	.015
27812534B	97011			1/8	.1250	1/8	2-1/2	3/4	.030
27815600B	36994			5/32	.1562	3/16	2	3/16	
27815610B	36995			5/32	.1562	3/16	2	7/16	
27818700B	36996			3/16	.1875	3/16	2	5/16	
27818702B	97014			3/16	.1875	3/16	2	5/16	.015
27818704B	97015			3/16	.1875	3/16	2	5/16	.030
27818710B	36997			3/16	.1875	3/16	2	7/16	
27818720B	97017			3/16	.1875	3/16	2	9/16	
27818721B	18958			3/16	.1875	3/16	2	9/16	.010
27818722B	97018			3/16	.1875	3/16	2	9/16	.015
27818724B	97019			3/16	.1875	3/16	2	9/16	.030
27818730B	97021			3/16	.1875	3/16	2-1/2	3/4	
27818732B	97022			3/16	.1875	3/16	2-1/2	3/4	.015
27818734B	97023			3/16	.1875	3/16	2-1/2	3/4	.030
27821800B	36998			7/32	.2187	1/4	2	1/4	
27821810B	36999			7/32	.2187	1/4	2-1/2	7/16	
27825000B	37000			1/4	.2500	1/4	2	3/8	
27825002B	37001			1/4	.2500	1/4	2	3/8	.015
27825004B	37002			1/4	.2500	1/4	2	3/8	.030

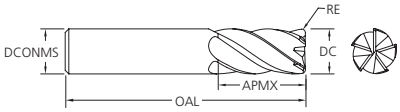
Inch	
DC	Tolerance
1/8 - 1/4	+.000/-.002
>1/4 - 1	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Inch	
RE	Tolerance
1/8 - 1	+.0000/-.0016

TECH
Page 136

TuffCut® XT - Series 278 *Continued*



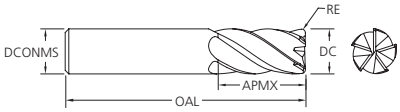
ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
27825006B	97028			1/4	.2500	1/4	2	3/8	.060
27825007B	97029			1/4	.2500	1/4	2	3/8	.090
27825010B	37003			1/4	.2500	1/4	2-1/2	3/4	
27825011B	18959			1/4	.2500	1/4	2-1/2	3/4	.010
27825012B	37004			1/4	.2500	1/4	2-1/2	3/4	.015
27825013B	18960			1/4	.2500	1/4	2-1/2	3/4	.020
27825014B	37005			1/4	.2500	1/4	2-1/2	3/4	.030
27825016B	97052			1/4	.2500	1/4	2-1/2	3/4	.060
27825017B	97053			1/4	.2500	1/4	2-1/2	3/4	.090
278L25000B	37006			1/4	.2500	1/4	3	1-1/4	
278L25002B	37007			1/4	.2500	1/4	3	1-1/4	.015
278L25004B	37008			1/4	.2500	1/4	3	1-1/4	.030
278L25006B	97058			1/4	.2500	1/4	3	1-1/4	.060
278L25007B	97059			1/4	.2500	1/4	3	1-1/4	.090
278X25000B	37009			1/4	.2500	1/4	4	1-3/4	
278X25002B	37010			1/4	.2500	1/4	4	1-3/4	.015
278X25004B	37075			1/4	.2500	1/4	4	1-3/4	.030
27831200B	97061			5/16	.3125	5/16	2	7/16	
27831202B	97062			5/16	.3125	5/16	2	7/16	.015
27831204B	97063			5/16	.3125	5/16	2	7/16	.030
27831206B	97064			5/16	.3125	5/16	2	7/16	.060
27831207B	97065			5/16	.3125	5/16	2	7/16	.090
27831210B	97067			5/16	.3125	5/16	2-1/2	13/16	
27831212B	97068			5/16	.3125	5/16	2-1/2	13/16	.015
27831214B	97069			5/16	.3125	5/16	2-1/2	13/16	.030
27831216B	97070			5/16	.3125	5/16	2-1/2	13/16	.060
27831217B	97071			5/16	.3125	5/16	2-1/2	13/16	.090
27831220B	97073			5/16	.3125	5/16	3	1-1/4	
27831222B	97074			5/16	.3125	5/16	3	1-1/4	.015
27831224B	97075			5/16	.3125	5/16	3	1-1/4	.030
27831226B	97076			5/16	.3125	5/16	3	1-1/4	.060
27831227B	97077			5/16	.3125	5/16	3	1-1/4	.090
27831230B	97079			5/16	.3125	5/16	4	2-1/8	
27831232B	97080			5/16	.3125	5/16	4	2-1/8	.015
27831234B	97081			5/16	.3125	5/16	4	2-1/8	.030
27831236B	97082			5/16	.3125	5/16	4	2-1/8	.060

TECH
Page 136

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
27831237B	97083			5/16	.3125	5/16	4	2-1/8	.090
27837500B	37013			3/8	.3750	3/8	2-1/2	1/2	
27837502B	37014			3/8	.3750	3/8	2-1/2	1/2	.015
27837504B	37015			3/8	.3750	3/8	2-1/2	1/2	.030
27837506B	97088			3/8	.3750	3/8	2-1/2	1/2	.060
27837507B	97089			3/8	.3750	3/8	2-1/2	1/2	.090
27837508B	97090			3/8	.3750	3/8	2-1/2	1/2	.120
278375011B	97091			3/8	.3750	3/8	2-1/2	1/2	.156
27837510B	37016			3/8	.3750	3/8	2-1/2	1	
27837511B	18961			3/8	.3750	3/8	2-1/2	1	.010
27837512B	37017			3/8	.3750	3/8	2-1/2	1	.015
27837513B	18962			3/8	.3750	3/8	2-1/2	1	.020
27837514B	37018			3/8	.3750	3/8	2-1/2	1	.030
27837516B	97136			3/8	.3750	3/8	2-1/2	1	.060
27837517B	97137			3/8	.3750	3/8	2-1/2	1	.090
27837518B	97138			3/8	.3750	3/8	2-1/2	1	.120
278375111B	97139			3/8	.3750	3/8	2-1/2	1	.156
27837520B	97141			3/8	.3750	3/8	3	1-1/4	
27837522B	97142			3/8	.3750	3/8	3	1-1/4	.015
27837523B	18326			3/8	.3750	3/8	3	1-1/4	.020
27837524B	97143			3/8	.3750	3/8	3	1-1/4	.030
27837526B	97144			3/8	.3750	3/8	3	1-1/4	.060
27837527B	97145			3/8	.3750	3/8	3	1-1/4	.090
27837528B	97146			3/8	.3750	3/8	3	1-1/4	.120
278375211B	97147			3/8	.3750	3/8	3	1-1/4	.156
27837530B	97149			3/8	.3750	3/8	3-1/2	1-5/8	
27837532B	97150			3/8	.3750	3/8	3-1/2	1-5/8	.015
27837534B	97151			3/8	.3750	3/8	3-1/2	1-5/8	.030
27837536B	97152			3/8	.3750	3/8	3-1/2	1-5/8	.060
27837537B	97153			3/8	.3750	3/8	3-1/2	1-5/8	.090
27837538B	97154			3/8	.3750	3/8	3-1/2	1-5/8	.120
278375311B	97155			3/8	.3750	3/8	3-1/2	1-5/8	.156
27837540B	97165			3/8	.3750	3/8	6	1-5/8	
27837542B	97166			3/8	.3750	3/8	6	1-5/8	.015
27837544B	97167			3/8	.3750	3/8	6	1-5/8	.030
27837546B	97168			3/8	.3750	3/8	6	1-5/8	.060
27837547B	97169			3/8	.3750	3/8	6	1-5/8	.090
27837548B	97170			3/8	.3750	3/8	6	1-5/8	.120
278375411B	97171			3/8	.3750	3/8	6	1-5/8	.156
27837550B	97173			3/8	.3750	3/8	4	2	
27837552B	97174			3/8	.3750	3/8	4	2	.015
27837554B	97175			3/8	.3750	3/8	4	2	.030
27837556B	97176			3/8	.3750	3/8	4	2	.060
27837557B	97177			3/8	.3750	3/8	4	2	.090
27837558B	97178			3/8	.3750	3/8	4	2	.120

TECH
Page 136

TuffCut® XT - Series 278 *Continued*



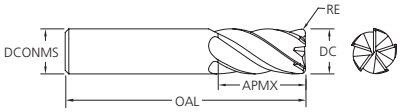
ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
278375511B	97179			3/8	.3750	3/8	4	2	.156
27837560B	97181			3/8	.3750	3/8	6	2-1/2	
27837562B	97182			3/8	.3750	3/8	6	2-1/2	.015
27837564B	97183			3/8	.3750	3/8	6	2-1/2	.030
27837566B	97184			3/8	.3750	3/8	6	2-1/2	.060
27837567B	97185			3/8	.3750	3/8	6	2-1/2	.090
27837568B	97186			3/8	.3750	3/8	6	2-1/2	.120
278375611B	97187			3/8	.3750	3/8	6	2-1/2	.156
278L37500B	37019			3/8	.3750	3/8	4	1-5/8	
278L37502B	37020			3/8	.3750	3/8	4	1-5/8	.015
278L37504B	37076			3/8	.3750	3/8	4	1-5/8	.030
278L37506B	97160			3/8	.3750	3/8	4	1-5/8	.060
278L37507B	97161			3/8	.3750	3/8	4	1-5/8	.090
278L37508B	97162			3/8	.3750	3/8	4	1-5/8	.120
278L375011B	97163			3/8	.3750	3/8	4	1-5/8	.156
278X37500B	37021			3/8	.3750	3/8	4	2-1/2	
278X37502B	37022			3/8	.3750	3/8	4	2-1/2	.015
278X37504B	37077			3/8	.3750	3/8	4	2-1/2	.030
27843700B	97189			7/16	.4375	7/16	2-1/2	5/8	
27843702B	97190			7/16	.4375	7/16	2-1/2	5/8	.015
27843704B	97191			7/16	.4375	7/16	2-1/2	5/8	.030
27843706B	97192			7/16	.4375	7/16	2-1/2	5/8	.060
27843707B	97193			7/16	.4375	7/16	2-1/2	5/8	.090
27843708B	97194			7/16	.4375	7/16	2-1/2	5/8	.120
278437011B	97195			7/16	.4375	7/16	2-1/2	5/8	.156
27843710B	97197			7/16	.4375	7/16	2-3/4	1	
27843712B	97198			7/16	.4375	7/16	2-3/4	1	.015
27843714B	97199			7/16	.4375	7/16	2-3/4	1	.030
27843716B	97200			7/16	.4375	7/16	2-3/4	1	.060
27843717B	97201			7/16	.4375	7/16	2-3/4	1	.090
27843718B	97202			7/16	.4375	7/16	2-3/4	1	.120
278437111B	97203			7/16	.4375	7/16	2-3/4	1	.156
27843720B	97205			7/16	.4375	7/16	4	2	
27843722B	97206			7/16	.4375	7/16	4	2	.015
27843724B	97207			7/16	.4375	7/16	4	2	.030
27843726B	97208			7/16	.4375	7/16	4	2	.060
27843727B	97209			7/16	.4375	7/16	4	2	.090
27843728B	97210			7/16	.4375	7/16	4	2	.120

TECH
Page 136

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
278437211B	97211			7/16	.4375	7/16	4	2	.156
27850000B	37025	27850000BW	13528	1/2	.5000	1/2	3	5/8	
27850002B	37026	27850002BW	13529	1/2	.5000	1/2	3	5/8	.015
27850004B	37027	27850004BW	13550	1/2	.5000	1/2	3	5/8	.030
27850006B	97216			1/2	.5000	1/2	3	5/8	.060
27850007B	97217			1/2	.5000	1/2	3	5/8	.090
27850008B	97218			1/2	.5000	1/2	3	5/8	.120
278500011B	97219			1/2	.5000	1/2	3	5/8	.156
27850009B	97220			1/2	.5000	1/2	3	5/8	.190
27850010B	97258			1/2	.5000	1/2	3	1	
27850011B	18963			1/2	.5000	1/2	3	1	.010
27850012B	97259			1/2	.5000	1/2	3	1	.015
27850013B	18964			1/2	.5000	1/2	3	1	.020
27850014B	97260			1/2	.5000	1/2	3	1	.030
27850016B	97261			1/2	.5000	1/2	3	1	.060
27850017B	97262			1/2	.5000	1/2	3	1	.090
27850018B	97263			1/2	.5000	1/2	3	1	.120
278500111B	97264			1/2	.5000	1/2	3	1	.156
27850019B	97265			1/2	.5000	1/2	3	1	.190
27850020B	37028	27850020BW	13551	1/2	.5000	1/2	3	1-1/4	
27850021B	18965			1/2	.5000	1/2	3	1-1/4	.010
27850022B	37029	27850022BW	13579	1/2	.5000	1/2	3	1-1/4	.015
27850023B	18966			1/2	.5000	1/2	3	1-1/4	.020
27850024B	37030	27850024BW	12761	1/2	.5000	1/2	3	1-1/4	.030
27850026B	37078	27850026BW	13584	1/2	.5000	1/2	3	1-1/4	.060
27850027B	97271			1/2	.5000	1/2	3	1-1/4	.090
27850028B	97272			1/2	.5000	1/2	3	1-1/4	.120
278500211B	97273			1/2	.5000	1/2	3	1-1/4	.156
27850029B	97274			1/2	.5000	1/2	3	1-1/4	.190
27850030B	97276			1/2	.5000	1/2	4	1-5/8	
27850032B	97277			1/2	.5000	1/2	4	1-5/8	.015
27850034B	97278			1/2	.5000	1/2	4	1-5/8	.030
27850036B	97279			1/2	.5000	1/2	4	1-5/8	.060
27850037B	97280			1/2	.5000	1/2	4	1-5/8	.090
27850038B	97281			1/2	.5000	1/2	4	1-5/8	.120
278500311B	97282			1/2	.5000	1/2	4	1-5/8	.156
27850039B	97283			1/2	.5000	1/2	4	1-5/8	.190
27850040B	97294			1/2	.5000	1/2	4	2-1/8	
27850042B	97295			1/2	.5000	1/2	4	2-1/8	.015
27850044B	97296			1/2	.5000	1/2	4	2-1/8	.030
27850046B	97297			1/2	.5000	1/2	4	2-1/8	.060
27850047B	97298			1/2	.5000	1/2	4	2-1/8	.090

TECH
Page 136

TuffCut® XT - Series 278 *Continued*



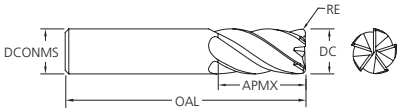
ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
27850048B	97299			1/2	.5000	1/2	4	2-1/8	.120
278500411B	97300			1/2	.5000	1/2	4	2-1/8	.156
27850049B	97301			1/2	.5000	1/2	4	2-1/8	.190
27850050B	97303			1/2	.5000	1/2	5	2-5/8	
27850052B	97304			1/2	.5000	1/2	5	2-5/8	.015
27850054B	97305			1/2	.5000	1/2	5	2-5/8	.030
27850056B	97306			1/2	.5000	1/2	5	2-5/8	.060
27850057B	97307			1/2	.5000	1/2	5	2-5/8	.090
27850058B	97308			1/2	.5000	1/2	5	2-5/8	.120
278500511B	97309			1/2	.5000	1/2	5	2-5/8	.156
27850059B	97310			1/2	.5000	1/2	5	2-5/8	.190
27850060B	97285			1/2	.5000	1/2	6	1-5/8	
27850062B	97286			1/2	.5000	1/2	6	1-5/8	.015
27850064B	97287			1/2	.5000	1/2	6	1-5/8	.030
27850066B	97288			1/2	.5000	1/2	6	1-5/8	.060
27850067B	97289			1/2	.5000	1/2	6	1-5/8	.090
27850068B	97290			1/2	.5000	1/2	6	1-5/8	.120
278500611B	97291			1/2	.5000	1/2	6	1-5/8	.156
27850069B	97292			1/2	.5000	1/2	6	1-5/8	.190
27850070B	97312			1/2	.5000	1/2	6	3-1/4	
27850072B	97313			1/2	.5000	1/2	6	3-1/4	.015
27850074B	97314			1/2	.5000	1/2	6	3-1/4	.030
27850076B	97315			1/2	.5000	1/2	6	3-1/4	.060
27850077B	97316			1/2	.5000	1/2	6	3-1/4	.090
27850078B	97317			1/2	.5000	1/2	6	3-1/4	.120
278500711B	97318			1/2	.5000	1/2	6	3-1/4	.156
27850079B	97319			1/2	.5000	1/2	6	3-1/4	.190
278L50000B	37031	278L50000BW	13588	1/2	.5000	1/2	4	2	
278L50002B	37032	278L50002BW	13589	1/2	.5000	1/2	4	2	.015
278L50004B	37033	278L50004BW	13593	1/2	.5000	1/2	4	2	.030
278X50000B	37034	278X50000BW	13606	1/2	.5000	1/2	5	3	
278X50002B	37035	278X50002BW	13607	1/2	.5000	1/2	5	3	.015
278X50004B	37036	278X50004BW	13608	1/2	.5000	1/2	5	3	.030
27862500B	97321			5/8	.6250	5/8	3	3/4	
27862502B	97322			5/8	.6250	5/8	3	3/4	.015
27862504B	97323			5/8	.6250	5/8	3	3/4	.030
27862506B	97324			5/8	.6250	5/8	3	3/4	.060
27862507B	97325			5/8	.6250	5/8	3	3/4	.090

TECH
Page 136

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
27862508B	97326			5/8	.6250	5/8	3	3/4	.120
278625011B	97327			5/8	.6250	5/8	3	3/4	.156
27862509B	97328			5/8	.6250	5/8	3	3/4	.190
278625012B	97329			5/8	.6250	5/8	3	3/4	.250
27862510B	37039	27862510BW	13609	5/8	.6250	5/8	3-1/2	1-1/4	
27862512B	37040	27862512BW	13611	5/8	.6250	5/8	3-1/2	1-1/4	.015
27862514B	37041	27862514BW	13612	5/8	.6250	5/8	3-1/2	1-1/4	.030
27862516B	37042	27862516BW	13613	5/8	.6250	5/8	3-1/2	1-1/4	.060
27862518B	37043	27862518BW	13614	5/8	.6250	5/8	3-1/2	1-1/4	.120
27862520B	97361			5/8	.6250	5/8	3-1/2	1-5/8	
27862522B	97362			5/8	.6250	5/8	3-1/2	1-5/8	.015
27862524B	97363			5/8	.6250	5/8	3-1/2	1-5/8	.030
27862526B	97364			5/8	.6250	5/8	3-1/2	1-5/8	.060
27862527B	97365			5/8	.6250	5/8	3-1/2	1-5/8	.090
27862528B	97366			5/8	.6250	5/8	3-1/2	1-5/8	.120
278625211B	97368			5/8	.6250	5/8	3-1/2	1-5/8	.156
27862529B	97367			5/8	.6250	5/8	3-1/2	1-5/8	.190
278625212B	97369			5/8	.6250	5/8	3-1/2	1-5/8	.250
27862530B	97371			5/8	.6250	5/8	4	2-1/8	
27862532B	97372			5/8	.6250	5/8	4	2-1/8	.015
27862534B	97373			5/8	.6250	5/8	4	2-1/8	.030
27862536B	97374			5/8	.6250	5/8	4	2-1/8	.060
27862537B	97375			5/8	.6250	5/8	4	2-1/8	.090
27862538B	97376			5/8	.6250	5/8	4	2-1/8	.120
278625311B	97377			5/8	.6250	5/8	4	2-1/8	.156
27862539B	97378			5/8	.6250	5/8	4	2-1/8	.190
278625312B	97379			5/8	.6250	5/8	4	2-1/8	.250
27862540B	97391			5/8	.6250	5/8	5	2-5/8	
27862542B	97392			5/8	.6250	5/8	5	2-5/8	.015
27862544B	97393			5/8	.6250	5/8	5	2-5/8	.030
27862546B	97394			5/8	.6250	5/8	5	2-5/8	.060
27862547B	97395			5/8	.6250	5/8	5	2-5/8	.090
27862548B	97396			5/8	.6250	5/8	5	2-5/8	.120
278625411B	97397			5/8	.6250	5/8	5	2-5/8	.156
27862549B	97398			5/8	.6250	5/8	5	2-5/8	.190
278625412B	97399			5/8	.6250	5/8	5	2-5/8	.250
27862550B	97381			5/8	.6250	5/8	6	2-1/8	
27862552B	97382			5/8	.6250	5/8	6	2-1/8	.015
27862554B	97383			5/8	.6250	5/8	6	2-1/8	.030
27862556B	97384			5/8	.6250	5/8	6	2-1/8	.060
27862557B	97385			5/8	.6250	5/8	6	2-1/8	.090
27862558B	97386			5/8	.6250	5/8	6	2-1/8	.120
278625511B	97387			5/8	.6250	5/8	6	2-1/8	.156
27862559B	97388			5/8	.6250	5/8	6	2-1/8	.190
278625512B	97389			5/8	.6250	5/8	6	2-1/8	.250

TECH
Page 136

TuffCut® XT - Series 278 *Continued*



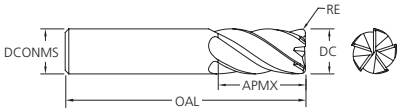
ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
27862560B	97401			5/8	.6250	5/8	6	3-1/4	
27862562B	97402			5/8	.6250	5/8	6	3-1/4	.015
27862564B	97403			5/8	.6250	5/8	6	3-1/4	.030
27862566B	97404			5/8	.6250	5/8	6	3-1/4	.060
27862567B	97405			5/8	.6250	5/8	6	3-1/4	.090
27862568B	97406			5/8	.6250	5/8	6	3-1/4	.120
278625611B	97407			5/8	.6250	5/8	6	3-1/4	.156
27862569B	97408			5/8	.6250	5/8	6	3-1/4	.190
278625612B	97409			5/8	.6250	5/8	6	3-1/4	.250
27862570B	97411			5/8	.6250	5/8	6	4	
27862572B	97412			5/8	.6250	5/8	6	4	.015
27862574B	97413			5/8	.6250	5/8	6	4	.030
27862576B	97414			5/8	.6250	5/8	6	4	.060
27862577B	97415			5/8	.6250	5/8	6	4	.090
27862578B	97416			5/8	.6250	5/8	6	4	.120
278625711B	97417			5/8	.6250	5/8	6	4	.156
27862579B	97418			5/8	.6250	5/8	6	4	.190
278625712B	97419			5/8	.6250	5/8	6	4	.250
278L62500B	37044	278L62500BW	13616	5/8	.6250	5/8	5	2-1/4	
278L62502B	37045	278L62502BW	13617	5/8	.6250	5/8	5	2-1/4	.015
278L62504B	37046	278L62504BW	13618	5/8	.6250	5/8	5	2-1/4	.030
278X62500B	37047	278X62500BW	13619	5/8	.6250	5/8	6	3	
278X62502B	37048	278X62502BW	13621	5/8	.6250	5/8	6	3	.015
278X62504B	37049	278X62504BW	13622	5/8	.6250	5/8	6	3	.030
27875000B	97421			3/4	.7500	3/4	3	1	
27875002B	97422			3/4	.7500	3/4	3	1	.015
27875004B	97423			3/4	.7500	3/4	3	1	.030
27875006B	97424			3/4	.7500	3/4	3	1	.060
27875007B	97425			3/4	.7500	3/4	3	1	.090
27875008B	97426			3/4	.7500	3/4	3	1	.120
278750011B	97427			3/4	.7500	3/4	3	1	.156
27875009B	97428			3/4	.7500	3/4	3	1	.190
278750012B	97429			3/4	.7500	3/4	3	1	.250
27875010B	37052	27875010BW	13623	3/4	.7500	3/4	4	1-1/2	
27875012B	37053	27875012BW	13624	3/4	.7500	3/4	4	1-1/2	.015
27875013B	18257			3/4	.7500	3/4	4	1-1/2	.020
27875014B	37054	27875014BW	13627	3/4	.7500	3/4	4	1-1/2	.030
27875016B	37055	27875016BW	13628	3/4	.7500	3/4	4	1-1/2	.060

TECH
Page 136

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
27875018B	37056	27875018BW	13629	3/4	.7500	3/4	4	1-1/2	.120
27875019B	37079	27875019BW	13632	3/4	.7500	3/4	4	1-1/2	.190
27875020B	97461			3/4	.7500	3/4	4	1-5/8	
27875022B	97462			3/4	.7500	3/4	4	1-5/8	.015
27875024B	97463			3/4	.7500	3/4	4	1-5/8	.020
27875026B	97464			3/4	.7500	3/4	4	1-5/8	.060
27875027B	97465			3/4	.7500	3/4	4	1-5/8	.090
27875028B	97466			3/4	.7500	3/4	4	1-5/8	.120
278750211B	97467			3/4	.7500	3/4	4	1-5/8	.156
27875029B	97468			3/4	.7500	3/4	4	1-5/8	.190
278750212B	97469			3/4	.7500	3/4	4	1-5/8	.250
27875030B	97471			3/4	.7500	3/4	5	2-3/8	
27875032B	97472			3/4	.7500	3/4	5	2-3/8	.015
27875034B	97473			3/4	.7500	3/4	5	2-3/8	.030
27875036B	97474			3/4	.7500	3/4	5	2-3/8	.060
27875037B	97475			3/4	.7500	3/4	5	2-3/8	.090
27875038B	97476			3/4	.7500	3/4	5	2-3/8	.120
278750311B	97477			3/4	.7500	3/4	5	2-3/8	.156
27875039B	97478			3/4	.7500	3/4	5	2-3/8	.190
278750312B	97479			3/4	.7500	3/4	5	2-3/8	.250
27875040B	97481			3/4	.7500	3/4	6	2-3/8	
27875042B	97482			3/4	.7500	3/4	6	2-3/8	.015
27875044B	97483			3/4	.7500	3/4	6	2-3/8	.030
27875046B	97484			3/4	.7500	3/4	6	2-3/8	.060
27875047B	97485			3/4	.7500	3/4	6	2-3/8	.090
27875048B	97486			3/4	.7500	3/4	6	2-3/8	.120
278750411B	97487			3/4	.7500	3/4	6	2-3/8	.156
27875049B	97488			3/4	.7500	3/4	6	2-3/8	.190
278750412B	97489			3/4	.7500	3/4	6	2-3/8	.250
27875050B	97491			3/4	.7500	3/4	6	3-1/4	
27875052B	97492			3/4	.7500	3/4	6	3-1/4	.015
27875054B	97493			3/4	.7500	3/4	6	3-1/4	.030
27875056B	97494			3/4	.7500	3/4	6	3-1/4	.060
27875057B	97495			3/4	.7500	3/4	6	3-1/4	.090
27875058B	97496			3/4	.7500	3/4	6	3-1/4	.120
278750511B	97497			3/4	.7500	3/4	6	3-1/4	.156
27875059B	97498			3/4	.7500	3/4	6	3-1/4	.190
278750512B	97499			3/4	.7500	3/4	6	3-1/4	.250
27875060B	97501			3/4	.7500	3/4	7	4-1/8	
27875062B	97502			3/4	.7500	3/4	7	4-1/8	.015
27875064B	97503			3/4	.7500	3/4	7	4-1/8	.030
27875066B	97504			3/4	.7500	3/4	7	4-1/8	.060
27875067B	97505			3/4	.7500	3/4	7	4-1/8	.090
27875068B	97506			3/4	.7500	3/4	7	4-1/8	.120

TECH
Page 136

TuffCut® XT - Series 278 *Continued*



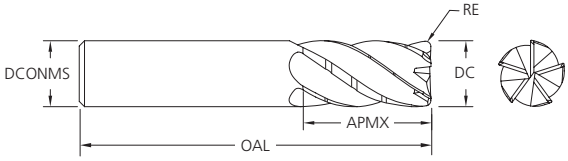
ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
278750611B	97507			3/4	.7500	3/4	7	4-1/8	.156
27875069B	97508			3/4	.7500	3/4	7	4-1/8	.190
278750612B	97509			3/4	.7500	3/4	7	4-1/8	.250
278L75000B	37057	278L75000BW	13633	3/4	.7500	3/4	5	2-1/4	
278L75002B	37058	278L75002BW	13634	3/4	.7500	3/4	5	2-1/4	.015
278L75004B	37059	278L75004BW	13636	3/4	.7500	3/4	5	2-1/4	.030
278X75000B	37060	278X75000BW	13637	3/4	.7500	3/4	6	3	
278X75002B	37061	278X75002BW	13639	3/4	.7500	3/4	6	3	.015
278X75004B	37062	278X75004BW	13656	3/4	.7500	3/4	6	3	.030
27810010B	37065	27810010BW	13657	1	1.0000	1	4	1-1/2	
27810014B	37066	27810014BW	13658	1	1.0000	1	4	1-1/2	.030
27810016B	37067	27810016BW	13659	1	1.0000	1	4	1-1/2	.060
27810018B	37068	27810018BW	13677	1	1.0000	1	4	1-1/2	.120
27810019B	37080	27810019BW	14112	1	1.0000	1	4	1-1/2	.190
27810020B	97555			1	1.0000	1	4	1-3/4	
27810022B	97556			1	1.0000	1	4	1-3/4	.015
27810024B	97557			1	1.0000	1	4	1-3/4	.030
27810026B	97558			1	1.0000	1	4	1-3/4	.060
27810027B	97559			1	1.0000	1	4	1-3/4	.090
27810028B	97560			1	1.0000	1	4	1-3/4	.120
278100211B	97561			1	1.0000	1	4	1-3/4	.156
27810029B	97562			1	1.0000	1	4	1-3/4	.190
278100212B	97563			1	1.0000	1	4	1-3/4	.250
278100213B	97564			1	1.0000	1	4	1-3/4	.375
27810030B	97566			1	1.0000	1	5	2-5/8	
27810032B	97567			1	1.0000	1	5	2-5/8	.015
27810034B	97568			1	1.0000	1	5	2-5/8	.030
27810036B	97569			1	1.0000	1	5	2-5/8	.060
27810037B	97570			1	1.0000	1	5	2-5/8	.090
27810038B	97571			1	1.0000	1	5	2-5/8	.120
278100311B	97572			1	1.0000	1	5	2-5/8	.156
27810039B	97573			1	1.0000	1	5	2-5/8	.190
278100312B	97574			1	1.0000	1	5	2-5/8	.250
278100313B	97575			1	1.0000	1	5	2-5/8	.375
27810040B	97588			1	1.0000	1	6	3-1/4	
27810042B	97589			1	1.0000	1	6	3-1/4	.015
27810044B	97590			1	1.0000	1	6	3-1/4	.030
27810046B	97591			1	1.0000	1	6	3-1/4	.060

TECH
Page 136

ALtima® Blaze		ALtima® Blaze Weldon Flat		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
27810047B	97592			1	1.0000	1	6	3-1/4	.090
27810048B	97593			1	1.0000	1	6	3-1/4	.120
278100411B	97594			1	1.0000	1	6	3-1/4	.156
27810049B	97595			1	1.0000	1	6	3-1/4	.190
278100412B	97596			1	1.0000	1	6	3-1/4	.250
278100413B	97597			1	1.0000	1	6	3-1/4	.375
27810050B	97599			1	1.0000	1	7	4-1/4	
27810052B	97600			1	1.0000	1	7	4-1/4	.015
27810054B	97601			1	1.0000	1	7	4-1/4	.030
27810056B	97602			1	1.0000	1	7	4-1/4	.060
27810057B	97603			1	1.0000	1	7	4-1/4	.090
27810058B	97604			1	1.0000	1	7	4-1/4	.120
278100511B	97605			1	1.0000	1	7	4-1/4	.156
27810059B	97606			1	1.0000	1	7	4-1/4	.190
278100512B	97607			1	1.0000	1	7	4-1/4	.250
278100513B	97608			1	1.0000	1	7	4-1/4	.375
278L10000B	37069	278L10000BW	14113	1	1.0000	1	5	2-1/4	
278L10002B	37070	278L10002BW	14114	1	1.0000	1	5	2-1/4	.015
278L10004B	37071	278L10004BW	14115	1	1.0000	1	5	2-1/4	.030
278X10000B	37072	278X10000BW	14116	1	1.0000	1	6	3	
278X10002B	37073	278X10002BW	14117	1	1.0000	1	6	3	.015
278X10004B	37074	278X10004BW	14118	1	1.0000	1	6	3	.030

TECH
Page 136

TuffCut® XT - Series 278CB



- Staggered chipbreaker technology.
- Improved geometries.
- Enhanced corner protection.

ALtima® Blaze		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
278LCB25000B	03900	1/4	.2500	1/4	3	1-1/4	
278LCB25002B	03901	1/4	.2500	1/4	3	1-1/4	.015
278LCB25004B	03902	1/4	.2500	1/4	3	1-1/4	.030
278LCB25006B	03903	1/4	.2500	1/4	3	1-1/4	.060
278LCB25007B	03904	1/4	.2500	1/4	3	1-1/4	.090
278XCB25000B	03905	1/4	.2500	1/4	4	1-3/4	
278XCB25002B	03906	1/4	.2500	1/4	4	1-3/4	.015
278XCB25004B	03907	1/4	.2500	1/4	4	1-3/4	.030
278CB37510B	03942	3/8	.3750	3/8	2-1/2	1	
278CB37511B	03943	3/8	.3750	3/8	2-1/2	1	.010
278CB37512B	03944	3/8	.3750	3/8	2-1/2	1	.015
278CB37513B	03945	3/8	.3750	3/8	2-1/2	1	.020
278CB37514B	03946	3/8	.3750	3/8	2-1/2	1	.030
278CB37516B	03947	3/8	.3750	3/8	2-1/2	1	.060
278LCB37500B	03908	3/8	.3750	3/8	4	1-5/8	
278LCB37502B	03909	3/8	.3750	3/8	4	1-5/8	.015
278LCB37504B	03910	3/8	.3750	3/8	4	1-5/8	.030
278LCB37506B	03911	3/8	.3750	3/8	4	1-5/8	.060
278LCB37507B	03912	3/8	.3750	3/8	4	1-5/8	.090
278LCB37508B	03913	3/8	.3750	3/8	4	1-5/8	.120
278LCB375011B	03914	3/8	.3750	3/8	4	1-5/8	.156
278XCB37500B	03915	3/8	.3750	3/8	4	2-1/2	
278XCB37502B	03916	3/8	.3750	3/8	4	2-1/2	.015
278XCB37504B	03917	3/8	.3750	3/8	4	2-1/2	.030
278CB50020B	03948	1/2	.5000	1/2	3	1-1/4	
278CB50021B	03949	1/2	.5000	1/2	3	1-1/4	.010
278CB50022B	03950	1/2	.5000	1/2	3	1-1/4	.015
278CB50023B	03951	1/2	.5000	1/2	3	1-1/4	.020

Inch	
DC	Tolerance
1/4	+.000/-.002
>1/4 - 1	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.2500 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Inch	
RE	Tolerance
1/4 - 1	+.0000/-.0016

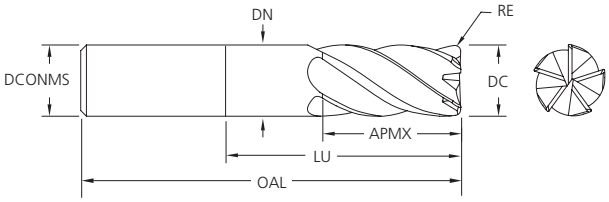
TECH
Page 136

NEW

ALtima® Blaze		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
278CB50024B	03952	1/2	.5000	1/2	3	1-1/4	.030
278CB50026B	03953	1/2	.5000	1/2	3	1-1/4	.060
278CB50030B	19401	1/2	.5000	1/2	4	1-5/8	
278CB50032B	19432	1/2	.5000	1/2	4	1-5/8	.015
278CB50034B	03956	1/2	.5000	1/2	4	1-5/8	.030
278CB50036B	03957	1/2	.5000	1/2	4	1-5/8	.060
278LCB50000B	03918	1/2	.5000	1/2	4	2	
278LCB50002B	03919	1/2	.5000	1/2	4	2	.015
278LCB50004B	03920	1/2	.5000	1/2	4	2	.030
278XCB50000B	03921	1/2	.5000	1/2	5	3	
278XCB50002B	03922	1/2	.5000	1/2	5	3	.015
278XCB50004B	03923	1/2	.5000	1/2	5	3	.030
278CB62510B	03958	5/8	.6250	5/8	3-1/2	1-1/4	
278CB62512B	03959	5/8	.6250	5/8	3-1/2	1-1/4	.015
278CB62514B	03960	5/8	.6250	5/8	3-1/2	1-1/4	.030
278CB62516B	03961	5/8	.6250	5/8	3-1/2	1-1/4	.060
278LCB62500B	03924	5/8	.6250	5/8	5	2-1/4	
278LCB62502B	03925	5/8	.6250	5/8	5	2-1/4	.015
278LCB62504B	03926	5/8	.6250	5/8	5	2-1/4	.030
278XCB62500B	03927	5/8	.6250	5/8	6	3	
278XCB62502B	03928	5/8	.6250	5/8	6	3	.015
278XCB62504B	03929	5/8	.6250	5/8	6	3	.030
278CB75010B	03962	3/4	.7500	3/4	4	1-1/2	
278CB75012B	03963	3/4	.7500	3/4	4	1-1/2	.015
278CB75014B	03964	3/4	.7500	3/4	4	1-1/2	.030
278CB75016B	03965	3/4	.7500	3/4	4	1-1/2	.060
278LCB75000B	03930	3/4	.7500	3/4	5	2-1/4	
278LCB75002B	03931	3/4	.7500	3/4	5	2-1/4	.015
278LCB75004B	03932	3/4	.7500	3/4	5	2-1/4	.030
278XCB75000B	03933	3/4	.7500	3/4	6	3	
278XCB75002B	03934	3/4	.7500	3/4	6	3	.015
278XCB75004B	03935	3/4	.7500	3/4	6	3	.030
278CB10010B	03966	1	1.0000	1	4	1-1/2	
278CB10014B	03967	1	1.0000	1	4	1-1/2	.030
278CB10016B	03968	1	1.0000	1	4	1-1/2	.060
278LCB10000B	03936	1	1.0000	1	5	2-1/4	
278LCB10002B	03937	1	1.0000	1	5	2-1/4	.015
278LCB10004B	03938	1	1.0000	1	5	2-1/4	.030
278XCB10000B	03939	1	1.0000	1	6	3	
278XCB10002B	03940	1	1.0000	1	6	3	.015
278XCB10004B	03941	1	1.0000	1	6	3	.030

TECH
Page 136

TuffCut® XT - Series 278N



- Improved geometries.
- Enhanced corner protection.

ALtima® Blaze		DC			DCONMS		DN		OAL		APMX		LU		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
278 0300N3-0.25RB	27820		3	.1181		6		2.9		57		8		10		0.25
278 0300N3-0.5RB	27822		3	.1181		6		2.9		57		8		10		0.50
278 0400N3-0.25RB	27824		4	.1575		6		3.9		57		11		13		0.25
278 0400N3-0.5RB	27826		4	.1575		6		3.9		57		11		13		0.50
278 0500N3-0.25RB	27828		5	.1968		6		4.9		57		13		16		0.25
278 0500N3-0.5RB	27830		5	.1968		6		4.9		57		13		16		0.50
278 0600N3-0.25RB	27832		6	.2362		6		5.9		57		13		19		0.25
278 0600N3-0.5RB	27834		6	.2362		6		5.9		57		13		19		0.50
278 0600N3-1.0RB	27836		6	.2362		6		5.9		57		13		19		1.00
27825022NB	37011	1/4		.2500	1/4				4		3/4		2-1/8		0.015	
27825024NB	37012	1/4		.2500	1/4				4		3/4		2-1/8		0.030	
278 0800N3-0.25RB	27837		8	.3150		8		7.8		63		19		25		0.25
278 0800N3-0.5RB	27838		8	.3150		8		7.8		63		19		25		0.50
278 0800N3-1.0RB	27840		8	.3150		8		7.8		63		19		25		1.00
278 0800N3-2.0RB	27842		8	.3150		8		7.8		63		19		25		2.00
27837522NB	37023	3/8		.3750	3/8				4		1		2-1/8		0.015	
27837524NB	37024	3/8		.3750	3/8				4		1		2-1/8		0.030	
278 1000N3-0.5RB	27844		10	.3937		10		9.8		72		22		31		0.50
278 1000N3-1.0RB	27846		10	.3937		10		9.8		72		22		31		1.00
278 1000N3-2.0RB	27848		10	.3937		10		9.8		72		22		31		2.00
278 1200N3-0.5RB	27850		12	.4724		12		11.4		84		26		38		0.50
278 1200N3-1.0RB	27852		12	.4724		12		11.4		84		26		38		1.00
278 1200N3-1.5RB	27854		12	.4724		12		11.4		84		26		38		1.50
278 1200N3-2.5RB	27856		12	.4724		12		11.4		84		26		38		2.50
278 1200N3-3.0RB	27858		12	.4724		12		11.4		84		26		38		3.00
278 1200N3-4.0RB	27860		12	.4724		12		11.4		84		26		38		4.00

Inch	
DC	Tolerance
1/4	+.000/-.002
>1/4 - 3/4	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7500	+0/-.00051

Metric (mm)	
DC	Tolerance (h10)
3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 25.00	+.000/-.084

Metric (mm)	
DCONMS	Tolerance (h6)
6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 18.0	+0/-.011
18.01 - 25.0	+0/-.013

Inch	
RE	Tolerance
1/4 - 3/4	+.0000/-.0016

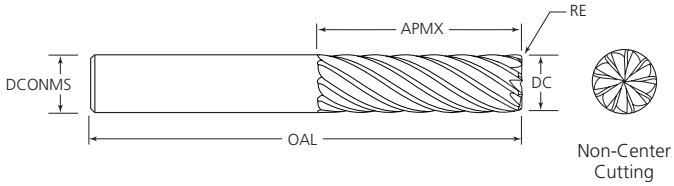
Metric (mm)	
RE	Tolerance
3.0 - 25.0	+.00/-.04

TECH
Page 136

ALtima® Blaze		DC			DCONMS		DN		OAL		APMX		LU		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
27850022NB	37037	1/2		.5000	1/2				4		1-1/4		2-1/8		0.015	
27850024NB	37038	1/2		.5000	1/2				4		1-1/4		2-1/8		0.030	
27862522NB	37050	5/8		.6250	5/8				4		1-1/2		2-1/8		0.015	
27862524NB	37051	5/8		.6250	5/8				4		1-1/2		2-1/8		0.030	
278 1600N3-0.5RB	27870		16	.6299		16		15.2		100		35		50		0.50
278 1600N3-1.0RB	27872		16	.6299		16		15.2		100		35		50		1.00
278 1600N3-1.5RB	27874		16	.6299		16		15.2		100		35		50		1.50
278 1600N3-2.5RB	27876		16	.6299		16		15.2		100		35		50		2.50
278 1600N3-3.0RB	27878		16	.6299		16		15.2		100		35		50		3.00
278 1600N3-4.0RB	27880		16	.6299		16		15.2		100		35		50		4.00
278 1600N4-1.0RB	27871		16	.6299		16		15.2		117		35		65		1.00
278 1600N4-3.0RB	27873		16	.6299		16		15.2		117		35		65		3.00
278 1600N5-1.0RB	27875		16	.6299		16		15.2		133		35		82		1.00
278 1600N5-3.0RB	27877		16	.6299		16		15.2		133		35		82		3.00
27875022NB	37063	3/4		.7500	3/4				5		1-7/8		3		0.015	
27875024NB	37064	3/4		.7500	3/4				5		1-7/8		3		0.030	
278 2000N3-1.0RB	27890		20	.7874		20		19.2		112		40		62		1.00
278 2000N3-2.0RB	27906		20	.7874		20		19.2		112		40		62		2.00
278 2000N3-3.0RB	27892		20	.7874		20		19.2		112		40		62		3.00
278 2000N3-4.0RB	27894		20	.7874		20		19.2		112		40		62		4.00
278 2000N4-1.0RB	27891		20	.7874		20		19.2		133		40		82		1.00
278 2000N4-3.0RB	27893		20	.7874		20		19.2		133		40		82		3.00
278 2000N5-1.0RB	27895		20	.7874		20		19.2		152		40		102		1.00
278 2000N5-3.0RB	27897		20	.7874		20		19.2		152		40		102		3.00
278 2500N3-1.0RB	27896		25	.9843		25		24.6		127		40		77		1.00
278 2500N3-3.0RB	27898		25	.9843		25		24.6		127		40		77		3.00
278 2500N3-4.0RB	27900		25	.9843		25		24.6		127		40		77		4.00
278 2500N4-1.0RB	27899		25	.9843		25		24.6		152		40		102		1.00
278 2500N4-3.0RB	27901		25	.9843		25		24.6		152		40		102		3.00
278 2500N5-1.0RB	27902		25	.9843		25		24.6		180		40		125		1.00
278 2500N5-3.0RB	27903		25	.9843		25		24.6		180		40		125		3.00

TECH
Page 136

TuffCut® XT9 - Series 380



- Designed for high speed machining of Titanium, Inconel, and similar materials.
- New ALtima® Xtreme (AX) coating designed for high speed machining and dry machining.
- Uneven number of flutes reduces harmonics to provide stable machining zones.

ALtima® Xtreme		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
380M0800-0.5RAX	38042		8	.3150		8.0		63		22		0.50
380M0800-1.0RAX	38044		8	.3150		8.0		63		22		1.00
38037511AX	18973	3/8		.3750	3/8		2-1/2		1		.010	
38037512AX	38038	3/8		.3750	3/8		2-1/2		1		.015	
38037513AX	18974	3/8		.3750	3/8		2-1/2		1		.020	
38037514AX	38040	3/8		.3750	3/8		2-1/2		1		.030	
380M1000-0.5RAX	38046		10	.3937		10.0		72		27		0.50
380M1000-1.0RAX	38048		10	.3937		10.0		72		27		1.00
380M1200-0.5RAX	38026		12	.4724		12.0		84		32		0.50
380M1200-1.0RAX	38028		12	.4724		12.0		84		32		1.00
380M1200-1.5RAX	19714		12	.4724		12.0		84		32		1.50
38050011AX	18975	1/2		.5000	1/2		3		1-1/4		.010	
38050012AX	38000	1/2		.5000	1/2		3		1-1/4		.015	
38050013AX	18976	1/2		.5000	1/2		3		1-1/4		.020	
38050014AX	38002	1/2		.5000	1/2		3		1-1/4		.030	
38050016AX	38004	1/2		.5000	1/2		3		1-1/4		.060	
380L5004AX	38006	1/2		.5000	1/2		3-1/2		1-3/4		.030	
380X5002AX	38081	1/2		.5000	1/2		4		2		.015	
38062512AX	38008	5/8		.6250	5/8		3-1/2		1-1/4		.015	
38062514AX	38010	5/8		.6250	5/8		3-1/2		1-1/4		.030	
38062516AX	38012	5/8		.6250	5/8		3-1/2		1-1/4		.060	
380L6254AX	38014	5/8		.6250	5/8		4		1-7/8		.030	
380M1600-0.5RAX	38030		16	.6299		16.0		92		42		0.50
380M1600-1.0RAX	38032		16	.6299		16.0		92		42		1.00
38075012AX	38016	3/4		.7500	3/4		4		1-1/2		.015	
38075014AX	38018	3/4		.7500	3/4		4		1-1/2		.030	
38075016AX	38020	3/4		.7500	3/4		4		1-1/2		.060	
38075018AX	38022	3/4		.7500	3/4		4		1-1/2		.120	
380L7504AX	38024	3/4		.7500	3/4		5		2-1/4		.030	
380M2000-0.5RAX	38034		20	.7874		20.0		104		52		0.50
380M2000-1.0RAX	38036		20	.7874		20.0		104		52		1.00

Inch	
DC	Tolerance
.3750 - .3937	+0/-.0020
>.3937 - 7874	+0/-.0025

Inch	
DCONMS	Tolerance (h6)
.3750 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7874	+0/-.00051

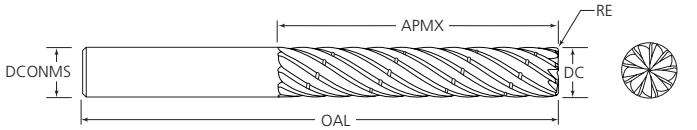
Metric (mm)	
DC	Tolerance
8.0 - 10.0	+0/-.050
>10.0 - 20.0	+0/-.064

Metric (mm)	
DCONMS	Tolerance (h6)
8.0 - 10.0	+0/-.009
>10.0 - 18.0	+0/-.011
>18.0 - 20.0	+0/-.013

ALtima® Xtreme Coating Properties				
Microhardness (HV)	Max. Service Temp.	Friction Coefficient	Designation	Color
3800	1100° C / 2012° F	0.3 - 0.5	AX	Copper

TECH
Page 140

TuffCut® XT - Series 380CB



Non-Center Cutting

- Staggered Chipbreaker Technology For Reduced Cutting Forces And Excellent Chip Management.
- Uneven 9 Flute Designed For High Feed Rates With Reduced Harmonics For Stable Machining.
- ALtima® Xtreme Coating Is Excellent For High-Heat And Wear Resistance.

ALtima® Xtreme		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
380CBM0800-0.5RAX	38050		8	.3150		8		63		22		0.5
380CBM0800-1.0RAX	38051		8	.3150		8		63		22		1.0
380CB37511AX	38052	3/8		.3750	3/8		2-1/2		1		.010	
380CB37512AX	38053	3/8		.3750	3/8		2-1/2		1		.015	
380CB37513AX	38054	3/8		.3750	3/8		2-1/2		1		.020	
380CB37514AX	38055	3/8		.3750	3/8		2-1/2		1		.030	
380CBM1000-0.5RAX	38056		10	.3937		10		72		27		0.5
380CBM1000-1.0RAX	38057		10	.3937		10		72		27		1.0
380CBM1200-0.5RAX	38058		12	.4724		12		84		32		0.5
380CBM1200-1.0RAX	38059		12	.4724		12		84		32		1.0
380CBM1200-1.5RAX	38083		12	.4724		12		84		32		1.5
380CB50011AX	38060	1/2		.5000	1/2		3		1-1/4		.010	
380CB50012AX	38061	1/2		.5000	1/2		3		1-1/4		.015	
380CB50013AX	38062	1/2		.5000	1/2		3		1-1/4		.020	
380CB50014AX	38063	1/2		.5000	1/2		3		1-1/4		.030	
380CB50016AX	38064	1/2		.5000	1/2		3		1-1/4		.060	
380LCB5004AX	38065	1/2		.5000	1/2		3-1/2		1-3/4		.030	
380XCB5002AX	38080	1/2		.5000	1/2		4		2		.015	
380CB62512AX	38066	5/8		.6250	5/8		3-1/2		1-1/4		.015	
380CB62514AX	38067	5/8		.6250	5/8		3-1/2		1-1/4		.030	
380CB62516AX	38068	5/8		.6250	5/8		3-1/2		1-1/4		.060	
380LCB6254AX	38069	5/8		.6250	5/8		4		1-7/8		.030	
380CBM1600-0.5RAX	38070		16	.6299		16		92		42		0.5
380CBM1600-1.0RAX	38071		16	.6299		16		92		42		1.0
380CB75012AX	38072	3/4		.7500	3/4		4		1-1/2		.015	
380CB75014AX	38073	3/4		.7500	3/4		4		1-1/2		.030	
380CB75016AX	38074	3/4		.7500	3/4		4		1-1/2		.060	
380CB75018AX	38075	3/4		.7500	3/4		4		1-1/2		.120	
380LCB7504AX	38076	3/4		.7500	3/4		5		2-1/4		.030	
380CBM2000-0.5RAX	38077		20	.7874		20		104		52		0.5
380CBM2000-1.0RAX	38078		20	.7874		20		104		52		1.0

Inch	
DC	Tolerance
.3750 - .3937	+0/-.0020
>.3937 - 7874	+0/-.0025

Inch	
DCONMS	Tolerance (h6)
.3750 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7874	+0/-.00051

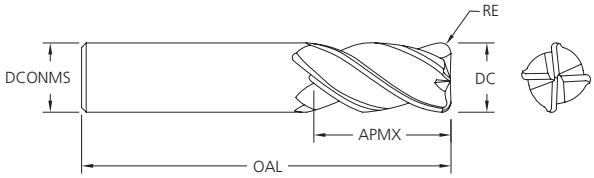
Metric (mm)	
DC	Tolerance
8.0 - 10.0	+0/-.050
>10.0 - 20.0	+0/-.064

Metric (mm)	
DCONMS	Tolerance (h6)
8.0 - 10.0	+0/-.009
>10.0 - 18.0	+0/-.011
>18.0 - 20.0	+0/-.013

TECH
Page 140

ALtima® Xtreme Coating Properties				
Microhardness (HV)	Max. Service Temp.	Friction Coefficient	Designation	Color
3800	1100° C / 2012° F	0.3 - 0.5	AX	Copper

TuffCut® XR - Series 177



- Designed for EXTREME Productivity. Unique flute geometry reduces harmonics at increased feeds and speeds.
- Variable helix.

ALtima®		ALtima® Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17705900A	17680				1.5	.0591		3.0		38		3.0		
17706250A	17692			1/16		.0625	1/8		1-1/2		1/8			
17707810A	17694			5/64		.0781	1/8		1-1/2		5/32			
17707870A	17682				2.0	.0787		3.0		38		4.0		
17709370A	17696			3/32		.0937	1/8		1-1/2		3/16			
17709840A	17684				2.5	.0984		3.0		38		5.0		
17711800A	17928				3.0	.1181		6.0		57		8.0		
17711801A	17783				3.0	.1181		6.0		57		8.0		0.50
17711803A	17686				3.0	.1181		3.0		38		6.0		
17711808A	17929				3.0	.1181		6.0		57		8.0		0.25
17712500A	17700			1/8		.1250	1/8		1-1/2		1/8			
17712502A	17729			1/8		.1250	1/8		1-1/2		1/8		0.015	
17712510A	17701			1/8		.1250	1/8		1-1/2		3/8			
17712512A	17730			1/8		.1250	1/8		1-1/2		3/8		0.015	
17713700A	17688				3.5	.1378		6.0		57		7.0		
17715600A	17702			5/32		.1562	3/16		2		3/16			
17715602A	17731			5/32		.1562	3/16		2		3/16		0.015	
17715610A	17703			5/32		.1562	3/16		2		7/16			
17715612A	17732			5/32		.1562	3/16		2		7/16		0.015	
17715700A	17930				4.0	.1575		6.0		57		11.0		
17715701A	17784				4.0	.1575		6.0		57		11.0		0.50
17715708A	17931				4.0	.1575		6.0		57		11.0		0.25
17717700A	17690				4.5	.1772		6.0		57		9.0		
17718700A	17704			3/16		.1875	3/16		2		3/16			

Inch	
DC	Tolerance
1/ 16 - 1/4	+.000/-.002
> 1/4 - 1.0	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Metric (mm)	
DC	Tolerance (h10)
1.50 - 3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 25.00	+.000/-.084

Metric (mm)	
DCONMS	Tolerance (h6)
3.0	+0/-0.006
3.01 - 6.0	+0/-0.008
6.01 - 10.0	+0/-0.009
10.01 - 18.0	+0/-0.011
18.01 - 25.0	+0/-.013

TECH
Page 142

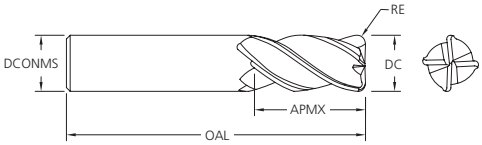
Inch	
RE	Tolerance
1/8 - 1	+.0000/-.0016

Metric (mm)	
RE	Tolerance
3.0 - 25.0	+.00/-.04

ALtima®		ALtima® Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17718702A	17733			3/16		.1875	3/16		2		3/16		0.015	
17718704A	17734			3/16		.1875	3/16		2		3/16		0.030	
17718710A	17705			3/16		.1875	3/16		2		7/16			
17718712A	17735			3/16		.1875	3/16		2		7/16		0.015	
17718714A	17736			3/16		.1875	3/16		2		7/16		0.030	
17719600A	17932				5.0	.1968		6.0		57		13.0		
17719601A	17785				5.0	.1968		6.0		57		13.0		0.50
17719608A	17933				5.0	.1968		6.0		57		13.0		0.25
17721800A	17706			7/32		.2187	1/4		2		1/4			
17721802A	17737			7/32		.2187	1/4		2		1/4		0.015	
17721804A	17738			7/32		.2187	1/4		2		1/4		0.030	
17721810A	17707			7/32		.2187	1/4		2-1/2		7/16			
17721812A	17739			7/32		.2187	1/4		2-1/2		7/16		0.015	
17721814A	17740			7/32		.2187	1/4		2-1/2		7/16		0.030	
17723600A	17934				6.0	.2362		6.0		57		13.0		
17723608A	17786				6.0	.2362		6.0		57		13.0		0.25
17723601A	17935				6.0	.2362		6.0		57		13.0		0.50
17723603A	17787				6.0	.2362		6.0		57		13.0		1.00
17723604A	17788				6.0	.2362		6.0		57		13.0		1.50
17723605A	18070				6.0	.2362		6.0		57		13.0		2.00
17725000A	17708			1/4		.2500	1/4		2		1/4			
17725002A	17741			1/4		.2500	1/4		2		1/4		0.015	
17725004A	17742			1/4		.2500	1/4		2		1/4		0.030	
17725010A	17709			1/4		.2500	1/4		2-1/2		1/2			
17725012A	17743			1/4		.2500	1/4		2-1/2		1/2		0.015	
17725014A	17744			1/4		.2500	1/4		2-1/2		1/2		0.030	
17728100A	17710			9/32		.2812	5/16		2-1/2		5/8			
17728102A	17745			9/32		.2812	5/16		2-1/2		5/8		0.015	
17728104A	17746			9/32		.2812	5/16		2-1/2		5/8		0.030	
17731200A	17711			5/16		.3125	5/16		2		5/16			
17731202A	17747			5/16		.3125	5/16		2		5/16		0.015	
17731204A	17748			5/16		.3125	5/16		2		5/16		0.030	
17731210A	17712			5/16		.3125	5/16		2-1/2		13/16			
17731212A	17749			5/16		.3125	5/16		2-1/2		13/16		0.015	
17731214A	17750			5/16		.3125	5/16		2-1/2		13/16		0.030	
17731500A	17937				8.0	.3150		8.0		63		19.0		
17731501A	17938				8.0	.3150		8.0		63		19.0		0.50
17731503A	17789				8.0	.3150		8.0		63		19.0		1.00
17731504A	17790				8.0	.3150		8.0		63		19.0		1.50
17731505A	17791				8.0	.3150		8.0		63		19.0		2.00
17731507A	18072				8.0	.3150		8.0		63		19.0		3.00
17734300A	17713			11/32		.3438	3/8		2-1/2		13/16			
17734302A	17751			11/32		.3438	3/8		2-1/2		13/16		0.015	
17734304A	17752			11/32		.3438	3/8		2-1/2		13/16		0.030	
17737500A	17714			3/8		.3750	3/8		2		3/8			
17737502A	17753			3/8		.3750	3/8		2		3/8		0.015	

TECH
Page 142

TuffCut® XR - Series 177 *Continued*



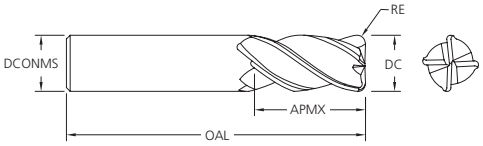
ALtima®		ALtima® Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17737504A	17754			3/8		.3750	3/8		2		3/8		0.030	
17737510A	17715			3/8		.3750	3/8		2-1/2		7/8			
17737512A	17755			3/8		.3750	3/8		2-1/2		7/8		0.015	
17737514A	17756			3/8		.3750	3/8		2-1/2		7/8		0.030	
17739300A	17940				10.0	.3937		10.0		72		22.0		
17739301A	17941				10.0	.3937		10.0		72		22.0		0.50
17739303A	17792				10.0	.3937		10.0		72		22.0		1.00
17739304A	17793				10.0	.3937		10.0		72		22.0		1.50
17739305A	17794				10.0	.3937		10.0		72		22.0		2.00
17739307A	96603				10.0	.3937		10.0		72		22.0		3.00
17740600A	17716			13/32		.4062	7/16		2-3/4		15/16			
17740602A	17757			13/32		.4062	7/16		2-3/4		15/16		0.015	
17740604A	17758			13/32		.4062	7/16		2-3/4		15/16		0.030	
17743700A	17717			7/16		.4375	7/16		2-1/2		7/16			
17743702A	17759			7/16		.4375	7/16		2-1/2		7/16		0.015	
17743704A	17760			7/16		.4375	7/16		2-1/2		7/16		0.030	
17743710A	17718			7/16		.4375	7/16		2-3/4		1			
17743712A	17761			7/16		.4375	7/16		2-3/4		1		0.015	
17743714A	17762			7/16		.4375	7/16		2-3/4		1		0.030	
17746800A	17719			15/32		.4688	1/2		3		1			
17746802A	17763			15/32		.4688	1/2		3		1		0.015	
17746804A	17764			15/32		.4688	1/2		3		1		0.030	
17747200A	17943				12.0	.4724		12.0		83		26.0		
17747201A	17795				12.0	.4724		12.0		83		26.0		0.50
17747202A	17944				12.0	.4724		12.0		83		26.0		0.75
17747203A	17796				12.0	.4724		12.0		83		26.0		1.00
17747204A	17797				12.0	.4724		12.0		83		26.0		1.50
17747205A	17798				12.0	.4724		12.0		83		26.0		2.00
17747206A	18074				12.0	.4724		12.0		83		26.0		2.50
17747207A	96506				12.0	.4724		12.0		83		26.0		3.00
17747209A	18076				12.0	.4724		12.0		83		26.0		4.00
17750000A	17720	17750000AW	13166	1/2		.5000	1/2		2-1/2		1/2			
17750002A	17765	17750002AW	13167	1/2		.5000	1/2		2-1/2		1/2		0.015	
17750004A	17766	17750004AW	13168	1/2		.5000	1/2		2-1/2		1/2		0.030	
17750010A	17721	17750010AW	58038	1/2		.5000	1/2		3		1			
17750012A	17767	17750012AW	13169	1/2		.5000	1/2		3		1		0.015	
17750014A	17768	17750014AW	58039	1/2		.5000	1/2		3		1		0.030	

TECH
Page 142

ALtima®		ALtima® Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17750016A	17901	17750016AW	58061	1/2		.5000	1/2		3		1		0.060	
17750017A	17902	17750017AW	13170	1/2		.5000	1/2		3		1		0.090	
17750018A	17903	17750018AW	13171	1/2		.5000	1/2		3		1		0.125	
17750020A	18094	17750020AW	58056	1/2		.5000	1/2		3		1-1/4			
17750022A	18095	17750022AW	13172	1/2		.5000	1/2		3		1-1/4		.015	
17750024A	18096	17750024AW	58051	1/2		.5000	1/2		3		1-1/4		.030	
17750026A	18097	17750026AW	12610	1/2		.5000	1/2		3		1-1/4		.060	
17750027A	18098	17750027AW	13173	1/2		.5000	1/2		3		1-1/4		.090	
17750028A	18099	17750028AW	13174	1/2		.5000	1/2		3		1-1/4		.125	
17755100A	17946				14.0	.5512		14.0		83		26.0		
17755102A	17947				14.0	.5512		14.0		83		26.0		0.75
17756200A	17722			9/16		.5625	9/16		3-1/2		1-1/8			
17756202A	17769			9/16		.5625	9/16		3-1/2		1-1/8		0.015	
17756204A	17770			9/16		.5625	9/16		3-1/2		1-1/8		0.030	
17762500A	17723	17762500AW	13175	5/8		.6250	5/8		3		5/8			
17762502A	18000	17762502AW	13176	5/8		.6250	5/8		3		5/8		0.015	
17762504A	17771	17762504AW	13177	5/8		.6250	5/8		3		5/8		0.030	
17762505A	17772	17762505AW	13178	5/8		.6250	5/8		3		5/8		0.045	
17762510A	17724	17762510AW	58040	5/8		.6250	5/8		3-1/2		1-1/4			
17762512A	18001	17762512AW	13179	5/8		.6250	5/8		3-1/2		1-1/4		0.015	
17762514A	17773	17762514AW	58041	5/8		.6250	5/8		3-1/2		1-1/4		0.030	
17762515A	17774	17762515AW	13180	5/8		.6250	5/8		3-1/2		1-1/4		0.045	
17762516A	17904	17762516AW	13181	5/8		.6250	5/8		3-1/2		1-1/4		0.060	
17762517A	17905	17762517AW	13182	5/8		.6250	5/8		3-1/2		1-1/4		0.090	
17762518A	17906	17762518AW	13183	5/8		.6250	5/8		3-1/2		1-1/4		0.125	
17762900A	17950				16.0	.6299		16.0		92		32.0		
17762901A	18078				16.0	.6299		16.0		92		32.0		0.50
17762903A	17951				16.0	.6299		16.0		92		32.0		1.00
17762904A	17799				16.0	.6299		16.0		92		32.0		1.50
17762905A	17673				16.0	.6299		16.0		92		32.0		2.00
17762906A	18080				16.0	.6299		16.0		92		32.0		2.50
17762907A	17674				16.0	.6299		16.0		92		32.0		3.00
17762909A	18082				16.0	.6299		16.0		92		32.0		4.00
17770800A	17952				18.0	.7087		18.0		92		32.0		
17770803A	17953				18.0	.7087		18.0		92		32.0		1.00
17775000A	17725	17775000AW	13184	3/4		.7500	3/4		3		3/4			
17775002A	18002	17775002AW	13185	3/4		.7500	3/4		3		3/4		0.015	
17775004A	17775	17775004AW	13186	3/4		.7500	3/4		3		3/4		0.030	
17775005A	17776	17775005AW	14590	3/4		.7500	3/4		3		3/4		0.045	
17775010A	17726	17775010AW	58042	3/4		.7500	3/4		4		1-1/2			
17775012A	18003	17775012AW	13187	3/4		.7500	3/4		4		1-1/2		0.015	
17775014A	17777	17775014AW	58043	3/4		.7500	3/4		4		1-1/2		0.030	
17775015A	17778	17775015AW	13188	3/4		.7500	3/4		4		1-1/2		0.045	
17775016A	17907	17775016AW	58053	3/4		.7500	3/4		4		1-1/2		0.060	

TECH
Page 142

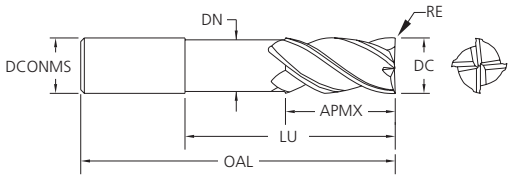
TuffCut® XR - Series 177 *Continued*



ALtima®		ALtima® Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17775017A	17908	17775017AW	13189	3/4		.7500	3/4		4		1-1/2		0.090	
17775018A	17909	17775018AW	13190	3/4		.7500	3/4		4		1-1/2		0.125	
17778700A	17955				20.0	.7874		20.0		104		38.0		
17778703A	17956				20.0	.7874		20.0		104		38.0		1.00
17778704A	18091				20.0	.7874		20.0		104		38.0		1.50
17778705A	18084				20.0	.7874		20.0		104		38.0		2.00
17778707A	18086				20.0	.7874		20.0		104		38.0		3.00
17778709A	18088				20.0	.7874		20.0		104		38.0		4.00
177787011A	18090				20.0	.7874		20.0		104		38.0		5.00
177787012A	18092				20.0	.7874		20.0		104		38.0		6.00
17798400A	17957				25.0	.9843		25.0		104		38.0		
17798403A	17958				25.0	.9843		25.0		104		38.0		1.00
17710000A	17727	17710000AW	13191	1		1.0000	1		4		1			
17710002A	18004	17710002AW	13192	1		1.0000	1		4		1		0.015	
17710004A	17779	17710004AW	13193	1		1.0000	1		4		1		0.030	
17710005A	17780	17710005AW	13194	1		1.0000	1		4		1		0.045	
17710010A	17728	17710010AW	58078	1		1.0000	1		4		1-1/2			
17710012A	18005	17710012AW	13195	1		1.0000	1		4		1-1/2		0.015	
17710014A	17781	17710014AW	58033	1		1.0000	1		4		1-1/2		0.030	
17710015A	17782	17710015AW	13197	1		1.0000	1		4		1-1/2		0.045	
17710016A	17910	17710016AW	13198	1		1.0000	1		4		1-1/2		0.060	
17710017A	17911	17710017AW	13199	1		1.0000	1		4		1-1/2		0.090	
17710018A	17912	17710018AW	13200	1		1.0000	1		4		1-1/2		0.125	

TECH
Page 142

TuffCut® XR - Series 177L



- Variable helix.

ALtima®		DC (h10)		DCONMS	DN	OAL	APMX	LU	RE
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm	Inch
177L2360R010N5A	18186	6	.2362	6	5.8	101	12	31	0.25
177L2360R020N5A	18183	6	.2362	6	5.8	101	12	31	0.5
177L2360R039N5A	18184	6	.2362	6	5.8	101	12	31	1.0
177L3150R020N5A	18187	8	.3150	8	7.6	101	16	41	0.5
177L3150R039N5A	18194	8	.3150	8	7.6	101	16	41	1.0
177L3150R078N5A	18195	8	.3150	8	7.6	101	16	41	2.0
177L3150R118N5A	18196	8	.3150	8	7.6	101	16	41	3.0
177L3930R020N5A	18188	10	.3937	10	9.6	127	20	51	0.5
177L3930R039N5A	18197	10	.3937	10	9.6	127	20	51	1.0
177L3930R078N5A	18198	10	.3937	10	9.6	127	20	51	2.0
177L3930R118N5A	18199	10	.3937	10	9.6	127	20	51	3.0
177L4720R020N5A	18189	12	.4724	12	11.4	150	24	62	0.5
177L4720R039N5A	18176	12	.4724	12	11.4	150	24	62	1.0
177L4720R078N5A	18177	12	.4724	12	11.4	150	24	62	2.0
177L4720R118N5A	18190	12	.4724	12	11.4	150	24	62	3.0
177L4720R157N5A	18178	12	.4724	12	11.4	150	24	62	4.0
177L6290R020N5A	18181	16	.6299	16	15.2	150	32	82	0.5
177L6290R039N5A	18191	16	.6299	16	15.2	150	32	82	1.0
177L6290R078N5A	18179	16	.6299	16	15.2	150	32	82	2.0
177L6290R118N5A	18180	16	.6299	16	15.2	150	32	82	3.0
177L7870R020N5A	18182	20	.7874	20	19.2	150	40	102	0.5
177L7870R039N5A	18192	20	.7874	20	19.2	150	40	102	1.0
177L7870R118N5A	18193	20	.7874	20	19.2	150	40	102	3.0

Inch size available upon request.

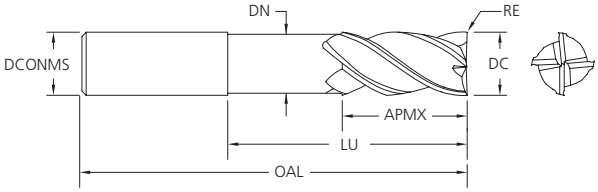
Metric (mm)	
DC	Tolerance (h10)
6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 20.00	+.000/-.084

Metric (mm)	
DCONMS	Tolerance (h6)
6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 18.0	+0/-.011
18.01 - 20.0	+0/-.013

Metric (mm)	
RE	Tolerance
6.0 - 20.0	+.00/-.10

TECH
Page 142

TuffCut® XR - Series 177S



- Variable helix.

ALtima®		DC (h10)		DCONMS	DN	OAL	APMX	LU	RE	Shank
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm	Inch	
177S1181A	18218	3	.1181	6	2.9	50	5	11		DIN 6535 HA
177S1181R008A	18200	3	.1181	6	2.9	50	5	11	0.20	DIN 6535 HA
177S1181AW	18254	3	.1181	6	2.9	50	5	11		DIN 6535 HB
177S1181R008AW	18236	3	.1181	6	2.9	50	5	11	0.20	DIN 6535 HB
177S1575A	18220	4	.1575	6	3.9	50	6	14		DIN 6535 HA
177S1575R008A	18202	4	.1575	6	3.9	50	6	14	0.20	DIN 6535 HA
177S1575AW	18256	4	.1575	6	3.9	50	6	14		DIN 6535 HB
177S1575R008AW	18238	4	.1575	6	3.9	50	6	14	0.20	DIN 6535 HB
177S1969A	18222	5	.1968	6	4.9	57	8	17		DIN 6535 HA
177S1969R008A	18204	5	.1968	6	4.9	57	8	17	0.20	DIN 6535 HA
177S1969AW	18258	5	.1968	6	4.9	57	8	17		DIN 6535 HB
177S1969R008AW	18240	5	.1968	6	4.9	57	8	17	0.20	DIN 6535 HB
177S2362A	18224	6	.2362	6	5.8	57	9	20		DIN 6535 HA
177S2362R012A	18206	6	.2362	6	5.8	57	9	20	0.30	DIN 6535 HA
177S2362AW	18260	6	.2362	6	5.8	57	9	20		DIN 6535 HB
177S2362R012AW	18242	6	.2362	6	5.8	57	9	20	0.30	DIN 6535 HB
177S3150A	18226	8	.3150	8	7.6	63	12	26		DIN 6535 HA
177S3150R020A	18208	8	.3150	8	7.6	63	12	26	0.50	DIN 6535 HA
177S3150AW	18262	8	.3150	8	7.6	63	12	26		DIN 6535 HB
177S3150R020AW	18244	8	.3150	8	7.6	63	12	26	0.50	DIN 6535 HB
177S3937A	18228	10	.3937	10	9.6	72	15	32		DIN 6535 HA
177S3937R020A	18210	10	.3937	10	9.6	72	15	32	0.50	DIN 6535 HA
177S3937AW	18264	10	.3937	10	9.6	72	15	32		DIN 6535 HB
177S3937R020AW	18246	10	.3937	10	9.6	72	15	32	0.50	DIN 6535 HB
177S4724A	18230	12	.4724	12	11.4	83	18	38		DIN 6535 HA
177S4724R020A	18212	12	.4724	12	11.4	83	18	38	0.50	DIN 6535 HA
177S4724AW	18266	12	.4724	12	11.4	83	18	38		DIN 6535 HB
177S4724R020AW	18248	12	.4724	12	11.4	83	18	38	0.50	DIN 6535 HB
177S6299A	18232	16	.6299	16	15.2	98	24	50		DIN 6535 HA
177S6299R039A	18214	16	.6299	16	15.2	98	24	50	1.00	DIN 6535 HA
177S6299AW	18268	16	.6299	16	15.2	98	24	50		DIN 6535 HB
177S6299R039AW	18250	16	.6299	16	15.2	98	24	50	1.00	DIN 6535 HB
177S7874A	18234	20	.7874	20	19.2	112	30	62		DIN 6535 HA
177S7874R039A	18216	20	.7874	20	19.2	112	30	62	1.00	DIN 6535 HA
177S7874AW	18270	20	.7874	20	19.2	112	30	62		DIN 6535 HB
177S7874R039AW	18252	20	.7874	20	19.2	112	30	62	1.00	DIN 6535 HB

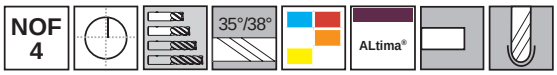
Metric (mm)	
DC	Tolerance (h10)
3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 20.00	+.000/-.084

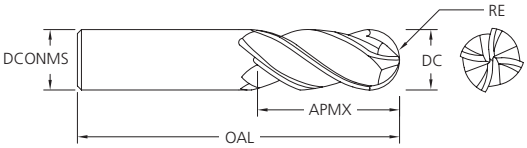
Metric (mm)	
DCONMS	Tolerance (h6)
6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 18.0	+0/-.011
18.01 - 20.0	+0/-.013

Metric (mm)	
RE	Tolerance
3.0 - 20.0	+.00/-.10

TECH
Page 142

TuffCut® XR - Series 179





- Variable helix.

ALtima®		DC			DCONMS		OAL		APMX	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
17905900A	18272		1.5	.0591		3		38		3.0
17906250A	18284	1/16		.0625	1/8		1-1/2		1/8	
17907810A	18286	5/64		.0781	1/8		1-1/2		5/32	
17907870A	18274		2	.0787		3		38		4.0
17909370A	18288	3/32		.0937	1/8		1-1/2		3/16	
17909840A	18276		2.5	.0984		3		38		5.0
17911800A	18018		3	.1181		6		57		8.0
17911803A	18278		3	.1181		3		38		6.0
17912500A	18034	1/8		.1250	1/8		1-1/2		1/4	
17912510A	18035	1/8		.1250	1/8		1-1/2		3/8	
17913700A	18280		3.5	.1378		6		63		7.0
17915700A	18019		4	.1575		6		57		11.0
17917700A	18282		4.5	.1772		6		63		9.0
17918700A	18038	3/16		.1875	3/16		2		3/8	
17918710A	18039	3/16		.1875	3/16		2		5/8	
17919600A	18020		5	.1968		6		57		13.0
17923600A	18021		6	.2362		6		57		13.0
17925000A	18042	1/4		.2500	1/4		2		3/8	
17925010A	18043	1/4		.2500	1/4		2-1/2		3/4	
17925020A	18063	1/4		.2500	1/4		4		1/2	
17931200A	18045	5/16		.3125	5/16		2		1/2	
17931210A	18046	5/16		.3125	5/16		2-1/2		13/16	
17931500A	18022		8	.3150		8		63		19.0
17937500A	18048	3/8		.3750	3/8		2		1/2	
17937510A	18049	3/8		.3750	3/8		2-1/2		7/8	
17937520A	18064	3/8		.3750	3/8		4		9/16	
17939300A	18023		10	.3937		10		72		22.0
17947200A	18024		12	.4724		12		83		26.0
17950000A	18054	1/2		.5000	1/2		2-1/2		5/8	

Inch	
DC	Tolerance
1/16 - 1/4	+.000/-.002
> 1/4 - 1.0	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Metric (mm)	
DC	Tolerance (h10)
1.50 - 3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070

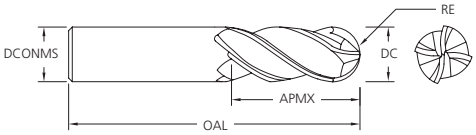
Metric (mm)	
DCONMS	Tolerance (h6)
3.0	+0/-0.006
3.01 - 6.0	+0/-0.008
6.01 - 10.0	+0/-0.009
10.01 - 18.0	+0/-0.011

TECH
Page 142

Inch	
RE	Tolerance
1/6 - 1	+.0/-.001

Metric (mm)	
RE	Tolerance
1.5 - 16.0	+.0/-.025

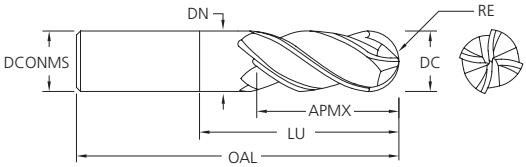
TuffCut® XR - Series 179 *Continued*



ALtima®		DC			DCONMS		OAL		APMX	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
17950010A	18055	1/2		.5000	1/2		3		1-1/4	
17950020A	18065	1/2		.5000	1/2		5		5/8	
17962510A	18058	5/8		.6250	5/8		3-1/2		1-1/4	
17962520A	18066	5/8		.6250	5/8		6		3/4	
17962900A	18059		16	.6299		16		92		32.0
17975010A	18060	3/4		.7500	3/4		4		1-1/2	
17975020A	18067	3/4		.7500	3/4		6		1	
17910010A	18062	1		1.0000	1		4		1-1/2	
17910020A	18068	1		1.0000	1		6		1-1/4	

TECH
Page 142

TuffCut® XR - Series 179L



- Variable helix.
- Inch Sizes Available upon request.

ALtima®		DC (h10)		DCONMS	DN	OAL	APMX	LU
Tool No.	EDP	mm	Decimal	Inch	mm	mm	mm	mm
179L1181N5A	18290	3	.1181	6	2.9	75	4.5	17
179L1575N5A	18292	4	.1575	6	3.9	75	6.0	22
179L1968N5A	18294	5	.1968	6	4.9	75	7.5	27
179L2362N5A	18296	6	.2362	6	5.8	101	9.0	32
179L3150N5A	18298	8	.3150	8	7.6	101	12.0	42
179L3937N5A	18302	10	.3937	10	9.6	127	15.0	52
179L4724N5A	18304	12	.4724	12	11.4	150	18.0	62
179L6299N5A	18306	16	.6299	16	15.2	150	24.0	82

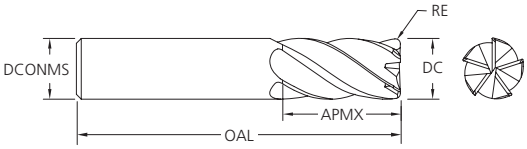
Metric (mm)	
DC	Tolerance (h10)
3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 16.00	+.000/-.070

Metric (mm)	
DCONMS	Tolerance (h6)
6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 16.0	+0/-.011

Metric (mm)	
RE	Tolerance
3.0 - 16.0	+.0/-.025

TECH
Page 142

TuffCut® XR - Series 178



- Designed for EXTREME Productivity. Gain 20% or more in productivity over four flute styles. Smooth cutting action to eliminate vibration.

ALtima®		ALtima® Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17811800A	17959				3	.1181		6		57		8		
17811810A	17998				3	.1181		3		75		25		
17812500A	17800			1/8		.1250	1/8		1-1/2		1/8			
17812510A	17801			1/8		.1250	1/8		1-1/2		3/8			
17815600A	17802			5/32		.1562	3/16		2		3/16			
17815610A	17803			5/32		.1562	3/16		2		7/16			
17815700A	17961				4	.1575		6		57		11		
17815710A	17999				4	.1575		4		75		25		
17818700A	17804			3/16		.1875	3/16		2		3/16			
17818710A	17805			3/16		.1875	3/16		2		7/16			
17819600A	17963				5	.1968		6		57		13		
17819610A	18026				5	.1968		5		75		25		
17821800A	17806			7/32		.2187	1/4		2		1/4			
17821810A	17807			7/32		.2187	1/4		2-1/2		7/16			
17823600A	17965				6	.2362		6		57		13		
17823601A	17966				6	.2362		6		57		13		0.500
17823610A	18027				6	.2362		6		75		25		
17825000A	17808			1/4		.2500	1/4		2		3/8			
17825002A	17829			1/4		.2500	1/4		2		3/8		0.015	
17825004A	17830			1/4		.2500	1/4		2		3/8		0.030	
17825010A	17809			1/4		.2500	1/4		2-1/2		5/8			
17825012A	17831			1/4		.2500	1/4		2-1/2		5/8		0.015	
17825014A	17832			1/4		.2500	1/4		2-1/2		5/8		0.030	
17825022A	18105			1/4		.2500	1/4		2-1/2		3/4		0.015	
17828100A	17810			9/32		.2812	5/16		2-1/2		5/8			
17828102A	17835			9/32		.2812	5/16		2-1/2		5/8		0.015	
17828104A	17836			9/32		.2812	5/16		2-1/2		5/8		0.030	
17831200A	17811			5/16		.3125	5/16		2		7/16			

Inch	
DC	Tolerance
1/8 - 1/4	+.000/-.002
> 1/4 - 1.0	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Metric (mm)	
DC	Tolerance (h10)
1.50 - 3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 25.00	+.000/-.084

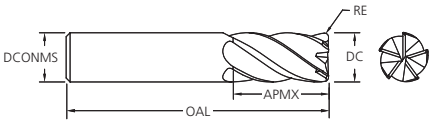
Metric (mm)	
DCONMS	Tolerance (h6)
3.0	+0/-0.006
3.01 - 6.0	+0/-0.008
6.01 - 10.0	+0/-0.009
10.01 - 18.0	+0/-0.011
18.01 - 25.0	+0/-.013

Inch	
RE	Tolerance
1/4 - 1	+.0000/-.0016

Metric (mm)	
RE	Tolerance
6.0 - 25.0	+.00/-.04

TECH
Page 146

TuffCut® XR - Series 178 *Continued*



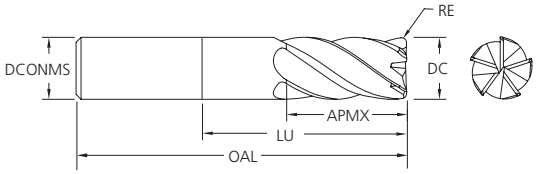
ALtima®		ALtima® Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17831202A	17837			5/16		.3125	5/16		2		7/16		0.015	
17831204A	17838			5/16		.3125	5/16		2		7/16		0.030	
17831210A	17812			5/16		.3125	5/16		2-1/2		13/16			
17831212A	17839			5/16		.3125	5/16		2-1/2		13/16		0.015	
17831214A	17840			5/16		.3125	5/16		2-1/2		13/16		0.030	
17831500A	17968				8	.3150		8		63		19		
17831501A	17969				8	.3150		8		63		19		0.500
17831510A	18028				8	.3150		8		75		30		
17834300A	17813			11/32		.3438	3/8		2-1/2		13/16			
17834302A	17843			11/32		.3438	3/8		2-1/2		13/16		0.015	
17834304A	17844			11/32		.3438	3/8		2-1/2		13/16		0.030	
17837500A	17814			3/8		.3750	3/8		2		1/2			
17837502A	17845			3/8		.3750	3/8		2		1/2		0.015	
17837504A	17846			3/8		.3750	3/8		2		1/2		0.030	
17837510A	17815			3/8		.3750	3/8		2-1/2		7/8			
17837512A	17847			3/8		.3750	3/8		2-1/2		7/8		0.015	
17837514A	17848			3/8		.3750	3/8		2-1/2		7/8		0.030	
17839300A	17971				10	.3937		10		72		22		
17839301A	17972				10	.3937		10		72		22		0.500
17839310A	18029				10	.3937		10		100		45		
17840600A	17816			13/32		.4062	7/16		2-3/4		7/8			
17840602A	17853			13/32		.4062	7/16		2-3/4		7/8		0.015	
17840604A	17854			13/32		.4062	7/16		2-3/4		7/8		0.030	
17843700A	17817			7/16		.4375	7/16		2-1/2		9/16			
17843702A	17855			7/16		.4375	7/16		2-1/2		9/16		0.015	
17843704A	17856			7/16		.4375	7/16		2-1/2		9/16		0.030	
17843710A	17818			7/16		.4375	7/16		2-3/4		1			
17843712A	17857			7/16		.4375	7/16		2-3/4		1		0.015	
17843714A	17858			7/16		.4375	7/16		2-3/4		1		0.030	
17846800A	17819			15/32		.4688	1/2		3		1			
17846802A	17863			15/32		.4688	1/2		3		1		0.015	
17846804A	17864			15/32		.4688	1/2		3		1		0.030	
17847200A	17974				12	.4724		12		83		26		
17847202A	17975				12	.4724		12		83		26		0.750
17847210A	18030				12	.4724		12		150		75		
17850000A	17820	17850000AW	10655	1/2		.5000	1/2		2-1/2		5/8			
17850002A	17865	17850002AW	13337	1/2		.5000	1/2		2-1/2		5/8		0.015	
17850004A	17866	17850004AW	13339	1/2		.5000	1/2		2-1/2		5/8		0.030	
17850010A	17821	17850010AW	13341	1/2		.5000	1/2		3		1			
17850012A	17867	17850012AW	13343	1/2		.5000	1/2		3		1		0.015	
17850014A	17868	17850014AW	13345	1/2		.5000	1/2		3		1		0.030	
17850015A	17869	17850015AW	13347	1/2		.5000	1/2		3		1		0.045	

TECH
Page 146

ALtima®		ALtima® Weldon Flat		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17850016A	17913	17850016AW	13349	1/2		.5000	1/2		3		1		0.060	
17850017A	17914	17850017AW	13351	1/2		.5000	1/2		3		1		0.090	
17850018A	17915	17850018AW	13353	1/2		.5000	1/2		3		1		0.125	
17855100A	17977				14	.5512		14		83		26		
17855102A	17978				14	.5512		14		83		26		0.750
17856200A	17822	17856200AW	13355	9/16		.5625	9/16		3-1/2		1-1/8			
17856202A	17875	17856202AW	13357	9/16		.5625	9/16		3-1/2		1-1/8		0.015	
17856204A	17876	17856204AW	13359	9/16		.5625	9/16		3-1/2		1-1/8		0.030	
17862500A	17823	17862500AW	13361	5/8		.6250	5/8		3		3/4			
17862502A	18006	17862502AW	13363	5/8		.6250	5/8		3		3/4		0.015	
17862504A	17877	17862504AW	13365	5/8		.6250	5/8		3		3/4		0.030	
17862505A	17878	17862505AW	13367	5/8		.6250	5/8		3		3/4		0.045	
17862510A	17824	17862510AW	13369	5/8		.6250	5/8		3-1/2		1-1/4			
17862512A	18007	17862512AW	13371	5/8		.6250	5/8		3-1/2		1-1/4		0.015	
17862514A	17879	17862514AW	13373	5/8		.6250	5/8		3-1/2		1-1/4		0.030	
17862515A	17880	17862515AW	13375	5/8		.6250	5/8		3-1/2		1-1/4		0.045	
17862516A	17916	17862516AW	13377	5/8		.6250	5/8		3-1/2		1-1/4		0.060	
17862517A	17917	17862517AW	13379	5/8		.6250	5/8		3-1/2		1-1/4		0.090	
17862518A	17918	17862518AW	13381	5/8		.6250	5/8		3-1/2		1-1/4		0.125	
17862900A	17981				16	.6299		16		92		32		
17862903A	17982				16	.6299		16		92		32		1.000
17862910A	18031				16	.6299		16		150		75		
17870800A	17983				18	.7087		18		92		32		
17870803A	17984				18	.7087		18		92		32		1.000
17875000A	17825	17875000AW	10656	3/4		.7500	3/4		3		1			
17875002A	18011	17875002AW	13385	3/4		.7500	3/4		3		1		0.015	
17875004A	17887	17875004AW	13387	3/4		.7500	3/4		3		1		0.030	
17875005A	17888	17875005AW	13389	3/4		.7500	3/4		3		1		0.045	
17875010A	17826	17875010AW	13394	3/4		.7500	3/4		4		1-1/2			
17875012A	18012	17875012AW	13395	3/4		.7500	3/4		4		1-1/2		0.015	
17875014A	17889	17875014AW	13396	3/4		.7500	3/4		4		1-1/2		0.030	
17875015A	17890	17875015AW	13397	3/4		.7500	3/4		4		1-1/2		0.045	
17875016A	17919	17875016AW	13398	3/4		.7500	3/4		4		1-1/2		0.060	
17875017A	17920	17875017AW	13399	3/4		.7500	3/4		4		1-1/2		0.090	
17875018A	17921	17875018AW	13402	3/4		.7500	3/4		4		1-1/2		0.125	
17878700A	17986				20	.7874		20		104		38		
17878703A	17987				20	.7874		20		104		38		1.000
17878710A	18032				20	.7874		20		150		75		
17898400A	17988				25	.9843		25		104		38		
17898403A	17989				25	.9843		25		104		38		1.000
17810000A	17827	17810000AW	13403	1		1.0000	1		4		1			
17810010A	17828	17810010AW	13404	1		1.0000	1		4		1-1/2			
17810012A	18015	17810012AW	13405	1		1.0000	1		4		1-1/2		0.015	
17810014A	17895	17810014AW	13406	1		1.0000	1		4		1-1/2		0.030	
17810015A	17896	17810015AW	13407	1		1.0000	1		4		1-1/2		0.045	
17810016A	17922	17810016AW	13408	1		1.0000	1		4		1-1/2		0.060	
17810017A	17923	17810017AW	13420	1		1.0000	1		4		1-1/2		0.090	
17810018A	17924	17810018AW	13421	1		1.0000	1		4		1-1/2		0.125	

TECH
Page 146

TuffCut® XR - Series 178N



ALtima®		DC		DCONMS	OAL	APMX	LU	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch
17825022NA	17833	1/4	.2500	1/4	4	3/4	2-1/8	0.015
17825024NA	17834	1/4	.2500	1/4	4	3/4	2-1/8	0.030
17831222NA	17841	5/16	.3125	5/16	4	1	2-1/8	0.015
17831224NA	17842	5/16	.3125	5/16	4	1	2-1/8	0.030
17837522NA	17849	3/8	.3750	3/8	4	1	2-1/8	0.015
17837524NA	17850	3/8	.3750	3/8	4	1	2-1/8	0.030
17837532NA	17851	3/8	.3750	3/8	6	1-1/4	3-3/8	0.015
17837534NA	17852	3/8	.3750	3/8	6	1-1/4	3-3/8	0.030
17843722NA	17859	7/16	.4375	7/16	4	1-1/4	2-1/8	0.015
17843724NA	17860	7/16	.4375	7/16	4	1-1/4	2-1/8	0.030
17843732NA	17861	7/16	.4375	7/16	6	1-1/2	3-3/8	0.015
17843734NA	17862	7/16	.4375	7/16	6	1-1/2	3-3/8	0.030
17850022NA	17925	1/2	.5000	1/2	4	1-1/4	2-1/8	0.015
17850024NA	17870	1/2	.5000	1/2	4	1-1/4	2-1/8	0.030
17850032NA	17871	1/2	.5000	1/2	5	1-3/8	3-1/8	0.015
17850034NA	17872	1/2	.5000	1/2	5	1-3/8	3-1/8	0.030
17850042NA	17873	1/2	.5000	1/2	6	1-1/2	4-1/8	0.015
17850044NA	17874	1/2	.5000	1/2	6	1-1/2	4-1/8	0.030
17862522NA	18008	5/8	.6250	5/8	4	1-1/2	2-1/8	0.015
17862524NA	17881	5/8	.6250	5/8	4	1-1/2	2-1/8	0.030
17862525NA	17882	5/8	.6250	5/8	4	1-1/2	2-1/8	0.045
17862532NA	18009	5/8	.6250	5/8	5	1-3/4	3-1/8	0.015
17862534NA	17883	5/8	.6250	5/8	5	1-3/4	3-1/8	0.030
17862535NA	17884	5/8	.6250	5/8	5	1-3/4	3-1/8	0.045
17862542NA	18010	5/8	.6250	5/8	6	2	4	0.015
17862544NA	17885	5/8	.6250	5/8	6	2	4	0.030
17862545NA	17886	5/8	.6250	5/8	6	2	4	0.045
17875022NA	18013	3/4	.7500	3/4	5	1-7/8	3	0.015
17875024NA	17891	3/4	.7500	3/4	5	1-7/8	3	0.030
17875025NA	17892	3/4	.7500	3/4	5	1-7/8	3	0.045
17875032NA	18014	3/4	.7500	3/4	6	2-1/4	4	0.015
17875034NA	17893	3/4	.7500	3/4	6	2-1/4	4	0.030
17875035NA	17894	3/4	.7500	3/4	6	2-1/4	4	0.045
17810022NA	18016	1	1.0000	1	5	2-1/4	3	0.015
17810024NA	17897	1	1.0000	1	5	2-1/4	3	0.030
17810025NA	17898	1	1.0000	1	5	2-1/4	3	0.045
17810032NA	18017	1	1.0000	1	6	3	4	0.015
17810034NA	17899	1	1.0000	1	6	3	4	0.030
17810035NA	17900	1	1.0000	1	6	3	4	0.045

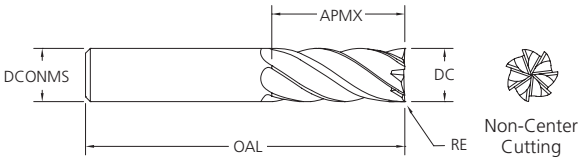
Inch	
DC	Tolerance
1/4	+.000/-.002
> 1/4 - 1.0	+.000/-.003

Inch	
DCONMS	Tolerance (h6)
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.000	+0/-.00051

Inch	
RE	Tolerance
1/4 - 1	+.0000/-.0016

TECH
Page 146

TuffCut® XR7 - Series 180



- 40% increase in productivity over a 5 flute tool.
- Designed specifically for Titanium, Inconel and similar materials.
- ALtima® Blaze coating for increased performance.

ALtima® Blaze		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
18023600B	18936		6	.2362		6		57		13		
18023601B	18938		6	.2362		6		57		13		0.5
18025000B	18900	1/4		.2500	1/4		2		3/8			
18025002B	18901	1/4		.2500	1/4		2		3/8		.015	
18025010B	18902	1/4		.2500	1/4		2-1/2		3/4			
18025011B	18967	1/4		.2500	1/4		2-1/2		3/4		.010	
18025012B	18903	1/4		.2500	1/4		2-1/2		3/4		.015	
18025013B	18968	1/4		.2500	1/4		2-1/2		3/4		.020	
18031500B	18944		8	.3150		8		63		19		
18031501B	18946		8	.3150		8		63		19		0.5
18037500B	18908	3/8		.3750	3/8		2-1/2		1/2			
18037502B	18909	3/8		.3750	3/8		2-1/2		1/2		.015	
18037504B	18932	3/8		.3750	3/8		2-1/2		1/2		.030	
18037510B	18910	3/8		.3750	3/8		2-1/2		1			
18037511B	18969	3/8		.3750	3/8		2-1/2		1		.010	
18037512B	18911	3/8		.3750	3/8		2-1/2		1		.015	
18037513B	18970	3/8		.3750	3/8		2-1/2		1		.020	
18037514B	18934	3/8		.3750	3/8		2-1/2		1		.030	
18039300B	18940		10	.3937		10		72		22		
18039301B	18942		10	.3937		10		72		22		0.5
18047201B	18501		12	.4724		12		84		32		0.5
18047203B	18503		12	.4724		12		84		32		1.0
18047205B	18505		12	.4724		12		84		32		2.0

Inch	
DC	Tolerance
.2362	+0/-.0017
.2363-.3937	+0/-.0020
.3938-1.0000	+0/-.0025

Inch	
DCONMS	Tolerance (h6)
.2362	+0/-.00031
.2363-.3937	+0/-.00035
.3938-.7087	+0/-.00043
.7088-1.0000	+0/-.00051

Metric (mm)	
DC	Tolerance
6.00	+0/-.043
6.01-.10.00	+0/-.050
10.01-.20.00	+0/-.064

Metric (mm)	
DCONMS	Tolerance (h6)
6.00	+0/-.008
6.01-.10.00	+0/-.009
10.01-.18.00	+0/-.011
18.01-20.00	+0/-.013

TECH
Page 150

Inch	
RE	Tolerance
1/4 - 1	+.001/-.001

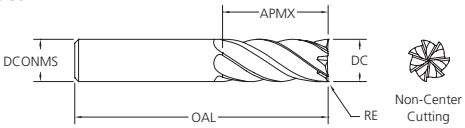
Metric (mm)	
RE	Tolerance
6.0 - 20.0	+.025/-.025

ALtima® Blaze Coating Properties	
Micro Hardness (HV)	3200
Max. Working Temperature	1100°C 2012°F
Friction Coefficient	0.35

ALtima® Blaze

Featuring high temperature hardness and oxidation resistance that provides extreme wear resistance under all machining conditions.

TuffCut® XR7 - Series 180 *Continued*



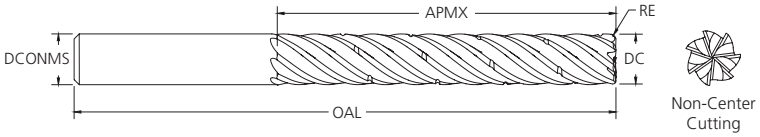
ALtima® Blaze		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
18047207B	18507		12	.4724		12		84		32		3.0
18047209B	18508		12	.4724		12		84		32		4.0
18050000B	18512	1/2		.5000	1/2		3		5/8			
18050002B	18515	1/2		.5000	1/2		3		5/8		.015	
18050004B	18517	1/2		.5000	1/2		3		5/8		.030	
18050006B	18519	1/2		.5000	1/2		3		5/8		.060	
18050007B	18521	1/2		.5000	1/2		3		5/8		.090	
18050008B	18523	1/2		.5000	1/2		3		5/8		.125	
18050010B	18514	1/2		.5000	1/2		3		1-1/4			
18050011B	18971	1/2		.5000	1/2		3		1-1/4		.010	
18050012B	18516	1/2		.5000	1/2		3		1-1/4		.015	
18050013B	18972	1/2		.5000	1/2		3		1-1/4		.020	
18050014B	18518	1/2		.5000	1/2		3		1-1/4		.030	
18050016B	18520	1/2		.5000	1/2		3		1-1/4		.060	
18050017B	18522	1/2		.5000	1/2		3		1-1/4		.090	
18050018B	18524	1/2		.5000	1/2		3		1-1/4		.125	
18062500B	18532	5/8		.6250	5/8		3-1/2		3/4			
18062502B	18535	5/8		.6250	5/8		3-1/2		3/4		.015	
18062504B	18537	5/8		.6250	5/8		3-1/2		3/4		.030	
18062506B	18539	5/8		.6250	5/8		3-1/2		3/4		.060	
18062507B	18541	5/8		.6250	5/8		3-1/2		3/4		.090	
18062508B	18543	5/8		.6250	5/8		3-1/2		3/4		.125	
18062510B	18534	5/8		.6250	5/8		3-1/2		1-1/4			
18062512B	18536	5/8		.6250	5/8		3-1/2		1-1/4		.015	
18062514B	18538	5/8		.6250	5/8		3-1/2		1-1/4		.030	
18062516B	18540	5/8		.6250	5/8		3-1/2		1-1/4		.060	
18062517B	18542	5/8		.6250	5/8		3-1/2		1-1/4		.090	
18062518B	18544	5/8		.6250	5/8		3-1/2		1-1/4		.125	
18062901B	18509		16	.6299		16		92		42		0.5
18062903B	18510		16	.6299		16		92		42		1.0
18062905B	18511		16	.6299		16		92		42		2.0
18062907B	18513		16	.6299		16		92		42		3.0
18062909B	18527		16	.6299		16		92		42		4.0
18075000B	18570	3/4		.7500	3/4		4		1			
18075002B	18573	3/4		.7500	3/4		4		1		.015	
18075004B	18575	3/4		.7500	3/4		4		1		.030	
18075006B	18577	3/4		.7500	3/4		4		1		.060	

TECH
Page 150

ALtima® Blaze		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
18075007B	18579	3/4		.7500	3/4		4		1		.090	
18075008B	18581	3/4		.7500	3/4		4		1		.125	
18075009B	18583	3/4		.7500	3/4		4		1		.190	
180750012B	18585	3/4		.7500	3/4		4		1		.250	
18075010B	18572	3/4		.7500	3/4		4		1-1/2			
18075012B	18574	3/4		.7500	3/4		4		1-1/2		.015	
18075014B	18576	3/4		.7500	3/4		4		1-1/2		.030	
18075016B	18578	3/4		.7500	3/4		4		1-1/2		.060	
18075017B	18580	3/4		.7500	3/4		4		1-1/2		.090	
18075018B	18582	3/4		.7500	3/4		4		1-1/2		.125	
18075019B	18584	3/4		.7500	3/4		4		1-1/2		.190	
180750112B	18586	3/4		.7500	3/4		4		1-1/2		.250	
18078701B	18528		20	.7874		20		102		52		0.5
18078703B	18529		20	.7874		20		102		52		1.0
18078705B	18530		20	.7874		20		102		52		2.0
18078707B	18531		20	.7874		20		102		52		3.0
18078709B	18533		20	.7874		20		102		52		4.0
18010000B	18597	1		1.0000	1		4		1			
18010002B	18599	1		1.0000	1		4		1		.015	
18010004B	18601	1		1.0000	1		4		1		.030	
18010006B	18603	1		1.0000	1		4		1		.060	
18010007B	18615	1		1.0000	1		4		1		.090	
18010008B	18607	1		1.0000	1		4		1		.125	
18010009B	18609	1		1.0000	1		4		1		.190	
180100012B	18611	1		1.0000	1		4		1		.250	
18010010B	18598	1		1.0000	1		4		1-1/2			
18010012B	18613	1		1.0000	1		4		1-1/2		.015	
18010014B	18602	1		1.0000	1		4		1-1/2		.030	
18010016B	18604	1		1.0000	1		4		1-1/2		.060	
18010017B	18606	1		1.0000	1		4		1-1/2		.090	
18010018B	18608	1		1.0000	1		4		1-1/2		.125	
18010019B	18616	1		1.0000	1		4		1-1/2		.190	
180100112B	18612	1		1.0000	1		4		1-1/2		.250	

TECH
Page 150

TuffCut® XR7 - Series 180CB



- Long and X-Long lengths now with chipbreaker.
- Higher feed rates allowed.
- Cutting forces minimized resulting in straighter walls on long axial engagements.
- Chatter reduced or eliminated.
- Prolongs life of tool by reducing re-cutting of chips.
- Creates shorter chips that can be evacuated more easily.
- Corner Radius provides a stronger corner for less wear during roughing or finishing.

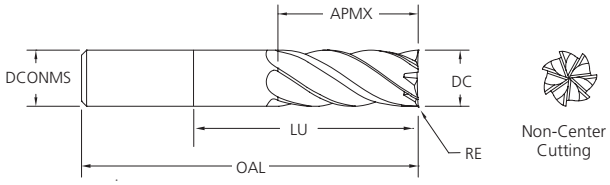
ALtima® Blaze		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
180L2500B	18904	1/4	.2500	1/4	3	1-1/4	
180L2504B	18913	1/4	.2500	1/4	3	1-1/4	.030
180X2500B	18906	1/4	.2500	1/4	4	1-3/4	
180X2504B	18915	1/4	.2500	1/4	4	1-3/4	.030
180L3750B	18912	3/8	.3750	3/8	4	1-1/2	
180L3754B	18917	3/8	.3750	3/8	4	1-1/2	.030
180X3750B	18914	3/8	.3750	3/8	4	2-1/2	
180X3754B	18919	3/8	.3750	3/8	4	2-1/2	.030
180L5000B	18916	1/2	.5000	1/2	4	2	
180L5004B	18921	1/2	.5000	1/2	4	2	.030
180X5000B	18918	1/2	.5000	1/2	5	3	
180X5004B	18923	1/2	.5000	1/2	5	3	.030
180L6250B	18920	5/8	.6250	5/8	5	2-1/4	
180L6254B	18925	5/8	.6250	5/8	5	2-1/4	.030
180X6250B	18922	5/8	.6250	5/8	6	3	
180X6254B	18927	5/8	.6250	5/8	6	3	.030
180L7500B	18924	3/4	.7500	3/4	5	2-1/4	
180L7504B	18929	3/4	.7500	3/4	5	2-1/4	.030
180X7500B	18926	3/4	.7500	3/4	6	3	
180X7504B	18931	3/4	.7500	3/4	6	3	.030
180L1000B	18928	1	1.0000	1	5	2-1/4	
180L1004B	18933	1	1.0000	1	5	2-1/4	.030
180X1000B	18930	1	1.0000	1	6	3	
180X1004B	18935	1	1.0000	1	6	3	.030

Inch	
DC	Tolerance
.2500-.3937	+0/-.0020
.3938-1.0000	+0/-.0025

Inch	
DCONMS	Tolerance (h6)
.2363-.3937	+0/-.00035
.3938-.7087	+0/-.00043
.7088-1.0000	+0/-.00051

TECH
Page 150

TuffCut® XR7 - Series 180N



- 40% increase in productivity over a 5 flute tool.
- Designed specifically for Titanium, Inconel and similar materials.
- ALtima® Blaze coating for increased performance.

ALtima® Blaze		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
18047203NB	18500		12.0	.4724		12.0		120		30		60		1.0
18047205NB	18502		12.0	.4724		12.0		120		30		60		2.0
18047207NB	18504		12.0	.4724		12.0		120		30		60		3.0
18047209NB	18506		12.0	.4724		12.0		120		30		60		4.0
18050024NB	18526	1/2		.5000	1/2		4		1-1/4		2-1/8		.030	
18062524NB	18546	5/8		.6250	5/8		4		1-1/4		2-1/8		.030	
18062903NB	18548		16.0	.6299		16.0		150		40		80		1.0
18062905NB	18550		16.0	.6299		16.0		150		40		80		2.0
18062907NB	18552		16.0	.6299		16.0		150		40		80		3.0
18062909NB	18554		16.0	.6299		16.0		150		40		80		4.0
18075024NB	18588	3/4		.7500	3/4		5		1-7/8		3		.030	
18078713NB	18590		20.0	.7874		20.0		150		50		100		1.0
18078715NB	18592		20.0	.7874		20.0		150		50		100		2.0
18078717NB	18594		20.0	.7874		20.0		150		50		100		3.0
18078719NB	18596		20.0	.7874		20.0		150		50		100		4.0
180100205NB	18614	1		1.0000	1		6		3		4		.045	

Inch	
DC	Tolerance
.5000-1.0000	+0/-.0025

Inch	
DCONMS	Tolerance (h6)
.5000-.7087	+0/-.00043
.7088-1.0000	+0/-.00051

Metric (mm)	
DC	Tolerance
12.00-.20.00	+0/-.064

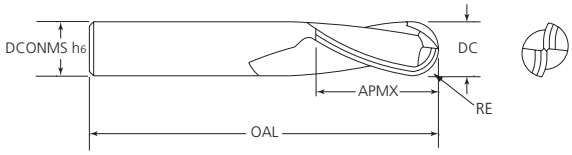
Metric (mm)	
DCONMS	Tolerance (h6)
12.00-.18.00	+0/-.011
18.01-20.00	+0/-.013

Inch	
RE	Tolerance
1/4 - 1	+.001/-.001

Metric (mm)	
RE	Tolerance
6.0 - 20.0	+.025/-.025

TECH
Page 150

TuffCut® 3D - Series 250



Features
- High performance geometry.
- Radius tolerance + 0.010mm.
- ALtima® Blaze coating.
- Economical price level.

Benefits
- Roughing and finishing applications.
- Accurate finishing in 3D shapes.
- Hardened steels <50HRC - alloy steel - stainless steel - titanium.
- Reduced tooling costs.

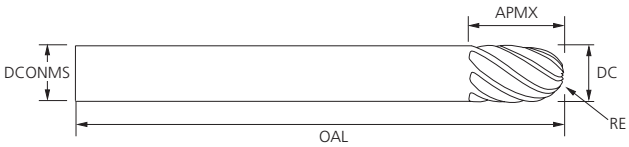
ALtima® Blaze		DC		DCONMS	OAL	APMX	RE
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm
250M01041B	25900	1.0	.0394	4.0	50.0	2.0	0.5
250M015041B	25901	1.5	.0591	4.0	50.0	3.0	0.75
250M02041B	25902	2.0	.0787	4.0	50.0	4.0	1.0
250M03041B	25903	3.0	.1181	4.0	50.0	6.0	1.5
250M04041B	25904	4.0	.1575	4.0	50.0	6.0	2.0
250M04061B	25905	4.0	.1575	6.0	50.0	6.0	2.0
250M05061B	25906	5.0	.1968	6.0	50.0	7.5	2.5
250M06061B	25907	6.0	.2362	6.0	50.0	9.0	3.0
250M06062B	25908	6.0	.2362	6.0	75.0	9.0	3.0
250M06063B	25909	6.0	.2362	6.0	100.0	12.0	3.0
250M08081B	25910	8.0	.3150	8.0	63.0	12.0	4.0
250M08082B	25911	8.0	.3150	8.0	75.0	12.0	4.0
250M08083B	25912	8.0	.3150	8.0	100.0	16.0	4.0
250M10101B	25913	10.0	.3937	10.0	75.0	15.0	5.0
250M10102B	25914	10.0	.3937	10.0	100.0	20.0	5.0
250M12121B	25915	12.0	.4724	12.0	75.0	18.0	6.0
250M12122B	25916	12.0	.4724	12.0	100.0	24.0	6.0
250M16161B	25917	16.0	.6299	16.0	75.0	24.0	8.0
250M16162B	25918	16.0	.6299	16.0	100.0	32.0	8.0

Inch	
DC	Tolerance
.0394 - .6299	+.000/-.0008

Metric (mm)	
DC	Tolerance
1.0 - 16.0	+0/-0.020

TECH
Page 152

TuffCut® 3D - Series MFPB



Multi-Flute Parallel Ballnose.
Designed for 4 & 5 axis, 3D surfacing applications in aerospace & medical materials.

Features
- Multi-flute design.
- ALtima® Xtreme coating.
- Short & long overall lengths.

Benefits
- High feed rates in semi-finishing & finishing applications.
- Excellent heat & wear resistance in tough-to-machine materials.
- Provides versatility for complex, tough to reach part features.

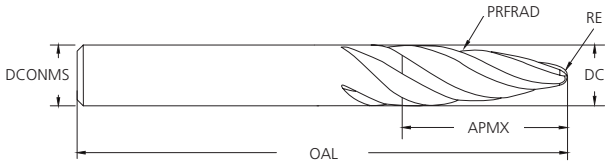
ALtima® Xtreme		DC			DCONMS		OAL		APMX		RE		NOF
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	
MFPBM0601AX	03800		6	.2362		6		57		9		3	6
MFPBM0602AX	03801		6	.2362		6		101		9		3	6
MFPB25001AX	03802	1/4		.2500	1/4		2-1/2		3/8		1/8		6
MFPB25002AX	03803	1/4		.2500	1/4		4		3/8		1/8		6
MFPB31251AX	03804	5/16		.3125	5/16		2-1/2		7/16		5/32		8
MFPB31252AX	03805	5/16		.3125	5/16		4		7/16		5/32		8
MFPBM0801AX	03806		8	.3150		8		63		12		4	8
MFPBM0802AX	03807		8	.3150		8		101		12		4	8
MFPB37501AX	03808	3/8		.3750	3/8		3		1/2		3/16		8
MFPB37502AX	03809	3/8		.3750	3/8		4		1/2		3/16		8
MFPBM1001AX	03810		10	.3937		10		72		15		5	8
MFPBM1002AX	03811		10	.3937		10		103		15		5	8
MFPBM1201AX	03812		12	.4724		12		83		18		6	8
MFPBM1202AX	03813		12	.4724		12		110		18		6	8
MFPB50001AX	03814	1/2		.5000	1/2		3		5/8		1/4		8
MFPB50002AX	03815	1/2		.5000	1/2		4		5/8		1/4		8
MFPB62501AX	03816	5/8		.6250	5/8		3-1/2		3/4		5/16		8
MFPB62502AX	03817	5/8		.6250	5/8		5		3/4		5/16		8
MFPBM1601AX	03818		16	.6299		16		92		24		8	8
MFPBM1602AX	03819		16	.6299		16		110		24		8	8
MFPB75001AX	03820	3/4		.7500	3/4		4		1		3/8		10
MFPB75002AX	03821	3/4		.7500	3/4		6		1		3/8		10
MFPBM2001AX	03822		20	.7874		20		104		30		10	10
MFPBM2002AX	03823		20	.7874		20		152		30		10	10

Inch	
DC	Tolerance
.2362 - .7874	+0/-0.002

Metric (mm)	
DC	Tolerance
6.0 - 20.0	+0/-0.050

TECH
Page 154

TuffCut® 3D - Series XFO



Xtreme **F**inisher, **O**val
Designed for optimized cycle times & improved surface finishes in 5-axis finishing operations.

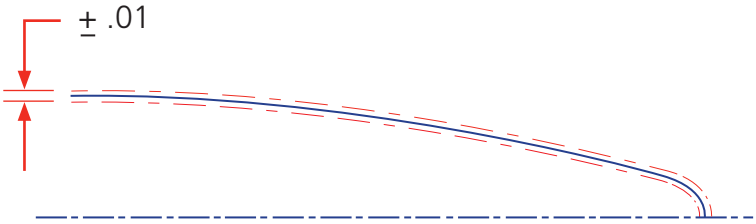
Features
- Multi-flute configurations.
- Progressive helix & rake angles.
- Enhanced edge preparation.
- ALtima® Q coating.

Benefits
- Allows for finishing & semi-finishing applications.
- Smooth, vibration free finishing.
- Increased strength & cutting-edge stabilization.
- Optimal heat & wear resistance.

ALtima® Q		DC		DCONMS	OAL	APMX	RE	PRFRAD	NOF
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm	
XFO-4M06R95AQ	19904	6	.2362	6	64	20.8	1	95	4
XFO-4M08R90AQ	19905	8	.3150	8	64	24.5	1	90	4
XFO-4M10R85AQ	19906	10	.3937	10	72	24.7	2	85	4
XFO-6M10R85AQ	19907	10	.3937	10	72	24.7	2	85	6
XFO-4M12R80AQ	19908	12	.4724	12	84	27.3	2	80	4
XFO-6M12R80AQ	19909	12	.4724	12	84	27.3	2	80	6

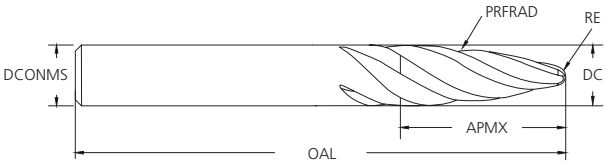
Radius form tolerance

The XFO and XFO-AL series are held to a precision radius form tolerance of ±.010mm to ensure high accuracy finishing, and prevention of mis-match on component surfaces.



TECH
Page 158

TuffCut® 3D - Series XFO-AL



Xtreme **F**inisher, **O**val - **AL**uminum
Designed for optimized cycle times & improved surface finishes in 5-axis finishing operations.

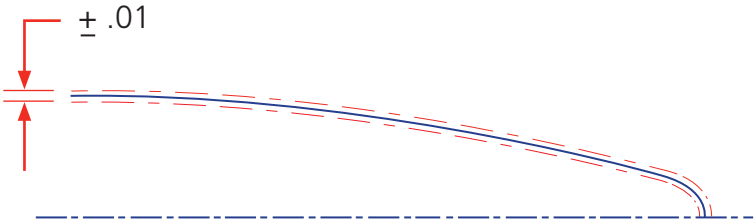
Features
- Enhanced notch design.
- Progressive helix & rake angles.
- High shear action.
- Fordlube coating.

Benefits
- Allows for milling capabilities with full cutting-edge, including nose radius.
- Smooth, vibration free finishing.
- Optimal performance in aluminum alloys.
- Increased wear resistance & lubricity.

Fordlube		DC		DCONMS	OAL	APMX	RE	PRFRAD	NOF
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm	
XFO-AL3M06R95F	19900	6	.2362	6	64	20.8	1	95	3
XFO-AL3M08R90F	19901	8	.3150	8	64	24.5	1	90	3
XFO-AL4M10R85F	19902	10	.3937	10	72	24.7	2	85	4
XFO-AL4M12R80F	19903	12	.4724	12	84	27.3	2	80	4

Radius form tolerance

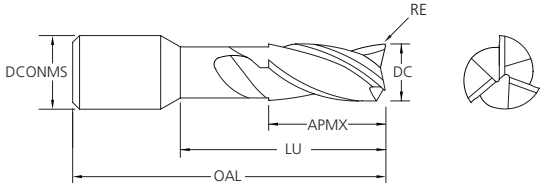
The XFO and XFO-AL series are held to a precision radius form tolerance of ±.010mm to ensure high accuracy finishing, and prevention of mis-match on component surfaces.



TECH
Page 160

TuffCut® Micro - Series 3MVS

Designed for high performance micro milling on any ferrous material, especially material used in medical and aerospace manufacturing.



- Variable helix.
- Stub length.
- Square end and corner radius options.
- Neck relief options.
- ALtima® Xtreme coated.
- Common shanks.

ALtima® Xtreme		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
3MVS0156AH	39000	1/64		.0156	1/8		1-1/2		0.023					
3MVS0156N5AH	39002	1/64		.0156	1/8		2-1/2		0.023		0.078			
3MVS0156N8AH	39003	1/64		.0156	1/8		2-1/2		0.023		0.125			
3MVS0156R.003AH	39066	1/64		.0156	1/8		1-1/2		0.023				.003	
3MVS0156R.003N5AH	39068	1/64		.0156	1/8		2-1/2		0.023		0.078		.003	
3MVS0156R.003N8AH	39069	1/64		.0156	1/8		2-1/2		0.023		0.125		.003	
3MVSM0050AH	39004		0.50	.0196		4		50		0.75				
3MVSM0050R.10AH	39070		0.50	.0196		4		50		0.75				.10
3MVSM0050R.10N5AH	39072		0.50	.0196		4		50		0.75		2.5		.10
3MVSM0050R.10N8AH	39073		0.50	.0196		4		50		0.75		4.0		.10
3MVS0312AH	39006	1/32		.0312	1/8		1-1/2		0.047					
3MVS0312N3AH	39008	1/32		.0312	1/8		1-1/2		0.047		0.093			
3MVS0312N5AH	39009	1/32		.0312	1/8		2-1/2		0.047		0.156			
3MVS0312N8AH	39010	1/32		.0312	1/8		2-1/2		0.047		0.250			
3MVS0312N10AH	39011	1/32		.0312	1/8		2-1/2		0.047		0.312			
3MVS0312N12AH	39012	1/32		.0312	1/8		2-1/2		0.047		0.375			
3MVS0312N15AH	39013	1/32		.0312	1/8		2-1/2		0.047		0.480			
3MVS0312R.005AH	39074	1/32		.0312	1/8		1-1/2		0.047				.005	
3MVS0312R.005N5AH	39076	1/32		.0312	1/8		2-1/2		0.047		0.156		.005	
3MVS0312R.005N8AH	39077	1/32		.0312	1/8		2-1/2		0.047		0.250		.005	
3MVS0312R.010AH	39078	1/32		.0312	1/8		1-1/2		0.047				.010	
3MVS0312R.010N5AH	39080	1/32		.0312	1/8		2-1/2		0.047		0.156		.010	
3MVS0312R.010N8AH	39081	1/32		.0312	1/8		2-1/2		0.047		0.250		.010	
3MVSM0100AH	39014		1.00	.0394		4		50		1.50				
3MVSM0100N5AH	39016		1.00	.0394		4		50		1.50		5		
3MVSM0100N8AH	39017		1.00	.0394		4		50		1.50		8		
3MVSM0100R.10AH	39082		1.00	.0394		4		50		1.50				.10
3MVSM0100R.10N5AH	39084		1.00	.0394		4		50		1.50		5		.10

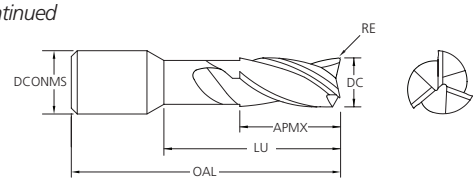
Inch		Inch		Metric (mm)		Metric (mm)	
DC	Tolerance	DCONMS	Tolerance (h6)	DC	Tolerance	DCONMS	Tolerance
.0156 - .1250	+0/-.0008	.1250	+0/-.00031	0.5 - 3.0	+0/-.020	4.0	+0/-.008

TECH
Page 164

ALtima® Xtreme		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
3MVSM0100R.10N8AH	39085		1.00	.0394		4		50		1.50		8		.10
3MVSM0100R.20AH	39165		1.00	.0394		4		50		1.50				.20
3MVS0468AH	39018	3/64		.0468	1/8		1-1/2		0.070					
3MVS0468N5AH	39020	3/64		.0468	1/8		2-1/2		0.070		0.250			
3MVS0468N8AH	39021	3/64		.0468	1/8		2-1/2		0.070		0.375			
3MVS0468N10AH	39022	3/64		.0468	1/8		2-1/2		0.070		0.480			
3MVS0468R.005AH	39086	3/64		.0468	1/8		1-1/2		0.070				.005	
3MVS0468R.005N5AH	39088	3/64		.0468	1/8		2-1/2		0.070		0.250		.005	
3MVS0468R.005N8AH	39089	3/64		.0468	1/8		2-1/2		0.070		0.375		.005	
3MVS0468R.010AH	39090	3/64		.0468	1/8		1-1/2		0.070				.010	
3MVS0468R.010N5AH	39092	3/64		.0468	1/8		2-1/2		0.070		0.250		.010	
3MVS0468R.010N8AH	39093	3/64		.0468	1/8		2-1/2		0.070		0.375		.010	
3MVSM0150AH	39023		1.50	.0591		4		50		2.25				
3MVSM0150R.20AH	39094		1.50	.0591		4		50		2.25				.20
3MVSM0150R.20N5AH	39096		1.50	.0591		4		50		2.25		7.5		.20
3MVSM0150R.20N8AH	39097		1.50	.0591		4		50		2.25		12		.20
3MVSM0150R.50AH	39162		1.50	.0591		4		50		2.25				.50
3MVSM0150R.50N6AH	39163		1.50	.0591		4		50		2.25		10		.50
3MVSM0150R.50N8AH	39164		1.50	.0591		4		50		2.25		12		.50
3MVS0625AH	39025	1/16		.0625	1/8		1-1/2		0.094					
3MVS0625N3AH	39027	1/16		.0625	1/8		1-1/2		0.094		0.187			
3MVS0625N5AH	39028	1/16		.0625	1/8		2-1/2		0.094		0.312			
3MVS0625N8AH	39029	1/16		.0625	1/8		2-1/2		0.094		0.500			
3MVS0625N10AH	39030	1/16		.0625	1/8		2-1/2		0.094		0.625			
3MVS0625N12AH	39031	1/16		.0625	1/8		2-1/2		0.094		0.750			
3MVS0625N15AH	39032	1/16		.0625	1/8		2-1/2		0.094		0.950			
3MVS0625R.005AH	39098	1/16		.0625	1/8		1-1/2		0.094				.005	
3MVS0625R.005N5AH	39100	1/16		.0625	1/8		2-1/2		0.094		0.312		.005	
3MVS0625R.005N8AH	39101	1/16		.0625	1/8		2-1/2		0.094		0.500		.005	
3MVS0625R.010AH	39102	1/16		.0625	1/8		1-1/2		0.094				.010	
3MVS0625R.010N5AH	39104	1/16		.0625	1/8		2-1/2		0.094		0.312		.010	
3MVS0625R.010N8AH	39105	1/16		.0625	1/8		2-1/2		0.094		0.500		.010	
3MVS0625R.015AH	39106	1/16		.0625	1/8		1-1/2		0.094				.015	
3MVS0625R.015N5AH	39108	1/16		.0625	1/8		2-1/2		0.094		0.312		.015	
3MVS0625R.015N8AH	39109	1/16		.0625	1/8		2-1/2		0.094		0.500		.015	
3MVS0781AH	39033	5/64		.0781	1/8		1-1/2		0.117					
3MVS0781N5AH	39035	5/64		.0781	1/8		2-1/2		0.117		0.406			
3MVS0781N8AH	39036	5/64		.0781	1/8		2-1/2		0.117		0.625			
3MVS0781N10AH	39037	5/64		.0781	1/8		2-1/2		0.117		0.800			
3MVS0781R.005AH	39110	5/64		.0781	1/8		1-1/2		0.117				.005	
3MVS0781R.005N5AH	39112	5/64		.0781	1/8		2-1/2		0.117		0.406		.005	
3MVS0781R.005N8AH	39113	5/64		.0781	1/8		2-1/2		0.117		0.625		.005	

TECH
Page 164

TuffCut® Micro - Series 3MVS *Continued*



NEW **CORNER RADIUS** OPTIONS

ALtima® Xtreme		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
3MVS0781R.010AH	39114	5/64		.0781	1/8		1-1/2		0.117				.010	
3MVS0781R.010N5AH	39116	5/64		.0781	1/8		2-1/2		0.117		0.406		.010	
3MVS0781R.010N8AH	39117	5/64		.0781	1/8		2-1/2		0.117		0.625		.010	
3MVS0781R.015AH	39118	5/64		.0781	1/8		1-1/2		0.117				.015	
3MVS0781R.015N5AH	39120	5/64		.0781	1/8		2-1/2		0.117		0.406		.015	
3MVS0781R.015N8AH	39121	5/64		.0781	1/8		2-1/2		0.117		0.625		.015	
3MVSM0200AH	39038		2.00	.0787		4		50		3.00				
3MVSM0200N5AH	39040		2.00	.0787		4		50		3.00		10		
3MVSM0200N8AH	39041		2.00	.0787		4		50		3.00		16		
3MVSM0200R.20AH	39122		2.00	.0787		4		50		3.00				.20
3MVSM0200R.20N5AH	39124		2.00	.0787		4		50		3.00		10		.20
3MVSM0200R.20N8AH	39125		2.00	.0787		4		50		3.00		16		.20
3MVS0938AH	39042	3/32		.0938	1/8		1-1/2		.141					
3MVS0938N3AH	39044	3/32		.0938	1/8		1-1/2		.141		0.279			
3MVS0938N5AH	39045	3/32		.0938	1/8		2-1/2		.141		0.500			
3MVS0938N8AH	39046	3/32		.0938	1/8		2-1/2		.141		0.750			
3MVS0938N10AH	39047	3/32		.0938	1/8		2-1/2		.141		0.950			
3MVS0938N12AH	39048	3/32		.0938	1/8		2-1/2		.141		1.125			
3MVS0938N15AH	39049	3/32		.0938	1/8		2-1/2		.141		1.400			
3MVS0938R.005AH	39126	3/32		.0938	1/8		1-1/2		.141				.005	
3MVS0938R.005N5AH	39128	3/32		.0938	1/8		2-1/2		.141		0.500		.005	
3MVS0938R.005N8AH	39129	3/32		.0938	1/8		2-1/2		.141		0.750		.005	
3MVS0938R.010AH	39130	3/32		.0938	1/8		1-1/2		.141				.010	
3MVS0938R.010N5AH	39132	3/32		.0938	1/8		2-1/2		.141		0.500		.010	
3MVS0938R.010N8AH	39133	3/32		.0938	1/8		2-1/2		.141		0.750		.010	
3MVS0938R.015AH	39134	3/32		.0938	1/8		1-1/2		.141				.015	
3MVS0938R.015N5AH	39136	3/32		.0938	1/8		2-1/2		.141		0.500		.015	
3MVS0938R.015N8AH	39137	3/32		.0938	1/8		2-1/2		.141		0.750		.015	
3MVS0938R.020AH	39138	3/32		.0938	1/8		1-1/2		.141				.020	
3MVS0938R.020N5AH	39140	3/32		.0938	1/8		2-1/2		.141		0.500		.020	
3MVS0938R.020N8AH	39141	3/32		.0938	1/8		2-1/2		.141		0.750		.020	
3MVSM0250AH	39050		2.50	.0984		4		50		3.75				
3MVS1094AH	39052	7/64		.1094	1/8		1-1/2		0.164					
3MVS1094N5AH	39054	7/64		.1094	1/8		2-1/2		0.164		0.570			
3MVS1094N8AH	39055	7/64		.1094	1/8		2-1/2		0.164		0.900			
3MVSM0300AH	39056		3.00	.1181		4		50		4.50				

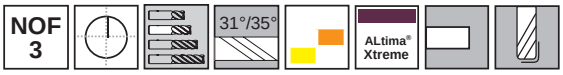
TECH
Page 164

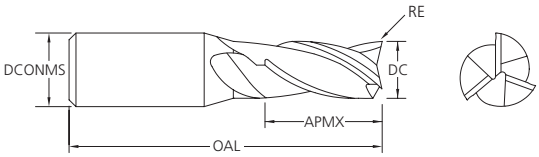
ALtima® Xtreme		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
3MVSM0300N5AH	39058		3.00	.1181		4		50		4.50		15		
3MVSM0300N8AH	39059		3.00	.1181		4		50		4.50		24		
3MVSM0300R.20AH	39142		3.00	.1181		4		50		4.50				.20
3MVSM0300R.20N5AH	39144		3.00	.1181		4		50		4.50		15		.20
3MVSM0300R.20N8AH	39145		3.00	.1181		4		50		4.50		24		.20
3MVS1250AH	39060	1/8		.1250	1/8		1-1/2		0.188					
3MVS1250N3AH	39062	1/8		.1250	1/8		1-1/2		0.188		0.375			
3MVS1250N5AH	39063	1/8		.1250	1/8		2-1/2		0.188		0.625			
3MVS1250N8AH	39064	1/8		.1250	1/8		2-1/2		0.188		1.000			
3MVS1250N10AH	39065	1/8		.1250	1/8		2-1/2		0.188		1.250			
3MVS1250R.005AH	39146	1/8		.1250	1/8		1-1/2		0.188				.005	
3MVS1250R.005N5AH	39148	1/8		.1250	1/8		2-1/2		0.188		0.625		.005	
3MVS1250R.005N8AH	39149	1/8		.1250	1/8		2-1/2		0.188		1.000		.005	
3MVS1250R.010AH	39150	1/8		.1250	1/8		1-1/2		0.188				.010	
3MVS1250R.010N5AH	39152	1/8		.1250	1/8		2-1/2		0.188		0.625		.010	
3MVS1250R.010N8AH	39153	1/8		.1250	1/8		2-1/2		0.188		1.000		.010	
3MVS1250R.015AH	39154	1/8		.1250	1/8		1-1/2		0.188				.015	
3MVS1250R.015N5AH	39156	1/8		.1250	1/8		2-1/2		0.188		0.625		.015	
3MVS1250R.015N8AH	39157	1/8		.1250	1/8		2-1/2		0.188		1.000		.015	
3MVS1250R.020AH	39158	1/8		.1250	1/8		1-1/2		0.188				.020	
3MVS1250R.020N5AH	39160	1/8		.1250	1/8		2-1/2		0.188		0.625		.020	
3MVS1250R.020N8AH	39161	1/8		.1250	1/8		2-1/2		0.188		1.000		.020	

TECH
Page 164

TuffCut® Micro - Series 3MVR

Designed for high performance micro milling on any ferrous material, especially material used in medical and aerospace manufacturing.





- Variable helix.
- Regular length.
- Square end and corner radius options.
- ALtima® Xtreme coated.
- Common shanks.

ALtima® Xtreme		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
3MVR0156AH	39001	1/64		.0156	1/8		1-1/2		0.047			
3MVR0156R.003AH	39067	1/64		.0156	1/8		1-1/2		0.047		.003	
3MVRM0050AH	39005		0.50	.0196		4		50		1.50		
3MVRM0050R.10AH	39071		0.50	.0196		4		50		1.50		.10
3MVR0312AH	39007	1/32		.0312	1/8		1-1/2		0.094			
3MVR0312R.005AH	39075	1/32		.0312	1/8		1-1/2		0.094		.005	
3MVR0312R.010AH	39079	1/32		.0312	1/8		1-1/2		0.094		.010	
3MVRM0100AH	39015		1.00	.0394		4		50		3.00		
3MVRM0100R.10AH	39083		1.00	.0394		4		50		3.00		.10
3MVRM0100R.20AH	39166		1.00	.0394		4		50		3.00		.20
3MVR0468AH	39019	3/64		.0468	1/8		1-1/2		0.140			
3MVR0468R.005AH	39087	3/64		.0468	1/8		1-1/2		0.140		.005	
3MVR0468R.010AH	39091	3/64		.0468	1/8		1-1/2		0.140		.010	
3MVRM0150AH	39024		1.50	.0591		4		50		4.50		
3MVRM0150R.20AH	39095		1.50	.0591		4		50		4.50		.20
3MVR0625AH	39026	1/16		.0625	1/8		1-1/2		0.188			
3MVR0625R.005AH	39099	1/16		.0625	1/8		1-1/2		0.188		.005	
3MVR0625R.010AH	39103	1/16		.0625	1/8		1-1/2		0.188		.010	
3MVR0625R.015AH	39107	1/16		.0625	1/8		1-1/2		0.188		.015	
3MVR0781AH	39034	5/64		.0781	1/8		1-1/2		0.234			
3MVR0781R.005AH	39111	5/64		.0781	1/8		1-1/2		0.234		.005	
3MVR0781R.010AH	39115	5/64		.0781	1/8		1-1/2		0.234		.010	
3MVR0781R.015AH	39119	5/64		.0781	1/8		1-1/2		0.234		.015	
3MVRM0200AH	39039		2.00	.0787		4		50		6.00		
3MVRM0200R.20AH	39123		2.00	.0787		4		50		6.00		.20
3MVR0938AH	39043	3/32		.0938	1/8		1-1/2		.281			
3MVR0938R.005AH	39127	3/32		.0938	1/8		1-1/2		.281		.005	
3MVR0938R.010AH	39131	3/32		.0938	1/8		1-1/2		.281		.010	

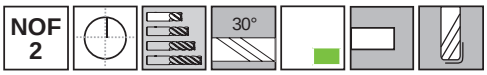
Inch		Inch		Metric (mm)		Metric (mm)	
DC	Tolerance	DCONMS	Tolerance (h6)	DC	Tolerance	DCONMS	Tolerance (h6)
.0156 - .1250	+0/-.0008	.1250	+0/-.00031	0.5 - 3.0	+0/-.020	4.0	+0/-.008

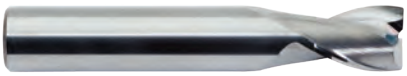
TECH
Page 164

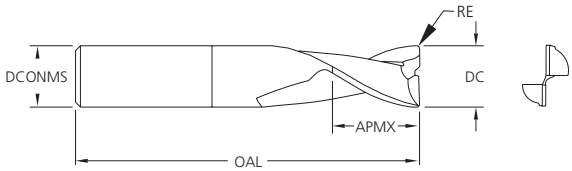
ALtima® Xtreme		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
3MVR0938R.015AH	39135	3/32		.0938	1/8		1-1/2		.281		.015	
3MVR0938R.020AH	39139	3/32		.0938	1/8		1-1/2		.281		.020	
3MVRM0250AH	39051		2.50	.0984		4		50		7.50		
3MVR1094AH	39053	7/64		.1094	1/8		1-1/2		0.328			
3MVRM0300AH	39057		3.00	.1181		4		50		9.00		
3MVRM0300R.20AH	39143		3.00	.1181		4		50		9.00		.20
3MVR1250AH	39061	1/8		.1250	1/8		1-1/2		0.375			
3MVR1250R.005AH	39147	1/8		.1250	1/8		1-1/2		0.375		.005	
3MVR1250R.010AH	39151	1/8		.1250	1/8		1-1/2		0.375		.010	
3MVR1250R.015AH	39155	1/8		.1250	1/8		1-1/2		0.375		.015	
3MVR1250R.020AH	39159	1/8		.1250	1/8		1-1/2		0.375		.020	

TECH
Page 164

TuffCut® AL - Series 135







- Extremely high chip loads - .040"/1mm per tooth and above.
- Performs equally well across a broad range of operating speeds.
- Zirconium coating also available.

Uncoated		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13511810	13523		3.0	.1181		3.0		38		3.5		0.20
13515750	13533		4.0	.1575		4.0		51		4.8		0.20
13518750	13500	3/16		.1875	3/16		2		1/4		0.008	
13518751	13513	3/16		.1875	3/16		3		1/4		0.008	
13519680	13502		5.0	.1968		5.0		51		6.0		0.25
13523620	13504		6.0	.2362		6.0		64		7.0		0.30
13525000	13506	1/4		.2500	1/4		2-1/2		5/16		0.011	
13525001	13514	1/4		.2500	1/4		3-1/2		5/16		0.011	
13531500	13508		8.0	.3150		8.0		64		9.5		0.35
13537500	13510	3/8		.3750	3/8		2-1/2		1/2		0.015	
13537501	13511	3/8		.3750	3/8		3		1/2		0.015	
13537502	13512	3/8		.3750	3/8		4		1/2		0.015	
13539370	13515		10.0	.3937		10.0		70		12.0		0.50
13539371	13516		10.0	.3937		10.0		76		12.0		0.50
13539372	13517		10.0	.3937		10.0		89		12.0		0.50
13547240	13525		12.0	.4724		12.0		76		14.0		0.50
13547241	13526		12.0	.4724		12.0		102		14.0		0.50
13547242	13527		12.0	.4724		12.0		127		14.0		0.50
13550000	13520	1/2		.5000	1/2		3		5/8		0.020	
13550001	13521	1/2		.5000	1/2		4		5/8		0.020	
13550002	13522	1/2		.5000	1/2		5		5/8		0.020	
13555120	13552		14.0	.5512		14.0		89		16.0		0.50
13555121	13554		14.0	.5512		14.0		102		16.0		0.50
13555122	13573		14.0	.5512		14.0		127		16.0		0.50
13562500	13538	5/8		.6250	5/8		3-1/2		3/4		0.025	
13562501	13539	5/8		.6250	5/8		4-5/8		3/4		0.025	
13562502	13543	5/8		.6250	5/8		5-1/4		3/4		0.025	
13562990	13535		16.0	.6299		16.0		89		18.0		0.75

Inch	
DC	Tolerance
3/16 - 1/4	+.000/-.002
>1/4 - 1	+.000/-.003

Inch	
RE	Tolerance
< 3/8	+.002/-.002
≥ 3/8	+.003/-.003

Metric (mm)	
DC	Tolerance (h10)
3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 25.00	+.000/-.084

Metric (mm)	
RE	Tolerance
< 10.0	+.05/-.05
≥ 10.0	+.075/-.075

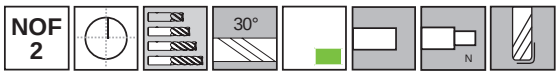
TECH
Page 169

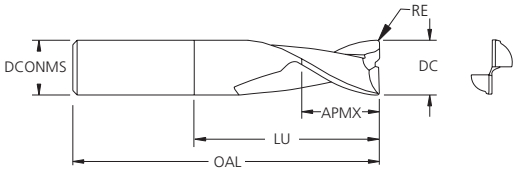
Uncoated		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13562991	13536		16.0	.6299		16.0		117		18.0		0.75
13562992	13537		16.0	.6299		16.0		133		18.0		0.75
13570870	13563		18.0	.7087		18.0		102		20.0		0.75
13570871	13568		18.0	.7087		18.0		127		20.0		0.75
13570872	13574		18.0	.7087		18.0		152		20.0		0.75
13575000	13530	3/4		.7500	3/4		4		1		0.030	
13575001	13531	3/4		.7500	3/4		5		1		0.030	
13575002	13532	3/4		.7500	3/4		6		1		0.030	
13578740	13545		20.0	.7874		20.0		102		22.0		0.75
13578741	13546		20.0	.7874		20.0		127		22.0		0.75
13578742	13547		20.0	.7874		20.0		152		22.0		0.75
13598430	13555		25.0	.9843		25.0		102		25.0		0.75
13598431	13556		25.0	.9843		25.0		127		25.0		0.75
13598432	13557		25.0	.9843		25.0		152		25.0		0.75
13510000	13540	1		1.0000	1		4		1-1/4		0.045	
13510001	13541	1		1.0000	1		5		1-1/4		0.045	
13510002	13542	1		1.0000	1		6		1-1/4		0.045	

TECH
Page 169

TuffCut® AL - Series 135N

The geometry of M.A. Ford® 135 Series solid carbide end mill allows it to be run at extremely high chip loads surpassing the current market leaders.





Uncoated Necked		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13511800N3	96620		3.0	.1181		3.0		38		3.5		11		
13511810N	13524		3.0	.1181		3.0		38		3.5		11		0.20
13511801N3	96621		3.0	.1181		3.0		38		3.5		11		0.50
13511803N3	96622		3.0	.1181		3.0		38		3.5		11		1.00
13511800N5	96623		3.0	.1181		3.0		38		3.5		16		
13511801N5	96624		3.0	.1181		3.0		38		3.5		16		0.50
13511803N5	96625		3.0	.1181		3.0		38		3.5		16		1.00
13515700N3	96626		4.0	.1575		4.0		51		4.8		14		
13515701N3	96627		4.0	.1575		4.0		51		4.8		14		0.50
13515703N3	96628		4.0	.1575		4.0		51		4.8		14		1.00
13515700N5	96629		4.0	.1575		4.0		51		4.8		22		
13515750N	13534		4.0	.1575		4.0		51		4.8		22		0.20
13515701N5	96630		4.0	.1575		4.0		51		4.8		22		0.50
13515703N5	96631		4.0	.1575		4.0		51		4.8		22		1.00
13518750N	13501	3/16		.1875	3/16		2		1/4		9/16		0.008	
13518751N	13518	3/16		.1875	3/16		3		1/4		1-9/16		0.008	
13519680N	13503		5.0	.1968		5.0		51		6.0		22		0.25
13519600N3	96632		5.0	.1968		6.0		64		6.0		17		
13519601N3	96633		5.0	.1968		6.0		64		6.0		17		0.50
13519603N3	96634		5.0	.1968		6.0		64		6.0		17		1.00
13519600N5	96635		5.0	.1968		6.0		64		6.0		27		
13519601N5	96636		5.0	.1968		6.0		64		6.0		27		0.50
13519603N5	96637		5.0	.1968		6.0		64		6.0		27		1.00
13523600N3	96638		6.0	.2362		6.0		64		7.0		20		
13523601N3	96639		6.0	.2362		6.0		64		7.0		20		0.50
13523603N3	96640		6.0	.2362		6.0		64		7.0		20		1.00
13523604N3	96641		6.0	.2362		6.0		64		7.0		20		1.50
13523605N3	96642		6.0	.2362		6.0		64		7.0		20		2.00
13523620N	13505		6.0	.2362		6.0		64		7.0		26		0.30
13523600N5	96643		6.0	.2362		6.0		64		7.0		32		

Inch	
DC	Tolerance
3/16 - 1/4	+.000/-.002
>1/4 - 1	+.000/-.003

Inch	
RE	Tolerance
< 3/8	+.002/-.002
≥ 3/8	+.003/-.003

Metric (mm)	
DC	Tolerance (h10)
3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 25.00	+.000/-.084

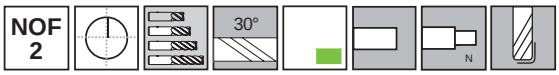
Metric (mm)	
RE	Tolerance
< 10.0	+.05/-.05
≥ 10.0	+.075/-.075

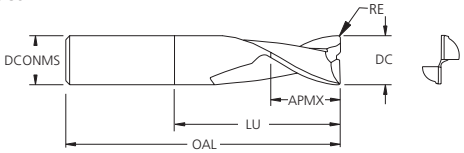
TECH
Page 169

Uncoated Necked		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13523601N5	96644		6.0	.2362		6.0		64		7.0		32		0.50
13523603N5	96645		6.0	.2362		6.0		64		7.0		32		1.00
13523604N5	96646		6.0	.2362		6.0		64		7.0		32		1.50
13523605N5	96647		6.0	.2362		6.0		64		7.0		32		2.00
13525000N	13507	1/4		.2500	1/4		2-1/2		5/16		3/4		0.011	
13525001N	13519	1/4		.2500	1/4		3-1/2		5/16		1-3/4		0.011	
13531500N3	96648		8.0	.3150		8.0		64		9.5		26		
13531500N	13509		8.0	.3150		8.0		64		9.5		26		0.35
13531501N3	96649		8.0	.3150		8.0		64		9.5		26		0.50
13531503N3	96650		8.0	.3150		8.0		64		9.5		26		1.00
13531504N3	96651		8.0	.3150		8.0		64		9.5		26		1.50
13531505N3	96652		8.0	.3150		8.0		64		9.5		26		2.00
13531507N3	96653		8.0	.3150		8.0		64		9.5		26		3.00
13531500N5	96654		8.0	.3150		8.0		75		9.5		42		
13531501N5	96655		8.0	.3150		8.0		75		9.5		42		0.50
13531503N5	96656		8.0	.3150		8.0		75		9.5		42		1.00
13531504N5	96657		8.0	.3150		8.0		75		9.5		42		1.50
13531505N5	96658		8.0	.3150		8.0		75		9.5		42		2.00
13531507N5	96659		8.0	.3150		8.0		75		9.5		42		3.00
13537500N	13560	3/8		.3750	3/8		2-1/2		1/2		7/8		0.015	
13537501N	13561	3/8		.3750	3/8		3		1/2		1-3/8		0.015	
13537502N	13562	3/8		.3750	3/8		4		1/2		2-3/8		0.015	
13539370N	13565		10.0	.3937		10.0		70		12.0		28		0.50
13539300N3	96660		10.0	.3937		10.0		76		12.0		34		
13539371N	13566		10.0	.3937		10.0		76		12.0		34		0.50
13539303N3	96662		10.0	.3937		10.0		76		12.0		34		1.00
13539304N3	96663		10.0	.3937		10.0		76		12.0		34		1.50
13539305N3	96664		10.0	.3937		10.0		76		12.0		34		2.00
13539307N3	96665		10.0	.3937		10.0		76		12.0		34		3.00
13539372N	13567		10.0	.3937		10.0		89		12.0		47		0.50
13539301N5	96666		10.0	.3937		10.0		89		12.0		52		0.50
13539303N5	96667		10.0	.3937		10.0		89		12.0		52		1.00
13539304N5	96668		10.0	.3937		10.0		89		12.0		52		1.50
13539305N5	96669		10.0	.3937		10.0		89		12.0		52		2.00
13539307N5	96670		10.0	.3937		10.0		89		12.0		52		3.00
13547240N	13575		12.0	.4724		12.0		76		14.0		28		0.50
13547200N3	96671		12.0	.4724		12.0		76		14.0		38		
13547201N3	96672		12.0	.4724		12.0		76		14.0		38		0.50
13547203N3	96673		12.0	.4724		12.0		76		14.0		38		1.00
13547204N3	96674		12.0	.4724		12.0		76		14.0		38		1.50
13547205N3	96675		12.0	.4724		12.0		76		14.0		38		2.00
13547207N3	96676		12.0	.4724		12.0		76		14.0		38		3.00

TECH
Page 169

TuffCut® AL - Series 135N *Continued*





Uncoated Necked		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13547209N3	96677		12.0	.4724		12.0		76		14.0		38		4.00
135472011N3	96721		12.0	.4724		12.0		76		14.0		38		5.00
13547241N	13576		12.0	.4724		12.0		102		14.0		54		0.50
13547201N5	96678		12.0	.4724		12.0		110		14.0		62		0.50
13547203N5	96679		12.0	.4724		12.0		110		14.0		62		1.00
13547204N5	96680		12.0	.4724		12.0		110		14.0		62		1.50
13547205N5	96681		12.0	.4724		12.0		110		14.0		62		2.00
13547207N5	96682		12.0	.4724		12.0		110		14.0		62		3.00
13547209N5	96683		12.0	.4724		12.0		110		14.0		62		4.00
135472011N5	96723		12.0	.4724		12.0		110		14.0		62		5.00
13547242N	13577		12.0	.4724		12.0		127		14.0		79		0.50
13550000N	13570	1/2		.5000	1/2		3		5/8		1-1/8		0.020	
13550001N	13571	1/2		.5000	1/2		4		5/8		2-1/8		0.020	
13550002N	13572	1/2		.5000	1/2		5		5/8		3-1/8		0.020	
13555120N	13553		14.0	.5512		14.0		89		16.0		42		0.50
13555121N	13558		14.0	.5512		14.0		102		16.0		55		0.50
13555122N	13559		14.0	.5512		14.0		127		16.0		80		0.50
13562500N	13544	5/8		.6250	5/8		3-1/2		3/4		1-1/2		0.025	
13562501N	13548	5/8		.6250	5/8		4-5/8		3/4		2-1/2		0.025	
13562502N	13549	5/8		.6250	5/8		5-1/4		3/4		3-1/2		0.025	
13562990N	13585		16.0	.6299		16.0		89		18.0		39		0.75
13562900N3	96684		16.0	.6299		16.0		117		18.0		53		
13562901N3	96685		16.0	.6299		16.0		117		18.0		53		0.50
13562903N3	96686		16.0	.6299		16.0		117		18.0		53		1.00
13562904N3	96687		16.0	.6299		16.0		117		18.0		53		1.50
13562905N3	96688		16.0	.6299		16.0		117		18.0		53		2.00
13562907N3	96689		16.0	.6299		16.0		117		18.0		53		3.00
13562909N3	96690		16.0	.6299		16.0		117		18.0		53		4.00
13562991N	13586		16.0	.6299		16.0		117		18.0		83		0.75
13562901N5	96691		16.0	.6299		16.0		127		18.0		85		0.50
13562903N5	96692		16.0	.6299		16.0		127		18.0		85		1.00
13562904N5	96693		16.0	.6299		16.0		127		18.0		85		1.50
13562905N5	96694		16.0	.6299		16.0		127		18.0		85		2.00
13562907N5	96695		16.0	.6299		16.0		127		18.0		85		3.00
13562909N5	96696		16.0	.6299		16.0		127		18.0		85		4.00
13562992N	13587		16.0	.6299		16.0		133		18.0		99		0.75
13570870N	13564		18.0	.7087		18.0		102		20.0		52		0.75

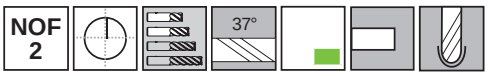
TECH
Page 169

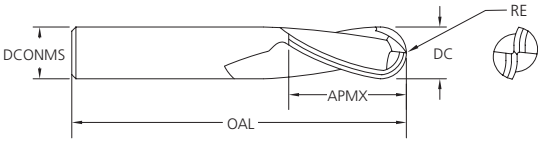
Uncoated Necked		DC			DCONMS		OAL		APMX		LU		RE	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13570871N	13569		18.0	.7087		18.0		127		20.0		77		0.75
13570872N	13578		18.0	.7087		18.0		152		20.0		102		0.75
13575000N	13580	3/4		.7500	3/4		4		1		1-7/8		0.030	
13575001N	13581	3/4		.7500	3/4		5		1		2-7/8		0.030	
13575002N	13582	3/4		.7500	3/4		6		1		3-7/8		0.030	
13578740N	13594		20.0	.7874		20.0		102		22.0		50		0.75
13578701N3	96697		20.0	.7874		20.0		127		22.0		65		0.50
13578703N3	96698		20.0	.7874		20.0		127		22.0		65		1.00
13578704N3	96699		20.0	.7874		20.0		127		22.0		65		1.50
13578705N3	96700		20.0	.7874		20.0		127		22.0		65		2.00
13578707N3	96701		20.0	.7874		20.0		127		22.0		65		3.00
13578709N3	96702		20.0	.7874		20.0		127		22.0		65		4.00
135787011N3	96722		20.0	.7874		20.0		127		22.0		65		5.00
13578741N	13595		20.0	.7874		20.0		127		22.0		75		0.75
13578742N	13596		20.0	.7874		20.0		152		22.0		100		0.75
13578701N5	96703		20.0	.7874		20.0		152		22.0		105		0.50
13578703N5	96704		20.0	.7874		20.0		152		22.0		105		1.00
13578704N5	96705		20.0	.7874		20.0		152		22.0		105		1.50
13578705N5	96706		20.0	.7874		20.0		152		22.0		105		2.00
13578707N5	96707		20.0	.7874		20.0		152		22.0		105		3.00
13578709N5	96708		20.0	.7874		20.0		152		22.0		105		4.00
135787011N5	96724		20.0	.7874		20.0		152		22.0		105		5.00
13598430N	13597		25.0	.9843		25.0		102		25.0		36		0.75
13598431N	13598		25.0	.9843		25.0		127		25.0		61		0.75
13598401N3	96709		25.0	.9843		25.0		127		25.0		80		0.50
13598403N3	96710		25.0	.9843		25.0		127		25.0		80		1.00
13598404N3	96711		25.0	.9843		25.0		127		25.0		80		1.50
13598405N3	96712		25.0	.9843		25.0		127		25.0		80		2.00
13598407N3	96713		25.0	.9843		25.0		127		25.0		80		3.00
13598409N3	96714		25.0	.9843		25.0		127		25.0		80		4.00
13598432N	13599		25.0	.9843		25.0		152		25.0		86		0.75
13598401N5	96715		25.0	.9843		25.0		180		25.0		130		0.50
13598403N5	96716		25.0	.9843		25.0		180		25.0		130		1.00
13598404N5	96717		25.0	.9843		25.0		180		25.0		130		1.50
13598405N5	96718		25.0	.9843		25.0		180		25.0		130		2.00
13598407N5	96719		25.0	.9843		25.0		180		25.0		130		3.00
13598409N5	96720		25.0	.9843		25.0		180		25.0		130		4.00
13510000N	13590	1		1.0000	1		4		1-1/4		1-5/8		0.045	
13510001N	13591	1		1.0000	1		5		1-1/4		2-5/8		0.045	
13510002N	13592	1		1.0000	1		6		1-1/4		3-5/8		0.045	

TECH
Page 169

TuffCut® AL - Series 135B

The geometry of M.A. Ford® 135 Series solid carbide end mill allows it to be run at extremely high chip loads surpassing the current market leaders.





- Performs equally well across a broad range of operating speeds.

Uncoated		DC		DCONMS	OAL	APMX
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch
135B12500	13440	1/8	.1250	1/8	1-1/2	3/8
135B12501	13442	1/8	.1250	1/8	2	1/2
135B18750	13444	3/16	.1875	3/16	2	3/8
135B18751	13446	3/16	.1875	3/16	2-1/2	5/8
135B25000	13448	1/4	.2500	1/4	2-1/2	1/2
135B25001	13450	1/4	.2500	1/4	2-1/2	3/4
135B31250	13452	5/16	.3125	5/16	2-1/2	1/2
135B31251	13454	5/16	.3125	5/16	2-1/2	13/16
135B37500	13456	3/8	.3750	3/8	2-1/2	5/8
135B37501	13458	3/8	.3750	3/8	2-1/2	1
135B43750	13460	7/16	.4375	7/16	2-3/4	9/16
135B43751	13462	7/16	.4375	7/16	2-3/4	1
135B50000	13464	1/2	.5000	1/2	3	5/8
135B50001	13466	1/2	.5000	1/2	3	1-1/4
135B50002	13468	1/2	.5000	1/2	6	1-1/4
135B62500	13470	5/8	.6250	5/8	3-1/2	1-1/4
135B62501	13472	5/8	.6250	5/8	4	1-5/8
135B75000	13474	3/4	.7500	3/4	4	1
135B75001	13476	3/4	.7500	3/4	4	1-5/8
135B10000	13478	1	1.0000	1	4	1-1/2
135B10001	13480	1	1.0000	1	5	2-1/4

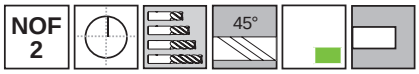
Inch	
DC	Tolerance
1/8 - 1/4	+.000/-.002
>1/4 - 1	+.000/-.003

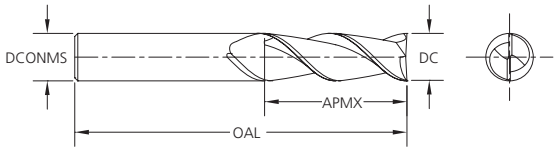
Inch	
RE	Tolerance
1/8 -1	+.0004/-.0004

TECH
Page 171

TuffCut® AL - Series 136

High performance aluminum finisher out performs competitors.





- Available with corner radius upon request. Call customer service for radius pricing.

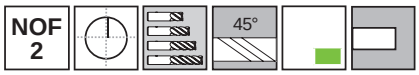
Uncoated		DC			DCONMS		OAL		APMX	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
13611810	13600		3.0	.1181		6.0		52		8.0
13612500	13641	1/8		.1250	1/8		1-1/2		1/4	
13612503	13671	1/8		.1250	1/8		1-1/2		3/8	
13612501	13642	1/8		.1250	1/8		1-1/2		1/2	
13612504	13672	1/8		.1250	1/8		2		3/4	
13612502	13643	1/8		.1250	1/8		2-1/2		1	
13615620	13673	5/32		.1562	5/32		2		5/16	
13615621	13674	5/32		.1562	5/32		2		9/16	
13615750	13602		4.0	.1575		6.0		55		11.0
13618750	13644	3/16		.1875	3/16		2		5/16	
13618753	13675	3/16		.1875	3/16		2		3/8	
13618751	13646	3/16		.1875	3/16		2-1/2		5/8	
13618754	13676	3/16		.1875	3/16		2-1/2		3/4	
13618752	13647	3/16		.1875	3/16		2-1/2		1	
13619680	13605		5.0	.1968		6.0		58		13.0
13623620	13610		6.0	.2362		6.0		58		13.0
13625003	13678	1/4		.2500	1/4		2		3/8	
13625004	13679	1/4		.2500	1/4		2		1/2	
13625005	13680	1/4		.2500	1/4		2-1/2		5/8	
13625000	13640	1/4		.2500	1/4		2-1/2		3/4	
13625006	13681	1/4		.2500	1/4		2-1/2		1	
13625007	13682	1/4		.2500	1/4		3		1-1/2	
13625001	13648	1/4		.2500	1/4		3-1/16		1-1/4	
13625002	13649	1/4		.2500	1/4		3-9/16		1-3/4	
13625008	13683	1/4		.2500	1/4		4		2	
13631253	13684	5/16		.3125	5/16		2		7/16	
13631250	13651	5/16		.3125	5/16		2		1/2	
13631254	13685	5/16		.3125	5/16		2-1/2		13/16	

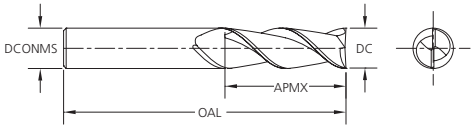
Inch	
DC	Tolerance
1/8 - 1/4	+.000/-.002
>1/4 - 1	+.000/-.003

Metric (mm)	
DC	Tolerance (h10)
3.00	+.000/-.040
>3.00 - 6.00	+.000/-.048
>6.00 - 10.00	+.000/-.058
>10.00 - 18.00	+.000/-.070
>18.00 - 20.00	+.000/-.084

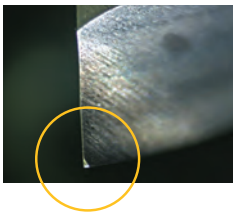
TECH
Page 173

TuffCut® AL - Series 136 *Continued*





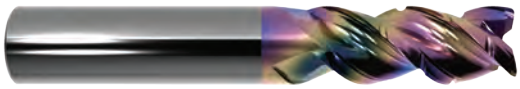
Uncoated		DC			DCONMS		OAL		APMX	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
13631251	13652	5/16		.3125	5/16		3-1/8		1-3/8	
13631252	13653	5/16		.3125	5/16		3-1/4		1-3/4	
13631500	13615		8.0	.3150		8.0		64		19.0
13637503	13686	3/8		.3750	3/8		2		1/2	
13637504	13687	3/8		.3750	3/8		2		5/8	
13637500	13645	3/8		.3750	3/8		2-1/2		3/4	
13637505	13688	3/8		.3750	3/8		2-1/2		1	
13637506	13689	3/8		.3750	3/8		3		1-1/4	
13637501	13654	3/8		.3750	3/8		3-1/4		1-1/2	
13637507	13690	3/8		.3750	3/8		4		2	
13637502	13660	3/8		.3750	3/8		4-1/4		2-1/2	
13639370	13620		10.0	.3937		10.0		70		22.0
13647240	13625		12.0	.4724		12.0		84		26.0
13650003	13691	1/2		.5000	1/2		3		5/8	
13650004	13692	1/2		.5000	1/2		3		3/4	
13650005	13693	1/2		.5000	1/2		3		1	
13650000	13650	1/2		.5000	1/2		3-1/2		1-1/4	
13650006	13694	1/2		.5000	1/2		4		1-1/2	
13650001	13661	1/2		.5000	1/2		4		2	
13650007	13695	1/2		.5000	1/2		5		2-1/2	
13650002	13662	1/2		.5000	1/2		5		3	
13655120	13626		14.0	.5512		14.0		84		26.0
13662500	13663	5/8		.6250	5/8		3-1/2		3/4	
13662503	13696	5/8		.6250	5/8		3-1/2		1-1/4	
13662501	13664	5/8		.6250	5/8		3-3/4		1-5/8	
13662502	13665	5/8		.6250	5/8		4-5/8		2-1/2	
13662504	13697	5/8		.6250	5/8		5		2	
13662990	13630		16.0	.6299		16.0		89		32.0
13670870	13631		18.0	.7087		18.0		92		32.0
13675003	13698	3/4		.7500	3/4		4		1	
13675000	13655	3/4		.7500	3/4		4		1-5/8	
13675004	13699	3/4		.7500	3/4		5		2	
13675005	13601	3/4		.7500	3/4		5		2-1/2	
13675001	13666	3/4		.7500	3/4		5-1/4		3	
13675002	13667	3/4		.7500	3/4		6-1/4		4	
13678740	13635		20.0	.7874		20.0		102		38.0
13610000	13668	1		1.0000	1		4		1-1/4	
13610001	13669	1		1.0000	1		4-1/2		2	
13610003	13603	1		1.0000	1		6		3	
13610002	13670	1		1.0000	1		6-1/2		4	
13610004	13604	1		1.0000	1		8		5-1/2	

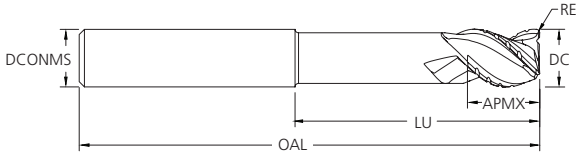


TuffCut® Series 138 and 136 wiper flat end geometry with face grind protection (as shown in photo) provides improved floor finishes on customer parts.

TECH
Page 173

TuffCut® XR-AL - Series 334





- Enhanced flute design for improved chip control and reduced cutting forces.
- Chipbreaker design provides better part finish than a traditional knuckle rougher and aids in chip management.
- Variable helix strengthens the tool corner reducing the chance of a chipped corner.
- Manufactured from premium grade ultrafine carbide material for extended tool life.

Gem+		DC		DCONMS	OAL	APMX	LU	RE
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch
33425000R.020GP	33400	1/4	.2500	1/4	2	1/2		.020
33425010R.020GP	33404	1/4	.2500	1/4	2-1/2	3/4		.020
33437500R.020GP	33408	3/8	.3750	3/8	2	5/8		.020
33437510R.020GP	33412	3/8	.3750	3/8	2-1/2	1		.020
33450000R.030GP	33416	1/2	.5000	1/2	3	5/8		.030
3345000N4R.030GP	33428	1/2	.5000	1/2	4	5/8	2-1/8	.030
33450010R.030GP	33419	1/2	.5000	1/2	3	1		.030
33450020R.030GP	33423	1/2	.5000	1/2	3	1-1/4		.030
334625010R.030GP	33430	5/8	.6250	5/8	3-1/2	1-1/4		.030
334625020R.030GP	33441	5/8	.6250	5/8	4	2		.030
33475000N4R.030GP	33436	3/4	.7500	3/4	5	1	3	.030
33475000R.030GP	33432	3/4	.7500	3/4	4	1		.030
33475010R.030GP	33434	3/4	.7500	3/4	4	1-5/8		.030
33475020R.030GP	33444	3/4	.7500	3/4	5	2-1/4		.030
33475030R.030GP	33443	3/4	.7500	3/4	6	3-1/4		.030
33410000R.030GP	33445	1	1.0000	1	6	1-1/4		.030
33410010R.030GP	33439	1	1.0000	1	4	1-1/2		.030
33410020R.030GP	33447	1	1.0000	1	5	2		.030
33410030R.030GP	33449	1	1.0000	1	6	2-1/2		.030
33410040R.030GP	33451	1	1.0000	1	6	3-1/4		.030

Inch	
DC	Tolerance
.2500 - 1.0000	+0/-.0005

Inch	
DCONMS	Tolerance (h6)
.2500 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - 1.0000	+0/-.00051

Gem+ Coating (GP):

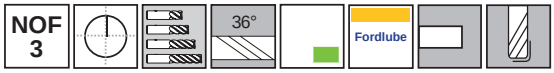
Recommended for aluminum and aluminum alloys up to 12% Si, non-ferrous metals and composites. Gem+ provides excellent wear resistance and maintains sharp cutting edges.

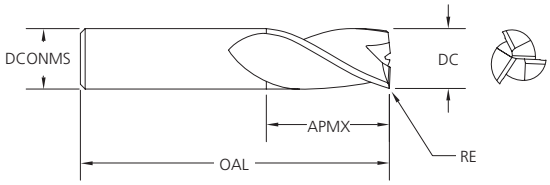
Gem+ Coating Properties			
Microhardness (HV)	Max. Service Temp.	Friction Coefficient	M.A.Ford® Tool Designation Number
4710	500° C / 932° F	0.10	GP

TECH
Page 175

TuffCut® X-AL - Series 138

Series 138 takes aluminum milling to the extreme with chip loads and speeds, definitely designed for extreme productivity.





Uncoated		Fordlube*		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13811810	13892	13811810F	14295		3.0	.1181		6.0		52.0		8.0		
13811810R.020	13100				3.0	.1181		6.0		52.0		8.0		0.50
13811810R.039	13101				3.0	.1181		6.0		52.0		8.0		1.00
13812500	13800	13812500F	14203	1/8		.1250	1/8		1-1/2		3/16			
13812501	13801	13812501F	14204	1/8		.1250	1/8		1-1/2		1/4			
13812502	13802	13812502F	14205	1/8		.1250	1/8		1-1/2		5/16			
13812503	13803	13812503F	14206	1/8		.1250	1/8		1-1/2		3/8			
13812504	13804	13812504F	14207	1/8		.1250	1/8		1-1/2		1/2			
13812505	13805	13812505F	14208	1/8		.1250	1/8		1-1/2		5/8			
13812506	13806	13812506F	14209	1/8		.1250	1/8		2		3/4			
13812507	13807	13812507F	14210	1/8		.1250	1/8		2		1			
13815750	13893	13815750F	14296		4.0	.1575		6.0		55.0		11.0		
13815750R.020	13102				4.0	.1575		6.0		55.0		11.0		0.50
13815750R.039	13103				4.0	.1575		6.0		55.0		11.0		1.00
13818750	13808	13818750F	14211	3/16		.1875	3/16		2		1/4			
13818751	13809	13818751F	14212	3/16		.1875	3/16		2		3/8			
13818752	13810	13818752F	14213	3/16		.1875	3/16		2		1/2			
13818753	13811	13818753F	14214	3/16		.1875	3/16		2-1/2		5/8			
13818754	13812	13818754F	14215	3/16		.1875	3/16		2-1/2		3/4			
13818755	13813	13818755F	14216	3/16		.1875	3/16		2-1/2		1			
13819680	13894	13819680F	14297		5.0	.1968		6.0		58.0		13.0		
13819680R.020	13104				5.0	.1968		6.0		58.0		13.0		0.50
13819680R.039	13105				5.0	.1968		6.0		58.0		13.0		1.00
13823620	13895	13823620F	14298		6.0	.2362		6.0		58.0		13.0		
13823620R.020	13106				6.0	.2362		6.0		58.0		13.0		0.50
13823620R.039	13107				6.0	.2362		6.0		58.0		13.0		1.00
13823620R.059	13108				6.0	.2362		6.0		58.0		13.0		1.50
13823620R.079	13109				6.0	.2362		6.0		58.0		13.0		2.00
13825000	13814	13825000F	14217	1/4		.2500	1/4		2		3/8			
13825000R.015	13000			1/4		.2500	1/4		2		3/8		0.015	
13825000R.030	13001			1/4		.2500	1/4		2		3/8		0.030	

*Allow 2 weeks to ship non-stock items.
Weldon flats available. Please specify when ordering. When ordering Weldon flats please call customer service for pricing.

Inch		Inch		Metric (mm)		Metric (mm)	
DC	Tolerance	RE	Tolerance	DC	Tolerance	RE	Tolerance
1/8 - 1	+.000/-.0005	1/8 - 1	+.0008/-.0008	3.00 - 20.00	+.000/-.013	3.0 - 20.0	+.02/-.02

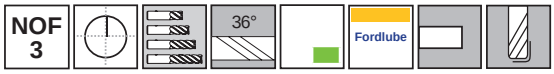
TECH
Page 173

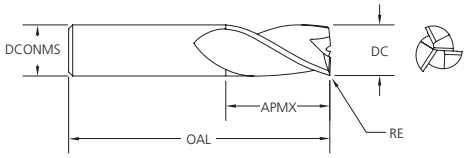
Uncoated		Fordlube*		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13825001	13815	13825001F	14218	1/4		.2500	1/4		2		1/2			
13825003	13817	13825003F	14220	1/4		.2500	1/4		2		5/8			
13825002	13816	13825002F	14219	1/4		.2500	1/4		4		1/2			
13825004	13818	13825004F	14221	1/4		.2500	1/4		2-1/2		3/4			
13825004R.015	13002			1/4		.2500	1/4		2-1/2		3/4		0.015	
13825004R.030	13003			1/4		.2500	1/4		2-1/2		3/4		0.030	
13825005	13819	13825005F	14222	1/4		.2500	1/4		3		1			
13825006	13820	13825006F	14223	1/4		.2500	1/4		3		1-1/8			
13825007	13821	13825007F	14224	1/4		.2500	1/4		3		1-1/4			
13825007R.015	13004			1/4		.2500	1/4		3		1-1/4		0.015	
13825007R.030	13005			1/4		.2500	1/4		3		1-1/4		0.030	
13825008	13822	13825008F	14225	1/4		.2500	1/4		3		1-1/2			
13825009	13823	13825009F	14226	1/4		.2500	1/4		4		1-3/4			
13825010	13824	13825010F	14227	1/4		.2500	1/4		4		2			
13831200	13390			5/16		.3125	5/16		2-1/2		5/16			
13831201	13391			5/16		.3125	5/16		2-1/2		3/8			
13831202	13392			5/16		.3125	5/16		2-1/2		7/16			
13831203	13393			5/16		.3125	5/16		2-1/2		1/2			
13831254	13829	13831254F	14232	5/16		.3125	5/16		2-1/2		13/16			
13831255	13830	13831255F	14233	5/16		.3125	5/16		2-1/2		1-1/8			
13831257	13832	13831257F	14235	5/16		.3125	5/16		3		1-1/4			
13831256	13831	13831256F	14234	5/16		.3125	5/16		3-1/8		1-3/8			
13831250	13825	13831250F	14228	5/16		.3125	5/16		4		5/16			
13831251	13826	13831251F	14229	5/16		.3125	5/16		4		3/8			
13831252	13827	13831252F	14230	5/16		.3125	5/16		4		7/16			
13831253	13828	13831253F	14231	5/16		.3125	5/16		4		1/2			
13831258	13833	13831258F	14236	5/16		.3125	5/16		4		1-1/2			
13831500	13896	13831500F	14299		8.0	.3150		8.0		64.0		19.0		
13831500R.020	13110				8.0	.3150		8.0		64.0		19.0		0.50
13831500R.039	13111				8.0	.3150		8.0		64.0		19.0		1.00
13831500R.059	13112				8.0	.3150		8.0		64.0		19.0		1.50
13831500R.079	13113				8.0	.3150		8.0		64.0		19.0		2.00
13831500R.118	13114				8.0	.3150		8.0		64.0		19.0		3.00
13837500	13834	13837500F	14237	3/8		.3750	3/8		2		1/2			
13837500R.015	13006			3/8		.3750	3/8		2		1/2		0.015	
13837500R.030	13007			3/8		.3750	3/8		2		1/2		0.030	
13837502	13836	13837502F	14239	3/8		.3750	3/8		2		5/8			
13837501	13835	13837501F	14238	3/8		.3750	3/8		2-1/2		9/16			
13837504	13838	13837504F	14241	3/8		.3750	3/8		2-1/2		3/4			
13837505	13839	13837505F	14242	3/8		.3750	3/8		2-1/2		1			
13837505R.015	13008			3/8		.3750	3/8		2-1/2		1		0.015	
13837505R.030	13009			3/8		.3750	3/8		2-1/2		1		0.030	
13837510	13844	13837510F	14247	3/8		.3750	3/8		3		9/16			
13837511	13845	13837511F	14248	3/8		.3750	3/8		3		1			

*Allow 2 weeks to ship non-stock items.
Weldon flats available. Please specify when ordering. When ordering Weldon flats please call customer service for pricing.

TECH
Page 173

TuffCut® X-AL - Series 138 *Continued*





Uncoated		Fordlube*		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13837506	13840	13837506F	14243	3/8		.3750	3/8		3		1-1/4			
13837507	13841	13837507F	14244	3/8		.3750	3/8		3-1/2		1-1/2			
13837507R.015	13010			3/8		.3750	3/8		3-1/2		1-1/2		0.015	
13837507R.030	13011			3/8		.3750	3/8		3-1/2		1-1/2		0.030	
13837503	13837	13837503F	14240	3/8		.3750	3/8		4		5/8			
13837508	13842	13837508F	14245	3/8		.3750	3/8		4		2			
13837509	13843	13837509F	14246	3/8		.3750	3/8		4-1/2		2-1/2			
13839370	13897	13839370F	14300		10.0	.3937		10.0		70.0		22.0		
13839370R.020	13115				10.0	.3937		10.0		70.0		22.0		0.50
13839370R.039	13116				10.0	.3937		10.0		70.0		22.0		1.00
13839370R.059	13117				10.0	.3937		10.0		70.0		22.0		1.50
13839370R.079	13118				10.0	.3937		10.0		70.0		22.0		2.00
13839370R.118	13119				10.0	.3937		10.0		70.0		22.0		3.00
13843750	13846	13843750F	14249	7/16		.4375	7/16		2-3/4		9/16			
13843751	13847	13843751F	14250	7/16		.4375	7/16		2-3/4		1			
13847240	13898	13847240F	14301		12.0	.4724		12.0		84.0		26.0		
13847240R.020	13120				12.0	.4724		12.0		84.0		26.0		0.50
13847240R.039	13121				12.0	.4724		12.0		84.0		26.0		1.00
13847240R.059	13122				12.0	.4724		12.0		84.0		26.0		1.50
13847240R.079	13123				12.0	.4724		12.0		84.0		26.0		2.00
13847240R.118	13124				12.0	.4724		12.0		84.0		26.0		3.00
13847240R.157	13125				12.0	.4724		12.0		84.0		26.0		4.00
13847240R.196	13126				12.0	.4724		12.0		84.0		26.0		5.00
13850000	13848	13850000F	14251	1/2		.5000	1/2		3		5/8			
13850000R.015	13012			1/2		.5000	1/2		3		5/8		0.015	
13850000R.030	13013			1/2		.5000	1/2		3		5/8		0.030	
13850000R.060	13014			1/2		.5000	1/2		3		5/8		0.060	
13850000R.090	13015			1/2		.5000	1/2		3		5/8		0.090	
13850000R.120	13016			1/2		.5000	1/2		3		5/8		0.120	
13850001	13849	13850001F	14252	1/2		.5000	1/2		3		3/4			
13850002	13850	13850002F	14253	1/2		.5000	1/2		3		1			
13850003	13851	13850003F	14254	1/2		.5000	1/2		3		1-1/4			
13850003R.015	13017			1/2		.5000	1/2		3		1-1/4		0.015	
13850003R.030	13018			1/2		.5000	1/2		3		1-1/4		0.030	
13850003R.060	13019			1/2		.5000	1/2		3		1-1/4		0.060	
13850003R.090	13020			1/2		.5000	1/2		3		1-1/4		0.090	
13850003R.120	13021			1/2		.5000	1/2		3		1-1/4		0.120	
13850004	13852	13850004F	14255	1/2		.5000	1/2		4		1-1/2			

*Allow 2 weeks to ship non-stock items.
Weldon flats available. Please specify when ordering. When ordering Weldon flats please call customer service for pricing.

TECH
Page 173

Uncoated		Fordlube*		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13850005	13853	13850005F	14256	1/2		.5000	1/2		4		2			
13850005R.015	13022			1/2		.5000	1/2		4		2		0.015	
13850005R.030	13023			1/2		.5000	1/2		4		2		0.030	
13850005R.060	13024			1/2		.5000	1/2		4		2		0.060	
13850005R.090	13025			1/2		.5000	1/2		4		2		0.090	
13850005R.120	13026			1/2		.5000	1/2		4		2		0.120	
13850006	13854	13850006F	14257	1/2		.5000	1/2		4		2-1/4			
13850007	13855	13850007F	14258	1/2		.5000	1/2		6		2-1/2			
13850008	13856	13850008F	14259	1/2		.5000	1/2		6		3-1/4			
13850009	13857	13850009F	14260	1/2		.5000	1/2		8		4			
13855120	13899	13855120F	14302		14.0	.5512		14.0		84.0		26.0		
13862500	13858	13862500F	14261	5/8		.6250	5/8		3-1/2		3/4			
13862500R.030	13027			5/8		.6250	5/8		3-1/2		3/4		0.030	
13862500R.060	13028			5/8		.6250	5/8		3-1/2		3/4		0.060	
13862500R.090	13029			5/8		.6250	5/8		3-1/2		3/4		0.090	
13862500R.120	13030			5/8		.6250	5/8		3-1/2		3/4		0.120	
13862501	13859	13862501F	14262	5/8		.6250	5/8		6		3/4			
13862502	13860	13862502F	14263	5/8		.6250	5/8		3-1/2		7/8			
13862503	13861	13862503F	14264	5/8		.6250	5/8		3-1/2		1-1/4			
13862504	13862	13862504F	14265	5/8		.6250	5/8		4		1-5/8			
13862504R.030	13031			5/8		.6250	5/8		4		1-5/8		0.030	
13862504R.060	13032			5/8		.6250	5/8		4		1-5/8		0.060	
13862504R.090	13033			5/8		.6250	5/8		4		1-5/8		0.090	
13862504R.120	13034			5/8		.6250	5/8		4		1-5/8		0.120	
13862505	13863	13862505F	14266	5/8		.6250	5/8		5		2			
13862506	13864	13862506F	14267	5/8		.6250	5/8		5		2-1/2			
13862506R.030	13035			5/8		.6250	5/8		5		2-1/2		0.030	
13862506R.060	13036			5/8		.6250	5/8		5		2-1/2		0.060	
13862506R.090	13037			5/8		.6250	5/8		5		2-1/2		0.090	
13862506R.120	13038			5/8		.6250	5/8		5		2-1/2		0.120	
13862507	13865	13862507F	14268	5/8		.6250	5/8		6		3-1/4			
13862990	13900	13862990F	14303		16.0	.6299		16.0		89.0		32.0		
13862990R.020	13127				16.0	.6299		16.0		89.0		32.0		0.50
13862990R.039	13128				16.0	.6299		16.0		89.0		32.0		1.00
13862990R.059	13129				16.0	.6299		16.0		89.0		32.0		1.50
13862990R.079	13130				16.0	.6299		16.0		89.0		32.0		2.00
13862990R.118	13131				16.0	.6299		16.0		89.0		32.0		3.00
13862990R.157	13132				16.0	.6299		16.0		89.0		32.0		4.00
13862990R.196	13133				16.0	.6299		16.0		89.0		32.0		5.00
13870870	13901	13870870F	14304		18.0	.7087		18.0		92.0		32.0		
13875000	13866	13875000F	14269	3/4		.7500	3/4		4		3/4			
13875001	13867	13875001F	14270	3/4		.7500	3/4		4		1			
13875001R.030	13039			3/4		.7500	3/4		4		1		0.030	
13875001R.060	13040			3/4		.7500	3/4		4		1		0.060	
13875001R.090	13041			3/4		.7500	3/4		4		1		0.090	

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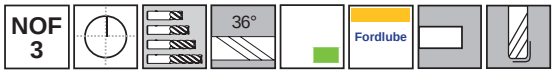
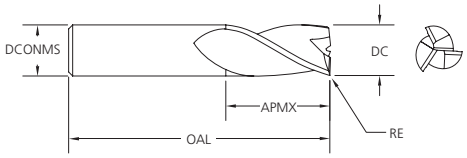
Weldon flats available. Please specify when ordering. When ordering Weldon flats please call customer service for pricing.

TECH
Page 173

TuffCut® X-AL - Series 138 *Continued*





Uncoated		Fordlube*		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13875001R.120	13042			3/4		.7500	3/4		4		1		0.120	
13875001R.190	13043			3/4		.7500	3/4		4		1		0.190	
13875001R.250	13044			3/4		.7500	3/4		4		1		0.250	
13875002	13868	13875002F	14271	3/4		.7500	3/4		6		1			
13875003	13869	13875003F	14272	3/4		.7500	3/4		6		1-1/2			
13875004	13870	13875004F	14273	3/4		.7500	3/4		4		1-5/8			
13875004R.030	13045			3/4		.7500	3/4		4		1-5/8		0.030	
13875004R.060	13046			3/4		.7500	3/4		4		1-5/8		0.060	
13875004R.090	13047			3/4		.7500	3/4		4		1-5/8		0.090	
13875004R.120	13048			3/4		.7500	3/4		4		1-5/8		0.120	
13875004R.190	13049			3/4		.7500	3/4		4		1-5/8		0.190	
13875004R.250	13050			3/4		.7500	3/4		4		1-5/8		0.250	
13875005	13871	13875005F	14274	3/4		.7500	3/4		5		2			
13875006	13872	13875006F	14275	3/4		.7500	3/4		5		2-1/4			
13875007	13873	13875007F	14276	3/4		.7500	3/4		5		2-1/2			
13875007R.030	13051			3/4		.7500	3/4		5		2-1/2			.030
13875007R.060	13052			3/4		.7500	3/4		5		2-1/2			.060
13875007R.090	13053			3/4		.7500	3/4		5		2-1/2			.090
13875007R.120	13054			3/4		.7500	3/4		5		2-1/2			.120
13875007R.190	13055			3/4		.7500	3/4		5		2-1/2			.190
13875007R.250	13056			3/4		.7500	3/4		5		2-1/2			.250
13875008	13874	13875008F	14277	3/4		.7500	3/4		6		3			
13875009	13875	13875009F	14278	3/4		.7500	3/4		6		3-1/4			
13875010	13876	13875010F	14279	3/4		.7500	3/4		6		3-1/2			
13875011	13877	13875011F	14280	3/4		.7500	3/4		6-1/4		4			
13875012	13878	13875012F	14281	3/4		.7500	3/4		8		5			
13878740	13902	13878740F	14305		20.0	.7874		20.0		102.0		38.0		
13878740R.020	13134				20.0	.7874		20.0		102.0		38.0		0.50
13878740R.039	13135				20.0	.7874		20.0		102.0		38.0		1.00
13878740R.059	13136				20.0	.7874		20.0		102.0		38.0		1.50
13878740R.079	13137				20.0	.7874		20.0		102.0		38.0		2.00
13878740R.118	13138				20.0	.7874		20.0		102.0		38.0		3.00
13878740R.157	13139				20.0	.7874		20.0		102.0		38.0		4.00
13878740R.196	13140				20.0	.7874		20.0		102.0		38.0		5.00
13810000	13879	13810000F	14282	1.00		1.0000	1		6		1-1/4			
13810001	13880	13810001F	14283	1.00		1.0000	1		8		1-1/4			
13810002	13881	13810002F	14284	1.00		1.0000	1		4		1-1/2			
13810002R.030	13057			1.00		1.0000	1		4		1-1/2		0.030	

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TECH
Page 173

Uncoated		Fordlube*		DC			DCONMS		OAL		APMX		RE	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13810002R.060	13058			1.00		1.0000	1		4		1-1/2		0.060	
13810002R.090	13059			1.00		1.0000	1		4		1-1/2		0.090	
13810002R.120	13060			1.00		1.0000	1		4		1-1/2		0.120	
13810002R.190	13061			1.00		1.0000	1		4		1-1/2		0.190	
13810002R.250	13062			1.00		1.0000	1		4		1-1/2		0.250	
13810003	13882	13810003F	14285	1.00		1.0000	1		5		2			
13810004	13883	13810004F	14286	1.00		1.0000	1		5		2-1/2			
13810004R.030	13063			1.00		1.0000	1		5		2-1/2		0.030	
13810004R.060	13064			1.00		1.0000	1		5		2-1/2		0.060	
13810004R.090	13065			1.00		1.0000	1		5		2-1/2		0.090	
13810004R.120	13066			1.00		1.0000	1		5		2-1/2		0.120	
13810004R.190	13067			1.00		1.0000	1		5		2-1/2		0.190	
13810004R.250	13068			1.00		1.0000	1		5		2-1/2		0.250	
13810005	13884	13810005F	14287	1.00		1.0000	1		6		3			
13810006	13885	13810006F	14288	1.00		1.0000	1		6		3-1/2			
13810006R.030	13069			1.00		1.0000	1		6		3-1/2		0.030	
13810006R.060	13070			1.00		1.0000	1		6		3-1/2		0.060	
13810006R.090	13071			1.00		1.0000	1		6		3-1/2		0.090	
13810006R.120	13072			1.00		1.0000	1		6		3-1/2		0.120	
13810006R.190	13073			1.00		1.0000	1		6		3-1/2		0.190	
13810006R.250	13074			1.00		1.0000	1		6		3-1/2		0.250	
13810007	13886	13810007F	14289	1.00		1.0000	1		6		4			
13810008	13887	13810008F	14290	1.00		1.0000	1		7		4-1/8			
13810009	13888	13810009F	14291	1.00		1.0000	1		8		5-1/2			

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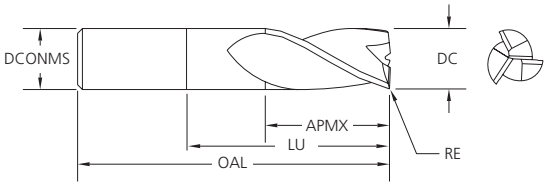
TECH
Page 173

TuffCut® X-AL - Series 138N



Uncoated		Fordlube*		DC		DCONMS	OAL	APMX	LU	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch
13812508N	14120			1/8	.1250	1/8	2	3/16	1/2	
13812508NR.015	11790			1/8	.1250	1/8	2	3/16	1/2	.015
13812509N	14121			1/8	.1250	1/8	2	3/16	3/4	
13812509NR.015	11792			1/8	.1250	1/8	2	3/16	3/4	.015
13812550N	14122			1/8	.1250	1/8	2	3/16	1	
13812550NR.015	11794			1/8	.1250	1/8	2	3/16	1	.015
13818750N	14123			3/16	.1875	3/16	2	1/4	1/2	
13818750NR.015	11796			3/16	.1875	3/16	2	1/4	1/2	.015
13818756N	14124			3/16	.1875	3/16	2	1/4	3/4	
13818756NR.015	11798			3/16	.1875	3/16	2	1/4	3/4	.015
13818757N	14125			3/16	.1875	3/16	2	1/4	1	
13818757NR.015	11800			3/16	.1875	3/16	2	1/4	1	.015
13825011N	14126			1/4	.2500	1/4	4	1/2	3/4	
13825011NR.015	11802			1/4	.2500	1/4	4	1/2	3/4	.015
13825011NR.030	11804			1/4	.2500	1/4	4	1/2	3/4	.030
13825002N	14450	13825002NF	14459	1/4	.2500	1/4	4	1/2	1-1/8	
13825002NR.015	11806			1/4	.2500	1/4	4	1/2	1-1/8	.015
13825002NR.030	11808			1/4	.2500	1/4	4	1/2	1-1/8	.030
13825012N	14127			1/4	.2500	1/4	4	1/2	2-1/8	
13825012NR.015	11810			1/4	.2500	1/4	4	1/2	2-1/8	.015
13825012NR.030	11812			1/4	.2500	1/4	4	1/2	2-1/8	.030
13831259N	14129			5/16	.3125	5/16	4	7/16	1-1/8	
13831259NR.015	11814			5/16	.3125	5/16	4	7/16	1-1/8	.015
13831259NR.030	11816			5/16	.3125	5/16	4	7/16	1-1/8	.030
13831252N	14451	13831252NF	14460	5/16	.3125	5/16	4	7/16	2-1/8	
13831252NR.015	11818			5/16	.3125	5/16	4	7/16	2-1/8	.015
13831252NR.030	11820			5/16	.3125	5/16	4	7/16	2-1/8	.030
13831210N	14128			5/16	.3125	5/16	6	7/16	3-1/8	
13831210NR.015	11822			5/16	.3125	5/16	6	7/16	3-1/8	.015
13831210NR.030	11824			5/16	.3125	5/16	6	7/16	3-1/8	.030
13837512N	14130			3/8	.3750	3/8	4	5/8	1-1/8	
13837512NR.015	11826			3/8	.3750	3/8	4	5/8	1-1/8	.015
13837512NR.030	11828			3/8	.3750	3/8	4	5/8	1-1/8	.030
13837512NR.060	11830			3/8	.3750	3/8	4	5/8	1-1/8	.060
13837503N	14452	13837503NF	14461	3/8	.3750	3/8	4	5/8	2-1/8	

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Inch	
DC	Tolerance
1/8 - 1.0	+.000/-.0005

Inch	
RE	Tolerance
1/8 - 1	+.0008/-.0008

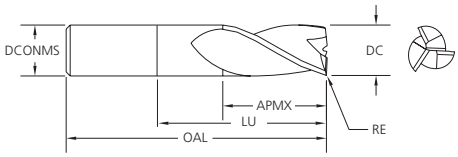
TECH
Page 173

Uncoated		Fordlube*		DC		DCONMS	OAL	APMX	LU	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch
13837503NR.015	11832			3/8	.3750	3/8	4	5/8	2-1/8	.015
13837503NR.030	11834			3/8	.3750	3/8	4	5/8	2-1/8	.030
13837503NR.060	11836			3/8	.3750	3/8	4	5/8	2-1/8	.060
13837513N	14131			3/8	.3750	3/8	6	5/8	3-1/8	
13837513NR.015	11838			3/8	.3750	3/8	6	5/8	3-1/8	.015
13837513NR.030	11840			3/8	.3750	3/8	6	5/8	3-1/8	.030
13837513NR.060	11842			3/8	.3750	3/8	6	5/8	3-1/8	.060
13850000N	14453	13850000NF	14462	1/2	.5000	1/2	3	5/8	1-3/8	
13850012N	14132			1/2	.5000	1/2	4	5/8	1-3/8	
13850012NR.015	11844			1/2	.5000	1/2	4	5/8	1-3/8	.015
13850012NR.030	11846			1/2	.5000	1/2	4	5/8	1-3/8	.030
13850012NR.060	11848			1/2	.5000	1/2	4	5/8	1-3/8	.060
13850012NR.090	11850			1/2	.5000	1/2	4	5/8	1-3/8	.090
13850012NR.120	11852			1/2	.5000	1/2	4	5/8	1-3/8	.120
13850010N	14454	13850010NF	14463	1/2	.5000	1/2	4	5/8	2-3/8	
13850010NR.015	11854			1/2	.5000	1/2	4	5/8	2-3/8	.015
13850010NR.030	11856			1/2	.5000	1/2	4	5/8	2-3/8	.030
13850010NR.060	11858			1/2	.5000	1/2	4	5/8	2-3/8	.060
13850010NR.090	11860			1/2	.5000	1/2	4	5/8	2-3/8	.090
13850010NR.120	11862			1/2	.5000	1/2	4	5/8	2-3/8	.120
13850011N	14455	13850011NF	14464	1/2	.5000	1/2	6	3/4	3-3/8	
13850011NR.015	11864			1/2	.5000	1/2	6	3/4	3-3/8	.015
13850011NR.030	11866			1/2	.5000	1/2	6	3/4	3-3/8	.030
13850011NR.060	11868			1/2	.5000	1/2	6	3/4	3-3/8	.060
13850011NR.090	11870			1/2	.5000	1/2	6	3/4	3-3/8	.090
13850011NR.120	11872			1/2	.5000	1/2	6	3/4	3-3/8	.120
13850013N	14133			1/2	.5000	1/2	6	3/4	4-3/8	
13850013NR.015	11874			1/2	.5000	1/2	6	3/4	4-3/8	.015
13850013NR.030	11876			1/2	.5000	1/2	6	3/4	4-3/8	.030
13850013NR.060	11878			1/2	.5000	1/2	6	3/4	4-3/8	.060
13850013NR.090	11880			1/2	.5000	1/2	6	3/4	4-3/8	.090
13850013NR.120	11882			1/2	.5000	1/2	6	3/4	4-3/8	.120
13862508N	14134			5/8	.6250	5/8	4	3/4	1-3/8	
13862508NR.030	11884			5/8	.6250	5/8	4	3/4	1-3/8	.030
13862508NR.060	11886			5/8	.6250	5/8	4	3/4	1-3/8	.060
13862508NR.090	11888			5/8	.6250	5/8	4	3/4	1-3/8	.090
13862508NR.120	11890			5/8	.6250	5/8	4	3/4	1-3/8	.120
13862509N	14135			5/8	.6250	5/8	6	3/4	2-3/8	
13862509NR.030	11892			5/8	.6250	5/8	6	3/4	2-3/8	.030
13862509NR.060	11894			5/8	.6250	5/8	6	3/4	2-3/8	.060
13862509NR.090	11896			5/8	.6250	5/8	6	3/4	2-3/8	.090
13862509NR.120	11898			5/8	.6250	5/8	6	3/4	2-3/8	.120
13862501N	14456	13862501NF	14465	5/8	.6250	5/8	6	3/4	3-3/8	
13862501NR.030	11900			5/8	.6250	5/8	6	3/4	3-3/8	.030
13862501NR.060	11902			5/8	.6250	5/8	6	3/4	3-3/8	.060
13862501NR.090	11904			5/8	.6250	5/8	6	3/4	3-3/8	.090
13862501NR.120	11906			5/8	.6250	5/8	6	3/4	3-3/8	.120

*Allow 2 weeks to ship non-stock items.
Weldon flats available. Please specify when ordering. When ordering Weldon flats please call customer service for pricing.

TECH
Page 173

TuffCut® X-AL - Series 138N *Continued*

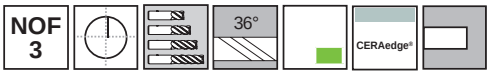


Uncoated		Fordlube*		DC		DCONMS	OAL	APMX	LU	RE
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch
13875013N	14136			3/4	.7500	3/4	6	1	1-3/8	
13875013NR.030	11908			3/4	.7500	3/4	6	1	1-3/8	.030
13875013NR.060	11910			3/4	.7500	3/4	6	1	1-3/8	.060
13875013NR.090	11912			3/4	.7500	3/4	6	1	1-3/8	.090
13875013NR.120	11914			3/4	.7500	3/4	6	1	1-3/8	.120
13875013NR.190	11916			3/4	.7500	3/4	6	1	1-3/8	.190
13875013NR.250	11918			3/4	.7500	3/4	6	1	1-3/8	.250
13875014N	14137			3/4	.7500	3/4	6	1	2-3/8	
13875014NR.030	11920			3/4	.7500	3/4	6	1	2-3/8	.030
13875014NR.060	11922			3/4	.7500	3/4	6	1	2-3/8	.060
13875014NR.090	11924			3/4	.7500	3/4	6	1	2-3/8	.090
13875014NR.120	11926			3/4	.7500	3/4	6	1	2-3/8	.120
13875014NR.190	11928			3/4	.7500	3/4	6	1	2-3/8	.190
13875014NR.250	11930			3/4	.7500	3/4	6	1	2-3/8	.250
13875002N	14457	13875002NF	14466	3/4	.7500	3/4	6	1	3-3/8	
13875002NR.030	11932			3/4	.7500	3/4	6	1	3-3/8	.030
13875002NR.060	11934			3/4	.7500	3/4	6	1	3-3/8	.060
13875002NR.090	11936			3/4	.7500	3/4	6	1	3-3/8	.090
13875002NR.120	11938			3/4	.7500	3/4	6	1	3-3/8	.120
13875002NR.190	11940			3/4	.7500	3/4	6	1	3-3/8	.190
13875002NR.250	11942			3/4	.7500	3/4	6	1	3-3/8	.250
13810010N	14138			1	1.0000	1	6	1-1/4	2-3/8	
13810010NR.030	11944			1	1.0000	1	6	1-1/4	2-3/8	.030
13810010NR.060	11946			1	1.0000	1	6	1-1/4	2-3/8	.060
13810010NR.090	11948			1	1.0000	1	6	1-1/4	2-3/8	.090
13810010NR.120	11950			1	1.0000	1	6	1-1/4	2-3/8	.120
13810010NR.190	11952			1	1.0000	1	6	1-1/4	2-3/8	.190
13810010NR.250	11954			1	1.0000	1	6	1-1/4	2-3/8	.250
13810000N	14458	13810000NF	14467	1	1.0000	1	6	1-1/4	3-3/8	
13810000NR.030	11956			1	1.0000	1	6	1-1/4	3-3/8	.030
13810000NR.060	11958			1	1.0000	1	6	1-1/4	3-3/8	.060
13810000NR.090	11960			1	1.0000	1	6	1-1/4	3-3/8	.090
13810000NR.120	11962			1	1.0000	1	6	1-1/4	3-3/8	.120
13810000NR.190	11964			1	1.0000	1	6	1-1/4	3-3/8	.190
13810000NR.250	11966			1	1.0000	1	6	1-1/4	3-3/8	.250
13810011N	14139			1	1.0000	1	7	1-1/4	4-3/8	
13810011NR.030	11968			1	1.0000	1	7	1-1/4	4-3/8	.030
13810011NR.060	11970			1	1.0000	1	7	1-1/4	4-3/8	.060
13810011NR.090	11972			1	1.0000	1	7	1-1/4	4-3/8	.090
13810011NR.120	11974			1	1.0000	1	7	1-1/4	4-3/8	.120
13810011NR.190	11976			1	1.0000	1	7	1-1/4	4-3/8	.190
13810011NR.250	11978			1	1.0000	1	7	1-1/4	4-3/8	.250

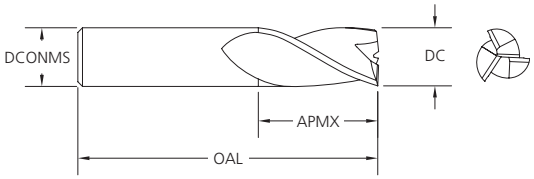
*Allow 2 weeks to ship non-stock items.
Weldon flats available. Please specify when ordering. When ordering Weldon flats please call customer service for pricing.

TECH
Page 173

TuffCut® X-AL - Series 138CE



CORNER RADIUS OPTIONS AVAILABLE.
CONTACT CUSTOMER SERVICE FOR PRICING.



CERAedge®		DC			DCONMS		OAL		APMX		Stock Status • Stocked
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	o Non-Stocked
13812501CE	07988	1/8		.1250	1/8		1-1/2		1/4		•
13812503CE	07990	1/8		.1250	1/8		1-1/2		3/8		•
13812504CE	07992	1/8		.1250	1/8		1-1/2		1/2		•
13812506CE	07994	1/8		.1250	1/8		2		3/4		•
13818751CE	07996	3/16		.1875	3/16		2		3/8		•
13818752CE	07998	3/16		.1875	3/16		2		1/2		o
13818753CE	08000	3/16		.1875	3/16		2-1/2		5/8		o
13818754CE	08002	3/16		.1875	3/16		2-1/2		3/4		•
13818755CE	08004	3/16		.1875	3/16		2-1/2		1		•
13823620CE	08006		6.0	.2362		6.0		58.0		13.0	•
13825000CE	08008	1/4		.2500	1/4		2		3/8		•
13825001CE	08010	1/4		.2500	1/4		2		1/2		•
13825003CE	08012	1/4		.2500	1/4		2		5/8		o
13825004CE	08014	1/4		.2500	1/4		2-1/2		3/4		•
13825005CE	08016	1/4		.2500	1/4		3		1		•
13825007CE	08018	1/4		.2500	1/4		3		1-1/4		•
13831500CE	08020		8.0	.3150		8.0		64.0		19.0	•
13837500CE	08022	3/8		.3750	3/8		2		1/2		•
13837504CE	08024	3/8		.3750	3/8		2-1/2		3/4		o
13837505CE	08026	3/8		.3750	3/8		2-1/2		1		•
13837506CE	08028	3/8		.3750	3/8		3		1-1/4		o
13837507CE	08030	3/8		.3750	3/8		3-1/2		1-1/2		o
13837508CE	08032	3/8		.3750	3/8		4		2		o
13839370CE	08034		10.0	.3937		10.0		70.0		22.0	•
13847240CE	08036		12.0	.4724		12.0		84.0		26.0	•

Inch	
DC	Tolerance
1/8 - 1	+.000/-.0005

Metric (mm)	
DC	Tolerance
6.00 - 20.00	+.000/-.013

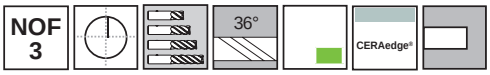
TECH
Page 173

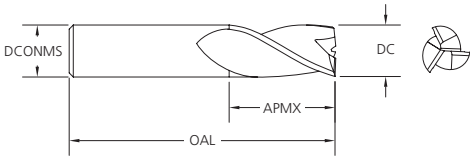
Hardness that makes it the 3rd hardest material when compared to industrial diamonds.

- Toughness that is comparable to Titanium.
- Lubricity that approaches Teflon.
- Extreme heat tolerance.
- Non-reactive to Titanium.

CERAedge® Coating Properties	
Microhardness (HV)	3400
Max. Service Temperature	1100° C / 2012° F
Friction Coefficient	0.25
Coating Thickness	2-3 microns
Color	Light Gray

TuffCut® X-AL - Series 138CE *Continued*



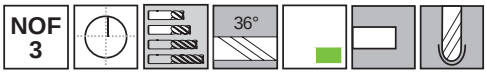


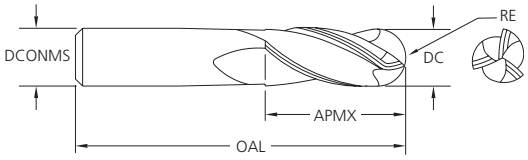
CERAedge®		DC			DCONMS		OAL		APMX		Stock Status • Stocked o Non-Stocked
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	
13850000CE	08038	1/2		.5000	1/2		3		5/8		•
13850001CE	08040	1/2		.5000	1/2		3		3/4		•
13850002CE	08042	1/2		.5000	1/2		3		1		o
13850003CE	08044	1/2		.5000	1/2		3		1-1/4		•
13850004CE	08046	1/2		.5000	1/2		4		1-1/2		•
13850005CE	08048	1/2		.5000	1/2		4		2		•
13850006CE	08050	1/2		.5000	1/2		4		2-1/4		o
13850007CE	08052	1/2		.5000	1/2		6		2-1/2		o
13855120CE	08054		14.0	.5512		14.0		84.0		26.0	•
13862503CE	08056	5/8		.6250	5/8		3-1/2		1-1/4		o
13862504CE	08058	5/8		.6250	5/8		4		1-5/8		o
13862506CE	08060	5/8		.6250	5/8		5		2-1/2		o
13862507CE	08062	5/8		.6250	5/8		6		3-1/4		o
13862990CE	08064		16.0	.6299		16.0		89.0		32.0	•
13875001CE	08066	3/4		.7500	3/4		4		1		•
13875004CE	08068	3/4		.7500	3/4		4		1-5/8		•
13875005CE	08070	3/4		.7500	3/4		5		2		o
13875006CE	08072	3/4		.7500	3/4		5		2-1/4		•
13875007CE	08074	3/4		.7500	3/4		5		2-1/2		o
13875008CE	08076	3/4		.7500	3/4		6		3		o
13878740CE	08078		20.0	.7874		20.0		102.0		38.0	o
13810002CE	08080	1		1.0000	1		4		1-1/2		o
13810003CE	08082	1		1.0000	1		5		2		o
13810005CE	08084	1		1.0000	1		6		3		o
13810006CE	08086	1		1.0000	1		6		3-1/2		o

TECH
Page 173

TuffCut® X-AL - Series 138B

Designed for extreme productivity.





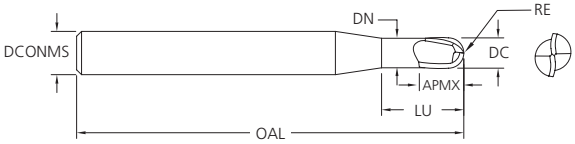
Uncoated		DC			DCONMS		OAL		APMX	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
138B11810	13356		3.0	.1181		3.0		38.0		12.0
138B12500	13300	1/8		.1250	1/8		1-1/2		3/8	
138B12501	13302	1/8		.1250	1/8		2		1/2	
138B15750	13358		4.0	.1575		4.0		51.0		15.0
138B18750	13304	3/16		.1875	3/16		2		3/8	
138B18751	13306	3/16		.1875	3/16		2-1/2		5/8	
138B19680	13360		5.0	.1968		5.0		64.0		20.0
138B23620	13362		6.0	.2362		6.0		64.0		20.0
138B25000	13308	1/4		.2500	1/4		2-1/2		1/2	
138B25001	13310	1/4		.2500	1/4		2-1/2		3/4	
138B31250	13312	5/16		.3125	5/16		2-1/2		1/2	
138B31251	13314	5/16		.3125	5/16		2-1/2		13/16	
138B31500	13364		8.0	.3150		8.0		64.0		20.0
138B37500	13316	3/8		.3750	3/8		2-1/2		5/8	
138B37501	13318	3/8		.3750	3/8		2-1/2		1	
138B39370	13366		10.0	.3937		10.0		70.0		25.0
138B43750	13320	7/16		.4375	7/16		2-3/4		9/16	
138B43751	13322	7/16		.4375	7/16		2-3/4		1	
138B47240	13368		12.0	.4724		12.0		76.0		25.0
138B50000	13324	1/2		.5000	1/2		3		5/8	
138B50001	13326	1/2		.5000	1/2		3		1-1/4	
138B50002	13328	1/2		.5000	1/2		6		1-1/4	
138B62500	13330	5/8		.6250	5/8		3-1/2		1-1/4	
138B62501	13332	5/8		.6250	5/8		4		1-5/8	
138B62990	13370		16.0	.6299		16.0		89.0		35.0
138B75000	13334	3/4		.7500	3/4		4		1	
138B75001	13336	3/4		.7500	3/4		4		1-5/8	
138B10000	13338	1		1.0000	1		4		1-1/2	
138B10001	13340	1		1.0000	1		5		2-1/4	

Inch		Inch		Metric (mm)		Metric (mm)	
DC	Tolerance	RE	Tolerance	DC	Tolerance	RE	Tolerance
1/8 - 1.0	+.000/-.0005	1/8 - 1	+.0004/-.0004	3.00 - 16.00	+.000/-.013	3.0 - 16.0	+.01/-.01

TECH
Page 171

TuffCut DM® - Series 156

Series 156 is designed for high-productivity milling of hard and difficult to cut materials Rc 45-60.
Coated with ALtima® Xtreme for materials Rc 52 and above.



• Neck relief options.

ALtima® Xtreme		DC			DCONMS (h5)		DN		OAL		APMX		LU	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
15601560A	15600	1/64		.0156	1/4				2-1/2		1/64			
156M0050N1A	15400		0.5	.0196		4.0		0.47		50		0.35		1
156M0050N2A	15401		0.5	.0196		4.0		0.47		50		0.35		2
156M0050N3A	15402		0.5	.0196		4.0		0.47		50		0.35		3
156M0050N4A	15403		0.5	.0196		4.0		0.47		50		0.35		4
156M0050N5A	15404		0.5	.0196		4.0		0.47		50		0.35		5
156M0050N6A	15406		0.5	.0196		4.0		0.47		50		0.35		6
15601960A	15602		0.5	.0196		6.0				63		0.50		
156M0060N2A	15409		0.6	.0236		4.0		0.57		50		0.40		2
156M0060N4A	15411		0.6	.0236		4.0		0.57		50		0.40		4
156M0060N6A	15413		0.6	.0236		4.0		0.57		50		0.40		6
156M0060N8A	15415		0.6	.0236		4.0		0.57		50		0.40		8
156M0060N10A	15417		0.6	.0236		4.0		0.57		50		0.40		10
15603120A	15604	1/32		.0312	1/4				2-1/2		1/32			
15603121A	15606	1/32		.0312	1/4		.0300		2-1/2		1/32		1/4	
15603122A	15608	1/32		.0312	1/4		.0300		2-1/2		1/32		5/16	
15603123A	15610	1/32		.0312	1/4		.0300		2-1/2		1/32		3/8	
15603124A	15612	1/32		.0312	1/4		.0300		2-1/2		1/32		1/2	
15603125A	15614	1/32		.0312	1/4		.0300		2-1/2		1/32		5/8	
156M0080N2A	15419		0.8	.0315		4.0		0.77		50		0.50		2
156M0080N4A	15420		0.8	.0315		4.0		0.77		50		0.50		4
156M0080N6A	15422		0.8	.0315		4.0		0.77		50		0.50		6
156M0080N8A	15423		0.8	.0315		4.0		0.77		50		0.50		8
156M0080N10A	15424		0.8	.0315		4.0		0.77		50		0.50		10
156M0100N2A	15425		1.0	.0394		4.0		0.96		50		0.80		2
156M0100N3A	15426		1.0	.0394		4.0		0.96		50		0.80		3
156M0100N4A	15427		1.0	.0394		4.0		0.96		50		0.80		4
156M0100N6A	15429		1.0	.0394		4.0		0.96		50		0.80		6

Inch	
DC	Tolerance
1/64 - 1/2	+.0 /-.0005

Inch	
DCONMS	Tolerance (h5)
.1182 - .2362	+.0 /-.00020
.2363 - .3937	+.0 /-.00024
.3938 - .7087	+.0 /-.00031

Metric (mm)	
DC	Tolerance
0.50 - 12.00	+.0 /-.015

Metric (mm)	
DCONMS	Tolerance (h5)
3.01 - 6.00	+.0 /-.005
6.01 - 10.00	+.0 /-.006
10.01 - 18.00	+.0 /-.008

TECH
Page 176

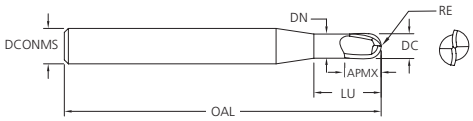
Inch	
RE	Tolerance
1/64 - 1/2	+.0004/-.0004

Metric (mm)	
RE	Tolerance
0.5 - 12.0	+.01/-.01

ALtima® Xtreme		DC			DCONMS (h5)		DN		OAL		APMX		LU	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
156M0100N10A	15431		1.0	.0394		4.0		0.96		50		0.80		10
156M0100N12A	15432		1.0	.0394		4.0		0.96		63		0.80		12
156M0100N14A	15433		1.0	.0394		4.0		0.96		63		0.80		14
156M0100N16A	15434		1.0	.0394		4.0		0.96		63		0.80		16
156M0100N18A	15435		1.0	.0394		4.0		0.96		63		0.80		18
156M0100N20A	15436		1.0	.0394		4.0		0.96		63		0.80		20
15603940A	15616		1.0	.0394		6.0				63		1.00		
15603941A	15618		1.0	.0394		6.0		0.96		63		1.00		6
15603942A	15620		1.0	.0394		6.0		0.96		63		1.00		8
15603943A	15622		1.0	.0394		6.0		0.96		63		1.00		10
15603944A	15624		1.0	.0394		6.0		0.96		63		1.00		12
15603945A	15626		1.0	.0394		6.0		0.96		63		1.00		16
156M0120N8A	15437		1.2	.0472		4.0		1.15		50		1.10		8
156M0120N12A	15438		1.2	.0472		4.0		1.15		63		1.10		12
156M0140N8A	15439		1.4	.0551		4.0		1.34		50		1.30		8
156M0140N12A	15440		1.4	.0551		4.0		1.34		63		1.30		12
156M0140N16A	15441		1.4	.0551		4.0		1.34		63		1.30		16
156M0150N4A	15442		1.5	.0591		4.0		1.44		50		1.35		4
156M0150N8A	15444		1.5	.0591		4.0		1.44		50		1.35		8
156M0150N16A	15446		1.5	.0591		4.0		1.44		63		1.35		16
156M0150N20A	15447		1.5	.0591		4.0		1.44		63		1.35		20
15605910A	15628		1.5	.0591		6.0				63		1.50		
15606250A	15630	1/16		.0625	1/4				2-1/2		1/16			
156M0160N8A	15448		1.6	.0630		4.0		1.54		50		1.40		8
156M0160N12A	15449		1.6	.0630		4.0		1.54		63		1.40		12
156M0160N16A	15450		1.6	.0630		4.0		1.54		63		1.40		16
156M0160N20A	15451		1.6	.0630		4.0		1.54		63		1.40		20
156M0180N8A	15452		1.8	.0709		4.0		1.73		50		1.60		8
156M0180N12A	15453		1.8	.0709		4.0		1.73		63		1.60		12
156M0180N16A	15454		1.8	.0709		4.0		1.73		63		1.60		16
156M0180N20A	15455		1.8	.0709		4.0		1.73		63		1.60		20
156M0200N3A	15456		2.0	.0787		4.0		1.92		50		1.70		3
156M0200N4A	15457		2.0	.0787		4.0		1.92		50		1.70		4
156M0200N6A	15458		2.0	.0787		4.0		1.92		50		1.70		6
156M0200N8A	15459		2.0	.0787		4.0		1.92		50		1.70		8
156M0200N10A	15460		2.0	.0787		4.0		1.92		50		1.70		10
156M0200N12A	15461		2.0	.0787		4.0		1.92		63		1.70		12
156M0200N16A	15463		2.0	.0787		4.0		1.92		63		1.70		16
156M0200N20A	15465		2.0	.0787		4.0		1.92		63		1.70		20
156M0200N25A	15467		2.0	.0787		4.0		1.92		80		1.70		25
156M0200N30A	15468		2.0	.0787		4.0		1.92		80		1.70		30

TECH
Page 176

TuffCut DM® - Series 156 *Continued*



ALtima® Xtreme		DC			DCONMS (h5)		DN		OAL		APMX		LU	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
156M0200N35A	15469		2.0	.0787		4.0		1.92		80		1.70		35
156M0200N40A	15470		2.0	.0787		4.0		1.92		80		1.70		40
15607870A	15632		2.0	.0787		6.0				63		2.00		
15607871A	15634		2.0	.0787		6.0		1.92		63		2.00		8
15607872A	15636		2.0	.0787		6.0		1.92		63		2.00		12
15607873A	15638		2.0	.0787		6.0		1.92		63		2.00		20
15609370A	15640	3/32		.0937	1/4				2-1/2		3/32			
15609371A	15642	3/32		.0937	1/4		.0900		2-1/2		3/32		5/16	
15609372A	15644	3/32		.0937	1/4		.0900		2-1/2		3/32		1/2	
15609373A	15646	3/32		.0937	1/4		.0900		2-1/2		3/32		3/4	
156M0300N8A	15471		3.0	.1181		6.0		2.90		75		2.50		8
156M0300N10A	15472		3.0	.1181		6.0		2.90		75		2.50		10
156M0300N16A	15474		3.0	.1181		6.0		2.90		75		2.50		16
156M0300N25A	15476		3.0	.1181		6.0		2.90		75		2.50		25
156M0300N30A	15477		3.0	.1181		6.0		2.90		75		2.50		30
156M0300N35A	15478		3.0	.1181		6.0		2.90		75		2.50		35
15611810A	15648		3.0	.1181		6.0				75		3.00		
15611812A	15676		3.0	.1181		6.0		2.90		75		3.00		12
15611811A	15650		3.0	.1181		6.0		2.90		75		3.00		20
15612500A	15652	1/8		.1250	1/4				3		1/8			
15612501A	15654	1/8		.1250	1/4		.1210		3		1/8		3/4	
15615620A	15656	5/32		.1562	1/4				3		5/32			
156M0400N10A	15480		4.0	.1575		6.0		3.90		75		3.00		10
156M0400N16A	15482		4.0	.1575		6.0		3.90		75		3.00		16
156M0400N25A	15484		4.0	.1575		6.0		3.90		75		3.00		25
156M0400N35A	15486		4.0	.1575		6.0		3.90		75		3.00		35
156M0400N40A	15487		4.0	.1575		6.0		3.90		75		3.00		40
156M0400N50A	15489		4.0	.1575		6.0		3.90		100		3.00		50
15615750A	15658		4.0	.1575		6.0				75		4.00		
15615751A	15678		4.0	.1575		6.0		3.90		75		4.00		12
15615752A	15679		4.0	.1575		6.0		3.90		75		4.00		20
15618750A	15659	3/16		.1875	1/4				3		3/16			
156M0500N25A	15490		5.0	.1968		6.0		4.90		75		3.50		25
156M0500N40A	15493		5.0	.1968		6.0		4.90		75		3.50		40
15619680A	15680		5.0	.1968		6.0				75		5.00		
15619681A	15681		5.0	.1968		6.0		4.90		75		5.00		12
15619682A	15682		5.0	.1968		6.0		4.90		75		5.00		25

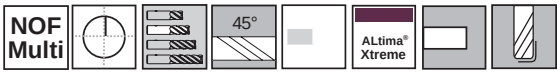
TECH
Page 176

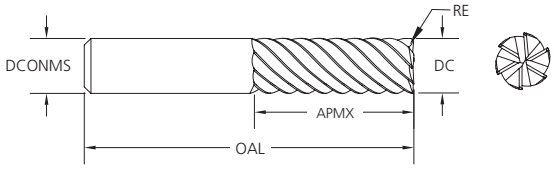
ALtima® Xtreme		DC			DCONMS (h5)		DN		OAL		APMX		LU	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
156M0600N30A	15494		6.0	.2362		6.0		5.90		75		4.50		30
156M0600N50A	15495		6.0	.2362		6.0		5.90		100		4.50		50
15623620A	15660		6.0	.2362		6.0				75		6.00		
15623621A	15683		6.0	.2362		6.0		5.90		75		6.00		12
15623622A	15684		6.0	.2362		6.0		5.90		75		6.00		25
15625000A	15662	1/4		.2500	1/4				3		1/4			
15631250A	15664	5/16		.3125	5/16				3-1/8		5/16			
156M0800N30A	15665		8.0	.3150		8.0		7.90		102		5.50		30
156M0800N50A	15667		8.0	.3150		8.0		7.90		102		5.50		50
15631500A	15666		8.0	.3150		8.0				80		8.00		
15637500A	15668	3/8		.3750	3/8				3-1/4		3/8			
156M1000N30A	15669		10.0	.3937		10.0		9.90		102		6.50		30
156M1000N50A	15671		10.0	.3937		10.0		9.90		102		6.50		50
15639370A	15670		10.0	.3937		10.0				82		10.00		
156M1200N30A	15673		12.0	.4724		12.0		11.90		102		7.50		30
156M1200N50A	15675		12.0	.4724		12.0		11.90		102		7.50		50
15647240A	15672		12.0	.4724		12.0				102		12.00		
15650000A	15674	1/2		.5000	1/2				4		1/2			

TECH
Page 176

TuffCut DM® - Series 157

Multi-Flute designed for hardened materials Rc 50-65. Available as a Square End and in 7 standard corner radii. Coated with ALtima® Xtreme for materials Rc 52 and above.





ALtima® Xtreme		DC			DCONMS		OAL		APMX		RE		NOF
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	
15711810A	15700		3	.1181		6		75		10			4
15711811A	15701		3	.1181		6		75		10		0.50	4
15712500A	15702	1/8		.1250	1/4		3		3/8				4
15712501A	15703	1/8		.1250	1/4		3		3/8		0.015		4
15712502A	15704	1/8		.1250	1/4		3		3/8		0.020		4
15715620A	15705	5/32		.1562	1/4		3		15/32				4
15715621A	15706	5/32		.1562	1/4		3		15/32		0.015		4
15715622A	15707	5/32		.1562	1/4		3		15/32		0.020		4
15715750A	15708		4	.1575		6		75		12			4
15715751A	15709		4	.1575		6		75		12		0.50	4
15715752A	15710		4	.1575		6		75		12		0.75	4
15718750A	15711	3/16		.1875	1/4		3		9/16				4
15718751A	15712	3/16		.1875	1/4		3		9/16		0.015		4
15718752A	15713	3/16		.1875	1/4		3		9/16		0.020		4
15718753A	15714	3/16		.1875	1/4		3		9/16		0.030		4
15719680A	15715		5	.1968		6		90		15			4
15719681A	15716		5	.1968		6		90		15		0.50	4
15719682A	15717		5	.1968		6		90		15		0.75	4
15719683A	15718		5	.1968		6		90		15		1.00	4
15723620A	15719		6	.2362		6		90		15			6
15723621A	15720		6	.2362		6		90		15		0.50	6
15723622A	15721		6	.2362		6		90		15		0.75	6
15723623A	15722		6	.2362		6		90		15		1.00	6
15725000A	15723	1/4		.2500	1/4		3-1/2		5/8				6
15725001A	15724	1/4		.2500	1/4		3-1/2		5/8		0.015		6
15725002A	15725	1/4		.2500	1/4		3-1/2		5/8		0.020		6
15725003A	15726	1/4		.2500	1/4		3-1/2		5/8		0.030		6
15725004A	15727	1/4		.2500	1/4		3-1/2		5/8		0.045		6

Inch	
DC	Tolerance
1/8 - 3/16	-.0006/-.0015
1/4 - 5/8	-.0008/-.0019

Inch	
DCONMS	Tolerance
1/8 - 5/8	-.0001/-.0003

Metric (mm)	
DC	Tolerance
3.0	-.005/-.028
4.0 - 6.0	-.015/-.038
8.0 - 16.0	-.020/-.048
20.0 - 25.0	-.020/-.053

Metric (mm)	
DCONMS	Tolerance
3.0 - 25.0	-.0025/-.0076

TECH
Page 178

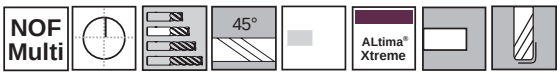
Inch	
RE	Tolerance
1/8 - 5/8	+.0012/-.0012

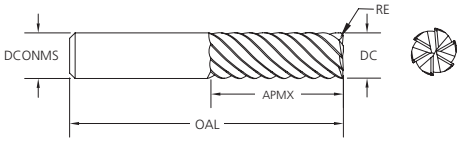
Metric (mm)	
RE	Tolerance
3.0 - 25.0	+.03/-.03

ALtima® Xtreme		DC			DCONMS		OAL		APMX		RE		NOF
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	
15731250A	15728	5/16		.3125	5/16		4		3/4				6
15731251A	15729	5/16		.3125	5/16		4		3/4		0.015		6
15731252A	15730	5/16		.3125	5/16		4		3/4		0.020		6
15731253A	15731	5/16		.3125	5/16		4		3/4		0.030		6
15731254A	15732	5/16		.3125	5/16		4		3/4		0.045		6
15731500A	15733		8	.3150		8		102		20			6
15731501A	15734		8	.3150		8		102		20		0.50	6
15731502A	15735		8	.3150		8		102		20		0.75	6
15731503A	15736		8	.3150		8		102		20		1.00	6
15731504A	15737		8	.3150		8		102		20		1.50	6
15731505A	15810		8	.3150		8		102		20		2.00	6
15737500A	15738	3/8		.3750	3/8		4		1				6
15737501A	15739	3/8		.3750	3/8		4		1		0.015		6
15737502A	15740	3/8		.3750	3/8		4		1		0.020		6
15737503A	15741	3/8		.3750	3/8		4		1		0.030		6
15737504A	15742	3/8		.3750	3/8		4		1		0.045		6
15739370A	15743		10	.3937		10		102		25			6
15739371A	15744		10	.3937		10		102		25		0.50	6
15739372A	15745		10	.3937		10		102		25		0.75	6
15739373A	15746		10	.3937		10		102		25		1.00	6
15739374A	15747		10	.3937		10		102		25		1.50	6
15739375A	15812		10	.3937		10		102		25		2.00	6
15747240A	15748		12	.4724		12		102		30			6
15747241A	15749		12	.4724		12		102		30		0.50	6
15747242A	15750		12	.4724		12		102		30		0.75	6
15747243A	15751		12	.4724		12		102		30		1.00	6
15747244A	15752		12	.4724		12		102		30		1.50	6
15747245A	15753		12	.4724		12		102		30		2.00	6
15747247A	15814		12	.4724		12		102		30		3.00	6
15750000A	15754	1/2		.5000	1/2		4		1-1/4				6
15750001A	15755	1/2		.5000	1/2		4		1-1/4		0.015		6
15750002A	15756	1/2		.5000	1/2		4		1-1/4		0.020		6
15750003A	15757	1/2		.5000	1/2		4		1-1/4		0.030		6
15750004A	15758	1/2		.5000	1/2		4		1-1/4		0.045		6
15750005A	15759	1/2		.5000	1/2		4		1-1/4		0.060		6
15762500A	15760	5/8		.6250	5/8		6		1-9/16				6
15762501A	15761	5/8		.6250	5/8		6		1-9/16		0.015		6
15762502A	15762	5/8		.6250	5/8		6		1-9/16		0.020		6
15762503A	15763	5/8		.6250	5/8		6		1-9/16		0.030		6

TECH
Page 178

TuffCut DM® - Series 157 *Continued*

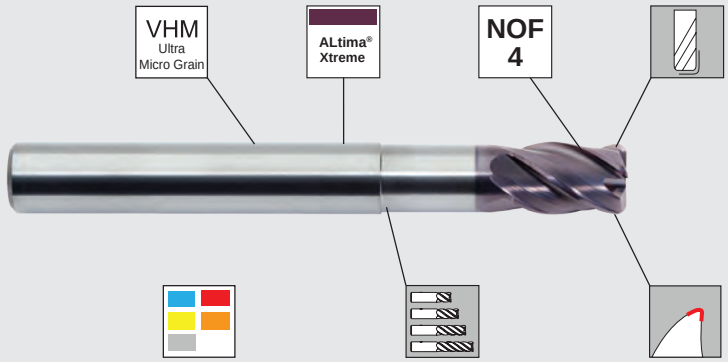




ALtima® Xtreme		DC			DCONMS		OAL		APMX		RE		NOF
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	
15762504A	15764	5/8		.6250	5/8		6		1-9/16		0.045		6
15762505A	15765	5/8		.6250	5/8		6		1-9/16		0.060		6
15762506A	15766	5/8		.6250	5/8		6		1-9/16		0.090		6
15762990A	15767		16	.6299		16		152		40			6
15762991A	15768		16	.6299		16		152		40		0.50	6
15762992A	15769		16	.6299		16		152		40		0.75	6
15762993A	15770		16	.6299		16		152		40		1.00	6
15762994A	15771		16	.6299		16		152		40		1.50	6
15762995A	15772		16	.6299		16		152		40		2.00	6
15762996A	15773		16	.6299		16		152		40		2.50	6
15762997A	15774		16	.6299		16		152		40		3.00	6
15778740A	15783		20	.7874		20		152		45			8
15778741A	15784		20	.7874		20		152		45		0.50	8
15778742A	15785		20	.7874		20		152		45		0.75	8
15778743A	15786		20	.7874		20		152		45		1.00	8
15778744A	15787		20	.7874		20		152		45		1.50	8
15778745A	15788		20	.7874		20		152		45		2.00	8
15778746A	15789		20	.7874		20		152		45		2.50	8
15778747A	15790		20	.7874		20		152		45		3.00	8
15798430A	15791		25	.9843		25		152		50			10
15798431A	15792		25	.9843		25		152		50		0.50	10
15798432A	15793		25	.9843		25		152		50		0.75	10
15798433A	15794		25	.9843		25		152		50		1.00	10
15798434A	15795		25	.9843		25		152		50		1.50	10
15798435A	15796		25	.9843		25		152		50		2.00	10
15798436A	15797		25	.9843		25		152		50		2.50	10
15798437A	15798		25	.9843		25		152		50		3.00	10

TECH
Page 178

TuffCut DM® Series 158



VHM Ultra Micro Grain

Micro Grain Carbide Grade
- Multi application for roughing and finishing.
- Covers wide range of materials.

ALtima® Xtreme

Proven ALtima® Xtreme Coating
- Designed for high speed and dry machining.

NOF 4

4 Flutes For Universal Application Range
- Increased core diameter for improved stiffness.
- Unequal flute spacing for reduced vibration.

Extensive Line-up of Corner Radius
- Large = High Feed Roughing.
- Small-medium = Semi Finishing and Finishing.

Wide Application Area
- Recommended for Hardened Steels, but works well in Steels, Stainless Steel, Cast Iron, Titanium, Super Alloys.

Wide Lineup of Neck Lengths
- Ideal for Die & Mold and 3D machining applications.

Special Cutting Edge Preparation
- Rounds edge for additional strength.
- Reduces cutting edge stresses.

Features

Application Materials
- Alloy Steels.
- Tool Steels.
- Cast Iron.
- Titanium.
- Heat Resistant Super Alloys.
- Hardened Steels up to Rc60.

Application Areas
- Die & Mold.
- 3D Complex Parts.
- Motorsports Components.
- High Speed 3D machining strategies.

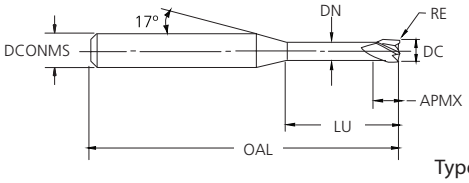
Innovation is what drives us and our TuffCut DM® 158 Series is a perfect example of how our advanced tooling technologies combine to make a positive difference to your business.

The 158 Series is designed for 3D machining and milling, delivering outstanding metal removal rates and a high quality finish particularly where HSC strategies are used.
The range includes a choice of different neck lengths and dedicated corner radius options for high feed roughing, semi-finishing and finishing applications.

By combining an asymmetrically spaced 4-flute design and special edge preparation, together with our proven ALtima® Xtreme coating and different corner radius options for high feed roughing or precision finishing, the 158 Series delivers exceptional performance and cutting efficiency with a diverse range of materials.

TuffCut DM® - Series 158

Corner Radius **Small - Medium = Semi Finishing and Finishing**
Large = High Feed Roughing



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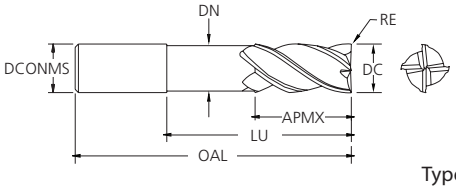


Type 2

ALtima® Xtreme		DC		DCONMS	DN	OAL	APMX	LU	RE	Type
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm	mm	
158M02N06-0.1RA	99150	2.0	.0787	6	1.9	63	3	6	0.1	1
158M02N06-0.2RA	99155	2.0	.0787	6	1.9	63	3	6	0.2	1
158M02N08-0.1RA	99151	2.0	.0787	6	1.9	63	3	8	0.1	1
158M02N08-0.2RA	99156	2.0	.0787	6	1.9	63	3	8	0.2	1
158M02N08-0.5RA	99160	2.0	.0787	6	1.9	63	3	8	0.5	1
158M02N12-0.1RA	99152	2.0	.0787	6	1.9	63	3	12	0.1	1
158M02N12-0.2RA	99157	2.0	.0787	6	1.9	63	3	12	0.2	1
158M02N16-0.1RA	99153	2.0	.0787	6	1.9	63	3	16	0.1	1
158M02N16-0.2RA	99158	2.0	.0787	6	1.9	63	3	16	0.2	1
158M02N20-0.1RA	99154	2.0	.0787	6	1.9	75	3	20	0.1	1
158M02N20-0.2RA	99159	2.0	.0787	6	1.9	75	3	20	0.2	1
158M03N10-0.2RA	99161	3.0	.1181	6	2.9	63	5	10	0.2	1
158M03N10-0.5RA	99167	3.0	.1181	6	2.9	63	5	10	0.5	1
158M03N10-0.8RA	99173	3.0	.1181	6	2.9	63	5	10	0.8	1
158M03N12-0.2RA	99162	3.0	.1181	6	2.9	63	5	12	0.2	1
158M03N12-0.5RA	99168	3.0	.1181	6	2.9	63	5	12	0.5	1
158M03N16-0.2RA	99163	3.0	.1181	6	2.9	63	5	16	0.2	1
158M03N16-0.5RA	99169	3.0	.1181	6	2.9	63	5	16	0.5	1

DC	DC Tolerance inch	RE Tolerance inch	DCONMS Tolerance
2.0 - 16.0	+0 / - 0.0008	-0.0008 / +0.0008	h6

DC	DC Tolerance mm	RE Tolerance mm	DCONMS Tolerance
2.0 - 16.0	+0 / - 0.02	-0.02 / +0.02	h6

Inch	
DCONMS	Tolerance (h6)
.0000 - .1181	+0/-.00024
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .6299	+0/-.00043

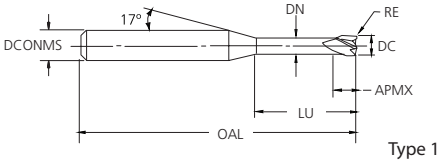
Metric (mm)	
DCONMS	Tolerance (h6)
0 - 3.0	+0/-.006
3.01 - 6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 16.0	+0/-.011

TECH
Page 182

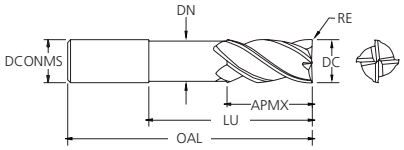
ALtima® Xtreme		DC		DCONMS	DN	OAL	APMX	LU	RE	Type
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm	mm	
158M03N20-0.2RA	99164	3.0	.1181	6	2.9	75	5	20	0.2	1
158M03N20-0.5RA	99170	3.0	.1181	6	2.9	75	5	20	0.5	1
158M03N25-0.2RA	99165	3.0	.1181	6	2.9	75	5	25	0.2	1
158M03N25-0.5RA	99171	3.0	.1181	6	2.9	75	5	25	0.5	1
158M03N30-0.2RA	99166	3.0	.1181	6	2.9	75	5	30	0.2	1
158M03N30-0.5RA	99172	3.0	.1181	6	2.9	75	5	30	0.5	1
158M04N10-0.2RA	99174	4.0	.1575	6	3.9	63	6	10	0.2	1
158M04N10-0.5RA	99180	4.0	.1575	6	3.9	63	6	10	0.5	1
158M04N12-0.2RA	99175	4.0	.1575	6	3.9	63	6	12	0.2	1
158M04N12-0.5RA	99181	4.0	.1575	6	3.9	63	6	12	0.5	1
158M04N12-1.0RA	99186	4.0	.1575	6	3.9	63	6	12	1.0	1
158M04N16-0.2RA	99176	4.0	.1575	6	3.9	63	6	16	0.2	1
158M04N16-0.5RA	99182	4.0	.1575	6	3.9	63	6	16	0.5	1
158M04N20-0.2RA	99177	4.0	.1575	6	3.9	75	6	20	0.2	1
158M04N20-0.5RA	99183	4.0	.1575	6	3.9	75	6	20	0.5	1
158M04N25-0.2RA	99178	4.0	.1575	6	3.9	75	6	25	0.2	1
158M04N25-0.5RA	99184	4.0	.1575	6	3.9	75	6	25	0.5	1
158M04N30-0.2RA	99179	4.0	.1575	6	3.9	75	6	30	0.2	1
158M04N30-0.5RA	99185	4.0	.1575	6	3.9	75	6	30	0.5	1
158M06N20-0.3RA	99187	6.0	.2362	6	5.8	75	9	20	0.3	2
158M06N20-0.5RA	99188	6.0	.2362	6	5.8	75	9	20	0.5	2
158M06N20-1.0RA	99189	6.0	.2362	6	5.8	75	9	20	1.0	2
158M06N20-1.5RA	99190	6.0	.2362	6	5.8	75	9	20	1.5	2
158M06N30-0.3RA	99191	6.0	.2362	6	5.8	100	9	30	0.3	2
158M06N30-0.5RA	99192	6.0	.2362	6	5.8	100	9	30	0.5	2
158M06N30-1.0RA	99193	6.0	.2362	6	5.8	100	9	30	1.0	2
158M06N30-1.5RA	99194	6.0	.2362	6	5.8	100	9	30	1.5	2
158M08N30-0.3RA	99195	8.0	.3150	8	7.6	75	12	30	0.3	2
158M08N30-0.5RA	99196	8.0	.3150	8	7.6	75	12	30	0.5	2
158M08N30-1.0RA	99197	8.0	.3150	8	7.6	75	12	30	1.0	2
158M08N30-2.0RA	99198	8.0	.3150	8	7.6	75	12	30	2.0	2
158M08N40-0.3RA	99199	8.0	.3150	8	7.6	100	12	40	0.3	2
158M08N40-0.5RA	99200	8.0	.3150	8	7.6	100	12	40	0.5	2
158M08N40-1.0RA	99201	8.0	.3150	8	7.6	100	12	40	1.0	2
158M08N40-2.0RA	99202	8.0	.3150	8	7.6	100	12	40	2.0	2
158M08N50-0.3RA	99203	8.0	.3150	8	7.6	120	12	50	0.3	2
158M08N50-0.5RA	99204	8.0	.3150	8	7.6	120	12	50	0.5	2
158M08N50-1.0RA	99205	8.0	.3150	8	7.6	120	12	50	1.0	2

TECH
Page 182

TuffCut DM® - Series 158 *Continued*



Type 1



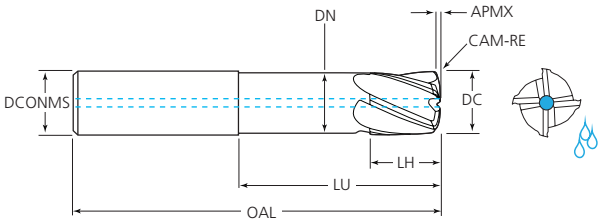
Type 2

ALtima® Xtreme		DC		DCONMS	DN	OAL	APMX	LU	RE	Type
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm	mm	
158M08N50-2.0RA	99206	8.0	.3150	8	7.6	120	12	50	2.0	2
158M10N30-0.3RA	99207	10.0	.3937	10	9.6	75	15	30	0.3	2
158M10N30-0.5RA	99208	10.0	.3937	10	9.6	75	15	30	0.5	2
158M10N30-1.0RA	99209	10.0	.3937	10	9.6	75	15	30	1.0	2
158M10N30-2.0RA	99210	10.0	.3937	10	9.6	75	15	30	2.0	2
158M10N50-0.3RA	99211	10.0	.3937	10	9.6	100	15	50	0.3	2
158M10N50-0.5RA	99212	10.0	.3937	10	9.6	100	15	50	0.5	2
158M10N50-1.0RA	99213	10.0	.3937	10	9.6	100	15	50	1.0	2
158M10N50-2.0RA	99214	10.0	.3937	10	9.6	100	15	50	2.0	2
158M10N60-0.3RA	99215	10.0	.3937	10	9.6	130	15	60	0.3	2
158M10N60-0.5RA	99216	10.0	.3937	10	9.6	130	15	60	0.5	2
158M10N60-1.0RA	99217	10.0	.3937	10	9.6	130	15	60	1.0	2
158M10N60-2.0RA	99218	10.0	.3937	10	9.6	130	15	60	2.0	2
158M12N40-0.3RA	99219	12.0	.4724	12	11.4	100	18	40	0.3	2
158M12N40-1.0RA	99220	12.0	.4724	12	11.4	100	18	40	1.0	2
158M12N40-2.0RA	99221	12.0	.4724	12	11.4	100	18	40	2.0	2
158M12N60-0.3RA	99222	12.0	.4724	12	11.4	140	18	60	0.3	2
158M12N60-1.0RA	99223	12.0	.4724	12	11.4	140	18	60	1.0	2
158M12N60-2.0RA	99224	12.0	.4724	12	11.4	140	18	60	2.0	2
158M16N50-0.3RA	99225	16.0	.6299	16	15.2	100	24	50	0.3	2
158M16N50-1.0RA	99226	16.0	.6299	16	15.2	100	24	50	1.0	2
158M16N50-3.0RA	99227	16.0	.6299	16	15.2	100	24	50	3.0	2
158M16N70-0.3RA	99228	16.0	.6299	16	15.2	150	24	70	0.3	2
158M16N70-1.0RA	99229	16.0	.6299	16	15.2	150	24	70	1.0	2
158M16N70-3.0RA	99230	16.0	.6299	16	15.2	150	24	70	3.0	2

TECH
Page 182

TuffCut® HF - Series FHFP N3

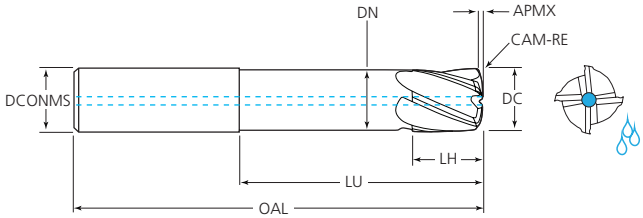
Note: Series FHFP is currently manufactured in the U.K. by M.A. Ford Europe.
U.S. manufacture to begin later in 2024.



M.A. **F**ord **H**igh-**F**eed, **P**ositive
High-feed roughing in 3D shapes, long reach applications, & difficult materials.

Tool Number	EDP	DC	Decimal	DCONMS	DN	OAL	LH	APMX	LU	NOF	CAM-RE
FHFP06N3-CCAQ	19877	6.0	.2362	6.0	5.8	57.0	6.0	0.31	20.0	4	0.6
FHFP08N3-CCAQ	19878	8.0	.3150	8.0	7.8	63.0	8.0	0.44	26.0	4	0.8
FHFP10N3-CCAQ	19879	10.0	.3937	10.0	9.8	72.0	10.0	0.55	32.0	4	1.0
FHFP12N3-CCAQ	19880	12.0	.4724	12.0	11.8	83.0	12.0	0.63	38.0	5	1.2
FHFP16N3-CCAQ	19881	16.0	.6299	16.0	15.8	100.0	16.0	0.77	50.0	5	1.6

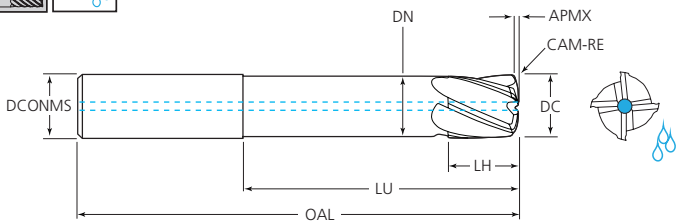
TuffCut® HF - Series FHFP N5



Tool Number	EDP	DC	Decimal	DCONMS	DN	OAL	LH	APMX	LU	NOF	CAM-RE
FHFP06N5-CCAQ	19882	6.0	.2362	6.0	5.8	75.0	6.0	0.31	32.0	4	0.6
FHFP08N5-CCAQ	19883	8.0	.3150	8.0	7.8	83.0	8.0	0.44	42.0	4	0.8
FHFP10N5-CCAQ	19884	10.0	.3937	10.0	9.8	100.0	10.0	0.55	52.0	4	1.0
FHFP12N5-CCAQ	19885	12.0	.4724	12.0	11.8	110.0	12.0	0.63	62.0	5	1.2
FHFP16N5-CCAQ	19886	16.0	.6299	16.0	15.8	133.0	16.0	0.77	82.0	5	1.6

TECH
Page 113

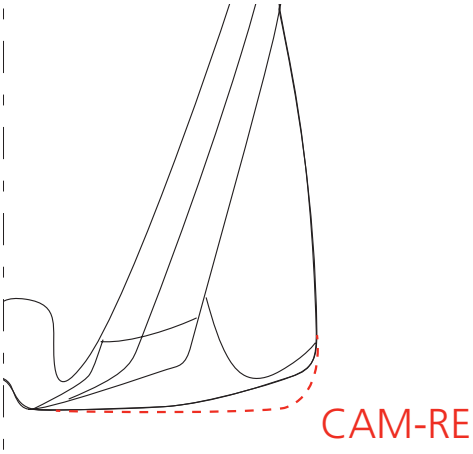
TuffCut® HF - Series FHFP N8



Tool Number	EDP	DC	Decimal	DCONMS	DN	OAL	LH	APMX	LU	NOF	CAM-RE
FHFP06N8-CCAQ	19887	6.0	.2362	6.0	5.8	90.0	6.0	0.31	50.0	4	0.6
FHFP08N8-CCAQ	19888	8.0	.3150	8.0	7.8	110.0	8.0	0.44	66.0	4	0.8
FHFP10N8-CCAQ	19889	10.0	.3937	10.0	9.8	130.0	10.0	0.55	82.0	4	1.0
FHFP12N8-CCAQ	19890	12.0	.4724	12.0	11.8	150.0	12.0	0.63	98.0	5	1.2

CAM-RE

- CAM-RE = theoretical radius
- Used to create tool definition in CAM to ensure high accuracy, near-net shape 3D roughing



TECH
Page 113

TuffCut® HF

FHFP Series Recommended Cutting Data - **Inch**

Series FHFP - 3xD - Inch

Workpiece Material Group	ISO	Coolant: Emulsion	Coolant: Air	Coolant: MQL	Vc-SFM	Tool Diameter (inch) .2362 Ap	.2362 Ae	.2362 Fz	.3150 Ap	.3150 Ae	.3150 Fz	.3937 Ap	.3937 Ae	.3937 Fz	.4724 Ap	.4724 Ae	.4724 Fz	.6299 Ap	.6299 Ae	.6299 Fz
Low Carbon Steels	P	●	●	o	985	.0118	.1772	.0154	.0157	.2362	.0205	.0197	.2953	.0256	.0236	.3543	.0307	.0276	.4724	.0409
Medium Carbon Steels	P	●	●	o	820	.0118	.1772	.0142	.0157	.2362	.0189	.0197	.2953	.0236	.0236	.3543	.0283	.0276	.4724	.0378
Alloy Steels	P	●	●	o	655	.0118	.1772	.0130	.0157	.2362	.0173	.0197	.2953	.0217	.0236	.3543	.0260	.0276	.4724	.0346
Die/Tool Steels	P	●	●	o	490	.0118	.1772	.0118	.0157	.2362	.0157	.0197	.2953	.0197	.0236	.3543	.0236	.0276	.4724	.0315
Austentic Stainless Steels	M	●	X	o	395	.0094	.1417	.0094	.0126	.1890	.0126	.0157	.2362	.0157	.0189	.2835	.0189	.0220	.3780	.0252
Duplex (22%)	M	●	X	o	295	.0083	.1417	.0094	.0110	.1890	.0126	.0138	.2362	.0157	.0165	.2835	.0189	.0193	.3780	.0252
Super Duplex (25%)	M	●	X	o	245	.0071	.0945	.0094	.0094	.1260	.0126	.0118	.1575	.0157	.0142	.1890	.0189	.0165	.2520	.0252
Titanium Alloys	S	●	X	X	330	.0071	.0945	.0094	.0094	.1260	.0126	.0118	.1575	.0157	.0142	.1890	.0189	.0165	.2520	.0252
High Temp Alloys	S	●	X	X	100	.0059	.0709	.0063	.0079	.0945	.0087	.0098	.1181	.0106	.0118	.1417	.0126	.0138	.1890	.0169
Hardened Steels 45 - 50HRC	H	●	●	o	295	.0106	.1772	.0106	.0142	.2362	.0142	.0177	.2953	.0177	.0213	.3543	.0213	.0248	.4724	.0283
Hardened Steels 50 - 55HRC	H	●	●	o	260	.0094	.1417	.0083	.0126	.1890	.0110	.0157	.2362	.0138	.0189	.2835	.0165	.0220	.3780	.0220

Series FHFP - 5xD - Inch

Workpiece Material Group	ISO	Coolant: Emulsion	Coolant: Air	Coolant: MQL	Vc-SFM	Tool Diameter (inch) .2362 Ap	.2362 Ae	.2362 Fz	.3150 Ap	.3150 Ae	.3150 Fz	.3937 Ap	.3937 Ae	.3937 Fz	.4724 Ap	.4724 Ae	.4724 Fz	.6299 Ap	.6299 Ae	.6299 Fz
Low Carbon Steels	P	●	●	o	885	.0094	.1772	.0154	.0126	.2362	.0205	.0157	.2953	.0256	.0189	.3543	.0307	.0220	.4724	.0409
Medium Carbon Steels	P	●	●	o	740	.0094	.1772	.0142	.0126	.2362	.0189	.0157	.2953	.0236	.0189	.3543	.0283	.0220	.4724	.0378
Alloy Steels	P	●	●	o	590	.0094	.1772	.0130	.0126	.2362	.0173	.0157	.2953	.0217	.0189	.3543	.0260	.0220	.4724	.0346
Die/Tool Steels	P	●	●	o	445	.0094	.1772	.0118	.0126	.2362	.0157	.0157	.2953	.0197	.0189	.3543	.0236	.0220	.4724	.0315
Austentic Stainless Steels	M	●	X	o	360	.0075	.1417	.0094	.0102	.1890	.0126	.0126	.2362	.0157	.0150	.2835	.0189	.0177	.3780	.0252
Duplex (22%)	M	●	X	o	260	.0067	.1417	.0094	.0087	.1890	.0126	.0110	.2362	.0157	.0134	.2835	.0189	.0154	.3780	.0252
Super Duplex (25%)	M	●	X	o	230	.0055	.0945	.0094	.0075	.1260	.0126	.0094	.1575	.0157	.0114	.1890	.0189	.0134	.2520	.0252
Titanium Alloys	S	●	X	X	295	.0055	.0945	.0094	.0075	.1260	.0126	.0094	.1575	.0157	.0114	.1890	.0189	.0134	.2520	.0252
High Temp Alloys	S	●	X	X	100	.0047	.0709	.0063	.0063	.0945	.0087	.0079	.1181	.0106	.0094	.1417	.0126	.0110	.1890	.0169
Hardened Steels 45 - 50HRC	H	●	●	o	260	.0087	.1772	.0106	.0114	.2362	.0142	.0142	.2953	.0177	.0169	.3543	.0213	.0197	.4724	.0283
Hardened Steels 50 - 55HRC	H	●	●	o	230	.0075	.1417	.0083	.0102	.1890	.0110	.0126	.2362	.0138	.0150	.2835	.0165	.0177	.3780	.0220

Series FHFP - 8xD - Inch

Workpiece Material Group	ISO	Coolant: Emulsion	Coolant: Air	Coolant: MQL	Vc-SFM	Tool Diameter (inch) .2362 Ap	.2362 Ae	.2362 Fz	.3150 Ap	.3150 Ae	.3150 Fz	.3937 Ap	.3937 Ae	.3937 Fz	.4724 Ap	.4724 Ae	.4724 Fz	.6299 Ap	.6299 Ae	.6299 Fz
Low Carbon Steels	P	●	●	o	490	.0071	.1417	.0154	.0094	.1890	.0205	.0118	.2362	.0256	.0142	.2835	.0307	.0165	.3780	.0409
Medium Carbon Steels	P	●	●	o	395	.0071	.1417	.0142	.0094	.1890	.0189	.0118	.2362	.0236	.0142	.2835	.0283	.0165	.3780	.0378
Alloy Steels	P	●	●	o	330	.0071	.1417	.0130	.0094	.1890	.0173	.0118	.2362	.0217	.0142	.2835	.0260	.0165	.3780	.0346
Die/Tool Steels	P	●	●	o	330	.0071	.1417	.0118	.0094	.1890	.0157	.0118	.2362	.0197	.0142	.2835	.0236	.0165	.3780	.0315
Austentic Stainless Steels	M	●	X	o	260	.0055	.1417	.0094	.0075	.1890	.0126	.0094	.2362	.0157	.0114	.2835	.0189	.0134	.3780	.0252
Duplex (22%)	M	●	X	o	195	.0051	.0945	.0094	.0067	.1260	.0126	.0083	.1575	.0157	.0098	.1890	.0189	.0114	.2520	.0252
Super Duplex (25%)	M	●	X	o	165	.0043	.0945	.0094	.0055	.1260	.0126	.0071	.1575	.0157	.0087	.1890	.0189	.0098	.2520	.0252
Titanium Alloys	S	●	X	X	230	.0043	.0945	.0094	.0055	.1260	.0126	.0071	.1575	.0157	.0087	.1890	.0189	.0098	.2520	.0252
High Temp Alloys	S	●	X	X	65	.0035	.0709	.0063	.0047	.0945	.0087	.0059	.1181	.0106	.0071	.1417	.0126	.0083	.1890	.0169
Hardened Steels 45 - 50HRC	H	●	●	o	195	.0063	.1417	.0106	.0087	.1890	.0142	.0106	.2362	.0177	.0126	.2835	.0213	.0150	.3780	.0283
Hardened Steels 50 - 55HRC	H	●	●	o	165	.0055	.0945	.0083	.0075	.1260	.0110	.0094	.1575	.0138	.0114	.1890	.0165	.0134	.2520	.0220

● Preferred O Possible X Not Possible

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® HF

FHFP Series Recommended Cutting Data - **Metric**

Series FHFP - 3xD - Metric

Workpiece Material Group	ISO	Coolant: Emulsion	Coolant: Air	Coolant: MQL	Vc-m/min	Tool Diameter (mm) 6 Ap	6 Ae	6 Fz	8 Ap	8 Ae	8 Fz	10 Ap	10 Ae	10 Fz	12 Ap	12 Ae	12 Fz	16 Ap	16 Ae	16 Fz
Low Carbon Steels	P	●	●	o	300	0.30	4.5	0.39	0.40	6.0	0.52	0.50	7.5	0.65	0.60	9.0	0.78	0.70	12.0	1.04
Medium Carbon Steels	P	●	●	o	250	0.30	4.5	0.36	0.40	6.0	0.48	0.50	7.5	0.60	0.60	9.0	0.72	0.70	12.0	0.96
Alloy Steels	P	●	●	o	200	0.30	4.5	0.33	0.40	6.0	0.44	0.50	7.5	0.55	0.60	9.0	0.66	0.70	12.0	0.88
Die/Tool Steels	P	●	●	o	150	0.30	4.5	0.30	0.40	6.0	0.40	0.50	7.5	0.50	0.60	9.0	0.60	0.70	12.0	0.80
Austentic Stainless Steels	M	●	X	o	120	0.24	3.6	0.24	0.32	4.8	0.32	0.40	6.0	0.40	0.48	7.2	0.48	0.56	9.6	0.64
Duplex (22%)	M	●	X	o	90	0.21	3.6	0.24	0.28	4.8	0.32	0.35	6.0	0.40	0.42	7.2	0.48	0.49	9.6	0.64
Super Duplex (25%)	M	●	X	o	75	0.18	2.4	0.24	0.24	3.2	0.32	0.30	4.0	0.40	0.36	4.8	0.48	0.42	6.4	0.64
Titanium Alloys	S	●	X	X	100	0.18	2.4	0.24	0.24	3.2	0.32	0.30	4.0	0.40	0.36	4.8	0.48	0.42	6.4	0.64
High Temp Alloys	S	●	X	X	30	0.15	1.8	0.16	0.20	2.4	0.22	0.25	3.0	0.27	0.30	3.6	0.32	0.35	4.8	0.43
Hardened Steels 45 - 50HRC	H	●	●	o	90	0.27	4.5	0.27	0.36	6.0	0.36	0.45	7.5	0.45	0.54	9.0	0.54	0.63	12.0	0.72
Hardened Steels 50 - 55HRC	H	●	●	o	80	0.24	3.6	0.21	0.32	4.8	0.28	0.40	6.0	0.35	0.48	7.2	0.42	0.56	9.6	0.56

Series FHFP - 5xD - Metric

Workpiece Material Group	ISO	Coolant: Emulsion	Coolant: Air	Coolant: MQL	Vc-m/min	Tool Diameter (mm) 6 Ap	6 Ae	6 Fz	8 Ap	8 Ae	8 Fz	10 Ap	10 Ae	10 Fz	12 Ap	12 Ae	12 Fz	16 Ap	16 Ae	16 Fz
Low Carbon Steels	P	●	●	o	270	0.24	4.5	0.39	0.32	6.0	0.52	0.40	7.5	0.65	0.48	9.0	0.78	0.56	12.0	1.04
Medium Carbon Steels	P	●	●	o	225	0.24	4.5	0.36	0.32	6.0	0.48	0.40	7.5	0.60	0.48	9.0	0.72	0.56	12.0	0.96
Alloy Steels	P	●	●	o	180	0.24	4.5	0.33	0.32	6.0	0.44	0.40	7.5	0.55	0.48	9.0	0.66	0.56	12.0	0.88
Die/Tool Steels	P	●	●	o	135	0.24	4.5	0.30	0.32	6.0	0.40	0.40	7.5	0.50	0.48	9.0	0.60	0.56	12.0	0.80
Austentic Stainless Steels	M	●	X	o	110	0.19	3.6	0.24	0.26	4.8	0.32	0.32	6.0	0.40	0.38	7.2	0.48	0.45	9.6	0.64
Duplex (22%)	M	●	X	o	80	0.17	3.6	0.24	0.22	4.8	0.32	0.28	6.0	0.40	0.34	7.2	0.48	0.39	9.6	0.64
Super Duplex (25%)	M	●	X	o	70	0.14	2.4	0.24	0.19	3.2	0.32	0.24	4.0	0.40	0.29	4.8	0.48	0.34	6.4	0.64
Titanium Alloys	S	●	X	X	90	0.14	2.4	0.24	0.19	3.2	0.32	0.24	4.0	0.40	0.29	4.8	0.48	0.34	6.4	0.64
High Temp Alloys	S	●	X	X	30	0.12	1.8	0.16	0.16	2.4	0.22	0.20	3.0	0.27	0.24	3.6	0.32	0.28	4.8	0.43
Hardened Steels 45 - 50HRC	H	●	●	o	80	0.22	4.5	0.27	0.29	6.0	0.36	0.36	7.5	0.45	0.43	9.0	0.54	0.50	12.0	0.72
Hardened Steels 50 - 55HRC	H	●	●	o	70	0.19	3.6	0.21	0.26	4.8	0.28	0.32	6.0	0.35	0.38	7.2	0.42	0.45	9.6	0.56

Series FHFP - 8xD - Metric

Workpiece Material Group	ISO	Coolant: Emulsion	Coolant: Air	Coolant: MQL	Vc-m/min	Tool Diameter (mm) 6 Ap	6 Ae	6 Fz	8 Ap	8 Ae	8 Fz	10 Ap	10 Ae	10 Fz	12 Ap	12 Ae	12 Fz	16 Ap	16 Ae	16 Fz
Low Carbon Steels	P	●	●	o	150	0.18	3.6	0.39	0.24	4.8	0.52	0.30	6.0	0.65	0.36	7.2	0.78	0.42	9.6	1.04
Medium Carbon Steels	P	●	●	o	120	0.18	3.6	0.36	0.24	4.8	0.48	0.30	6.0	0.60	0.36	7.2	0.72	0.42	9.6	0.96
Alloy Steels	P	●	●	o	100	0.18	3.6	0.33	0.24	4.8	0.44	0.30	6.0	0.55	0.36	7.2	0.66	0.42	9.6	0.88
Die/Tool Steels	P	●	●	o	100	0.18	3.6	0.30	0.24	4.8	0.40	0.30	6.0	0.50	0.36	7.2	0.60	0.42	9.6	0.80
Austentic Stainless Steels	M	●	X	o	80	0.14	3.6	0.24	0.19	4.8	0.32	0.24	6.0	0.40	0.29	7.2	0.48	0.34	9.6	0.64
Duplex (22%)	M	●	X	o	60	0.13	2.4	0.24	0.17	3.2	0.32	0.21	4.0	0.40	0.25	4.8	0.48	0.29	6.4	0.64
Super Duplex (25%)	M	●	X	o	50	0.11	2.4	0.24	0.14	3.2	0.32	0.18	4.0	0.40	0.22	4.8	0.48	0.25	6.4	0.64
Titanium Alloys	S	●	X	X	70	0.11	2.4	0.24	0.14	3.2	0.32	0.18	4.0	0.40	0.22	4.8	0.48	0.25	6.4	0.64
High Temp Alloys	S	●	X	X	20	0.09	1.8	0.16	0.12	2.4	0.22	0.15	3.0	0.27	0.18	3.6	0.32	0.21	4.8	0.43
Hardened Steels 45 - 50HRC	H	●	●	o	60	0.16	3.6	0.27	0.22	4.8	0.36	0.27	6.0	0.45	0.32	7.2	0.54	0.38	9.6	0.72
Hardened Steels 50 - 55HRC	H	●	●	o	50	0.14	2.4	0.21	0.19	3.2	0.28	0.24	4.0	0.35	0.29	4.8	0.42	0.34	6.4	0.56

● Preferred O Possible X Not Possible

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut®

End Mill Icon Glossary

Glossaire des icônes de la fraise en bout | Glosario de iconos de molinos de extremo

NOF 4 — Number of Flutes

Center Cutting

Length: Stub / Standard / Long / Extra-Long

Coatings

- ALtima® Xtreme
- ALtima®
- TiCN
- TiN
- Fordlube
- CERAedge®

38°/41° — Helix Angle

Ball Nose

N — Neck Relief

Corner Radius

Shank

HB DIN6535 — Shank/DIN

Chipbreaker — Chipbreaker

Workpiece Material Group

- **P** — Steels
- **H** — Hardened Steels (35-65Rc)
- **M** — Stainless Steels
- **K** — Cast Iron
- **S** — Special Alloys
- **N** — Non-Ferrous

Cutting Calculations And Definitions			Metric	U.S.
ae	=	Width of cut, radial depth of cut	(mm)	(inch)
ap	=	Depth of cut, axial depth of cut	(mm)	(inch)
Dc	=	Cutter diameter	(mm)	(inch)
f	=	Feed per revolution	(mm/rev)	(IPR)
fz	=	Feed per tooth	(mm/tooth)	(IPT)
NOF	=	Number of teeth	Number	
n	=	RPM	(rev/min)	(rev/min)
Q	=	Metal removal rate	(cm^3/min)	(in^3/min)
vc	=	Cutting speed	(m/min)	(SFM)
vf	=	Feed speed	(mm/min)	(IPM)
Dw	=	Working diameter	(mm)	(inch)

Formulas

Inch
RPM (n) = SFM (vc) x 3.82/Tool Diam.
IPM (vf) = RPM (n) x IPR (f)

Conversion Inch to Metric
SFM (vc) to m/min (vc) = SFM (vc) x .3048
IPM (vf) to mm/min (vf) = IPM (vf) x 25.4

Metric
RPM (n) = m/min (vc) x 318.057/Tool Diam.
mm/min (vf) = RPM (n) x mm/Revolution (f).

Conversion Metric to Inch
m/min (vc) to SFM (vc) = (m/min)/.3048
mm/min (vf) to IPM (vf) = (mm/min)/25.4

Safety Note

Always wear the appropriate personal protective equipment such as safety glasses and protective clothing when using solid carbide or HSS cutting tools. Machines should be fully guarded. Technical data provided should be considered advisory only as variations may be necesary depending on the particular application.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

End Mill Troubleshooting

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Excessive Flank Wear	Speed too high	Reduce the cutting speed RPM's (n).
	Improper feed speed (too slow)	Increase feed per tooth (fz).
	Hard workpiece material > 55 Rc	Try 90-100 SFM (vc) with multi-fluted tool (5 flutes+). Use ALtima® Xtreme hard coating.
	Recutting Chips	Change feed speed to change chip size or clear chips with coolant or air pressure.
	Milling Strategy	Ensure you are climb milling unless workpiece material has hard/abrasive outer skin or high impact tool steel like D2, then conventional milling technique is preferred for breakthrough (see pg 119).
	Improper cutting angle	Change to correct cutting angle, tilt tool at 15 degrees.
	Too low a primary relief angle	Change to larger relief angle.
PROBLEM	**POSSIBLE CAUSE**	**POSSIBLE SOLUTION**
Excessive Corner Wear	No Corner Radius	Implementing corner radius on tool adds strength and increases tool life.
	Speed too high	Reduce the cutting speed RPM's (n).
	Tool Runout	Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible.
	Tool Overhang	Ensure you are using shortest OAL possible, stub tool in holder. Utilize stronger necked tool for longer reaches.
PROBLEM	**POSSIBLE CAUSE**	**POSSIBLE SOLUTION**
Cutting Edge Chipping	Lack of rigidity (tool)	Use shortest end mill available, hold shank deeper in holder, investigate for tool slippage. Use short gage length holder.
	Lack of rigidity (workpiece)	Tighten workpiece fixture - a common problem.
	Feed too high	Decrease feed per tooth (fz)
	Feed to high on first pass	Decrease feed per tooth (fz) on first pass through workpiece skin or reduce radial width of cut (ae) first pass.
	Part Entry	Reduce FPT on entry - implement radius in or sweeping entrances - avoid 90° (perpendicular) entry.
	Milling Strategy	Ensure you are climb milling unless workpiece material has hard/abrasive outer skin or high impact tool steel like D2, then conventional milling technique is preferred for breakthrough (see pg 119).
	Tool Overhang	Ensure you are using shortest OAL possible, stub tool in holder. Utilize stronger necked tool for longer reaches.
	Tool Runout	Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible.
	Not enough rigidity of machine tool & holder	Change rigid machine tool or holder.
	Cutting Edge Prep	Ensure tool has proper edge prep for workpiece material.
	Teeth too sharp	Change to lower cutting angle, primary relief.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

End Mill Troubleshooting Continued

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Breakage	Lack of rigidity (workpiece)	Tighten workpiece fixture - a common problem.
	Speed too low	Increase the cutting speed RPM's (n).
	Feed too high	Decrease feed per tooth (fz).
	Heavy depth of cut	Reduce width of cut, radial depth of cut (ae) & depth of cut, axial depth of cut (ap).
	Part Entry	Reduce FPT on entry - implement radius in or sweeping entrances - avoid 90° (perpendicular) entry.
	Milling Strategy	Review tool path and ensure there are no arbitrary moves, extreme arc of engagement increases & undesirable situations for the tool. Keep constant radial engagement. See tool path diagrams on page 120.
	Tool Overhang	Ensure you are using shortest OAL possible, stub tool in holder. Utilize stronger necked tool for longer reaches.
	Tool Runout	Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible.
	Excessive edge wear	Recondition at earlier stage. Factory recondition service is recommended. See M.A. Ford's® RED BOX reconditioning program on page 558.
PROBLEM	**POSSIBLE CAUSE**	**POSSIBLE SOLUTION**
Built Up Edge (BUE)	Chip Welding to cutting edge	Utilize proper tool coating for workpiece material being cut. Climb mill preferred.
	Feed too low	Increase feed per tooth (fz).
	Speed too low	Increase the cutting speed RPM's (n).
	Coolant Strategy	Add coolant or readjust coolant flow, use through tool coolant if available. Check coolant mixture concentration.
PROBLEM	**POSSIBLE CAUSE**	**POSSIBLE SOLUTION**
Chip Packing	Insufficient chip room	Use end mill with fewer flutes.
	Feed too high	Decrease feed per tooth (fz).
	Heavy depth of cut	Reduce width of cut, radial depth of cut (ae) & depth of cut, axial depth of cut (ap).
	Not enough coolant	Apply more coolant to flush chips. Use air pressure or op. stop to clear chips away.
	Large heavy chip	Utilize chipbreaker style tool to cut chip size.
PROBLEM	**POSSIBLE CAUSE**	**POSSIBLE SOLUTION**
Poor Surface Finish	Feed too high	Decrease feed per tooth (fz).
	Speed too low	Increase the cutting speed RPM's (n).
	Too light width of cut	Increase width of cut, radial depth of cut (ae) to stabilize tool in cut.
	Tool Runout	Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible.
	Built up Edge	Use Flood Coolant.
	Recutting Chips	Redirect/Evaluate coolant flush - or use fewer number of flutes.
	No end tooth concavity	Add margin (touch primary with oilstone).

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

End Mill Troubleshooting Continued

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Chatter/Vibration	Lack of rigidity (workpiece)	Tighten workpiece fixture - a common problem.
	Lack of rigidity (machine & holder)	Use better machine tool, holder or change condition. Ask your M.A.Ford® representative about harmonic testing.
	Tool Runout	Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible.
	Speed too high	Reduce the cutting speed RPM's (n).
	Feed too low	Increase feed per tooth (fz).
	Chip too thin	Utilize chip thinning adjustment multiplier.
	Arc of engagement violation	Use smaller tools and generate corner radii in pockets. Avoid tools that diameter matches workpiece corner radius, or rough plunge corners.
	Milling Strategy	Ensure you are climb milling unless workpiece material has hard/abrasive outer skin or high impact tool steel like D2 then conventional milling technique is preferred for breakthrough.
PROBLEM	**POSSIBLE CAUSE**	**POSSIBLE SOLUTION**
Tool Deflection	Tool Overhang	Ensure you are using shortest OAL possible, stub tool in holder. Utilize stronger necked tool for longer reaches.
	End mill Diameter	Increase diameter of end mill for higher strength to length ratio.
	Increase number of flutes	Higher number of flutes = larger core diameter = increased strength.
	Feed too high	Decrease feed per tooth (fz).
	Too high width of cut	Decrease width of cut, radial depth of cut (ae).
	Milling Strategy	Climb milling can help reduce the amount of deflection in some cases.
PROBLEM	**POSSIBLE CAUSE**	**POSSIBLE SOLUTION**
No Dimensional Accuracy (Wall Tapered)	Coolant Strategy	Add coolant or readjust coolant flow, use through tool coolant if available. Check coolant mixture concentration.
	Tool Deflection	See Tool Deflection above.
	Feed too high	Decrease feed per tooth (fz).
	Too high width of cut	Decrease width of cut, radial depth of cut (ae).
	Tool Runout	Check tool runout in holder/spindle, <.0003" (.0076mm) desired. Hand ground flats can be suspect and common cause. Use collet, milling chuck, or shrink fit holders if possible.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Milling Strategy Comparison

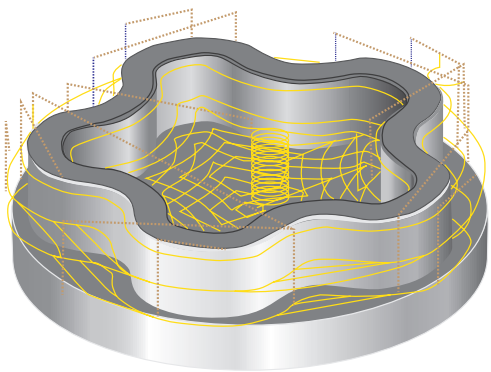
Conventional Machining

- Reduced Axial Depths Of Cut (ap) - Normally 1 x Tool Diameter.
- Higher Radial Depths Of Cut (ae) - Normally 0.5 x Tool Diameter.
- Lower Spindle Speed RPM (n).
- Lower Feed Rate (vf) (inch/min or mm/min).
- Slower Machining Time.
- Low Metal Removal Rate (Q - in^3/min or cm^3/min).

High Speed Machining (HSM)

- Increased Axial Depths Of Cut (ap) - up to 2 x Tool Diameter.
- Reduced Radial Depths Of Cut (ae) - 0.1/0.2 x Tool Diameter.
- Higher Spindle Speed RPM (n).
- Higher Feed Rate (vf) (inch/min or mm/min).
- Faster Machining Time.
- High Metal Removal Rate (Q - in^3/min or cm^3/min).

Conventional



Tool Ø 12.0mm (.4724") 4 Flute

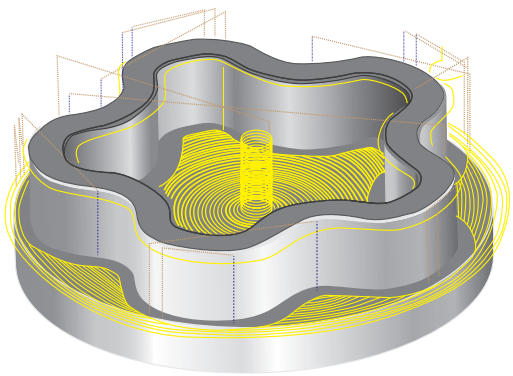
vc - 150m/min (5,905 in/min)
n - 3,975 RPM
fz - 0.06mm/z (.0024 in/z)
vf - 954mm/min (37.6 in/min)

ap - 2 x 12.0mm (.4724") 1xD
ae - 6.0mm (.2362") 0.5xD

Metal Removal Rate (MRR)
68.7 cm^3/min (4.2 in^3/min)

Machining Time
7 minutes 45 Seconds

High Speed



Tool Ø 12.0mm (.4724") 5 Flute

vc - 300m/min (11,811 in/min)
n - 8,000 RPM
fz - 0.15mm/z (.006 in/z)
vf - 6,000mm/min (240 in/min)

ap - 24.0mm (.945") 2xD
ae - 1.2mm (.047") 0.1xD

Metal Removal Rate (MRR)
172.8 cm^3/min (10.5 in^3/min)

Machining Time
3 minutes 35 Seconds

Contact Your Local M.A. Ford® Representative
For More Information On The Right Milling Strategy For Your Application.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

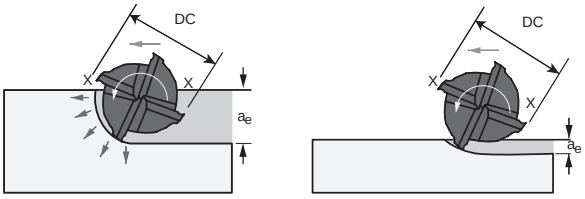
Radial Chip Thinning

During profile or side milling with a solid carbide end mill at 50% (ae) radial width of cut, the chip formed is at full programmed thickness. When your radial depth of cut decreases to something less than 50%, the chip formed is not as thick. This is known as "radial chip thinning". When less than 50% (ae) radial depths are used, it becomes necessary to increase your feed to achieve full chip thickness. This means a higher programmed feed rate is needed to achieve the recommended chip thickness.

Programmers and Machinists have a tendency to lower feed rate due to previous experience. With the utilization of new programming methods, such as trochoidal and peel milling, manufacturers can increase productivity and tool life. These methods take advantage of much deeper (ap) axial cuts with less (ae) radial width of cut. With these methods, it's possible to run higher surface footages (SFM or m/min) along with these higher feed rates (IPM or mm/min) because less heat is generated at the cutting zone. Plus, you're utilizing chip thinning.

With the introduction of M.A. Ford®'s variable pitch tools, harmonics have virtually been eliminated, thus easing Programmers and Machinists fears of previous experiences. Advancements in our hard coatings enable our tools to withstand 900 degrees F, thus eliminating heat concerns. In addition, machine tools have advanced greatly to take advantage of these new methods. Use the following chart as a reference to increase feed rates by multiplying recommended feed rate by the increase feed factor, according to your (ae) radial depth of cut as % of (Dc) cutter diameter.

(ae) Radial Depth of Cut as to % of (Dc) Cutter Diameter	Increase Feed Factor
30%	1.10
25%	1.20
20%	1.20
15%	1.41
10%	1.80
7%	2.00
5%	2.30
3%	2.93
2%	3.60
1%	5.00

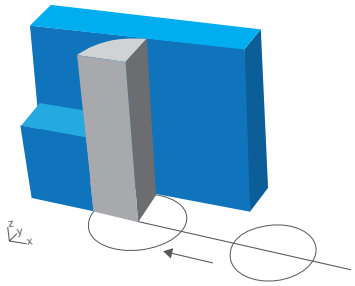


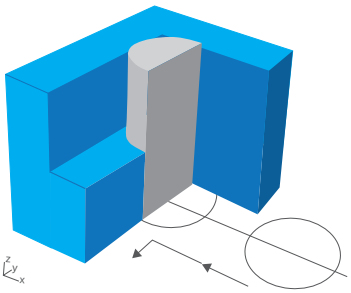
Tool Engagement Angle

Sometimes referred to as "Arc of Engagement", this is the degrees of engagement the end mill will contact the part during cut depths in the radial direction. Ideally you would like to engage the end mill at a constant engagement angle of 30-40 degrees. At this degree of engagement the tool will perform best because of acceptable loading while not exceeding deflection limits.

As the tool travels around the geometrical shape of the part features, it will encounter areas where it could exceed the acceptable engagement angle. Software manufacturers have created methods to calculate algorithms to avoid these situations. One such case would be the entry into a pocket corner. At 50% radial depth of cut (ae), the cutter runs along the pocket side with a tool engagement angle of 90 degrees. As it enters the corner, it can quickly jump to 180 degrees as shown in the example to the right.

At this intersection, large engagement would cause tool chatter and even breakage. Using CAD CAM software to generate the corner avoids an abrupt stop and change of direction. It also keeps a constant arc of engagement while providing smooth chatter free cutting and long tool life.





Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Deflection

During the machining process, high cutting forces are directed on the end mill causing it to deflect. How much the end mill deflects depends on cutting parameters, tool diameter, tool stick out, and the elasticity coefficient (PSI) of the cutting tool material. The cutting tool strength will vary from different suppliers. At M.A. Ford®, we use only raw material of the highest quality and strength.

During roughing, deflection can be slightly higher than finishing. Deflection may be tolerable when roughing because at some point you will come back and finish cut your part. On larger carbide tools, deflection less than .001" (.025mm) is acceptable. However, on small micro end mills, deflection of less than .0005" (.0127mm) is acceptable.

Depending whether you are conventional milling or climb milling, deflection will be in different directions. With climb milling, deflection is in the direct opposite of the cut, but with conventional milling its direction is more parallel with the cut. This difference in direction will impart a different pattern finish on the wall of the workpiece. In climb milling, the tool engagement lines are more vertical and distinct. With conventional milling, your chip starts out thin and then gets thicker as your end mill continues through the cut; tool engagement lines are not as distinctly vertical.

M.A. Ford® has designed computer software to perform the many calculations required to determine tool deflection. All M.A. Ford® tools carry a Lot Number which can be traced back to that tool's DNA. With this information, we can plug the exact carbide TRS number into our software. How does this benefit you? We can increase cutting parameters to the point of maximum deflection, thus optimizing your operation parameters.

Please contact M.A. Ford®'s Tech Line (1-800-553-8024 or maftech@maford.com) with your tooling application questions.

Pocket Corners

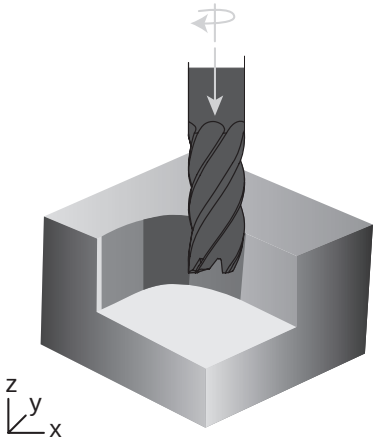
Inside or pocket corners present a different challenge in two ways. First, if the corner radius is proportionally smaller than the related pocket size, it is necessary to use a much smaller diameter end mill to achieve the necessary radius. With a small diameter end mill there are restrictions from a cut depth standpoint; a small end mill will deflect when axial depth of cut (ap) exceeds the end mills limits and breakage can occur.

Secondly, to rough the pocket the programmer may use a much larger end mill to remove large amounts of stock. If you plow into the rough corner with the small end mill, your tool engagement angle can cause the small end mill to deflect and chip or break. To avoid these problems, you must use one of two methods: peck milling or rest milling. Software packages again ease this procedure by maintaining low tool engagement angle.

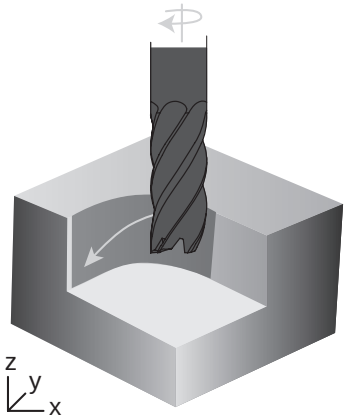
Peck milling is a series of axial plunge moves to remove much of the stock remaining in the corner. Plunging directs forces axially on the machine spindle, thus eliminating radial force and deflection. This is particularly beneficial for light duty machines.

Rest milling is a series of circular moves while traveling in the Z direction, very similar to helical milling. This removes the remaining stock much like trochoidal milling but with the addition of Z movements.

Peck Milling



Rest Milling



Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XV

XV5CB Series Recommended Cutting Data - Profile Milling with 3xD Cutting Length - **Inch**

Workpiece Material Group	ISO	Hardness	• Preferred o Possible x Not Possible			RWOC (ae)			End Mill Diameter (inch)			
									3/8	1/2	5/8	3/4
			Emulsion	Compressed Air	MQL	5%	10%	15%	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.			
						2.3	1.67	1.4				
						Vc - SFM			fz - in/tooth			
Low Carbon Steels 12L14, 1018, A36	P	≤ 28 HRC	o	•	o	1150	985	820	.0023	.0030	.0038	.0045
Medium Carbon Steels 1045, 1050, 1070	P	≤ 38 HRC	o	•	o	850	785	720	.0023	.0030	.0038	.0045
Alloy Steels 4130, 4140, 4340	P	≤ 38 HRC	o	•	o	785	720	655	.0023	.0030	.0038	.0045
Die / Tool Steels A2, D2, H13, P20	P	≤ 45 HRC	o	•	o	720	655	590	.0023	.0030	.0038	.0045
Stainless Steels - Free Machining 303, 400 Series	M	≤ 28 HRC	•	•	o	675	590	500	.0023	.0030	.0038	.0045
Stainless Steels - Austenitic 304, 316	M	≤ 28 HRC	•	x	o	525	460	330	.0018	.0024	.0030	.0036
Stainless Steels - Difficult to Machine 13-8PH, Nitronics	M	≤ 45 HRC	•	x	o	360	295	230	.0015	.0020	.0025	.0030
Stainless Steels - Precipitation Hardened 15-5 PH, 17-4 PH, 17-7 PH	M	≤ 45 HRC	•	•	o	525	460	330	.0018	.0024	.0030	.0036
Titanium Alloys 6Al-4V	S	≤ 42 HRC	•	x	x	400	330	265	.0015	.0020	.0025	.0030

Notes

- Cutting data provided should be considered advisory only. Adjustments may be necessary depending on the application, workpiece rigidity, machine tool, etc.
- The XV5CB should only be used in accurate tool holders with high gripping power. ER collet type holders are not recommended.
- For optimal performance in ISO S materials, ae = ≤ 0.1 x D.

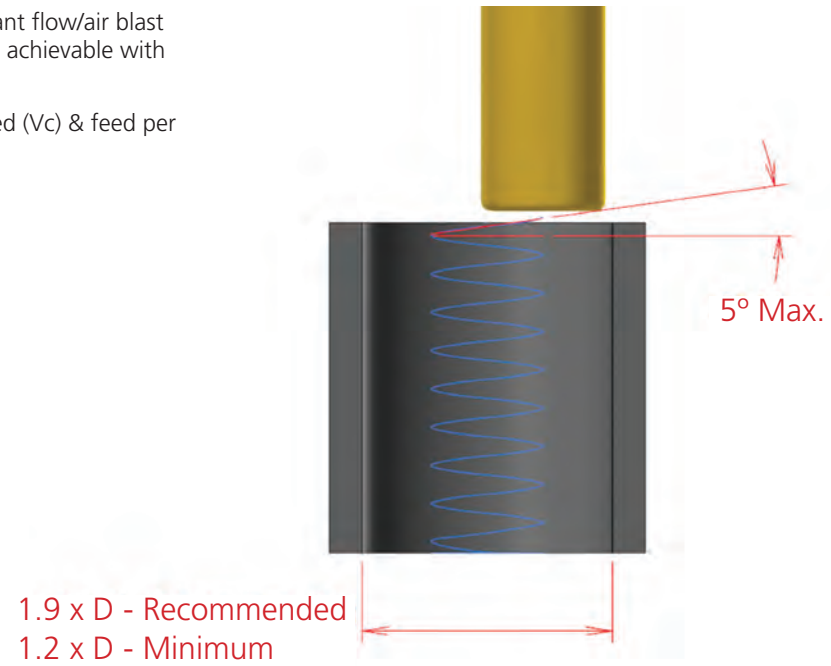
Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XV

XV5CB Series Recommended Cutting Data - Profile Milling with 3xD Cutting Length - **Inch**

Helical interpolation recommendations

- Under optimal conditions, with proper coolant flow/air blast techniques, up to 5° helical ramp angles are achievable with the XV5CB in most materials.
- A reduction of 30-50% in both cutting speed (Vc) & feed per tooth (fz) are recommended.
- Recommended hole diameter = 1.9 x D.
- Minimum hole diameter = 1.2 x D.



RWOC (ae)	Chip Thicknesss Compensation Factor
5%	2.30
7%	1.96
8%	1.84
10%	1.67
13%	1.49
15%	1.40

During profile milling with a radial width of less than 50% of the cutter diameter, the actual chip thickness at the cutting edge is less than the programmed chipload. The accompanying table shows the increase in chipload by given radial width percentage to adjust for chip thinning. Multiply your recommended chip thickness by the appropriate feed factor to establish the correct feed rate.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XV

XV5CB Series Recommended Cutting Data - Profile Milling with 4xD Cutting Length - **Inch**

Workpiece Material Group	ISO	Hardness	• Preferred o Possible x Not Possible			RWOC (ae)		End Mill Diameter (inch)			
								3/8	1/2	5/8	3/4
			Emulsion	Compressed Air	MQL	5%	10%	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.			
						2.3	1.67				
						Vc - SFM		fz - in/tooth			
Low Carbon Steels 12L14, 1018, A36	P	≤ 28 HRC	o	•	o	985	820	.0015	.0020	.0025	.0030
Medium Carbon Steels 1045, 1050, 1070	P	≤ 38 HRC	o	•	o	785	720	.0015	.0020	.0025	.0030
Alloy Steels 4130, 4140, 4340	P	≤ 38 HRC	o	•	o	720	655	.0015	.0020	.0025	.0030
Die / Tool Steels A2, D2, H13, P20	P	≤ 45 HRC	o	•	o	655	590	.0015	.0020	.0025	.0030
Stainless Steels - Free Machining 303, 400 Series	M	≤ 28 HRC	•	•	o	590	500	.0015	.0020	.0025	.0030
Stainless Steels - Austenitic 304, 316	M	≤ 28 HRC	•	x	o	525	460	.0011	.0014	.0018	.0021
Stainless Steels - Difficult to Machine 13-8PH, Nitronics	M	≤ 45 HRC	•	x	o	295	230	.0009	.0012	.0015	.0018
Stainless Steels - Precipitation Hardened 15-5 PH, 17-4 PH, 17-7 PH	M	≤ 45 HRC	•	•	o	525	460	.0011	.0014	.0018	.0021
Titanium Alloys 6Al-4V	S	≤ 42 HRC	•	x	x	330	265	.0009	.0012	.0015	.0018

Notes

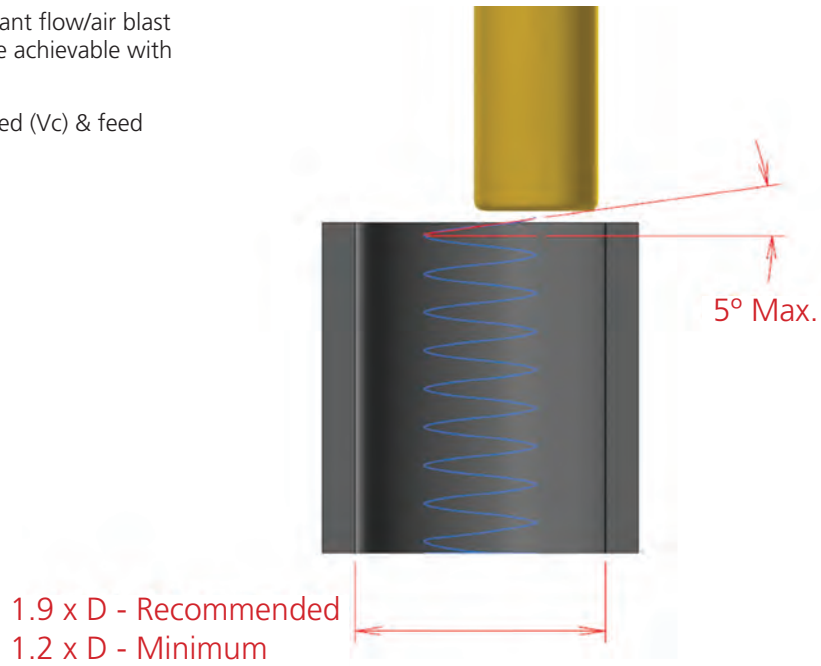
- Cutting data provided should be considered advisory only. Adjustments may be necessary depending on the application, workpiece rigidity, machine tool, etc.
- The XV5CB should only be used in accurate tool holders with high gripping power. ER collet type holders are not recommended.
- For optimal performance in ISO S materials, ae = ≤ 0.07 x D.

TuffCut® XV

XV5CB Series Recommended Cutting Data - Profile Milling with 4xD Cutting Length - **Inch**

Helical interpolation recommendations

- Under optimal conditions, with proper coolant flow/air blast techniques, up to 5° helical ramp angles are achievable with the XV5CB in most materials.
- A reduction of 30-50% in both cutting speed (Vc) & feed per tooth (fz) are recommended.
- Recommended hole diameter = 1.9 x D.
- Minimum hole diameter = 1.2 x D.



RWOC (ae)	Chip Thicknesss Compensation Factor
5%	2.30
7%	1.96
8%	1.84
10%	1.67

During profile milling with a radial width of less than 50% of the cutter diameter, the actual chip thickness at the cutting edge is less than the programmed chipload. The accompanying table shows the increase in chipload by given radial width percentage to adjust for chip thinning. Multiply your recommended chip thickness by the appropriate feed factor to establish the correct feed rate.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XV

XV7 / XV7CB Series Recommended Cutting Data - Profile Milling with ≤ 2xD Cutting Length - **Inch**

Workpiece Material Group	ISO	Hardness	• Preferred o Possible x Not Possible			RWOC (ae)			End Mill Diameter (inch)				
									1/4	3/8	1/2	5/8	3/4
			Emulsion	Compressed Air	MQL	5%	10%	15%	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.				
						2.3	1.67	1.4					
						Vc - SFM			fz - in/tooth				
Low Carbon Steels 12L14, 1018, A36	P	≤ 28 HRC	o	•	o	1475	1150	985	.0015	.0023	.0030	.0038	.0045
Medium Carbon Steels 1045, 1050, 1070	P	≤ 38 HRC	o	•	o	885	850	785	.0015	.0023	.0030	.0038	.0045
Alloy Steels 4130, 4140, 4340	P	≤ 38 HRC	o	•	o	850	785	720	.0015	.0023	.0030	.0038	.0045
Die / Tool Steels A2, D2, H13, P20	P	≤ 45 HRC	o	•	o	720	655	590	.0015	.0023	.0030	.0038	.0045
Stainless Steels - Free Machining 303, 400 Series	M	≤ 28 HRC	•	•	o	675	590	500	.0015	.0023	.0030	.0038	.0045
Stainless Steels - Austenitic 304, 316	M	≤ 28 HRC	•	x	o	525	460	330	.0013	.0019	.0025	.0031	.0038
Stainless Steels - Difficult to Machine 13-8PH, Nitronics	M	≤ 45 HRC	•	x	o	360	295	230	.0010	.0015	.0020	.0025	.0030
Stainless Steels - Precipitation Hardened 15-5 PH, 17-4 PH, 17-7 PH	M	≤ 45 HRC	•	•	o	525	460	330	.0010	.0015	.0020	.0025	.0030
Cobalt Chrome Alloys	M	≤ 45 HRC	•	x	o	400	330	265	.0010	.0015	.0020	.0025	.0030
Duplex (22%)	M	≤ 45 HRC	•	x	o	245	215	195	.0010	.0015	.0020	.0025	.0030
Super Duplex (25%)	M	≤ 45 HRC	•	x	o	230	195	180	.0010	.0015	.0020	.0025	.0030
High Temp Alloys Inconel, Hastelloy, Monel	S	≤ 42 HRC	•	x	x	150	130	-	.0010	.0015	.0020	.0025	.0030
Titanium Alloys 6Al-4V	S	≤ 42 HRC	•	x	x	400	330	265	.0010	.0015	.0020	.0025	.0030
Cast Iron - Gray	K	≤ 240 HB	•	o	o	1350	1180	790	.0015	.0023	.0030	.0038	.0045
Cast Iron - Ductile	K	> 240 HB	•	o	o	975	885	625	.0015	.0023	.0030	.0038	.0045
Cast Iron - Malleable	K	> 240 HB	•	o	o	525	490	460	.0015	.0023	.0030	.0038	.0045
Hardened Steels	H	45-50 HRC	o	•	o	490	445	-	.0013	.0019	.0025	.0031	.0038
Hardened Steels	H	50-55 HRC	o	•	o	375	-	-	.0006	.0009	.0013	.0016	.0019

Notes

- The XV7 / XV7CB should only be used in accurate tool holders with high gripping power. ER collet type holders are not recommended.

Helical interpolation recommendations:

- Under optimal conditions, with proper coolant flow/air blast techniques, up to 3° helical ramp angles are achievable with the XV7 / XV7CB in most materials.
- A reduction of 30-50% in both cutting speed (Vc) & feed per tooth (fz) are recommended.
- Recommended hole diameter = 1.9 x D.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XV

XV7 / XV7CB Series Recommended Cutting Data - Profile Milling with 3xD Cutting Length - **Inch**

Workpiece Material Group	ISO	Hardness	• Preferred o Possible x Not Possible			RWOC (ae)		End Mill Diameter (inch)				
								1/4	3/8	1/2	5/8	3/4
			Emulsion	Compressed Air	MQL	5%	10%	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.				
						2.3	1.67					
						Vc - SFM		fz - in/tooth				
Low Carbon Steels 12L14, 1018, A36	P	≤ 28 HRC	o	•	o	1150	985	.0012	.0019	.0025	.0031	.0038
Medium Carbon Steels 1045, 1050, 1070	P	≤ 38 HRC	o	•	o	850	785	.0012	.0019	.0025	.0031	.0038
Alloy Steels 4130, 4140, 4340	P	≤ 38 HRC	o	•	o	785	720	.0012	.0019	.0025	.0031	.0038
Die / Tool Steels A2, D2, H13, P20	P	≤ 45 HRC	o	•	o	720	655	.0012	.0019	.0025	.0031	.0038
Stainless Steels - Free Machining 303, 400 Series	M	≤ 28 HRC	•	•	o	675	590	.0012	.0019	.0025	.0031	.0038
Stainless Steels - Austenitic 304, 316	M	≤ 28 HRC	•	x	o	525	460	.0010	.0015	.0020	.0025	.0030
Stainless Steels - Difficult to Machine 13-8PH, Nitronics	M	≤ 45 HRC	•	x	o	360	295	.0007	.0012	.0016	.0019	.0023
Stainless Steels - Precipitation Hardened 15-5 PH, 17-4 PH, 17-7 PH	M	≤ 45 HRC	•	•	o	525	460	.0007	.0012	.0016	.0019	.0023
Cobalt Chrome Alloys	M	≤ 45 HRC	•	x	o	330	265	.0007	.0012	.0016	.0019	.0023
Duplex (22%)	M	≤ 45 HRC	•	x	o	245	215	.0007	.0012	.0016	.0019	.0023
Super Duplex (25%)	M	≤ 45 HRC	•	x	o	180	155	.0007	.0012	.0016	.0019	.0023
High Temp Alloys Inconel, Hastelloy, Monel	S	≤ 42 HRC	•	x	x	130	-	.0007	.0012	.0016	.0019	.0023
Titanium Alloys 6Al-4V	S	≤ 42 HRC	•	x	x	330	265	.0007	.0012	.0016	.0019	.0023
Cast Iron - Gray	K	≤ 240 HB	•	o	o	1085	945	.0012	.0019	.0025	.0031	.0038
Cast Iron - Ductile	K	> 240 HB	•	o	o	815	710	.0012	.0019	.0025	.0031	.0038
Cast Iron - Malleable	K	> 240 HB	•	o	o	420	390	.0012	.0019	.0025	.0031	.0038
Hardened Steels	H	45-50 HRC	o	•	o	390	350	.0011	.0017	.0022	.0028	.0033
Hardened Steels	H	50-55 HRC	o	•	o	300	-	.0005	.0008	.0011	.0014	.0017

Notes

- The XV7 / XV7CB should only be used in accurate tool holders with high gripping power. ER collet type holders are not recommended.

Helical interpolation recommendations:

- Under optimal conditions, with proper coolant flow/air blast techniques, up to 3° helical ramp angles are achievable with the XV7 / XV7CB in most materials.
- A reduction of 30-50% in both cutting speed (Vc) & feed per tooth (fz) are recommended.
- Recommended hole diameter = 1.9 x D.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XV

XV7 / XV7CB Series Recommended Cutting Data - Profile Milling with 4xD Cutting Length - **Inch**

Workpiece Material Group	ISO	Hardness	• Preferred o Possible x Not Possible			RWOC (ae)	End Mill Diameter (inch)			
							3/8	1/2	5/8	3/4
			Emulsion	Compressed Air	MQL	5%	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.			
						2.3				
						Vc - SFM	fz - in/tooth			
Low Carbon Steels 12L14, 1018, A36	P	≤ 28 HRC	o	•	o	985	.0015	.0020	.0025	.0030
Medium Carbon Steels 1045, 1050, 1070	P	≤ 38 HRC	o	•	o	785	.0015	.0020	.0025	.0030
Alloy Steels 4130, 4140, 4340	P	≤ 38 HRC	o	•	o	720	.0015	.0020	.0025	.0030
Die / Tool Steels A2, D2, H13, P20	P	≤ 45 HRC	o	•	o	655	.0015	.0020	.0025	.0030
Stainless Steels - Free Machining 303, 400 Series	M	≤ 28 HRC	•	•	o	590	.0015	.0020	.0025	.0030
Stainless Steels - Austenitic 304, 316	M	≤ 28 HRC	•	x	o	460	.0011	.0015	.0019	.0023
Stainless Steels - Difficult to Machine 13-8PH, Nitronics	M	≤ 45 HRC	•	x	o	295	.0009	.0013	.0016	.0019
Stainless Steels - Precipitation Hardened 15-5 PH, 17-4 PH, 17-7 PH	M	≤ 45 HRC	•	•	o	460	.0009	.0013	.0016	.0019
Cobalt Chrome Alloys	M	≤ 45 HRC	•	x	o	265	.0009	.0013	.0016	.0019
Duplex (22%)	M	≤ 45 HRC	•	x	o	215	.0009	.0013	.0016	.0019
Super Duplex (25%)	M	≤ 45 HRC	•	x	o	155	.0009	.0013	.0016	.0019
High Temp Alloys Inconel, Hastelloy, Monel	S	≤ 42 HRC	•	x	x	100	.0008	.0010	.0013	.0015
Titanium Alloys 6Al-4V	S	≤ 42 HRC	•	x	x	265	.0009	.0013	.0016	.0019
Cast Iron - Gray	K	≤ 240 HB	•	o	o	945	.0015	.0020	.0025	.0030
Cast Iron - Ductile	K	> 240 HB	•	o	o	710	.0015	.0020	.0025	.0030
Cast Iron - Malleable	K	> 240 HB	•	o	o	390	.0015	.0020	.0025	.0030
Hardened Steels	H	45-50 HRC	o	•	o	355	.0015	.0020	.0025	.0030
Hardened Steels	H	50-55 HRC	o	•	o	270	.0008	.0010	.0013	.0015

Notes

- The XV7 / XV7CB should only be used in accurate tool holders with high gripping power. ER collet type holders are not recommended.

Helical interpolation recommendations:

- Under optimal conditions, with proper coolant flow/air blast techniques, up to 2° helical ramp angles are achievable with the XV7 / XV7CB in most materials.
- A reduction of 30-50% in both cutting speed (Vc) & feed per tooth (fz) are recommended.
- Recommended hole diameter = 1.9 x D.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XV

XV7 / XV7CB Series Recommended Cutting Data - Chip Thickness Compensation Factors - **Inch**

RWOC (ae)	Chip Thicknesss Compensation Factor
2%	3.57
3%	2.93
5%	2.30
7%	1.96
8%	1.84
10%	1.67
13%	1.49
15%	1.40

During profile milling with a radial width of less than 50% of the cutter diameter, the actual chip thickness at the cutting edge is less than the programmed chipload. The accompanying table shows the increase in chipload by given radial width percentage to adjust for chip thinning. Multiply your recommended chip thickness by the appropriate feed factor to establish the correct feed rate.

TuffCut® XT

277 / 277CB / 277N Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)*				End Mill Diameter (inch)								
										1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
						5%	10%	25%	50%	*Profile milling at ≥ 50% ap is not recommended for diameters 1/4" and below.								
			Emulsion	Compressed Air	MQL	2.3	1.8	1.2	1.0	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
						vc - SFM				fz - in/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	1475	1150	980	500	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	1130	900	840	250	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	1035	840	755	250	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	900	725	615	200	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	610	495	325	250	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	510	410	280	200	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	675	545	425	360	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	525	430	400	210	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	410	330	295	210	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	525	430	395	110	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Cobalt Chrome Alloys	M		•	x	o	410	325	295	130	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Duplex (22%)	M		•	x	o	245	195	180	130	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Super Duplex (25%)	M		•	x	o	245	195	180	110	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
High Temp Alloys	S	up to 42 Rc	•	x	x	180	150	130	85	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Inconel	S		•	x	x	180	150	130	85	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	375	350	330	175	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	1625	1295	870	350	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	675	540	510	260	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XT

277 / 277CB / 277N Series Recommended Cutting Data - Profile Milling - **Metric**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)*				End Mill Diameter (mm)							
										3*	5*	6*	8	10	12	16	20
						5%	10%	25%	50%	*Profile milling at ≥ 50% ap is not recommended for diameters 6mm and below.							
			Emulsion	Compressed Air	MQL	2.3	1.8	1.2	1.0	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.							
						vc- m/min				fz - mm/tooth							
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	450	350	300	150	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	345	275	255	75	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	315	255	230	75	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	275	220	187	60	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	185	150	100	75	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	155	125	85	60	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	205	165	130	110	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	160	130	120	65	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	125	100	90	65	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	160	130	120	35	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Cobalt Chrome Alloys	M		•	x	o	125	100	90	40	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Duplex (22%)	M		•	x	o	75	60	55	40	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Super Duplex (25%)	M		•	x	o	75	60	55	35	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000
High Temp Alloys	S	up to 42 Rc	•	x	x	55	45	40	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Inconel	S		•	x	x	55	45	40	25								
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	115	105	100	55	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	495	395	265	110	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	205	165	155	80	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XT

277 / 277CB / 277N Series Recommended Cutting Data - Slotting - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting*			End Mill Diameter (inch)								
									1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
			Emulsion	Compressed Air	MQL	25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 1/4" and below.								
						vc - SFM			fz - in/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	550	500	475	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	275	250	225	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	275	250	225	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	225	200	175	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	275	250	225	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	225	200	175	.0001	.0002	.0003	.0004	.0005	.0006	.0008	.0010	.0015
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	385	360	350	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	225	210	200	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	225	210	200	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	125	110	100	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cobalt Chrome Alloys	M		•	x	o	150	130	120	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Duplex (22%)	M		•	x	o	150	130	120	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Super Duplex (25%)	M		•	x	o	120	110	100	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
High Temp Alloys	S	up to 42 Rc	•	x	x	100	85	75	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Inconel	S		•	x	x	95	85	75	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	180	175	160	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	375	350	325	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	275	260	250	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XT

277 / 277CB / 277N Series Recommended Cutting Data - Slotting - **Metric**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting*			End Mill Diameter (mm)							
									3*	5*	6*	8	10	12	16	20
			Emulsion	Compressed Air	MQL	25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 6mm and below.							
						vc -m/min			fz - mm/tooth							
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	170	150	145	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	85	75	70	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	85	75	70	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	70	60	55	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	85	75	70	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	70	60	55	.0030	.0060	.0070	.0100	.0120	.0150	.0200	.0250
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	120	110	110	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	70	65	60	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	70	65	60	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	40	35	30	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Cobalt Chrome Alloys	M		•	x	o	45	40	40	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Duplex (22%)	M		•	x	o	45	40	40	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Super Duplex (25%)	M		•	x	o	40	35	30	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
High Temp Alloys	S	up to 42 Rc	•	x	x	30	25	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Inconel	S		•	x	x	30	25	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	55	55	50	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	115	105	100	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	85	80	75	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

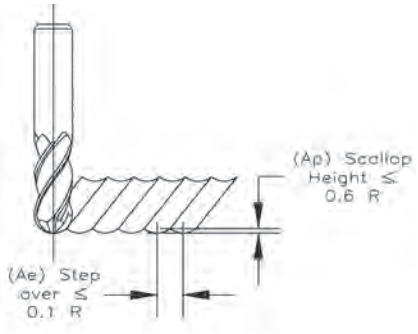
TuffCut® XT

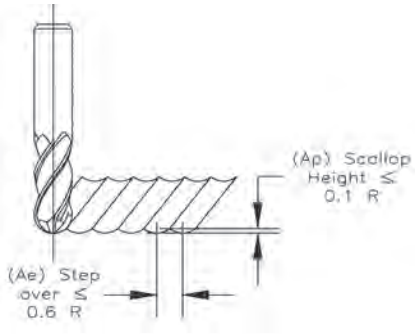
279 Series Recommended Cutting Data - Contouring - **Inch**

See pages 142-145 for profile milling and slotting data.

Semi Roughing / Roughing (25 - 48 Rc)						
					Max	Max
Diameter	Decimal	Radius	SFM	in/tooth Range	Ae	Ap
1/8	0.1250	0.063	820	.0008 - .0012	0.006	0.035
3/16	0.1875	0.094	1020	.0010 - .0017	0.009	0.053
1/4	0.2500	0.125	1235	.0010 - .0027	0.012	0.071
5/16	0.3125	0.156	1235	.0014 - .0032	0.016	0.094
3/8	0.3750	0.188	1235	.0018 - .0037	0.020	0.118
1/2	0.5000	0.250	1235	.0018 - .0040	0.024	0.142
5/8	0.6250	0.313	1235	.0020 - .0041	0.032	0.189
3/4	0.7500	0.375	1235	.0025 - .0045	0.038	0.225

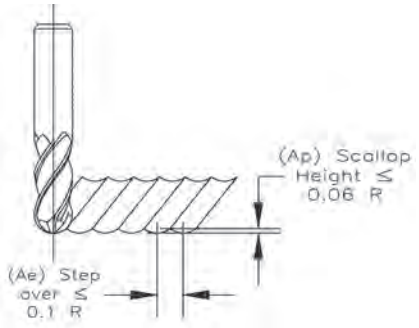
Semi Finishing / Finishing (25 - 48 Rc)						
					Max	Max
Diameter	Decimal	Radius	SFM	in/tooth Range	Ae	Ap
1/8	0.1250	0.063	820	.0008 - .0012	0.035	0.006
3/16	0.1875	0.094	1020	.0010 - .0017	0.053	0.009
1/4	0.2500	0.125	1235	.0010 - .0027	0.070	0.012
5/16	0.3125	0.156	1235	.0014 - .0032	0.094	0.016
3/8	0.3750	0.188	1235	.0018 - .0037	0.118	0.020
1/2	0.5000	0.250	1235	.0018 - .0040	0.141	0.024
5/8	0.6250	0.313	1235	.0020 - .0041	0.188	0.031
3/4	0.7500	0.375	1235	.0025 - .0045	0.225	0.038





Titanium				
Diameter	Decimal	Radius	SFM	In/tooth
1/8	0.1250	0.063	500	0.0011
3/16	0.1875	0.094	500	0.0015
1/4	0.2500	0.125	500	0.0018
5/16	0.3125	0.156	500	0.0026
3/8	0.3750	0.188	500	0.0031
1/2	0.5000	0.250	500	0.0036
5/8	0.6250	0.313	500	0.0039
3/4	0.7500	0.375	500	0.0041

High Temp Alloys				
Diameter	Decimal	Radius	SFM	In/tooth
1/8	0.1250	0.063	150	0.0011
3/16	0.1875	0.094	150	0.0015
1/4	0.2500	0.125	150	0.0018
5/16	0.3125	0.156	150	0.0026
3/8	0.3750	0.188	150	0.0031
1/2	0.5000	0.250	150	0.0036
5/8	0.6250	0.313	150	0.0039
3/4	0.7500	0.375	150	0.0041



Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

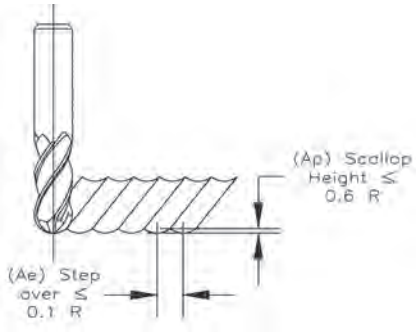
TuffCut® XT

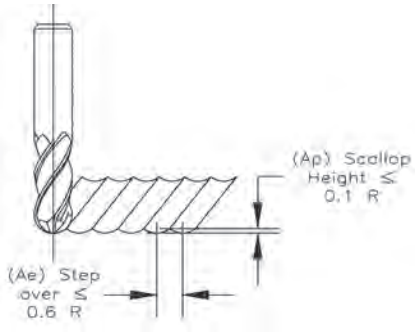
279 Series Recommended Cutting Data - Contouring - **Metric**

See pages 142-145 for profile milling and slotting data.

Semi Roughing / Roughing (25 - 48 Rc)					
				Max	Max
Diameter	Radius	meters/min	mm/tooth Range	Ae	Ap
3	1.5	250	.020 - .030	0.15	0.9
4	2	290	.025 - .040	0.2	1.2
5	2.5	315	.025 - .045	0.25	1.5
6	3	375	.025 - .065	0.3	1.8
8	4	375	.035 - .080	0.4	2.4
10	5	375	.045 - .090	0.5	3
12	6	375	.045 - .100	0.6	3.6
16	8	375	.050 - .105	0.8	4.8

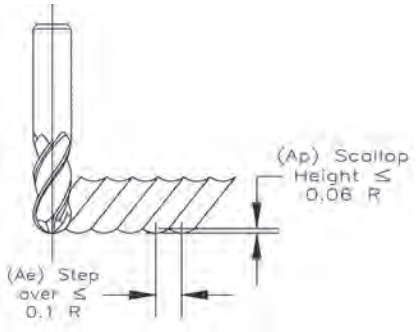
Semi Finishing / Finishing (25 - 48 Rc)					
				Max	Max
Diameter	Radius	meters/min	mm/tooth Range	Ae	Ap
3	1.5	250	.020 - .030	0.9	0.15
4	2	290	.025 - .040	1.2	0.2
5	2.5	315	.025 - .045	1.5	0.25
6	3	375	.025 - .065	1.8	0.3
8	4	375	.035 - .080	2.4	0.4
10	5	375	.045 - .090	3	0.5
12	6	375	.045 - .100	3.6	0.6
16	8	375	.050 - .105	4.8	0.8

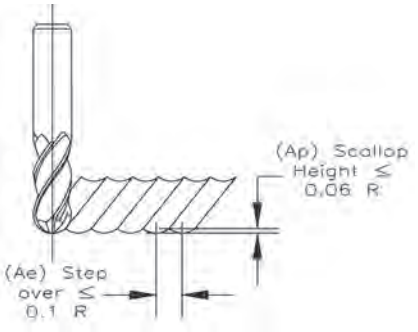




Titanium					
				Max	Max
Diameter	Radius	meters/min	mm/tooth	Ae	Ap
3	1.5	150	0.030	0.15	0.09
4	2	150	0.035	0.2	0.12
5	2.5	150	0.040	0.25	0.15
6	3	150	0.045	0.3	0.18
8	4	150	0.065	0.4	0.24
10	5	150	0.080	0.5	0.3
12	6	150	0.090	0.6	0.36
16	8	150	0.100	0.8	0.48

High Temp Alloys					
				Max	Max
Diameter	Radius	meters/min	mm/tooth	Ae	Ap
3	1.5	45	0.030	0.15	0.09
4	2	45	0.035	0.2	0.12
5	2.5	45	0.040	0.25	0.15
6	3	45	0.045	0.3	0.18
8	4	45	0.065	0.4	0.24
10	5	45	0.080	0.5	0.3
12	6	45	0.090	0.6	0.36
16	8	45	0.100	0.8	0.48





Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XT

278 / 278CB / 278N Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)*				End Mill Diameter (inch)								
						5%	10%	25%	50%	1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
										*Profile Milling at ≥ 50% ap is not recommended for diameters 1/4" and below.								
			Emulsion	Compressed Air	MQL	2.3	1.8	1.2	1.0	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
						vc - SFM				fz - in/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	1475	1150	980	500	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	1130	900	830	250	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	1035	840	755	250	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	900	725	615	200	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	610	495	325	250	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	510	410	280	200	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	675	545	425	360	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	525	430	400	210	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	410	330	295	210	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	525	430	395	110	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Cobalt Chrome Alloys	M		•	x	o	410	325	295	130	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Duplex (22%)	M		•	x	o	245	195	180	130	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Super Duplex (25%)	M		•	x	o	245	195	180	110	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
High Temp Alloys	S	up to 42 Rc	•	x	x	180	150	130	85	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Inconel	S		•	x	x	180	150	130	85	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	375	350	330	175	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	1625	1295	870	350	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	675	540	510	260	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XT

278 / 278CB / 278N Series Recommended Cutting Data - Profile Milling - **Metric**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)*				End Mill Diameter (mm)								
										3*	5*	6*	8	10	12	16	20	25
						5%	10%	25%	50%	*Profile Milling at ≥ 50% ap is not recommended for diameters 6mm and below.								
			Emulsion	Compressed Air	MQL	2.3	1.8	1.2	1.0	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
						vc - m/min				fz - mm/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	450	350	300	150	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	345	275	255	75	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	315	255	230	75	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	275	220	185	60	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	185	150	100	75	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	155	125	85	60	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	205	165	130	110	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	160	130	120	65	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	125	100	90	65	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	160	130	120	35	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Cobalt Chrome Alloys	M		•	x	o	125	100	90	40	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Duplex (22%)	M		•	x	o	75	60	55	40	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Super Duplex (25%)	M		•	x	o	75	60	55	35	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
High Temp Alloys	S	up to 42 Rc	•	x	x	55	45	40	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Inconel	S		•	x	x	55	45	40	25									
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	115	105	100	55									
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	495	395	265	110	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	205	165	155	80	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XT

278 / 278CB / 278N Series Recommended Cutting Data - Slotting - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting*			End Mill Diameter (inch)								
			Emulsion	Compressed Air	MQL	25%	50%	100%	1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
						vc - SFM			*Slotting at > 25% ap is not recommended for diameters 1/4" and below. fz - in/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	550	500	475	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	275	250	225	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	275	250	225	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	225	200	175	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	275	250	225	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	225	200	175	.0001	.0002	.0003	.0004	.0005	.0006	.0008	.0010	.0015
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	385	360	350	.0002	.0004	.0008	.0012	.0014	.0018	.0022	.0026	.0038
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	225	210	200	.0002	.0004	.0008	.0012	.0014	.0018	.0022	.0026	.0038
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	225	210	200	.0002	.0004	.0008	.0012	.0014	.0018	.0022	.0026	.0038
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	125	110	100	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cobalt Chrome Alloys	M		•	x	o	150	130	120	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Duplex (22%)	M		•	x	o	150	130	120	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Super Duplex (25%)	M		•	x	o	120	110	100	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
High Temp Alloys	S	up to 42 Rc	•	x	x	100	85	75	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Inconel	S		•	x	x	95	85	75	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	180	175	160	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	375	350	325	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	275	260	250	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XT

278 / 278CB / 278N Series Recommended Cutting Data - Slotting - **Metric**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting*			End Mill Diameter (mm)								
									3*	5*	6*	8	10	12	16	20	25
			Emulsion	Compressed Air	MQL	25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 6mm and below.								
						vc - m/min			fz - mm/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	170	150	145	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	85	75	70	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	85	75	70	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	70	60	55	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	85	75	70	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	70	60	55	.0030	.0060	.0070	.0100	.0120	.0150	.0200	.0250	.0370
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	120	110	110	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	70	65	60	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	70	65	60	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	40	35	30	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Cobalt Chrome Alloys	M		•	x	o	45	40	40	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Duplex (22%)	M		•	x	o	45	40	40	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Super Duplex (25%)	M		•	x	o	40	35	30	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
High Temp Alloys	S	up to 42 Rc	•	x	x	30	25	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Inconel	S		•	x	x	30	25	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	55	55	50	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	115	105	100	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	85	80	75	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

TuffCut® XT9

380 / 380CB Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			RWOC (Ae)		End Mill Diameter (inch)			
							3/8	1/2	5/8	3/4
					5%	10%				
		Emulsion	Compressed Air	MQL	2.3	1.67	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.			
					Vc - SFM		fz - in/tooth			
Low Carbon Steels	P	o	•	o	1475	1150	.0023	.0030	.0038	.0045
Medium Carbon Steels	P	o	•	o	1130	900	.0023	.0030	.0038	.0045
Alloy Steels	P	o	•	o	1035	840	.0023	.0030	.0038	.0045
Die / Tool Steels	P	o	•	o	900	725	.0023	.0030	.0038	.0045
Free Machining Stainless Steel	M	•	•	o	675	545	.0023	.0030	.0038	.0045
Austenitic Stainless Steel	M	•	x	o	525	430	.0019	.0025	.0031	.0038
Difficult Stainless Steel	M	•	x	o	410	330	.0015	.0020	.0025	.0030
PH Stainless Steels	M	•	•	o	525	430	.0015	.0020	.0025	.0030
Cobalt Chrome Alloys	M	•	x	o	410	325	.0015	.0020	.0025	.0030
Duplex (22%)	M	•	x	o	330	295	.0015	.0020	.0025	.0030
Super Duplex (25%)	M	•	x	o	245	195	.0015	.0020	.0025	.0030
High Temp Alloys	S	•	x	x	180	150	.0009	.0013	.0016	.0019
Titanium Alloys	S	•	x	x	375	330	.0015	.0020	.0025	.0030
Gray Cast Iron	K	•	o	o	1625	1295	.0023	.0030	.0038	.0045
Ductile Cast Iron	K	•	o	o	975	885	.0023	.0030	.0038	.0045
Malleable Cast Irons	K	•	o	o	575	490	.0023	.0030	.0038	.0045
Hardened Steels 45-50 HRC	H	o	•	o	610	495	.0019	.0025	.0031	.0038
Hardened Steels 50-55 HRC	H	o	•	o	510	-	.0013	.0018	.0022	.0026
Hardened Steels 55-60 HRC	H	o	•	o	330	-	.0008	.0010	.0013	.0015

Notes: For machining materials above 50 HRC, reduce stepover (ae) to 2-3% of DC for optimal performance.

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

380 Series Recommended Cutting Data - Chip Thickness Compensation Factors

RWOC (Ae)	Chip Thicknesss Compensation Factor
2%	3.57
3%	2.93
5%	2.30
7%	1.96
8%	1.84
10%	1.67

During profile milling with a radial width of less than 50% of the cutter diameter, the actual chip thickness at the cutting edge is less than the programmed chipload.

The accompanying table shows the increase in chipload by given radial width percentage to adjust for chip thinning. Multiply your recommended chip thickness by the appropriate feed factor to establish the correct feed rate.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XT9

380 / 380CB Series Recommended Cutting Data - Profile Milling - **Metric**

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			RWOC (Ae)		End Mill Diameter (mm)			
					5%	10%	10	12	16	20
		Emulsion	Compressed Air	MQL	2.3	1.67	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.			
					vc - m/min		fz - mm/tooth			
Low Carbon Steels	P	o	•	o	450	350	0.060	0.072	0.096	0.120
Medium Carbon Steels	P	o	•	o	345	275	0.060	0.072	0.096	0.120
Alloy Steels	P	o	•	o	315	255	0.060	0.072	0.096	0.120
Die / Tool Steels	P	o	•	o	275	220	0.060	0.072	0.096	0.120
Free Machining Stainless Steel	M	•	•	o	205	165	0.060	0.072	0.096	0.120
Austenitic Stainless Steel	M	•	x	o	160	130	0.050	0.060	0.080	0.100
Difficult Stainless Steel	M	•	x	o	125	100	0.040	0.048	0.064	0.080
PH Stainless Steels	M	•	•	o	160	130	0.040	0.048	0.064	0.080
Cobalt Chrome Alloys	M	•	x	o	125	100	0.040	0.048	0.064	0.080
Duplex (22%)	M	•	x	o	100	90	0.040	0.048	0.064	0.080
Super Duplex (25%)	M	•	x	o	75	60	0.040	0.048	0.064	0.080
High Temp Alloys	S	•	x	x	55	45	0.025	0.030	0.040	0.050
Titanium Alloys	S	•	x	x	115	100	0.040	0.048	0.064	0.080
Gray Cast Iron	K	•	o	o	495	395	0.060	0.072	0.096	0.120
Ductile Cast Iron	K	•	o	o	295	270	0.060	0.072	0.096	0.120
Malleable Cast Irons	K	•	o	o	175	150	0.060	0.072	0.096	0.120
Hardened Steels 45-50 HRC	H	o	•	o	185	150	0.050	0.060	0.080	0.100
Hardened Steels 50-55 HRC	H	o	•	o	155	-	0.035	0.042	0.056	0.070
Hardened Steels 55-60 HRC	H	o	•	o	100	-	0.020	0.024	0.032	0.040

Notes: For machining materials above 50 HRC, reduce stepover (ae) to 2-3% of DC for optimal performance.

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

380 Series Recommended Cutting Data - Chip Thickness Compensation Factors

RWOC (Ae)	Chip Thicknesss Compensation Factor
2%	3.57
3%	2.93
5%	2.30
7%	1.96
8%	1.84
10%	1.67

During profile milling with a radial width of less than 50% of the cutter diameter, the actual chip thickness at the cutting edge is less than the programmed chipload.

The accompanying table shows the increase in chipload by given radial width percentage to adjust for chip thinning. Multiply your recommended chip thickness by the appropriate feed factor to establish the correct feed rate.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR

279 / 177 / 177L / 177S / 179 / 179L Series Recommended Cutting Data - Profile Milling - **Inch**

279 / 179 / 179L series - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter. See pages 134-135 for 279 Series contouring data.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)*				End Mill Diameter (inch)								
						5%	10%	25%	50%	1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
										*Profile Milling at ≥ 50% ap is not recommended for diameters 1/4" and below.								
			Emulsion	Compressed Air	MQL	2.3	1.8	1.2	1.0	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
						vc - SFM				fz - in/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	1475	1150	980	500	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	1130	900	840	250	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	1035	840	755	250	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	900	725	615	200	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	610	495	325	250	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	510	410	280	200	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	675	545	425	360	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	525	430	400	210	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	410	330	295	210	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	525	430	395	110	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Cobalt Chrome Alloys	M		•	x	o	410	325	295	130	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Duplex (22%)	M		•	x	o	245	195	180	130	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Super Duplex (25%)	M		•	x	o	245	195	180	110	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
High Temp Alloys	S	up to 42 Rc	•	x	x	180	150	130	85	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Inconel	S		•	x	x	180	150	130	85	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	375	350	330	175	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	1625	1295	870	350	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	675	540	510	260	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR

279 / 177 / 177L / 177S / 179 / 179L Series Recommended Cutting Data - Profile Milling - **Metric**

279 / 179 / 179L series - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter. See pages 134-135 for 279 Series contouring data.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)*				End Mill Diameter (mm)								
						5%	10%	25%	50%	3*	5*	6*	8	10	12	16	20	25
										*Profile Milling at ≥ 50% ap is not recommended for diameters 6mm and below.								
			Emulsion	Compressed Air	MQL	2.3	1.8	1.2	1.0	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
						vc - m/min				fz - mm/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	450	350	300	150	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	345	275	255	75	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	315	255	230	75	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	275	220	185	60	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	185	150	100	75	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	155	125	85	60	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	205	165	130	110	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	160	130	120	65	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	125	100	90	65	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	160	130	120	35	0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Cobalt Chrome Alloys	M		•	x	o	125	100	90	40	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Duplex (22%)	M		•	x	o	75	60	55	40	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Super Duplex (25%)	M		•	x	o	75	60	55	35	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
High Temp Alloys	S	up to 42 Rc	•	x	x	55	45	40	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Inconel	S		•	x	x	55	45	40	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	115	105	100	55	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	495	395	265	110	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	205	165	155	80	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR

279 / 177 / 177L / 177S / 179 / 179L Series Recommended Cutting Data - Slotting - **Inch**

279 / 179 / 179L series - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter. See pages 134-135 for 279 Series contouring data.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting*			End Mill Diameter (inch)								
									1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
			Emulsion	Compressed Air	MQL	25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 1/4" and below.								
						vc - SFM			fz - in/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	550	500	475	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	275	250	225	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	275	250	225	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	225	200	175	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	275	250	225	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	225	200	175	.0001	.0002	.0003	.0004	.0005	.0006	.0008	.0010	.0015
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	385	360	350	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	225	210	200	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	225	210	200	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	125	110	100	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cobalt Chrome Alloys	M		•	x	o	150	130	120	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Duplex (22%)	M		•	x	o	150	130	120	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Super Duplex (25%)	M		•	x	o	120	110	100	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
High Temp Alloys	S	up to 42 Rc	•	x	x	100	85	75	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Inconel	S		•	x	x	95	85	75	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	180	175	160	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	375	350	325	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	275	260	250	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR

279 / 177 / 177L / 177S / 179 / 179L Series Recommended Cutting Data - Slotting - **Metric**

279 / 179 / 179L series - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter. See pages 134-135 for 279 Series contouring data.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting*			End Mill Diameter (mm)								
			Emulsion	Compressed Air	MQL	25%	50%	100%	3*	5*	6*	8	10	12	16	20	25
						vc - m/min			*Slotting at > 25% ap is not recommended for diameters 6mm and below. fz - mm/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	170	150	145	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	85	75	70	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	85	75	70	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	70	60	55	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	85	75	70	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	70	60	55	.0030	.0060	.0070	.0100	.0120	.0150	.0200	.0250	.0370
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	120	110	110	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	70	65	60	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	70	65	60	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	40	35	30	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Cobalt Chrome Alloys	M		•	x	o	45	40	40	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Duplex (22%)	M		•	x	o	45	40	40	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Super Duplex (25%)	M		•	x	o	40	35	30	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
High Temp Alloys	S	up to 42 Rc	•	x	x	30	25	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Inconel	S		•	x	x	30	25	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	55	55	50	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	115	105	100	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	85	80	75	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR

178 / 178N Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)*				End Mill Diameter (inch)								
						5%	10%	25%	50%	1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
										*Profile Milling at ≥ 50% ap is not recommended for diameters 1/4" and below.								
			Emulsion	Compressed Air	MQL	2.3	1.8	1.2	1.0	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
						vc - SFM				fz - in/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	1475	1150	980	500	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	1130	900	840	250	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	1035	840	755	250	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	900	725	615	200	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	610	495	325	250	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	510	410	280	200	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	675	545	425	360	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	525	430	400	210	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	410	330	295	210	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	525	430	395	110	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Cobalt Chrome Alloys	M		•	x	o	410	325	295	130	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Duplex (22%)	M		•	x	o	245	195	180	130	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
Super Duplex (25%)	M		•	x	o	245	195	180	110	.0006	.0010	.0012	.0016	.0020	.0024	.0030	.0040	.0050
High Temp Alloys	S	up to 42 Rc	•	x	x	180	150	130	85	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Inconel	S		•	x	x	180	150	130	85	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	375	350	330	175	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	1625	1295	870	350	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	675	540	510	260	.0012	.0020	.0024	.0031	.0039	.0047	.0060	.0078	.0100

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR

178 / 178N Series Recommended Cutting Data - Profile Milling - **Metric**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)*				End Mill Diameter (mm)								
						5%	10%	25%	50%	3*	5*	6*	8	10	12	16	20	25
										*Profile Milling at ≥ 50% ap is not recommended for diameters 6mm and below.								
			Emulsion	Compressed Air	MQL	2.3	1.8	1.2	1.0	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
						vc - m/min				fz - mm/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	450	350	300	150	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	345	275	265	75	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	315	255	230	75	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	275	220	185	60	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	185	150	100	75	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	155	125	85	60	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	205	165	130	110	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	160	130	120	65	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	125	100	90	65	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	160	130	120	35	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Cobalt Chrome Alloys	M		•	x	o	125	100	90	40	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Duplex (22%)	M		•	x	o	75	60	55	40	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Super Duplex (25%)	M		•	x	o	75	60	55	35	.0150	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
High Temp Alloys	S	up to 42 Rc	•	x	x	55	45	40	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Inconel	S		•	x	x	55	45	40	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	115	105	100	55	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	495	395	265	110	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	205	165	155	80	.0300	.0500	.0600	.0800	.1000	.1200	.1600	.2000	.2500

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR

178 / 178N Series Recommended Cutting Data - Slotting - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting*			End Mill Diameter (inch)								
			Emulsion	Compressed Air	MQL	25%	50%	100%	1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
						vc - SFM			*Slotting at > 25% ap is not recommended for diameters 1/4" and below. fz - in/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	550	500	475	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	275	250	225	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	275	250	225	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	225	200	175	.0004	.0010	.0012	.0016	.0020	.0025	.0031	.0040	.0050
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	275	250	225	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	225	200	175	.0001	.0002	.0003	.0004	.0005	.0006	.0008	.0010	.0015
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	385	360	350	.0002	.0004	.0008	.0012	.0014	.0018	.0022	.0026	.0038
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	225	210	200	.0002	.0004	.0008	.0012	.0014	.0018	.0022	.0026	.0038
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	225	210	200	.0002	.0004	.0008	.0012	.0014	.0018	.0022	.0026	.0038
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	125	110	100	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cobalt Chrome Alloys	M		•	x	o	150	130	120	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Duplex (22%)	M		•	x	o	150	130	120	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Super Duplex (25%)	M		•	x	o	120	110	100	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
High Temp Alloys	S	up to 42 Rc	•	x	x	100	85	75	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Inconel	S		•	x	x	95	85	75	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	180	175	160	.0003	.0005	.0006	.0008	.0010	.0012	.0016	.0020	.0024
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	375	350	325	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	275	260	250	.0004	.0010	.0012	.0016	.0020	.0024	.0031	.0040	.0050

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR

178 / 178N Series Recommended Cutting Data - Slotting - **Metric**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting*			End Mill Diameter (mm)								
			Emulsion	Compressed Air	MQL	25%	50%	100%	3*	5*	6*	8	10	12	16	20	25
									*Slotting at > 25% ap is not recommended for diameters 6mm and below.								
						vc - m/min			fz - mm/tooth								
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	170	150	145	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	85	75	70	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	85	75	70	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	70	60	55	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Hardened Steels A2, D2	H	45 to 50 Rc	•	o	o	85	75	70	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Hardened Steels A2, D2	H	50 to 55 Rc	•	o	o	70	60	55	.0030	.0060	.0070	.0100	.0120	.0150	.0200	.0250	.0370
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	120	110	110	.0050	.0100	.0200	.0300	.0350	.0450	.0550	.0650	.0950
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	70	65	60	.0050	.0100	.0200	.0300	.0350	.0450	.0550	.0650	.0950
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	70	65	60	.0050	.0100	.0200	.0300	.0350	.0450	.0550	.0650	.0950
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	40	35	30	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Cobalt Chrome Alloys	M		•	x	o	45	40	40	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Duplex (22%)	M		•	x	o	45	40	40	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Super Duplex (25%)	M		•	x	o	40	35	30	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
High Temp Alloys	S	up to 42 Rc	•	x	x	30	25	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Inconel	S		•	x	x	30	25	25	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	55	55	50	.0070	.0120	.0150	.0200	.0250	.0300	.0400	.0500	.0620
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	115	105	100	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	85	80	75	.0100	.0250	.0300	.0400	.0500	.0600	.0800	.1000	.1250

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR7

180 / 180CB / 180N Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)			End Mill Diameter (inch)					
									1/4	3/8	1/2	5/8	3/4	1
						5%	10%	25%						
			Emulsion	Compressed Air	MQL	2.3	1.67	1.15	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.					
						vc - SFM			fz - in/tooth					
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	1475	1150	980	.0024	.0039	.0047	.0060	.0078	.0100
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	1130	900	840	.0024	.0039	.0047	.0060	.0078	.0100
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	1035	840	765	.0024	.0039	.0047	.0060	.0078	.0100
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	900	725	615	.0024	.0039	.0047	.0060	.0078	.0100
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	675	545	425	.0010-.0015	.0015-.0020	.0020-.0031	.0020-.0033	.0022-.0035	.0024-.0039
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	525	430	400	.0010-.0015	.0015-.0020	.0020-.0031	.0020-.0033	.0022-.0035	.0024-.0039
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	410	330	295	.0010-.0015	.0015-.0020	.0020-.0031	.0020-.0033	.0022-.0035	.0024-.0039
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	525	430	395	.0010-.0015	.0015-.0020	.0020-.0031	.0020-.0033	.0022-.0035	.0024-.0039
Cobalt Chrome Alloys	M		•	x	o	410	325	295	.0015	.0020	.0031	.0033	.0035	.0039
Duplex (22%)	M		•	x	o	245	195	180	.0015	.0020	.0031	.0033	.0035	.0039
Super Duplex (25%)	M		•	x	o	245	195	180	.0015	.0020	.0031	.0033	.0035	.0039
High Temp Alloys	S	up to 42 Rc	•	x	x	180	150	130	.0010-.0015	.0015-.0020	.0020-.0031	.0020-.0033	.0022-.0035	.0024-.0039
Inconel	S		•	x	x	180	150	130	.0006-.0010	.0010-.0016	.0010-.0016	.0010-.0017	.0011-.0018	.0012-.0020
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	375	350	330	.0006-.0010	.0010-.0016	.0010-.0016	.0010-.0017	.0011-.0018	.0012-.0020
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	1625	1295	870	.0024	.0039	.0047	.0060	.0078	.0100
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	675	540	510	.0012	.0031	.0039	.0047	.0078	.0100
Hardened Steels	H	40-50 Rc	•	o	o	610	495	325	.0014	.0024	.0030	.0040	.0048	.0064
Hardened Steels	H	50-55 Rc	•	o	o	510	410	280	.0008	.0016	.0018	.0024	.0028	.0038
Hardened Steels	H	>55 Rc	•	o	o	330	310	280	.0006	.0010	.0015	.0018	.0021	.0028

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® XR7

180 / 180CB / 180N Series Recommended Cutting Data - Profile Milling - **Metric**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profiling (ae)			End Mill Diameter (mm)			
						5%	10%	25%	12	16	18	20
			Emulsion	Compressed Air	MQL	2.3	1.67	1.15	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.			
						vc - m/min			fz - mm/tooth			
Low Carbon Steels 1018, 1020	P	up to 28 Rc	•	•	•	450	350	300	.1100	.1500	.1900	.2540
Medium Carbon Steels 1140, 1145	P	28 to 38 Rc	•	•	•	345	275	255	.1100	.1500	.1900	.2540
Alloy Steels 4140, 4145	P	28 to 44 Rc	•	•	•	315	255	230	.1100	.1500	.1900	.2540
Die / Tool Steels A2, D2, H13, P20	P	28 to 44 Rc	•	•	•	275	220	185	.1100	.1500	.1900	.2540
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430	M	up to 28 Rc	•	x	o	205	165	130	.050-.078	.050-.083	.055-.088	.060-.099
Stainless Steel - Austenitic 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	160	130	120	.050-.078	.050-.083	.055-.088	.060-.099
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321	M	up to 28 Rc	•	x	o	125	100	90	.050-.078	.050-.083	.055-.088	.060-.099
Stainless Steel - Difficult to Machine 17-4 PH, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	160	130	120	.050-.078	.050-.083	.055-.088	.060-.099
Cobalt Chrome Alloys	M		•	x	o	125	100	90	.0780	.0830	.0880	.0990
Duplex (22%)	M		•	x	o	75	60	55	.0780	.0830	.0880	.0990
Super Duplex (25%)	M		•	x	o	75	60	55	.0780	.0830	.0880	.0990
High Temp Alloys	S	up to 42 Rc	•	x	x	55	45	40	.025-.040	.025-.043	.027-.045	.050-.075
Inconel	S		•	x	x	55	45	40	.025-.040	.025-.043	.027-.045	.050-.075
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	115	105	100	.050-.078	.050-.083	.055-.088	.060-.090
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	495	395	265	.1100	.1500	.1900	.2540
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	205	165	155	.1100	.1500	.1900	.2540
Hardened Steels	H	40-50 Rc	•	o	o	185	150	100	.1016	.1168	.1310	.1524
Hardened Steels		50-55 Rc	•	o	o	155	125	85	.0610	.0762	.0857	.0889
Hardened Steels		>55 Rc	•	o	o	100	95	85	.0457	.0559	.0628	.0635

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

TuffCut® 3D

250 Series Recommended Cutting Data - **Inch**

Workpiece Material Group		Material Type	Coolant: Emulsion	Coolant: Compressed Air	Coolant: MQL	Roughing Vc-SFM	Finishing Vc-SFM
						Roughing	Finishing
			Ap			0.5 - 1.0 x D	0.02 - 0.05 x D
			Ae			0.2 - 0.3 x D	0.02 - 0.05 x D
Steels	P	Low Carbon Steels ≤180HB	○	●	●	820	920
		Med Carbon / Alloy Steels 180-350HB	○	●	●	660	720
		Pre-Hardened Steels 35-45HRC	○	●	●	590	660
Stainless Steels	M	Free Machining Stainless	●	○	○	520	590
		Austenitic Stainless	●	○	○	430	490
		Difficult Stainless	●	○	○	330	360
Special Alloys	S	High Temp Alloys	●	X	X	160	180
		Titanium Alloys	●	X	X	360	390
Cast Irons	K	Grey Cast Iron	○	●	X	720	820
		Ductile Cast Iron	○	●	X	590	660
Hardened Steels	H	Hardened Steels 45 - 50HRC	○	●	○	520	560
Non-Ferrous	N	Aluminum Alloys	●	X	○	980	1640
		Brass / Bronze / Copper	●	X	○	820	1310

● Preferred ○ Possible X Not Possible

Recommended Feed per Tooth by Material Group - **Inch**

Workpiece Material Group		Material Type	Tool Diameter & Radius (mm): 1 / 0.5 Rough	1 / 0.5 Finish	1.5 / 0.75 Rough	1.5 / 0.75 Finish	2 / 1 Rough	2 / 1 Finish	3 / 1.5 Rough	3 / 1.5 Finish	4 / 2 Rough	4 / 2 Finish	5 / 2.5 Rough	5 / 2.5 Finish
			Fz - in/tooth											
Steels	P	Low Carbon Steels ≤180HB	.0008	.0006	.0012	.0009	.0016	.0012	.0024	.0018	.0032	.0024	.0040	.0030
		Med Carbon / Alloy Steels 180-350HB	.0008	.0006	.0012	.0009	.0016	.0012	.0024	.0018	.0032	.0024	.0040	.0030
		Pre-Hardened Steels 35-45HRC	.0007	.0006	.0011	.0009	.0014	.0012	.0021	.0018	.0028	.0024	.0035	.0030
Stainless Steels	M	Free Machining Stainless	.0007	.0006	.0011	.0009	.0014	.0012	.0021	.0018	.0028	.0024	.0035	.0030
		Austenitic Stainless	.0006	.0006	.0009	.0009	.0012	.0012	.0018	.0018	.0024	.0024	.0030	.0030
		Difficult Stainless	.0006	.0006	.0009	.0009	.0012	.0012	.0018	.0018	.0024	.0024	.0030	.0030
Special Alloys	S	High Temp Alloys	.0003	.0004	.0005	.0006	.0006	.0008	.0009	.0012	.0012	.0016	.0015	.0020
		Titanium Alloys	.0005	.0004	.0008	.0006	.0010	.0008	.0015	.0012	.0020	.0016	.0025	.0020
Cast Irons	K	Grey Cast Iron	.0008	.0006	.0012	.0009	.0016	.0012	.0024	.0018	.0032	.0024	.0040	.0030
		Ductile Cast Iron	.0007	.0006	.0011	.0009	.0014	.0012	.0021	.0018	.0028	.0024	.0035	.0030
Hardened Steels	H	Hardened Steels 45 - 50HRC	.0005	.0005	.0008	.0008	.0010	.0010	.0015	.0015	.0020	.0020	.0025	.0025
Non-Ferrous	N	Aluminum Alloys	.0010	.0006	.0015	.0009	.0020	.0012	.0030	.0018	.0040	.0024	.0050	.0030
		Brass / Bronze / Copper	.0008	.0006	.0012	.0009	.0016	.0012	.0024	.0018	.0032	.0024	.0040	.0030

Workpiece Material Group		Material Type	Tool Diameter & Radius (mm): 6 / 3 Rough	6 / 3 Finish	8 / 4 Rough	8 / 4 Finish	10 / 5 Rough	10 / 5 Finish	12 / 6 Rough	12 / 6 Finish	16 / 8 Rough	16 / 8 Finish
			Fz - in/tooth									
Steels	P	Low Carbon Steels ≤180HB	.0048	.0036	.0064	.0048	.0080	.0060	.0096	.0072	.0128	.0096
		Med Carbon / Alloy Steels 180-350HB	.0048	.0036	.0064	.0048	.0080	.0060	.0096	.0072	.0128	.0096
		Pre-Hardened Steels 35-45HRC	.0042	.0036	.0056	.0048	.0070	.0060	.0084	.0072	.0112	.0096
Stainless Steels	M	Free Machining Stainless	.0042	.0036	.0056	.0048	.0070	.0060	.0084	.0072	.0112	.0096
		Austenitic Stainless	.0036	.0036	.0048	.0048	.0060	.0060	.0072	.0072	.0096	.0096
		Difficult Stainless	.0036	.0036	.0048	.0048	.0060	.0060	.0072	.0072	.0096	.0096
Special Alloys	S	High Temp Alloys	.0018	.0024	.0024	.0032	.0030	.0040	.0036	.0048	.0048	.0064
		Titanium Alloys	.0030	.0024	.0040	.0032	.0050	.0040	.0060	.0048	.0080	.0064
Cast Irons	K	Grey Cast Iron	.0048	.0036	.0064	.0048	.0080	.0060	.0096	.0072	.0128	.0096
		Ductile Cast Iron	.0042	.0036	.0056	.0048	.0070	.0060	.0084	.0072	.0112	.0096
Hardened Steels	H	Hardened Steels 45 - 50HRC	.0030	.0030	.0040	.0040	.0050	.0050	.0060	.0060	.0080	.0080
Non-Ferrous	N	Aluminum Alloys	.0060	.0036	.0080	.0048	.0100	.0060	.0120	.0072	.0160	.0096
		Brass / Bronze / Copper	.0048	.0036	.0064	.0048	.0080	.0060	.0096	.0072	.0128	.0096

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® 3D

250 Series Recommended Cutting Data - **Metric**

Workpiece Material Group		Material Type	Coolant: Emulsion	Coolant: Compressed Air	Coolant: MQL	Roughing	Finishing
			Ap			0.5 - 0.10 x D	0.02 - 0.05 x D
			Ae			0.2 - 0.3 x D	0.02 - 0.05 x D
						Vc-m/min	
Steels	P	Low Carbon Steels ≤180HB	○	●	●	250	280
		Med Carbon / Alloy Steels 180-350HB	○	●	●	200	220
		Pre-Hardened Steels 35-45HRC	○	●	●	180	200
Stainless Steels	M	Free Machining Stainless	●	○	○	160	180
		Austenitic Stainless	●	○	○	130	150
		Difficult Stainless	●	○	○	100	110
Special Alloys	S	High Temp Alloys	●	X	X	50	55
		Titanium Alloys	●	X	X	110	120
Cast Irons	K	Grey Cast Iron	○	●	X	220	250
		Ductile Cast Iron	○	●	X	180	200
Hardened Steels	H	Hardened Steels 45 - 50HRC	○	●	○	160	170
Non-Ferrous	N	Aluminum Alloys	●	X	○	300	500
		Brass / Bronze / Copper	●	X	○	250	400

● Preferred ○ Possible X Not Possible

Recommended Feed per Tooth by Material Group - **Metric**

Workpiece Material Group		Material Type	Tool Diameter & Radius (mm)											
			1		1.5		2		3		4		5	
			0.5		0.75		1		1.5		2		2.5	
			Rough	Finish	Rough	Finish	Rough	Finish	Rough	Finish	Rough	Finish	Rough	Finish
			Fz - mm/tooth											
Steels	P	Low Carbon Steels ≤180HB	0.020	0.015	0.030	0.023	0.040	0.030	0.060	0.045	0.080	0.060	0.100	0.075
		Med Carbon / Alloy Steels 180-350HB	0.020	0.015	0.030	0.023	0.040	0.030	0.060	0.045	0.080	0.060	0.100	0.075
		Pre-Hardened Steels 35-45HRC	0.018	0.015	0.027	0.023	0.036	0.030	0.054	0.045	0.072	0.060	0.090	0.075
Stainless Steels	M	Free Machining Stainless	0.018	0.015	0.027	0.023	0.036	0.030	0.054	0.045	0.072	0.060	0.090	0.075
		Austenitic Stainless	0.015	0.015	0.023	0.023	0.030	0.030	0.045	0.045	0.060	0.060	0.075	0.075
		Difficult Stainless	0.015	0.015	0.023	0.023	0.030	0.030	0.045	0.045	0.060	0.060	0.075	0.075
Special Alloys	S	High Temp Alloys	0.008	0.010	0.012	0.015	0.016	0.020	0.024	0.030	0.032	0.040	0.040	0.050
		Titanium Alloys	0.012	0.010	0.018	0.015	0.024	0.020	0.036	0.030	0.048	0.040	0.060	0.050
Cast Irons	K	Grey Cast Iron	0.020	0.015	0.030	0.023	0.040	0.030	0.060	0.045	0.080	0.060	0.100	0.075
		Ductile Cast Iron	0.018	0.015	0.027	0.023	0.036	0.030	0.054	0.045	0.072	0.060	0.090	0.075
Hardened Steels	H	Hardened Steels 45 - 50HRC	0.013	0.013	0.020	0.019	0.026	0.025	0.039	0.038	0.052	0.050	0.065	0.063
Non-Ferrous	N	Aluminum Alloys	0.025	0.015	0.038	0.023	0.050	0.030	0.075	0.045	0.100	0.060	0.125	0.075
		Brass / Bronze / Copper	0.020	0.015	0.030	0.023	0.040	0.030	0.060	0.045	0.080	0.060	0.100	0.075

Workpiece Material Group		Material Type	Tool Diameter & Radius (mm)									
			6		8		10		12		16	
			3		4		5		6		8	
			Rough	Finish	Rough	Finish	Rough	Finish	Rough	Finish	Rough	Finish
			Fz - mm/tooth									
Steels	P	Low Carbon Steels ≤180HB	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240
		Med Carbon / Alloy Steels 180-350HB	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240
		Pre-Hardened Steels 35-45HRC	0.108	0.090	0.144	0.120	0.180	0.150	0.216	0.180	0.288	0.240
Stainless Steels	M	Free Machining Stainless	0.108	0.090	0.144	0.120	0.180	0.150	0.216	0.180	0.288	0.240
		Austenitic Stainless	0.090	0.090	0.120	0.120	0.150	0.150	0.180	0.180	0.240	0.240
		Difficult Stainless	0.090	0.090	0.120	0.120	0.150	0.150	0.180	0.180	0.240	0.240
Special Alloys	S	High Temp Alloys	0.048	0.060	0.064	0.080	0.080	0.100	0.096	0.120	0.128	0.160
		Titanium Alloys	0.072	0.060	0.096	0.080	0.120	0.100	0.144	0.120	0.192	0.160
Cast Irons	K	Grey Cast Iron	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240
		Ductile Cast Iron	0.108	0.090	0.144	0.120	0.180	0.150	0.216	0.180	0.288	0.240
Hardened Steels	H	Hardened Steels 45 - 50HRC	0.078	0.075	0.104	0.100	0.130	0.125	0.156	0.150	0.208	0.200
Non-Ferrous	N	Aluminum Alloys	0.150	0.090	0.200	0.120	0.250	0.150	0.300	0.180	0.400	0.240
		Brass / Bronze / Copper	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® 3D

MFPB Series Recommended Cutting Data - Speeds - **Inch**

Recommended Speeds by Material Group						Finishing	Semi-Finishng
Workpiece Material Group		Material Type	Ap			0.01-0.03 x D	0.05-0.1 x D
			Ae			0.02-0.03 x D	0.05-0.1 x D
			Coolant			Vc - SFM	
			Emulsion	Compressed Air	MQL		
Steels	P	Low Carbon	●	●	●	1480	1150
		Medium Carbon	●	●	●	1130	900
		Alloy Steels	●	●	●	1030	840
		Die / Tool Steels (≤ 45 HRC)	●	●	●	900	720
Stainless Steels	M	Free Machining	●	x	○	670	540
		Austenitic	●	x	○	520	430
		Difficult Stainless	●	x	○	410	330
		PH Stainless (≤ 45 HRC)	●	x	○	520	430
		Cobalt Chrome Alloys	●	x	○	410	330
		Duplex (22%)	●	x	○	250	200
		Super Duplex (25%)	●	x	○	250	200
Special Alloys	S	High Temp Alloys	●	x	x	180	150
		Titanium Alloys	●	x	x	380	340
Cast Irons	K	Gray Cast Iron	●	○	○	1620	1300
		Ductile Cast Iron	●	○	○	1050	920
		Malleable Iron	●	○	○	670	540
Hardened Steels	H	HRC 45-50	●	○	○	490	410
		HRC 50-55	●	○	○	330	310

● Preferred ○ Possible X Not Possible

MFPB Series Recommended Cutting Data - Feeds - **Inch**

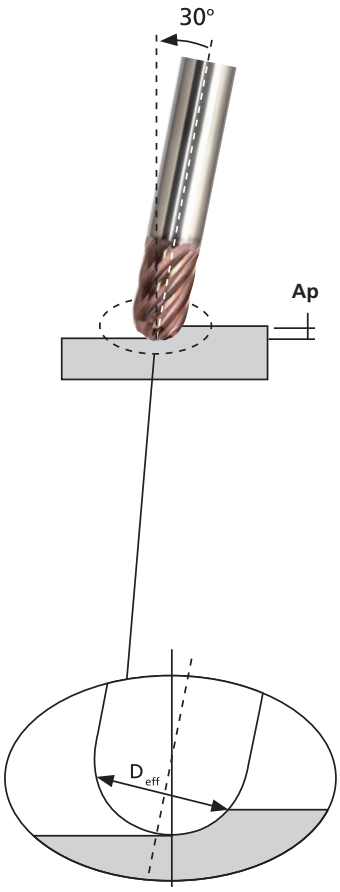
Recommended Feeds by Material Group			Tool Diameter (Inch)											
Workpiece Material Group		Material Type	1/4		5/16		3/8		1/2		5/8		3/4	
			Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish
			Fz - in/tooth											
Steels	P	Low Carbon	.0075	.0038	.0094	.0047	.0113	.0056	.0150	.0075	.0188	.0094	.0225	.0113
		Medium Carbon	.0075	.0038	.0094	.0047	.0113	.0056	.0150	.0075	.0188	.0094	.0225	.0113
		Alloy Steels	.0075	.0038	.0094	.0047	.0113	.0056	.0150	.0075	.0188	.0094	.0225	.0113
		Die / Tool Steels (≤ 45 HRC)	.0050	.0038	.0063	.0047	.0075	.0056	.0100	.0075	.0125	.0094	.0150	.0113
Stainless Steels	M	Free Machining	.0050	.0038	.0063	.0047	.0075	.0056	.0100	.0075	.0125	.0094	.0150	.0113
		Austenitic	.0050	.0038	.0063	.0047	.0075	.0056	.0100	.0075	.0125	.0094	.0150	.0113
		Difficult Stainless	.0050	.0038	.0063	.0047	.0075	.0056	.0100	.0075	.0125	.0094	.0150	.0113
		PH Stainless (≤ 45 HRC)	.0050	.0038	.0063	.0047	.0075	.0056	.0100	.0075	.0125	.0094	.0150	.0113
		Cobalt Chrome Alloys	.0045	.0030	.0056	.0038	.0068	.0045	.0090	.0060	.0113	.0075	.0135	.0090
		Duplex (22%)	.0045	.0030	.0056	.0038	.0068	.0045	.0090	.0060	.0113	.0075	.0135	.0090
		Super Duplex (25%)	.0043	.0028	.0053	.0034	.0064	.0041	.0085	.0055	.0106	.0069	.0128	.0083
Special Alloys	S	High Temp Alloys	.0038	.0025	.0047	.0031	.0056	.0038	.0075	.0050	.0094	.0063	.0113	.0075
		Titanium Alloys	.0038	.0025	.0047	.0031	.0056	.0038	.0075	.0050	.0094	.0063	.0113	.0075
Cast Irons	K	Gray Cast Iron	.0075	.0050	.0094	.0063	.0113	.0075	.0150	.0100	.0188	.0125	.0225	.0150
		Ductile Cast Iron	.0063	.0050	.0078	.0063	.0094	.0075	.0125	.0100	.0156	.0125	.0188	.0150
		Malleable Iron	.0050	.0038	.0063	.0047	.0075	.0056	.0100	.0075	.0125	.0094	.0150	.0113
Hardened Steels	H	HRC 45-50	.0038	.0035	.0047	.0044	.0056	.0053	.0075	.0070	.0094	.0088	.0113	.0105
		HRC 50-55	.0031	.0035	.0039	.0044	.0047	.0053	.0063	.0070	.0078	.0088	.0094	.0105

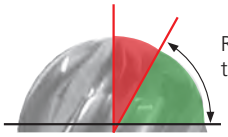
Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® 3D

MFPB Series Recommended Cutting Data - **Inch**

Tool Ø (in)	Effective Diameter at 30°						
	Axial Depth of Cut (Ap) - inch						
	.008	.016	.024	.031	.039	.059	.079
1/4	.193	.215	.229	.237	.243	-	-
5/16	.234	.260	.276	.287	.296	.309	-
3/8	.273	.303	.322	.335	.347	.365	.373
1/2	.351	.386	.411	.428	.443	.470	.487
5/8	.426	.467	.497	.517	.535	.570	.593
3/4	.500	.547	.580	.603	.624	.666	.695





Tool Ø (in)	Tilt Angle	No. of Flutes
1/4	33°	6
5/16	25°	8
3/8	22°	8
1/2	24°	8
5/8	25°	8
3/4	25°	10

Tool Ø (in)	Effective Teeth		
	Tilt Angle		
	20°	25°	33°
1/4	2	4	6
5/16	2	8	8
3/8	2	8	8
1/2	6	8	8
5/8	6	8	8
3/4	6	10	10

Red Area:
Does not have complete effective number of flutes to center of tool.

Green Area:
Programming at the listed tilt angle will utilize the full effective number of flutes.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® 3D

MFPB Series Recommended Cutting Data - Speeds - **Metric**

Recommended Speeds by Material Group						Finishing	Semi-Finishng
Workpiece Material Group		Material Type	Ap			0.01-0.03 x D	0.05-0.1 x D
			Ae			0.02-0.03 x D	0.05-0.1 x D
			Coolant			Vc - M/Min	
			Emulsion	Compressed Air	MQL		
Steels	P	Low Carbon	●	●	●	450	350
		Medium Carbon	●	●	●	345	275
		Alloy Steels	●	●	●	315	255
		Die / Tool Steels (≤ 45 HRC)	●	●	●	275	220
Stainless Steels	M	Free Machining	●	x	○	205	165
		Austenitic	●	x	○	160	130
		Difficult Stainless	●	x	○	125	100
		PH Stainless (≤ 45 HRC)	●	x	○	160	130
		Cobalt Chrome Alloys	●	x	○	125	100
		Duplex (22%)	●	x	○	75	60
		Super Duplex (25%)	●	x	○	75	60
Special Alloys	S	High Temp Alloys	●	x	x	55	45
		Titanium Alloys	●	x	x	115	105
Cast Irons	K	Gray Cast Iron	●	○	○	495	395
		Ductile Cast Iron	●	○	○	320	280
		Malleable Iron	●	○	○	205	165
Hardened Steels	H	HRC 45-50	●	○	○	150	125
		HRC 50-55	●	○	○	100	95

● Preferred ○ Possible X Not Possible

MFPB Series Recommended Cutting Data - Feeds - **Metric**

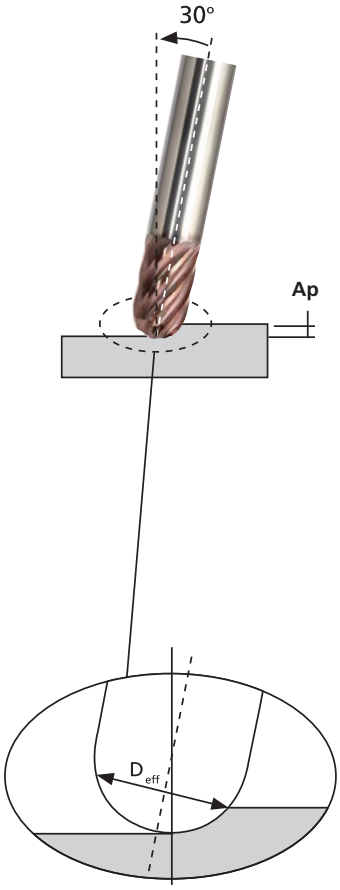
Recommended Feeds by Material Group			Tool Diameter (mm)											
Workpiece Material Group		Material Type	6		8		10		12		16		20	
			Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish
			Fz - mm/tooth											
Steels	P	Low Carbon	0.180	0.090	0.240	0.120	0.300	0.150	0.360	0.180	0.480	0.240	0.600	0.300
		Medium Carbon	0.180	0.090	0.240	0.120	0.300	0.150	0.360	0.180	0.480	0.240	0.600	0.300
		Alloy Steels	0.180	0.090	0.240	0.120	0.300	0.150	0.360	0.180	0.480	0.240	0.600	0.300
		Die / Tool Steels (≤ 45 HRC)	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240	0.400	0.300
Stainless Steels	M	Free Machining	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240	0.400	0.300
		Austenitic	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240	0.400	0.300
		Difficult Stainless	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240	0.400	0.300
		PH Stainless (≤ 45 HRC)	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240	0.400	0.300
		Cobalt Chrome Alloys	0.108	0.072	0.144	0.096	0.180	0.120	0.216	0.144	0.288	0.192	0.360	0.240
		Duplex (22%)	0.108	0.072	0.144	0.096	0.180	0.120	0.216	0.144	0.288	0.192	0.360	0.240
		Super Duplex (25%)	0.102	0.066	0.136	0.088	0.170	0.110	0.204	0.132	0.272	0.176	0.340	0.220
Special Alloys	S	High Temp Alloys	0.090	0.060	0.120	0.080	0.150	0.100	0.180	0.120	0.240	0.160	0.300	0.200
		Titanium Alloys	0.090	0.060	0.120	0.080	0.150	0.100	0.180	0.120	0.240	0.160	0.300	0.200
Cast Irons	K	Gray Cast Iron	0.180	0.120	0.240	0.160	0.300	0.200	0.360	0.240	0.480	0.320	0.600	0.400
		Ductile Cast Iron	0.150	0.120	0.200	0.160	0.250	0.200	0.300	0.240	0.400	0.320	0.500	0.400
		Malleable Iron	0.120	0.090	0.160	0.120	0.200	0.150	0.240	0.180	0.320	0.240	0.400	0.300
Hardened Steels	H	HRC 45-50	0.090	0.084	0.120	0.112	0.150	0.140	0.180	0.168	0.240	0.224	0.300	0.280
		HRC 50-55	0.075	0.084	0.100	0.112	0.125	0.140	0.150	0.168	0.200	0.224	0.250	0.280

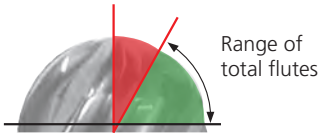
Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® 3D

MFPB Series Recommended Cutting Data - **Metric**

Tool Ø (mm)	Effective Diameter at 30°						
	Axial Depth of Cut (Ap) - mm						
	0.2	0.4	0.6	0.8	1	1.5	2
6	4.67	5.19	5.52	5.73	5.87	-	-
8	5.96	6.62	7.05	7.36	7.58	7.91	-
10	7.22	7.99	8.51	8.90	9.20	9.68	9.93
12	8.46	9.33	9.93	10.38	10.74	11.37	11.75
16	10.88	11.93	12.66	13.24	13.71	14.58	15.17
20	13.25	14.45	15.31	15.99	16.55	17.62	18.39





Tool Ø (mm)	Tilt Angle	No. of Flutes
6	33°	6
8	25°	8
10	22°	8
12	24°	8
16	25°	8
20	25°	10

Tool Ø (mm)	Effective Teeth		
	Tilt Angle		
	20°	25°	33°
6	2	4	6
8	2	8	8
10	2	8	8
12	6	8	8
16	6	8	8
20	6	10	10

Red Area:
Does not have complete effective number of flutes to center of tool.

Green Area:
Programming at the listed tilt angle will utilize the full effective number of flutes.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® 3D

XFO Series Recommended Cutting Data - Speeds - **Inch**

Recommended Speeds by Material Group						Finishing	Semi-Finishing
Workpiece Material Group		Material Type	Stock Allowance			.01-.03 x D	.05-.07 x D
			Coolant			Vc-SFM	
			Emulsion	Compressed Air	MQL		
Steels	P	Low Carbon	●	●	●	1480	1150
		Medium Carbon	●	●	●	1130	900
		Alloy Steels	●	●	●	1030	840
		Die / Tool Steels (≤ 45 HRC)	●	●	●	900	720
Stainless Steels	M	Free Machining	●	X	○	670	540
		Austenitic	●	X	○	520	430
		Difficult Stainless	●	X	○	410	330
		PH Stainless (≤ 45 HRC)	●	X	○	520	430
		Cobalt Chrome Alloys	●	X	○	410	330
		Duplex (22%)	●	X	○	250	200
		Super Duplex (25%)	●	X	○	200	160
Special Alloys	S	High Temp Alloys	●	X	X	150	100
		Titanium Alloys	●	X	X	360	300

● Preferred ○ Possible X Not Possible

XFO Series Recommended Cutting Data - Feeds - **Inch**

Recommended Feeds by Material Group			Tool Diameter (inch)							
Workpiece Material Group		Material Type	.2362		.3150		.3937		.4724	
			Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish
			Fz - in/tooth							
Steels	P	Low Carbon	.0019	.0012	.0025	.0016	.0031	.0020	.0038	.0024
		Medium Carbon	.0019	.0012	.0025	.0016	.0031	.0020	.0038	.0024
		Alloy Steels	.0019	.0012	.0025	.0016	.0031	.0020	.0038	.0024
		Die / Tool Steels (≤ 45 HRC)	.0014	.0009	.0019	.0013	.0024	.0016	.0028	.0019
Stainless Steels	M	Free Machining	.0019	.0012	.0025	.0016	.0031	.0020	.0038	.0024
		Austenitic	.0019	.0012	.0025	.0016	.0031	.0020	.0038	.0024
		Difficult Stainless	.0019	.0012	.0025	.0016	.0031	.0020	.0038	.0024
		PH Stainless (≤ 45 HRC)	.0014	.0009	.0019	.0013	.0024	.0016	.0028	.0019
		Cobalt Chrome Alloys	.0014	.0009	.0019	.0013	.0024	.0016	.0028	.0019
		Duplex (22%)	.0014	.0009	.0019	.0013	.0024	.0016	.0028	.0019
		Super Duplex (25%)	.0014	.0009	.0019	.0013	.0024	.0016	.0028	.0019
Special Alloys	S	High Temp Alloys	.0014	.0009	.0019	.0013	.0024	.0016	.0028	.0019
		Titanium Alloys	.0017	.0012	.0022	.0016	.0028	.0020	.0033	.0024

Notes:

- To prevent chip evcaution issues, utilize 4-flute tools for semi-finishing operations & avoid cutting with the tip of the tool wherever possible.
- Reduced feeds required when cutting with the tip of the tool.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® 3D

XFO Series Recommended Cutting Data - Speeds - **Metric**

Recommended Speeds by Material Group						Finishing	Semi-Finishing
Workpiece Material Group		Material Type	Stock Allowance			.01-.03 x D	.05-.07 x D
			Coolant			Vc - M/Min	
			Emulsion	Compressed Air	MQL		
Steels	P	Low Carbon	●	●	●	450	350
		Medium Carbon	●	●	●	345	275
		Alloy Steels	●	●	●	315	255
		Die / Tool Steels (≤ 45 HRC)	●	●	●	275	220
Stainless Steels	M	Free Machining	●	X	○	205	165
		Austenitic	●	X	○	160	130
		Difficult Stainless	●	X	○	125	100
		PH Stainless (≤ 45 HRC)	●	X	○	160	130
		Cobalt Chrome Alloys	●	X	○	125	100
		Duplex (22%)	●	X	○	75	60
		Super Duplex (25%)	●	X	○	60	50
Special Alloys	S	High Temp Alloys	●	X	X	45	30
		Titanium Alloys	●	X	X	110	90

● Preferred ○ Possible X Not Possible

XFO Series Recommended Cutting Data - Feeds - **Metric**

Recommended Feeds by Material Group			Tool Diameter (mm)							
Workpiece Material Group		Material Type	6		8		10		12	
			Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish
			Fz - mm/tooth							
Steels	P	Low Carbon	.048	.030	.064	.040	.080	.050	.096	.060
		Medium Carbon	.048	.030	.064	.040	.080	.050	.096	.060
		Alloy Steels	.048	.030	.064	.040	.080	.050	.096	.060
		Die / Tool Steels (≤ 45 HRC)	.036	.024	.048	.032	.060	.040	.072	.048
Stainless Steels	M	Free Machining	.048	.030	.064	.040	.080	.050	.096	.060
		Austenitic	.048	.030	.064	.040	.080	.050	.096	.060
		Difficult Stainless	.048	.030	.064	.040	.080	.050	.096	.060
		PH Stainless (≤ 45 HRC)	.036	.024	.048	.032	.060	.040	.072	.048
		Cobalt Chrome Alloys	.036	.024	.048	.032	.060	.040	.072	.048
		Duplex (22%)	.036	.024	.048	.032	.060	.040	.072	.048
		Super Duplex (25%)	.036	.024	.048	.032	.060	.040	.072	.048
Special Alloys	S	High Temp Alloys	.036	.024	.048	.032	.060	.040	.072	.048
		Titanium Alloys	.042	.030	.056	.040	.070	.050	.084	.060

Notes:

- To prevent chip evcaution issues, utilize 4-flute tools for semi-finishing operations & avoid cutting with the tip of the tool wherever possible.
- Reduced feeds required when cutting with the tip of the tool.

TuffCut® 3D

XFO-AL Series Recommended Cutting Data - Speeds - **Inch**

Recommended Speeds by Material Group						Finishing	Semi-Finishing
Workpiece Material Group		Material Type	Stock Allowance			.01-.03 x D	.05-.07 x D
			Coolant			Vc-SFM	
			Emulsion	Compressed Air	MQL		
Aluminum	N	Wrought (≤ 10% Si)	●	X	○	2000	1900
		Cast (> 10% Si)	●	X	○	1710	1610

● Preferred ○ Possible X Not Possible

XFO-AL Series Recommended Cutting Data - Feeds - **Inch**

Recommended Feeds by Material Group			Tool Diameter (inch)							
Workpiece Material Group		Material Type	.2362		.3150		.3937		.4724	
			Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish
			Fz - in/tooth							
Aluminum	N	Wrought (≤ 10% Si)	.0024	.0015	.0032	.0020	.0039	.0026	.0047	.0031
		Cast (> 10% Si)	.0024	.0015	.0032	.0020	.0039	.0026	.0047	.0031

Notes:
- To prevent chip evcaution issues, avoid cutting with the tip of the tool wherever possible.
- Reduced feeds required when cutting with the tip of the tool.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® 3D

XFO-AL Series Recommended Cutting Data - Speeds - **Metric**

Recommended Speeds by Material Group						Finishing	Semi-Finishing
Workpiece Material Group		Material Type	Stock Allowance			.01-.03 x D	.05-.07 x D
			Coolant			Vc - M/Min	
			Emulsion	Compressed Air	MQL		
Aluminum	N	Wrought (≤ 10% Si)	●	X	○	610	580
		Cast (> 10% Si)	●	X	○	520	490

● Preferred ○ Possible X Not Possible

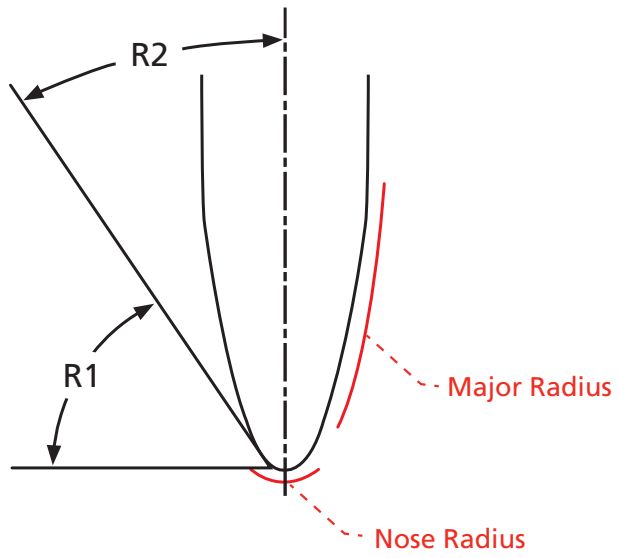
XFO-AL Series Recommended Cutting Data - Feeds - **Metric**

Recommended Feeds by Material Group			Tool Diameter (mm)							
Workpiece Material Group		Material Type	6		8		10		12	
			Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish	Semi Finish	Finish
			Fz - mm/tooth							
Aluminum	N	Wrought (≤ 10% Si)	.060	.039	.080	.052	.100	.065	.120	.078
		Cast (> 10% Si)	.060	.039	.080	.052	.100	.065	.120	.078

Notes:
- To prevent chip evcaution issues, avoid cutting with the tip of the tool wherever possible.
- Reduced feeds required when cutting with the tip of the tool.

TuffCut® 3D

XFO / XFO-AL Series



Effective Angles

Tool Ø	Nose Radius		Major Radius	
DC	R1	Effective Angle (Max.)	R2	Effective Angle (Max.)
6	1	78.2°	95	11.8°
8	1	75.1°	90	14.9°
10	2	74.6°	85	15.4°
12	2	71.6°	80	18.4°

*Numbers above represent maximum angle values.

TuffCut® 3D
XFO / XFO-AL Series

Stepover Distance by Cusp Height - **Inch**

Tool Ø (mm)		Cusp Height (Inch)	.0001	.0002	.0003	.0004	.0005
DC	R2						
6	95	Stepover (Inch)	.059	.077	.097	.109	.124
8	90		.058	.075	.094	.106	.120
10	85		.056	.072	.092	.103	.117
12	80		.054	.070	.089	.100	.113

Stepover Distance by Cusp Height - **Metric**

Tool Ø (mm)		Cusp Height (mm)	0.003	0.005	0.008	0.010	0.013
DC	R2						
6	95	Stepover (mm)	1.50	1.95	2.46	2.76	3.14
8	90		1.47	1.90	2.40	2.69	3.06
10	85		1.43	1.84	2.33	2.61	2.97
12	80		1.38	1.79	2.26	2.53	2.88

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® Micro

3MVS / 3MVR Series Recommended Cutting Data - **Inch**

Note: Square corner tools recommended for finishing applications only.

Stub Length - 3MVS Series

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible: Emulsion	Compressed Air	MQL	Application	Depth of Cut Per Application: Radial (Ae)	Axial (Ap)	vc - SFM	End Mill Diameter (inch): .015	.031	.047	.062	.078	.093	.109	.125
									fz - in/tooth by Cutter Diameter							
Moderate Machining & PH Stainless Steels	M	•	X	○	Slotting	-	.5 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.2 x D	1 x D	490	.00010	.00020	.00031	.00041	.00051	.00061	.00072	.00083
High Temp Alloys	S	•	X	X	Slotting	-	.5 x D	100	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.1 x D	1 x D	150	.00008	.00017	.00026	.00035	.00044	.00052	.00061	.00070
Titanium Alloys	S	•	X	X	Slotting	-	.5 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.2 x D	1 x D	350	.00006	.00012	.00019	.00025	.00031	.00037	.00044	.00050

Regular Length - 3MVR Series

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible: Emulsion	Compressed Air	MQL	Application	Depth of Cut Per Application: Radial (Ae)	Axial (Ap)	vc - SFM	End Mill Diameter (inch): .015	.031	.047	.062	.078	.093	.109	.125
									fz - in/tooth by Cutter Diameter							
Moderate Machining & PH Stainless Steels	M	•	X	○	Slotting	-	.5 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.1 x D	2-2.5 x D	490	.00010	.00020	.00031	.00041	.00051	.00061	.00072	.00083
High Temp Alloys	S	•	X	X	Slotting	-	.5 x D	100	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.05 x D	2-2.5 x D	150	.00008	.00017	.00026	.00035	.00044	.00052	.00061	.00070
Titanium Alloys	S	•	X	X	Slotting	-	.5 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.1 x D	2-2.5 x D	350	.00006	.00012	.00019	.00025	.00031	.00037	.00044	.00050

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Inch necked tools cutting data on page 166.

TuffCut® Micro

3MVS / 3MVR Series Recommended Cutting Data - **Metric**

Note: Square corner tools recommended for finishing applications only.

Stub Length - 3MVS Series

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			Application	Depth of Cut Per Application		vc - m/min	End Mill Diameter (mm)					
		Emulsion	Compressed Air	MQL		Radial (Ae)	Axial (Ap)		0.5	1.0	1.5	2.0	2.5	3.0
									fz - mm/tooth by Cutter Diameter					
Moderate Machining & PH Stainless Steels	M	•	X	○	Slotting	-	.5 x D	75	.0012	.0024	.0036	.0048	.0060	.0072
					Profiling	.2 x D	1 x D	150	.0033	.0066	.0099	.0132	.0165	.0198
High Temp Alloys	S	•	X	X	Slotting	-	.5 x D	30	.0010	.0020	.0030	.0040	.0050	.0060
					Profiling	.1 x D	1 x D	45	.0028	.0056	.0084	.0112	.0140	.0168
Titanium Alloys	S	•	X	X	Slotting	-	.5 x D	75	.0012	.0024	.0036	.0048	.0060	.0072
					Profiling	.2 x D	1 x D	107	.0020	.0040	.0060	.0080	.0100	.0120

Regular Length - 3MVR Series

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			Application	Depth of Cut Per Application		vc - m/min	End Mill Diameter (mm)					
		Emulsion	Compressed Air	MQL		Radial (Ae)	Axial (Ap)		0.5	1.0	1.5	2.0	2.5	3.0
									fz - mm/tooth by Cutter Diameter					
Moderate Machining & PH Stainless Steels	M	•	X	○	Slotting	-	.5 x D	75	.0012	.0024	.0036	.0048	.0060	.0072
					Profiling	.1 x D	2-2.5 x D	150	.0033	.0066	.0099	.0132	.0165	.0198
High Temp Alloys	S	•	X	X	Slotting	-	.5 x D	30	.0010	.0020	.0030	.0040	.0050	.0060
					Profiling	.05 x D	2-2.5 x D	45	.0028	.0056	.0084	.0112	.0140	.0168
Titanium Alloys	S	•	X	X	Slotting	-	.5 x D	75	.0012	.0024	.0036	.0048	.0060	.0072
					Profiling	.1 x D	2-2.5 x D	107	.0020	.0040	.0060	.0080	.0100	.0120

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Metric necked tools cutting data on page 168.

TuffCut® Micro

3MVS Series Recommended Cutting Data - Necked Tools - **Inch**

Note: Square corner tools recommended for finishing applications only.

3 X D Necked Tools (3MVS Series - N3)

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible: Emulsion	Compressed Air	MQL	Application	Depth of Cut Per Application: Radial (Ae)	Axial (Ap)	vc - SFM	End Mill Diameter (inch): .015	.031	.047	.062	.078	.093	.109	.125
									fz - in/tooth by Cutter Diameter							
Moderate Machining & PH Stainless Steels	M	•	X	o	Slotting	-	.5 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.1 x D	1 x D	490	.00010	.00020	.00031	.00041	.00051	.00061	.00072	.00083
High Temp Alloys	S	•	X	X	Slotting	-	.5 x D	100	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.05 x D	1 x D	150	.00008	.00017	.00026	.00035	.00044	.00052	.00061	.00070
Titanium Alloys	S	•	X	X	Slotting	-	.5 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.1 x D	1 x D	350	.00006	.00012	.00019	.00025	.00031	.00037	.00044	.00050

5 X D Necked Tools (3MVS Series - N5)

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible: Emulsion	Compressed Air	MQL	Application	Depth of Cut Per Application: Radial (Ae)	Axial (Ap)	vc - SFM	End Mill Diameter (inch): .015	.031	.047	.062	.078	.093	.109	.125
									fz - in/tooth by Cutter Diameter							
Moderate Machining & PH Stainless Steels	M	•	X	o	Slotting	-	.3 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.08 x D	1 x D	490	.00010	.00020	.00031	.00041	.00051	.00061	.00072	.00083
High Temp Alloys	S	•	X	X	Slotting	-	.3 x D	100	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.05 x D	1 x D	150	.00008	.00017	.00026	.00035	.00044	.00052	.00061	.00070
Titanium Alloys	S	•	X	X	Slotting	-	.3 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.08 x D	1 x D	350	.00006	.00012	.00019	.00025	.00031	.00037	.00044	.00050

8 X D Necked Tools (3MVS Series - N8)

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible: Emulsion	Compressed Air	MQL	Application	Depth of Cut Per Application: Radial (Ae)	Axial (Ap)	vc - SFM	End Mill Diameter (inch): .015	.031	.047	.062	.078	.093	.109	.125
									fz - in/tooth by Cutter Diameter							
Moderate Machining & PH Stainless Steels	M	•	X	o	Slotting	-	.2 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.05 x D	.75 x D	490	.00010	.00020	.00031	.00041	.00051	.00061	.00072	.00083
High Temp Alloys	S	•	X	X	Slotting	-	.2 x D	100	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.05 x D	.75 x D	150	.00008	.00017	.00026	.00035	.00044	.00052	.00061	.00070
Titanium Alloys	S	•	X	X	Slotting	-	.2 x D	245	.00004	.00007	.00011	.00015	.00019	.00022	.00026	.00030
					Profiling	.05 x D	.75 x D	350	.00006	.00012	.00019	.00025	.00031	.00037	.00044	.00050

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Inch non-necked tools cutting data on page 164.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® Micro

3MVS Series Recommended Cutting Data - Necked Tools - **Inch** Continued

Note: Square corner tools recommended for finishing applications only.

10 X D Necked Tools (3MVS Series - N10)

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			Application	Depth of Cut Per Application		vc - SFM	End Mill Diameter (inch)							
		Emulsion	Compressed Air	MQL		Radial (Ae)	Axial (Ap)		.015	.031	.047	.062	.078	.093	.109	.125
									fz - in/tooth by Cutter Diameter							
Moderate Machining & PH Stainless Steels	M	•	X	o	Slotting	-	.15 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.5 x D	.15 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
High Temp Alloys	S	•	X	X	Slotting	-	.15 x D	100	.00002	.00005	.00008	.00010	.00012	.00015	.00017	.00020
					Profiling	.5 x D	.15 x D	100	.00002	.00005	.00008	.00010	.00012	.00015	.00017	.00020
Titanium Alloys	S	•	X	X	Slotting	-	.15 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.5 x D	.15 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025

12 X D Necked Tools (3MVS Series - N12)

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			Application	Depth of Cut Per Application		vc - SFM	End Mill Diameter (inch)							
		Emulsion	Compressed Air	MQL		Radial (Ae)	Axial (Ap)		.015	.031	.047	.062	.078	.093	.109	.125
									fz - in/tooth by Cutter Diameter							
Moderate Machining & PH Stainless Steels	M	•	X	o	Slotting	-	.1 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.5 x D	.1 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
High Temp Alloys	S	•	X	X	Slotting	-	.1 x D	100	.00002	.00005	.00008	.00010	.00012	.00015	.00017	.00020
					Profiling	.5 x D	.1 x D	100	.00002	.00005	.00008	.00010	.00012	.00015	.00017	.00020
Titanium Alloys	S	•	X	X	Slotting	-	.1 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.5 x D	.1 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025

15 X D Necked Tools (3MVS Series - N15)

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			Application	Depth of Cut Per Application		vc - SFM	End Mill Diameter (inch)							
		Emulsion	Compressed Air	MQL		Radial (Ae)	Axial (Ap)		.015	.031	.047	.062	.078	.093	.109	.125
									fz - in/tooth by Cutter Diameter							
Moderate Machining & PH Stainless Steels	M	•	X	o	Slotting	-	.07 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.5 x D	.07 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
High Temp Alloys	S	•	X	X	Slotting	-	.07 x D	100	.00002	.00005	.00008	.00010	.00012	.00015	.00017	.00020
					Profiling	.5 x D	.07 x D	100	.00002	.00005	.00008	.00010	.00012	.00015	.00017	.00020
Titanium Alloys	S	•	X	X	Slotting	-	.07 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025
					Profiling	.5 x D	.07 x D	245	.00003	.00006	.00009	.00012	.00016	.00019	.00022	.00025

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Inch non-necked tools cutting data on page 164.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® Micro

3MVS Series Recommended Cutting Data - Necked Tools - **Metric**

Note: Square corner tools recommended for finishing applications only.

5 X D Necked Tools (3MVS Series - N5)

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			Application	Depth of Cut Per Application		Vc m/min	End Mill Diameter (mm)					
		Emulsion	Compressed Air	MQL		Radial (Ae)	Axial (Ap)		0.5	1.0	1.5	2.0	2.5	3.0
									fz - mm/tooth by Cutter Diameter					
Moderate Machining & PH Stainless Steels	M	•	X	○	Slotting	-	.3 x D	75	.0012	.0024	.0036	.0048	.0060	.0072
					Profiling	.08 x D	1 x D	150	.0033	.0066	.0099	.0132	.0165	.0198
High Temp Alloys	S	•	X	X	Slotting	-	.3 x D	30	.0010	.0020	.0030	.0040	.0050	.0060
					Profiling	.05 x D	1 x D	45	.0028	.0056	.0084	.0112	.0140	.0168
Titanium Alloys	S	•	X	X	Slotting	-	.3 x D	75	.0012	.0024	.0036	.0048	.0060	.0072
					Profiling	.08 x D	1 x D	107	.0020	.0040	.0060	.0080	.0100	.0120

8 X D Necked Tools (3MVS Series - N8)

Workpiece Material Group	ISO	Coolant • Preferred o Possible x Not Possible			Application	Depth of Cut Per Application		Vc m/min	End Mill Diameter (mm)					
		Emulsion	Compressed Air	MQL		Radial (Ae)	Axial (Ap)		0.5	1.0	1.5	2.0	2.5	3.0
									fz - mm/tooth by Cutter Diameter					
Moderate Machining & PH Stainless Steels	M	•	X	○	Slotting	-	.2 x D	75	.0012	.0024	.0036	.0048	.0060	.0072
					Profiling	.05 x D	.75 x D	150	.0033	.0066	.0099	.0132	.0165	.0198
High Temp Alloys	S	•	X	X	Slotting	-	.2 x D	30	.0010	.0020	.0030	.0040	.0050	.0060
					Profiling	.05 x D	.75 x D	45	.0028	.0056	.0084	.0112	.0140	.0168
Titanium Alloys	S	•	X	X	Slotting	-	.2 x D	75	.0012	.0024	.0036	.0048	.0060	.0072
					Profiling	.05 x D	.75 x D	107	.0020	.0040	.0060	.0080	.0100	.0120

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Metric non-necked tools cutting data on page 165.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® AL

135 / 135N Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Coolant • Preferred	Profile Milling (ae)*				End Mill Diameter (inch)							
							3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
			10%	20%	30%	50%	ae > .3D use < 1D ap ae < .2D use < 2D ap *Profile Milling at > 25% ap is not recommended for diameters 1/4" and below.							
		Emulsion	3.8	3.1	2	1	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.							
			vc - SFM				fz - in/tooth							
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	2000	1800	1200	900	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	1500	1200	1000	800	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100
Non-Ferrous - Brass	N	•	900	800	600	500	.0025	.0032	.0037	.0050	.0065	.0075	.0100	.0120
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	1000	800	600	500	.0025	.0032	.0037	.0050	.0065	.0075	.0100	.0120
Non-Ferrous - Plastics	N	•	900	800	600	500	.0025	.0032	.0037	.0050	.0065	.0075	.0100	.0120

Above 20,000 RPM, Tool Balancing Required.

135 / 135N Series Recommended Cutting Data - Profile Milling - **Metric**

Workpiece Material Group	ISO	Coolant • Preferred	Profile Milling (ae)*				End Mill Diameter (mm)								
							3*	5*	6*	8	10	14	16	18	25
			10%	20%	30%	50%	ae > .3D use < 1D ap ae < .2D use < 2D ap *Profile Milling at > 25% ap is not recommended for diameters 6mm and below.								
		Emulsion	3.8	3.1	2	1	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
			vc - m/min				fz - mm/tooth								
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	600	550	365	275	.030	.045	.063	.081	.093	.127	.165	.190	.254
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	450	365	305	250	.030	.045	.063	.081	.093	.127	.165	.190	.254
Non-Ferrous - Brass	N	•	275	250	180	150	.045	.063	.081	.093	.127	.165	.190	.254	.304
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	300	250	180	150	.045	.063	.081	.093	.127	.165	.190	.254	.304
Non-Ferrous - Plastics	N	•	275	250	180	150	.045	.063	.081	.093	.127	.165	.190	.254	.304

Above 20,000 RPM, Tool Balancing Required.

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® AL

135 / 135N Series Recommended Cutting Data - Slotting - **Inch**

Workpiece Material Group	ISO	Coolant • Preferred Emulsion	Slotting* 25%	Slotting* 50%	Slotting* 100%	End Mill Diameter (inch) 3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
			vc - SFM			*Slotting at > 25% ap is not recommended for diameters 1/4" and below. fz- in/tooth							
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	2000	1500	1000	.004-.006	.004-.008	.006-.009	.007-.012	.010-.045	.015-.045	.015-.045	.015-.040
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	1500	1200	800	.004-.006	.004-.008	.006-.009	.007-.012	.010-.045	.015-.045	.015-.045	.015-.040
Non-Ferrous - Brass	N	•	600	500	400	.004-.006	.004-.008	.006-.009	.007-.012	.010-.045	.015-.045	.015-.045	.015-.040
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	500	400	300	.0025	.0032	.0037	.0050	.0065	.0075	.0100	.0120
Non-Ferrous - Plastics	N	•	1200	1000	800	.004-.006	.004-.008	.006-.009	.007-.012	.010-.045	.015-.045	.015-.045	.015-.040

Above 20,000 RPM, Tool Balancing Required.

135 / 135N Series Recommended Cutting Data - Slotting - **Metric**

Workpiece Material Group	ISO	Coolant • Preferred Emulsion	Slotting* 25%	Slotting* 50%	Slotting* 100%	End Mill Diameter (mm) 3*	5*	6*	8	10	14	16	20	25
			vc - m/min			*Slotting at > 25% ap is not recommended for diameters 6mm and below. fz - mm/tooth								
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	600	450	300	.076-.101	.101-.152	.101-.203	.152-.203	.177-.304	.254-1.143	.381-1.016	.381-1.016	.381-1.016
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	450	365	250	.076-.101	.101-.151	.101-.203	.152-.203	.177-.304	.254-1.143	.381-1.016	.381-1.016	.381-1.016
Non-Ferrous - Brass	N	•	180	150	120	.076-.101	.101-.152	.101-.203	.152-.203	.177-.304	.254-1.143	.381-1.016	.381-1.016	.381-1.016
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	150	120	90	.045	.063	.076	.093	.127	.165	.190	.254	.304
Non-Ferrous - Plastics	N	•	365	300	250	.076-.101	.101-.152	.101-.203	.152-.203	.177-.304	.254-1.143	.381-1.016	.381-1.016	.381-1.016

Above 20,000 RPM, Tool Balancing Required.

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® AL / X-AL

135B / 138B Series Recommended Cutting Data - Profile Milling - **Inch**

If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Workpiece Material Group	ISO	Coolant • Preferred	Profile Milling (ae)*				End Mill Diameter (inch)								
			10%	20%	30%	50%	1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
							ae > .3D use <1D ap ae < .2D use < 2D ap *Profile Milling at > 25% ap is not recommended for diameters 1/4" and below.								
		Emulsion	3.8	3.1	2	1	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
			vc - SFM				fz - in/tooth								
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	2000	1800	1200	900	.0010	.0018	.0025	.0030	.0037	.0050	.0065	.0075	.0100
Non-Ferrous _ Aluminum / Aluminum Alloys > 10% Si	N	•	1500	1200	1000	800	.0010	.0018	.0025	.0030	.0037	.0050	.0065	.0075	.0100
Non-Ferrous - Brass	N	•	900	800	600	500	.0015	.0025	.0032	.0040	.0050	.0060	.0075	.0100	.0120
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	1000	800	600	500	.0015	.0025	.0032	.0040	.0050	.0060	.0075	.0100	.0120
Non-Ferrous - Plastics	N	•	900	800	600	500	.0015	.0025	.0032	.0040	.0050	.0060	.0075	.0100	.0120

Above 20,000 RPM, Tool Balancing Required.

135B / 138B Series Recommended Cutting Data - Profile Milling - **Metric**

If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Workpiece Material Group	ISO	Coolant • Preferred	Profile Milling (ae)*				End Mill Diameter (mm)						
			10%	20%	30%	50%	3*	5*	6*	8	10	14	16
							ae > .3D use <1D ap ae < .2D use < 2D ap *Profile Milling at > 25% ap is not recommended for diameters 6mm and below.						
		Emulsion	3.8	3.1	2	1	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.						
			vc - m/min				fz - mm/tooth						
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	600	550	365	275	.0300	.0450	.0630	.0810	.0930	.1270	.1650
Non-Ferrous Aluminum / Aluminum Alloys > 10% Si	N	•	450	365	305	250	.0300	.0450	.0630	.0810	.0930	.1270	.1650
Non-Ferrous - Brass	N	•	275	250	180	150	.0450	.0630	.0810	.0810	.1270	.1650	.1900
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	300	250	180	150	.0450	.0630	.0810	.0810	.1270	.1650	.1900
Non-Ferrous - Plastics	N	•	275	250	180	150	.0450	.0630	.0810	.0810	.1270	.1650	.1900

Above 20,000 RPM, Tool Balancing Required.

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® AL / X-AL

135B / 138B Series Recommended Cutting Data - Slotting - **Inch**

If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Workpiece Material Group	ISO	Coolant • Preferred	Slotting*			End Mill Diameter (inch)								
						1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
		Emulsion	25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 1/4" and below.								
			vc - SFM			fz - in/tooth								
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	2000	1500	1000	.001-.002	.004-.006	.004-.008	.005-.009	.007-.012	.010-.020	.015-.020	.015-.020	.015-.020
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	1500	1200	800	.001-.002	.004-.006	.004-.008	.005-.009	.007-.012	.010-.020	.015-.020	.015-.020	.015-.020
Non-Ferrous - Brass	N	•	600	500	400	.001-.002	.004-.006	.004-.008	.005-.009	.007-.012	.010-.020	.015-.020	.015-.020	.015-.020
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	500	400	300	.001-.002	.004-.006	.004-.008	.005-.009	.007-.012	.010-.020	.015-.020	.015-.020	.015-.020
Non-Ferrous/Plastics	N	•	1200	1000	800	.001-.002	.004-.006	.004-.008	.005-.009	.007-.012	.010-.020	.015-.020	.015-.020	.015-.020

Above 20,000 RPM, Tool Balancing Required.

135B / 138B Series Recommended Cutting Data - Slotting - **Metric**

If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Workpiece Material Group	ISO	Coolant • Preferred	Slotting*			End Mill Diameter (mm)						
						3*	5*	6*	8	10	14	16
		Emulsion	25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 6mm and below.						
			vc - m/min			fz - mm/tooth						
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	600	450	300	.076-.101	.101-.152	.101-.203	.152-.203	.177-.304	.254-.508	.381-.508
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	450	365	250	.076-.101	.101-.152	.101-.203	.152-.203	.177-.304	.254-.508	.381-.508
Non-Ferrous - Brass	N	•	180	150	120	.076-.101	.101-.152	.101-.203	.152-.203	.177-.304	.254-.508	.381-.508
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	150	120	90	.076-.101	.101-.152	.101-.203	.152-.203	.177-.304	.254-.508	.381-.508
Non-Ferrous - Plastics	N	•	365	300	250	.076-.101	.101-.152	.101-.203	.152-.203	.177-.304	.254-.508	.381-.508

Above 20,000 RPM, Tool Balancing Required.

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® AL / X-AL

136 / 138 / 138N / 138CE Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Coolant • Preferred	Profile Milling (ae)*				End Mill Diameter (inch)								
							1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
			10%	20%	30%	50%	If ae = ≥ 0.3xDC, use ap = ≤ 2xDC								
		Emulsion	1.67	1.25	1.09	1	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
			vc - SFM				fz - in/tooth								
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	2000	1800	1200	900	.0025	.0037	.0050	.0062	.0075	.0100	.0125	.0150	.0200
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	1500	1200	1000	800	.0025	.0037	.0050	.0062	.0075	.0100	.0125	.0150	.0200
Non-Ferrous - Brass	N	•	900	800	600	500	.0025	.0037	.0050	.0062	.0075	.0100	.0125	.0150	.0200
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	1000	800	600	500	.0025	.0037	.0050	.0062	.0075	.0100	.0125	.0150	.0200
Non-Ferrous - Plastics	N	•	900	800	600	500	.0025	.0037	.0050	.0062	.0075	.0100	.0125	.0150	.0200

Above 20,000 RPM, Tool Balancing Required.

136 / 138 / 138N / 138CE Series Recommended Cutting Data - Profile Milling - **Metric**

Workpiece Material Group	ISO	Coolant • Preferred	Profile Milling (ae)*				End Mill Diameter (mm)						
							3*	5*	6*	8	10	14	16
			10%	20%	30%	50%	If ae = ≥ 0.3xDC, use ap = ≤ 2xDC						
		Emulsion	1.67	1.25	1.09	1	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.						
			vc - m/min				fz - mm/tooth						
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	600	550	365	275	.0600	.1000	.1200	.1600	.2000	.2800	.3200
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	450	365	305	250	.0600	.1000	.1200	.1600	.2000	.2800	.3200
Non-Ferrous - Brass	N	•	275	250	180	150	.0600	.1000	.1200	.1600	.2000	.2800	.3200
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	300	250	180	150	.0600	.1000	.1200	.1600	.2000	.2800	.3200
Non-Ferrous - Plastics	N	•	275	250	180	150	.0600	.1000	.1200	.1600	.2000	.2800	.3200

Above 20,000 RPM, Tool Balancing Required.

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

TuffCut® AL / X-AL

136 / 138 / 138N / 138CE Series Recommended Cutting Data - Slotting - **Inch**

Workpiece Material Group	ISO	Coolant • Preferred	Slotting*			End Mill Diameter (inch)								
						1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
		Emulsion	25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 1/4" and below.								
			vc - SFM			fz - in/tooth								
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	2000	1500	1000	.0012	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	1500	1200	800	.0012	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100
Non-Ferrous - Brass	N	•	600	500	400	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100	.0120
Non- Ferrous - Cu/Cu Alloys / Magnesium	N	•	500	400	300	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100	.0120
Non-Ferrous - Plastics	N	•	1200	1000	800	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100	.0120

Above 20,000 RPM, Tool Balancing Required.

136 / 138 / 138N / 138CE Series Recommended Cutting Data - Slotting - **Metric**

Workpiece Material Group	ISO	Coolant • Preferred	Slotting*			End Mill Diameter (mm)							
						3*	5*	6*	8	10	14	16	20
		Emulsion	25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 6mm and below.							
			vc - m/min			fz - mm/tooth							
Non-Ferrous - Aluminum / Aluminum Alloys < 10% Si	N	•	600	450	300	.0300	.0450	.0630	.0810	.0930	.1270	.1650	.1900
Non-Ferrous - Aluminum / Aluminum Alloys > 10% Si	N	•	450	365	250	.0300	.0450	.0630	.0810	.0930	.1270	.1650	.1900
Non-Ferrous - Brass	N	•	180	150	120	.0450	.0630	.0810	.0930	.1270	.1650	.1900	.2540
Non-Ferrous - Cu/Cu Alloys / Magnesium	N	•	150	120	90	.0450	.0630	.0810	.0930	.1270	.1650	.1900	.2540
Non-Ferrous - Plastics	N	•	365	300	250	.0450	.0630	.0810	.0930	.1270	.1650	.1900	.2540

Above 20,000 RPM, Tool Balancing Required.

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed

TuffCut® XR-AL

334 Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Coolant • Preferred Emulsion	Profile Milling (ap) 1 x D	1.5 x D	2 x D
			vc - SFM		
Non-Ferrous - Aluminum	N	•	2000-2500	1750-2000	1250-1750
Non-Ferrous - Aluminum Cast	N	•	1600-2000	1400-1600	1000-1400
Non-Ferrous - Brass Yellow/Red	N	•	750-1250	500-1000	400-800
Non-Ferrous - Bronze, Aluminum Bronze	N	•	500-1000	400-800	300-600
Non-Ferrous - Copper	N	•	1500-2000	1250-1500	800-1200

Diameter (inch)	1/4	1/4	3/8	3/8	1/2	1/2	5/8	5/8	3/4	3/4	1	1
Max. ae	30%	50%	30%	50%	30%	50%	30%	50%	30%	50%	30%	50%
fz=in/tooth	.008	.006	.012	.009	.016	.012	.018	.013	.020	.015	.024	.018

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

334 Series Recommended Cutting Data - Slotting - **Inch**

Workpiece Material Group	ISO	Coolant • Preferred Emulsion	Slotting (ap) .5 x D	1 x D
			vc - SFM	
Non-Ferrous - Aluminum	N	•	1750-2000	1250-1750
Non-Ferrous - Aluminum Cast	N	•	1400-1600	1000-1400
Non-Ferrous - Brass Yellow/Red	N	•	500-1000	400-800
Non-Ferrous - Bronze, Aluminum Bronze	N	•	400-800	300-600
Non-Ferrous - Copper	N	•	1250-1500	800-1000

Diameter (inch)	1/4	1/4	3/8	3/8	1/2	1/2	5/8	5/8	3/4	3/4	1	1
Max. ap	50%	100%	50%	100%	50%	100%	50%	100%	50%	100%	50%	100%
fz=in/tooth	.008	.005	.012	.008	.020	.010	.022	.012	.025	.015	.030	.020

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

156 Series Recommended Cutting Data - Contouring - **Inch**

If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			End Mill Diameter (inch)											
			Emulsion	Compressed Air	MQL	1/32		1/16		3/32		1/8		5/32		1/4	
						RPM (n)	IPM (vf)	RPM (n)	IPM (vf)	RPM (n)	IPM (vf)	RPM (n)	IPM (vf)	RPM (n)	IPM (vf)	RPM (n)	IPM (vf)
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	30000	26.9	30000	62	25000	84	17500	95	14000	120	8750	140
Hardened Steels	H	40-45 Rc	•	o	o	30000	24	23500	57	22000	96	14500	90	11500	90	7250	70
Hardened Steels		46-55 Rc				30000	18	23500	37	20000	35	12000	35	9600	37	6000	38
Hardened Steels		55-60 Rc				30000	15	15000	15	10000	15	7000	15	5600	20	3500	18
Stainless Steel - Ferritic / Martensitic / PH	M	over 28 Rc	•	x	o	30000	26	30000	62	25000	85	17500	95	14000	120	8750	140

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			End Mill Diameter (inch)					
			Emulsion	Compressed Air	MQL	5/16		3/8		1/2	
						RPM (n)	IPM (vf)	RPM (n)	IPM (vf)	RPM (n)	IPM (vf)
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	7000	168	5800	125	4300	140
Hardened Steels	H	40-45 Rc	•	o	o	5800	68	4800	50	3625	45
Hardened Steels		46-55 Rc				4800	35	4000	30	3000	25
Hardened Steels		55-60 Rc				2800	15	2300	15	1750	10
Stainless Steel - Ferritic / Martensitic / PH	M	over 28 Rc	•	x	o	7000	170	5800	125	4300	140

Axial & Radial Depth - Roughing / Semi Finishing

30 - 40 Rc 10% of Diameter ap
40 - 50 Rc 5% of Diameter ap
50 - 60 Rc 4% of Diameter ap
Radial Step Over 25%-40% of Diameter

Axial & Radial Depth - Finishing

< 40 Rc 3% of Diameter ap
40 - 50 Rc 2% of Diameter ap
50 - 60 Rc 1% of Diameter ap
ae (step over) depends on finish requirement of the part.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

156 Series Recommended Cutting Data - Contouring - **Metric**

If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			End Mill Diameter (mm)											
			Emulsion	Compressed Air	MQL	0.5		1.0		1.5		2.0		3.0		4.0	
						RPM (n)	mm/min (vf)	RPM (n)	mm/min (vf)	RPM (n)	mm/min (vf)	RPM (n)	mm/min (vf)	RPM (n)	mm/min (vf)	RPM (n)	mm/min (vf)
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	30000	508	30000	683	25000	1575	17500	2133	14000	2392	8750	3050
Hardened Steels	H	40-45 Rc	•	o	o	30000	508	30000	608	23500	1450	22000	2442	14500	2283	11500	2233
Hardened Steels		46-55 Rc				30000	308	30000	458	23500	942	20000	892	12000	892	9600	942
Hardened Steels		55-60 Rc				30000	250	30000	383	15000	383	10000	383	7000	383	5600	508
Stainless Steel - Ferritic / Martensitic / PH	M	over 28 Rc	•	x	o	30000	508	30000	683	30000	1575	25000	2133	17500	2392	14000	3050

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			End Mill Diameter (mm)							
			Emulsion	Compressed Air	MQL	6.0		8.0		10.0		12.0	
						RPM (n)	mm/min (vf)	RPM (n)	mm/min (vf)	RPM (n)	mm/min (vf)	RPM (n)	mm/min (vf)
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	7000	3558	5800	4267	4300	3175	4300	3558
Hardened Steels	H	40-45 Rc	•	o	o	7250	1775	5800	1725	4800	1292	3625	1167
Hardened Steels		46-55 Rc				6000	967	4800	892	4000	758	3000	633
Hardened Steels		55-60 Rc				3500	458	2800	383	2300	383	1750	250
Stainless Steel - Ferritic / Martensitic / PH	M	over 28 Rc	•	x	o	8750	3558	7000	4267	5800	3175	4300	3558

Axial & Radial Depth - Roughing / Semi Finishing

30 - 40 Rc 10% of Diameter ap
40 - 50 Rc 5% of Diameter ap
50 - 60 Rc 4% of Diameter ap
Radial Step Over 25%-40% of Diameter

Axial & Radial Depth - Finishing

< 40 Rc 3% of Diameter ap
40 - 50 Rc 2% of Diameter ap
50 - 60 Rc 1% of Diameter ap
ae (step over) depends on finish requirement of the part.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

157 Series Recommended Cutting Data - Profile Milling - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible: Emulsion	Compressed Air	MQL	Profile Milling (ae)* 5%	10%	20%	30%	50%	End Mill Diameter (inch) 1/8	1/4	3/8	1/2	5/8
						*Axial depth during profile milling: OD < 1/4" .25D ap; OD > 1/4" 1D ap									
						2.3	1.8	1.2	1.1	1	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.				
						vc - SFM					fz - in/tooth				
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	•	•	•	600	550	500	450	400	.0011	.0022	.0035	.0042	.0059
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	•	•	•	600	550	500	450	400	.0011	.0022	.0035	.0042	.0059
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	550	500	450	400	375	.0011	.0020	.0033	.0040	.0055
Hardened Steels	H	40-50 Rc	•	o	o	360	340	300	280	260	.0007	.0014	.0024	.0030	.0040
Hardened Steels	H	50-55 Rc	•	o	o	360	340	300	280	260	.0004	.0008	.0016	.0018	.0024
Hardened Steels	H	>55 Rc	•	o	o	320	300	280	260	240	.0003	.0006	.0010	.0015	.0018
Stainless Steel - Ferritic	M	up to 28 Rc	•	x	o	550	525	500	450	425	.0010	.0020	.0033	.0040	.0055
Stainless Steel - Martensitic	M	up to 28 Rc	•	x	o	550	525	500	450	425	.0010	.0020	.0033	.0040	.0055
Stainless Steel - PH 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	550	525	500	450	425	.0010	.0020	.0033	.0040	.0055
High Temp Alloys Nimonics, Inconel, Monel, Hastelloy	S	up to 42 Rc	•	x	x	165	165	130	115	100	.0004	.0008	.0016	.0018	.0024
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	400	375	350	300	250	.0004	.0008	.0016	.0018	.0024

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

157 Series Recommended Cutting Data - Profile Milling - **Metric**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible: Emulsion	Compressed Air	MQL	Profile Milling (ae)* 5%	10%	20%	30%	50%	End Mill Diameter (mm) 3	6	8	10	12	16	20
						2.3	1.8	1.2	1.1	1	*Axial depth during profile milling: OD < 6mm .25D ap; OD > 6mm 1D ap. Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.						
						vc - m/min					fz - mm/tooth						
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	•	•	•	183	168	152	137	122	.0280	.0559	.0889	.1067	.1498	.1778	.2032
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	•	•	•	183	168	152	137	122	.0280	.0559	.0889	.1067	.1498	.1778	.2032
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	168	152	137	122	114	.0254	.0508	.0838	.1016	.1397	.1702	.1905
Hardened Steels	H	40-50 Rc	•	o	o	110	104	90	85	80	.0178	.0356	.0610	.0762	.1016	.1168	.1524
Hardened Steels	H	50-55 Rc	•	o	o	110	104	90	85	80	.0102	.0203	.0406	.0457	.0610	.0762	.0889
Hardened Steels	H	>55 Rc	•	o	o	100	90	85	80	75	.0076	.0152	.0254	.0381	.0457	.0559	.0635
Stainless Steel - Ferritic	M	up to 28 Rc	•	x	o	168	160	152	137	130	.0254	.0508	.0838	.1016	.1397	.1702	.1905
Stainless Steel - Martensitic	M	up to 28 Rc	•	x	o	168	160	152	137	130	.0254	.0508	.0838	.1016	.1397	.1702	.1905
Stainless Steel - PH 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	168	160	152	137	130	.0254	.0508	.0838	.1016	.1397	.1702	.1905
High Temp Alloys Nimonics, Inconel, Monel, Hastelloy	S	up to 42 Rc	•	x	x	50	50	40	35	30	.0102	.0203	.0406	.0457	.0610	.0762	.0889
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	122	114	107	90	75	.0102	.0203	.0406	.0457	.0610	.0762	.0889

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

157 Series Recommended Cutting Data - Slotting - **Inch**

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting**			End Mill Diameter (inch)				
			Emulsion	Compressed Air	MQL	25%	50%	100%* *Trochoidal Milling	1/8	1/4	3/8	1/2	5/8
						vc - SFM			**Axial Depth (ap) during slotting: OD > 1/4" .25D ap — fz - in/tooth				
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	•	•	•	480	480	400	.0005	.0011	.0017	.0021	.0029
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	•	•	•	480	480	400	.0005	.0011	.0017	.0020	.0029
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	420	420	380	.0005	.0010	.0016	.0020	.0027
Hardened Steels	H	40-50 Rc	•	o	o	350	350	300	.0003	.0006	.0012	.0015	.0020
Hardened Steels	H	50-55 Rc	•	o	o	180	180	150	.0002	.0004	.0008	.0009	.0012
Hardened Steels	H	>55 Rc	•	o	o	150	150	100	.00015	.0003	.0005	.0007	.0009
Stainless Steel - Ferritic	M	up to 28 Rc	•	x	o	420	420	400	.0005	.0010	.0016	.0020	.0027
Stainless Steel - Martensitic	M	up to 28 Rc	•	x	o	420	420	400	.0005	.0010	.0016	.0020	.0027
Stainless Steel - PH 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	400	400	380	.0005	.0010	.0016	.0020	.0027
High Temp Alloys Nimonics, Inconel, Monel, Hastelloy	S	up to 42 Rc	•	x	x	120	120	95	.0002	.0004	.0008	.0009	.0012
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	200	200	175	.0002	.0004	.0008	.0009	.0012

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

TuffCut DM®

157 Series Recommended Cutting Data - Slotting - **Metric**

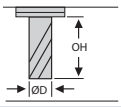
Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting**			End Mill Diameter (mm)						
			Emulsion	Compressed Air	MQL	25%	50%	100%* *Trochoidal Milling	3	6	8	10	12	16	20
									**Axial depth (ap) during slotting: OD > 6mm .25D ap						
						vc - m/min			fz - mm/tooth						
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	•	•	•	146	146	122	.0122	.0279	.0432	.0533	.0737	.0762	.1016
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	•	•	•	146	146	122	.0122	.0279	.0432	.0533	.0737	.0762	.1016
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	128	128	115	.0122	.0254	.0406	.0508	.0686	.0839	.0940
Hardened Steels	H	40-50 Rc	•	o	o	106	106	92	.0076	.0152	.0305	.0381	.0508	.0584	.0762
Hardened Steels	H	50-55 Rc	•	o	o	55	55	45	.0051	.0102	.0203	.0229	.0305	.0381	.0432
Hardened Steels	H	>55 Rc	•	o	o	45	45	30	.0038	.0076	.0127	.0178	.0229	.0279	.0305
Stainless Steel - Ferritic	M	up to 28 Rc	•	x	o	128	128	122	.0127	.0254	.0406	.0508	.0686	.0838	.0940
Stainless Steel - Martensitic	M	up to 28 Rc	•	x	o	128	128	122	.0127	.0254	.0406	.0508	.0686	.0838	.0940
Stainless Steel - PH 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	122	122	115	.0127	.0254	.0406	.0508	.0686	.0838	.0940
High Temp Alloys Nimonics, Inconel, Monel, Hastelloy	S	up to 42 Rc	•	x	x	36	36	30	.0051	.0102	.0203	.0229	.0305	.0381	.0432
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	60	60	55	.0051	.0102	.0203	.0229	.0305	.0381	.0432

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula: (Calculated Feed x Spindle Maximum)/Calculated Speed.

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

158 Series Recommended Cutting Data - High Feed Roughing - **Inch**



Workpiece Material Group		Material Type	Coolant		OH	Vc-SFM	Tool Diameter and Corner Radius (inch)								
							.0787 x R.0197			.1181 x R.0315			.1575 x R.0394		
							2.0 x R0.5			3.0 x R0.8			4.0 x R1.0		
			Compressed Air	Emulsion			Ap	Ae	Fz	Ap	Ae	Fz	Ap	Ae	Fz
Steel	P	Alloy & Tool Steel Below 260HB	•	o	3D	395	.0039	.020	.0039	.0063	.028	.0063	.0079	.039	.0079
					4D	360	.0035		.0039	.0055		.0063	.0071		.0079
					5D	330	.0035		.0039	.0055		.0063	.0067		.0079
					6D	310	.0028		.0039	.0043		.0063	.0055		.0079
					8D	280	.0024		.0039	.0039		.0063	.0047		.0079
					10D	230	.0020		.0039	.0031		.0063	.0039		.0079
		Pre-hardened Tool Steel Rc30-40	•	o	3D	310	.0031	.020	.0035	.0051	.028	.0055	.0063	.039	.0071
					4D	280	.0028		.0035	.0047		.0055	.0055		.0071
					5D	260	.0028		.0035	.0043		.0055	.0055		.0071
					6D	245	.0020		.0035	.0035		.0055	.0043		.0071
					8D	215	.0020		.0035	.0031		.0055	.0039		.0071
					10D	180	.0016		.0035	.0024		.0055	.0031		.0071
Stainless Steel	M	Stainless Steel 300 & PH series	x	•	3D	230	.0031	.020	.0035	.0051	.028	.0055	.0063	.039	.0071
					4D	215	.0028		.0035	.0047		.0055	.0055		.0071
					5D	200	.0028		.0035	.0043		.0055	.0055		.0071
					6D	180	.0020		.0035	.0035		.0055	.0043		.0071
					8D	165	.0020		.0035	.0031		.0055	.0039		.0071
					10D	130	.0016		.0035	.0024		.0055	.0031		.0071
Special Alloys	S	High Temp Alloys	x	•	3D	100	.0012	.016	.0020	.0016	.024	.0031	.0020	.032	.0039
					4D	80	.0008		.0020	.0016		.0031	.0020		.0039
					5D	80	.0008		.0020	.0012		.0031	.0016		.0039
					6D	80	.0008		.0020	.0012		.0031	.0012		.0039
					8D	65	.0008		.0020	.0008		.0031	.0012		.0039
					10D	65	.0004		.0020	.0008		.0031	.0012		.0039
		Titanium Alloys	x	•	3D	230	.0024	.016	.0031	.0035	.024	.0047	0043	.032	.0059
					4D	215	.0020		.0031	.0031		.0047	.0039		.0059
					5D	200	.0020		.0031	.0028		.0047	.0035		.0059
					6D	180	.0016		.0031	.0024		.0047	.0028		.0059
					8D	165	.0012		.0031	.0020		.0047	.0028		.0059
					10D	130	.0012		.0031	.0016		.0047	.0024		.0059
Cast Iron	K	GG, GGG	•	•	3D	395	.0039	.020	.0039	.0063	.028	.0063	.0079	.039	.0079
					4D	360	.0035		.0039	.0055		.0063	.0071		.0079
					5D	330	.0035		.0039	.0055		.0063	.0067		.0079
					6D	310	.0028		.0039	.0043		.0063	.0055		.0079
					8D	280	.0024		.0039	.0039		.0063	.0047		.0079
					10D	230	.0020		.0039	.0031		.0063	.0039		.0079
Hardened Steels	H	Hardened Steels Rc45-50	•	o	3D	260	.0024	.020	.0028	.0039	.028	.0043	.0047	.039	.0055
					4D	230	.0020		.0028	.0035		.0043	.0043		.0055
					5D	230	.0020		.0028	.0031		.0043	.0039		.0055
					6D	215	.0016		.0028	.0028		.0043	.0031		.0055
					8D	180	.0016		.0028	.0024		.0043	.0028		.0055
					10D	165	.0012		.0028	.0020		.0043	.0024		.0055
		Hardened Steels Rc50-55	•	x	3D	200	.0020	.016	.0020	.0031	.024	.0031	.0039	.032	.0039
					4D	180	.0020		.0020	.0028		.0031	.0035		.0039
					5D	165	.0016		.0020	.0028		.0031	.0035		.0039
					6D	165	.0012		.0020	.0020		.0031	.0028		.0039
					8D	130	.0012		.0020	.0020		.0031	.0024		.0039
					10D	115	.0012		.0020	.0016		.0031	.0020		.0039

Coolant: • Preferred o Possible x Not Possible

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

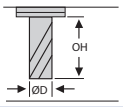
158 Series Recommended Cutting Data - High Feed Roughing - **Inch**

Tool Diameter and Corner Radius (inch)														
.2362 x R.059			.3150 x R.0787			.3937 x R.0787			.4724 X R.0787			.6299 x R.1181		
6.0 x R1.5			8.0 x R2.0			10.0 x R2.0			12 x R2.0			16 x R3.0		
Ap	Ae	Fz	Ap	Ae	Fz	Ap	Ae	Fz	Ap	Ae	Fz	Ap	Ae	Fz
.0118	.059	.0118	.0157	.079	.0157	.0157	.118	.0157	.0157	.157	.0157	.0236	.197	.0236
.0106		.0118	.0142		.0157	.0142		.0157	.0142		.0157	.0213		.0236
.0102		.0118	.0134		.0157	.0134		.0157	.0134		.0157	.0201		.0236
.0079		.0118	.0106		.0157	.0106		.0157	.0106		.0157	.0161		.0236
.0071		.0118	.0094		.0157	.0094		.0157	.0094		.0157	.0142		.0236
.0059		.0118	.0079		.0157	.0079		.0157	.0079		.0157	.0118		.0236
.0094	.059	.0106	.0126	.079	.0142	.0126	.118	.0142	.0126	.157	.0142	.0189	.197	.0213
.0087		.0106	.0114		.0142	.0114		.0142	.0114		.0142	.0169		.0213
.0079		.0106	.0106		.0142	.0106		.0142	.0106		.0142	.0161		.0213
.0063		.0106	.0087		.0142	.0087		.0142	.0087		.0142	.0130		.0213
.0055		.0106	.0075		.0142	.0075		.0142	.0075		.0142	.0114		.0213
.0047		.0106	.0063		.0142	.0063		.0142	.0063		.0142	.0110		.0213
.0094	.059	.0106	.0126	.079	.0142	.0126	.118	.0142	.0126	.157	.0142	.0189	.197	.0213
.0087		.0106	.0114		.0142	.0114		.0142	.0114		.0142	.0169		.0213
.0079		.0106	.0106		.0142	.0106		.0142	.0106		.0142	.0161		.0213
.0063		.0106	.0087		.0142	.0087		.0142	.0087		.0142	.0130		.0213
.0055		.0106	.0075		.0142	.0075		.0142	.0075		.0142	.0114		.0213
.0047		.0106	.0063		.0142	.0063		.0142	.0063		.0142	.0094		.0213
.0031	.048	.0059	.0039	.063	.0079	.0039	.098	.0079	.0039	.138	.0079	.0059	.169	.0118
.0028		.0059	.0035		.0079	.0035		.0079	.0035		.0079	.0055		.0118
.0024		.0059	.0035		.0079	.0035		.0079	.0035		.0079	.0051		.0118
.0020		.0059	.0028		.0079	.0028		.0079	.0028		.0079	.0039		.0118
.0020		.0059	.0024		.0079	.0024		.0079	.0024		.0079	.0035		.0118
.0016		.0059	.0020		.0079	.0020		.0079	.0020		.0079	.0031		.0118
.0067	.048	.0091	.0087	.063	.0118	.0087	.098	.0118	.0087	.138	.0118	.0130	.169	.0177
.0059		.0091	.0079		.0118	.0079		.0118	.0079		.0118	.0118		.0177
.0055		.0091	.0075		.0118	.0075		.0118	.0075		.0118	.0110		.0177
.0043		.0091	.0059		.0118	.0059		.0118	.0059		.0118	.0087		.0177
.0039		.0091	.0051		.0118	.0051		.0118	.0051		.0118	.0079		.0177
.0031		.0091	.0043		.0118	.0043		.0118	.0043		.0118	.0067		.0177
.0118	.059	.0118	.0157	.079	.0157	.0157	.118	.0157	.0157	.157	.0157	.0236	.197	.0236
.0106		.0118	.0142		.0157	.0142		.0157	.0142		.0157	.0213		.0236
.0102		.0118	.0134		.0157	.0134		.0157	.0134		.0157	.0201		.0236
.0079		.0118	.0106		.0157	.0106		.0157	.0106		.0157	.0161		.0236
.0071		.0118	.0094		.0157	.0094		.0157	.0094		.0157	.0142		.0236
.0059		.0118	.0079		.0157	.0079		.0157	.0079		.0157	.0118		.0236
.0071	.059	.0083	.0094	.079	.0110	.0094	.118	.0110	.0094	.157	.0110	.0142	.197	.0165
.0063		.0083	.0087		.0110	.0087		.0110	.0087		.0110	.0126		.0165
.0059		.0083	.0079		.0110	.0079		.0110	.0079		.0110	.0122		.0165
.0047		.0083	.0063		.0110	.0063		.0110	.0063		.0110	.0094		.0165
.0043		.0083	.0055		.0110	.0055		.0110	.0055		.0110	.0087		.0165
.0035		.0083	.0047		.0110	.0047		.0110	.0047		.0110	.0071		.0165
.0059	.048	.0059	.0079	.063	.0079	.0079	.098	.0079	.0079	.138	.0079	.0118	.169	.0118
.0055		.0059	.0071		.0079	.0071		.0079	.0071		.0079	.0106		.0118
.0051		.0059	.0067		.0079	.0067		.0079	.0067		.0079	.0102		.0118
.0039		.0059	.0055		.0079	.0055		.0079	.0055		.0079	.0079		.0118
.0035		.0059	.0047		.0079	.0047		.0079	.0047		.0079	.0071		.0118
.0031		.0059	.0039		.0079	.0039		.0079	.0039		.0079	.0059		.0118

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

158 Series Recommended Cutting Data - High Feed Roughing - **Metric**



Workpiece Material Group		Material Type	Coolant: Compressed Air	Coolant: Emulsion	OH	Vc-M/Min	Tool Diameter and Corner Radius (mm) 2.0 x R0.5 Ap	Ae	Fz	3.0 x R0.8 Ap	Ae	Fz	4.0 x R1.0 Ap	Ae	Fz
Steel	P	Alloy & Tool Steel Below 260HB	•	o	3D	120	0.10	0.5	0.10	0.16	0.7	0.16	0.20	1.0	0.20
					4D	110	0.09		0.10	0.14		0.16	0.18		0.20
					5D	100	0.09		0.10	0.14		0.16	0.17		0.20
					6D	95	0.07		0.10	0.11		0.16	0.14		0.20
					8D	85	0.06		0.10	0.10		0.16	0.12		0.20
					10D	70	0.05		0.10	0.08		0.16	0.10		0.20
		Pre-hardened Tool Steel Rc30-40	•	o	3D	95	0.08	0.5	0.09	0.13	0.7	0.14	0.16	1.0	0.18
					4D	85	0.07		0.09	0.12		0.14	0.14		0.18
					5D	80	0.07		0.09	0.11		0.14	0.14		0.18
					6D	75	0.05		0.09	0.09		0.14	0.11		0.18
					8D	65	0.05		0.09	0.08		0.14	0.10		0.18
					10D	55	0.04		0.09	0.06		0.14	0.08		0.18
Stainless Steel	M	Stainless Steel 300 & PH series	x	•	3D	70	0.08	0.5	0.09	0.13	0.7	0.14	0.16	1.0	0.18
					4D	65	0.07		0.09	0.12		0.14	0.14		0.18
					5D	60	0.07		0.09	0.11		0.14	0.14		0.18
					6D	55	0.05		0.09	0.09		0.14	0.11		0.18
					8D	50	0.05		0.09	0.08		0.14	0.10		0.18
					10D	40	0.04		0.09	0.06		0.14	0.08		0.18
Special Alloys	S	High Temp Alloys	x	•	3D	30	0.03	0.4	0.05	0.04	0.6	0.08	0.05	0.8	0.10
					4D	25	0.02		0.05	0.04		0.08	0.05		0.10
					5D	25	0.02		0.05	0.03		0.08	0.04		0.10
					6D	25	0.02		0.05	0.03		0.08	0.03		0.10
					8D	20	0.02		0.05	0.02		0.08	0.03		0.10
					10D	20	0.01		0.05	0.02		0.08	0.03		0.10
		Titanium Alloys	x	•	3D	70	0.06	0.4	0.08	0.09	0.6	0.12	0.11	0.8	0.15
					4D	65	0.05		0.08	0.08		0.12	0.10		0.15
					5D	60	0.05		0.08	0.07		0.12	0.09		0.15
					6D	55	0.04		0.08	0.06		0.12	0.07		0.15
					8D	50	0.03		0.08	0.05		0.12	0.07		0.15
					10D	40	0.03		0.08	0.04		0.12	0.06		0.15
Cast Iron	K	GG, GGG	•	•	3D	120	0.10	0.5	0.10	0.16	0.7	0.16	0.20	1.0	0.20
					4D	110	0.09		0.10	0.14		0.16	0.18		0.20
					5D	100	0.09		0.10	0.14		0.16	0.17		0.20
					6D	95	0.07		0.10	0.11		0.16	0.14		0.20
					8D	85	0.06		0.10	0.10		0.16	0.12		0.20
					10D	70	0.05		0.10	0.08		0.16	0.10		0.20
Hardened Steels	H	Hardened Steels Rc45-50	•	o	3D	80	0.06	0.5	0.07	0.10	0.7	0.11	0.12	1.0	0.14
					4D	70	0.05		0.07	0.09		0.11	0.11		0.14
					5D	70	0.05		0.07	0.08		0.11	0.10		0.14
					6D	65	0.04		0.07	0.07		0.11	0.08		0.14
					8D	55	0.04		0.07	0.06		0.11	0.07		0.14
					10D	50	0.03		0.07	0.05		0.11	0.06		0.14
		Hardened Steels Rc50-55	•	x	3D	60	0.05	0.4	0.05	0.08	0.6	0.08	0.10	0.8	0.10
					4D	55	0.05		0.05	0.07		0.08	0.09		0.10
					5D	50	0.04		0.05	0.07		0.08	0.09		0.10
					6D	50	0.03		0.05	0.05		0.08	0.07		0.10
					8D	40	0.03		0.05	0.05		0.08	0.06		0.10
					10D	35	0.03		0.05	0.04		0.08	0.05		0.10

Coolant: • Preferred o Possible x Not Possible

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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Back to Table of Contents

TuffCut DM®

158 Series Recommended Cutting Data - High Feed Roughing - **Metric**

Tool Diameter and Corner Radius (mm)														
6.0 x R1.5			8.0 x R2.0			10.0 x R2.0			12 x R2.0			16 x R3.0		
Ap	Ae	Fz	Ap	Ae	Fz	Ap	Ae	Fz	Ap	Ae	Fz	Ap	Ae	Fz
0.30	1.5	0.30	0.40	2.0	0.40	0.40	3.0	0.40	0.40	4.0	0.40	0.60	5.0	0.60
0.27		0.30	0.36		0.40	0.36		0.40	0.36		0.40	0.54		0.60
0.26		0.30	0.34		0.40	0.34		0.40	0.34		0.40	0.51		0.60
0.20		0.30	0.27		0.40	0.27		0.40	0.27		0.40	0.41		0.60
0.18		0.30	0.24		0.40	0.24		0.40	0.24		0.40	0.36		0.60
0.15		0.30	0.20		0.40	0.20		0.40	0.20		0.40	0.30		0.60
0.24	1.5	0.27	0.32	2.0	0.36	0.32	3.0	0.36	0.32	4.0	0.36	0.48	5.0	0.54
0.22		0.27	0.29		0.36	0.29		0.36	0.29		0.36	0.43		0.54
0.20		0.27	0.27		0.36	0.27		0.36	0.27		0.36	0.41		0.54
0.16		0.27	0.22		0.36	0.22		0.36	0.22		0.36	0.33		0.54
0.14		0.27	0.19		0.36	0.19		0.36	0.19		0.36	0.29		0.54
0.12		0.27	0.16		0.36	0.16		0.36	0.16		0.36	1.28		0.54
0.24	1.5	0.27	0.32	2.0	0.36	0.32	3.0	0.36	0.32	4.0	0.36	0.48	5.0	0.54
0.22		0.27	0.29		0.36	0.29		0.36	0.29		0.36	0.43		0.54
0.20		0.27	0.27		0.36	0.27		0.36	0.27		0.36	0.41		0.54
0.16		0.27	0.22		0.36	0.22		0.36	0.22		0.36	0.33		0.54
0.14		0.27	0.19		0.36	0.19		0.36	0.19		0.36	0.29		0.54
0.12		0.27	0.16		0.36	0.16		0.36	0.16		0.36	0.24		0.54
0.08	1.2	0.15	0.10	1.6	0.20	0.10	2.5	0.20	0.10	3.5	0.20	0.15	4.3	0.30
0.07		0.15	0.09		0.20	0.09		0.20	0.09		0.20	0.14		0.30
0.06		0.15	0.09		0.20	0.09		0.20	0.09		0.20	0.13		0.30
0.05		0.15	0.07		0.20	0.07		0.20	0.07		0.20	0.10		0.30
0.05		0.15	0.06		0.20	0.06		0.20	0.06		0.20	0.09		0.30
0.04		0.15	0.05		0.20	0.05		0.20	0.05		0.20	0.08		0.30
0.17	1.2	0.23	0.22	1.6	0.30	0.22	2.5	0.30	0.22	3.5	0.30	0.33	4.3	0.45
0.15		0.23	0.20		0.30	0.20		0.30	0.20		0.30	0.30		0.45
0.14		0.23	0.19		0.30	0.19		0.30	0.19		0.30	0.28		0.45
0.11		0.23	0.15		0.30	0.15		0.30	0.15		0.30	0.22		0.45
0.10		0.23	0.13		0.30	0.13		0.30	0.13		0.30	0.20		0.45
0.08		0.23	0.11		0.30	0.11		0.30	0.11		0.30	0.17		0.45
0.30	1.5	0.30	0.40	2.0	0.4	0.40	3.0	0.40	0.40	4.0	0.40	0.60	5.0	0.6
0.27		0.30	0.36		0.4	0.36		0.40	0.36		0.40	0.54		0.6
0.26		0.30	0.34		0.4	0.34		0.40	0.34		0.40	0.51		0.6
0.20		0.30	0.27		0.4	0.27		0.40	0.27		0.40	0.41		0.6
0.18		0.30	0.24		0.4	0.24		0.40	0.24		0.40	0.36		0.6
0.15		0.30	0.20		0.4	0.20		0.40	0.20		0.40	0.30		0.6
0.18	1.5	0.21	0.24	2.0	0.28	0.24	3.0	0.28	0.24	4.0	0.28	0.36	5.0	0.42
0.16		0.21	0.22		0.28	0.22		0.28	0.22		0.28	0.32		0.42
0.15		0.21	0.20		0.28	0.20		0.28	0.20		0.28	0.31		0.42
0.12		0.21	0.16		0.28	0.16		0.28	0.16		0.28	0.24		0.42
0.11		0.21	0.14		0.28	0.14		0.28	0.14		0.28	0.22		0.42
0.09		0.21	0.12		0.28	0.12		0.28	0.12		0.28	0.18		0.42
0.15	1.2	0.15	0.20	1.6	0.20	0.20	2.5	0.20	0.20	3.5	0.20	0.30	4.3	0.30
0.14		0.15	0.18		0.20	0.18		0.20	0.18		0.20	0.27		0.30
0.13		0.15	0.17		0.20	0.17		0.20	0.17		0.20	0.26		0.30
0.10		0.15	0.14		0.20	0.14		0.20	0.14		0.20	0.20		0.30
0.09		0.15	0.12		0.20	0.12		0.20	0.12		0.20	0.18		0.30
0.08		0.15	0.10		0.20	0.10		0.20	0.10		0.20	0.15		0.30

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

158 Series Recommended Cutting Data - **Inch**

Workpiece Material Group		Material Type	Coolant • Preferred o Possible x Not Possible		1 x D / 0.1 x D	0.1 x D / 1 x D	2D/3D HFR a_p / a_e
					Slotting	Profiling	2D/3D HSC
			Compressed Air	Emulsion	Vc-SFM		
Steels	P	Alloy & Tool Steels Below 260HB	•	o	330	590	655
		Pre-hardened Tools Steel Rc30-40	•	•	230	395	590
Stainless Steels	M	Stainless Steels 300 & PH series	x	•	260	330	490
Special Alloys	S	High Temp Alloys	x	•	80	165	230
		Titanium Alloys	x	•	195	330	395
Cast Irons	K	GG, GGG	•	•	330	655	720
Hardened Steels	H	Hardened Steels Rc45-50	•	o	245	295	460
		Hardened Steels Rc50-55	•	o	130	230	395

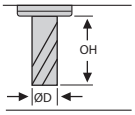
Workpiece Material Group		Material Type	Operation	Tool Diameter (inch)							
				.0787	.1181	.1575	.2362	.3150	.3937	.4724	.6299
				2.0	3.0	4.0	6.0	8.0	10.0	12.0	16.0
				fz-in/tooth							
Steels	P	Alloy & Tool Steels Below 260HB	Slotting	.0004	.0006	.0008	.0012	.0016	.0020	.0024	.0031
			Profiling	.0008	.0012	.0016	.0024	.0031	.0039	.0047	.0063
			HSC 2D/3D	.0024	.0035	.0047	.0071	.0094	.0118	.0142	.0189
		Pre-hardened Tool Steels Rc30-40	Slotting	.0003	.0005	.0006	.0009	.0013	.0016	.0019	.0025
			Profiling	.0006	.0009	.0013	.0019	.0025	.0031	.0038	.0050
			HSC 2D/3D	.0020	.0030	.0039	.0059	.0079	.0098	.0118	.0157
Stainless Steels	M	Stainless Steel 300 & PH series	Slotting	.0003	.0004	.0005	.0008	.0010	.0013	.0016	.0021
			Profiling	.0005	.0008	.0010	.0016	.0021	.0026	.0031	.0042
			HSC 2D/3D	.0016	.0024	.0031	.0047	.0063	.0079	.0094	.0126
Special Alloys	S	High Temp Alloys	Slotting	.0002	.0002	.0003	.0005	.0007	.0008	.0010	.0013
			Profiling	.0003	.0005	.0007	.0010	.0013	.0017	.0020	.0026
			HSC 2D/3D	.0008	.0012	.0016	.0024	.0031	.0039	.0047	.0063
		Titanium Alloys	Slotting	.0002	.0004	.0005	.0007	.0009	.0012	.0014	.0019
			Profiling	.0005	.0007	.0009	.0014	.0019	.0024	.0028	.0038
			HSC 2D/3D	.0016	.0024	.0031	.0047	.0063	.0079	.0094	.0126
Cast Irons	K	GG, GGG	Slotting	.0004	.0006	.0008	.0012	.0016	.0020	.0024	.0031
			Profiling	.0008	.0012	.0016	.0024	.0031	.0039	.0047	.0063
			HSC 2D/3D	.0024	.0035	.0047	.0071	.0094	.0118	.0142	.0189
Hardened Steels	H	Hardened Steels Rc45-50	Slotting	.0003	.0004	.0005	.0008	.0010	.0013	.0016	.0021
			Profiling	.0005	.0008	.0010	.0016	.0021	.0026	.0031	.0042
			HSC 2D/3D	.0016	.0024	.0031	.0047	.0063	.0079	.0094	.0126
		Hardened Steels Rc50-55	Slotting	.0002	.0003	.0004	.0006	.0008	.0010	.0012	.0016
			Profiling	.0004	.0006	.0008	.0012	.0016	.0020	.0024	.0031
			HSC 2D/3D	.0012	.0018	.0024	.0035	.0047	.0059	.0071	.0094

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

158 Series Recommended Cutting Data - **Inch**

Depth of Cut
High Feed Roughing 2D/3D Axial & Radial



Workpiece Material Group		Material Type	OH	Tool Diameter (inch)							
				.0787	.1181	.1575	.2362	.3150	.3937	.4724	.6299
				2.0	3.0	4.0	6.0	8.0	10.0	12.0	16.0
				Ap-in / Ae-in							
Steels	P	Alloy & Tool Steels Below 260HB	3D-4D	.0024	.0035	.0047	.0071	.0094	.0118	.0142	.0189
			5D-6D	.0020	.0028	.0039	.0055	.0075	.0094	.0114	.0150
			8D-10D	.0016	.0020	.0028	.0043	.0055	.0071	.0087	.0114
		Pre-hardened Tool Steels Rc30-40	3D-4D	.0024	.0035	.0047	.0071	.0094	.0118	.0142	.0189
			5D-6D	.0020	.0028	.0039	.0055	.0075	.0094	.0114	.0150
			8D-10D	.0016	.0020	.0028	.0043	.0055	.0071	.0087	.0114
Stainless Steels	M	Stainless Steel 300 & PH series	3D-4D	.0024	.0035	.0047	.0071	.0094	.0118	.0142	.0189
			5D-6D	.0020	.0028	.0039	.0055	.0075	.0094	.0114	.0150
			8D-10D	.0016	.0020	.0028	.0043	.0055	.0071	.0087	.0114
Special Alloys	S	High Temp Alloys	3D-4D	.0016	.0024	.0031	.0047	.0063	.0079	.0094	.0126
			5D-6D	.0012	.0020	.0024	.0039	.0051	.0063	.0075	.0102
			8D-10D	.0008	.0016	.0020	.0028	.0039	.0047	.0055	.0075
		Titanium Alloys	3D-4D	.0024	.0035	.0047	.0071	.0094	.0118	.0142	.0189
			5D-6D	.0020	.0028	.0039	.0055	.0075	.0094	.0114	.0150
			8D-10D	.0016	.0020	.0028	.0043	.0055	.0071	.0087	.0114
Cast Irons	K	GG, GGG	3D-4D	.0024	.0035	.0047	.0071	.0094	.0118	.0142	.0189
			5D-6D	.0020	.0028	.0039	.0055	.0075	.0094	.0114	.0150
			8D-10D	.0016	.0020	.0028	.0043	.0055	.0071	.0087	.0114
Hardened Steels	H	Hardened Steels Rc45-50	3D-4D	.0020	.0031	.0039	.0059	.0079	.0098	.0118	.0157
			5D-6D	.0016	.0024	.0031	.0047	.0063	.0079	.0094	.0126
			8D-10D	.0012	.0020	.0024	.0035	.0047	.0059	.0071	.0094
		Hardened Steels Rc50-55	3D-4D	.0016	.0024	.0031	.0047	.0063	.0079	.0094	.0126
			5D-6D	.0012	.0020	.0024	.0039	.0051	.0063	.0075	.0102
			8D-10D	.0008	.0016	.0020	.0028	.0039	.0047	.0055	.0075

Notes:

For profile machining
adjust radial cut (Ae)

OH	Ae (x Ø)
3D-4D	0.10
5D-6D	0.07
8D-10D	0.05

For slotting
adjust axial cut (Ap)

OH	Ap (x Ø)
3D-4D	0.10
5D-6D	0.07
8D-10D	0.05

Radial Cut (Ae)	Chip thickness Compensation factor
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

158 Series Recommended Cutting Data - **Metric**

Workpiece Material Group		Material Type	Coolant • Preferred o Possible x Not Possible		1 x D, 0.1 x D	0.1 x D, 1 x D	2D/3D HFR ap, ae
					Slotting	Profiling	2D/3D HSC
			Compressed Air	Emulsion	Vc-M/Min		
Steels	P	Alloy & Tool Steels Below 260HB	•	o	100	180	200
		Pre-hardened Tools Steel Rc30-40	•	•	70	120	180
Stainless Steels	M	Stainless Steels 300 & PH series	x	•	80	100	150
Special Alloys	S	High Temp Alloys	x	•	25	50	70
		Titanium Alloys	x	•	60	100	120
Cast Irons	K	GG, GGG	•	•	100	200	220
Hardened Steels	H	Hardened Steels Rc45-50	•	o	75	90	140
		Hardened Steels Rc50-55	•	o	40	70	120

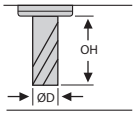
Workpiece Material Group		Material Type	Operation	Tool Diameter (mm)							
				2.0	3.0	4.0	6.0	8.0	10.0	12.0	16.0
				fz-mm/tooth							
Steels	P	Alloy & Tool Steels Below 260HB	Slotting	0.010	0.015	0.020	0.030	0.040	0.050	0.060	0.080
			Profiling	0.020	0.030	0.040	0.060	0.080	0.100	0.120	0.160
			HSC 2D/3D	0.060	0.090	0.120	0.180	0.240	0.300	0.360	0.480
		Pre-hardened Tool Steels Rc30-40	Slotting	0.008	0.012	0.016	0.024	0.032	0.040	0.048	0.064
			Profiling	0.016	0.024	0.032	0.048	0.064	0.080	0.096	0.128
			HSC 2D/3D	0.050	0.075	0.100	0.150	0.200	0.250	0.300	0.400
Stainless Steels	M	Stainless Steel 300 & PH series	Slotting	0.007	0.010	0.013	0.020	0.026	0.033	0.040	0.053
			Profiling	0.013	0.020	0.026	0.040	0.053	0.066	0.079	0.106
			HSC 2D/3D	0.040	0.060	0.080	0.120	0.160	0.200	0.240	0.320
Special Alloys	S	High Temp Alloys	Slotting	0.004	0.006	0.008	0.013	0.017	0.021	0.025	0.034
			Profiling	0.008	0.013	0.017	0.025	0.034	0.042	0.050	0.067
			HSC 2D/3D	0.020	0.030	0.040	0.060	0.080	0.100	0.120	0.160
		Titanium Alloys	Slotting	0.006	0.009	0.012	0.018	0.024	0.030	0.036	0.048
			Profiling	0.012	0.018	0.024	0.036	0.048	0.060	0.072	0.096
			HSC 2D/3D	0.040	0.060	0.080	0.120	0.160	0.200	0.240	0.320
Cast Irons	K	GG, GGG	Slotting	0.010	0.015	0.020	0.030	0.040	0.050	0.060	0.080
			Profiling	0.020	0.030	0.040	0.060	0.080	0.100	0.120	0.160
			HSC 2D/3D	0.060	0.090	0.120	0.180	0.240	0.300	0.360	0.480
Hardened Steels	H	Hardened Steels Rc45-50	Slotting	0.007	0.010	0.013	0.020	0.026	0.033	0.040	0.053
			Profiling	0.013	0.020	0.026	0.040	0.053	0.066	0.079	0.106
			HSC 2D/3D	0.040	0.060	0.080	0.120	0.160	0.200	0.240	0.320
		Hardened Steels Rc50-55	Slotting	0.005	0.008	0.010	0.015	0.020	0.025	0.030	0.040
			Profiling	0.010	0.015	0.020	0.030	0.040	0.050	0.060	0.080
			HSC 2D/3D	0.030	0.045	0.060	0.090	0.120	0.150	0.180	0.240

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut DM®

158 Series Recommended Cutting Data - **Metric**

Depth of Cut
High Feed Roughing 2D/3D Axial & Radial



Workpiece Material Group		Material Type	OH	Tool Diameter (mm)							
				2.0	3.0	4.0	6.0	8.0	10.0	12.0	16.0
				Ap-mm / Ae-mm							
Steels	P	Alloy & Tool Steels Below 260HB	3D-4D	0.06	0.09	0.12	0.18	0.24	0.30	0.36	0.48
			5D-6D	0.05	0.07	0.10	0.14	0.19	0.24	0.29	0.38
			8D-10D	0.04	0.05	0.07	0.11	0.14	0.18	0.22	0.29
		Pre-hardened Tool Steels Rc30-40	3D-4D	0.06	0.09	0.12	0.18	0.24	0.30	0.36	0.48
			5D-6D	0.05	0.07	0.10	0.14	0.19	0.24	0.29	0.38
			8D-10D	0.04	0.05	0.07	0.11	0.14	0.18	0.22	0.29
Stainless Steels	M	Stainless Steel 300 & PH series	3D-4D	0.06	0.09	0.12	0.18	0.24	0.30	0.36	0.48
			5D-6D	0.05	0.07	0.10	0.14	0.19	0.24	0.29	0.38
			8D-10D	0.04	0.05	0.07	0.11	0.14	0.18	0.22	0.29
Special Alloys	S	High Temp Alloys	3D-4D	0.04	0.06	0.08	0.12	0.16	0.20	0.24	0.32
			5D-6D	0.03	0.05	0.06	0.10	0.13	0.16	0.19	0.26
			8D-10D	0.02	0.04	0.05	0.07	0.10	0.12	0.14	0.19
		Titanium Alloys	3D-4D	0.06	0.09	0.12	0.18	0.24	0.30	0.36	0.48
			5D-6D	0.05	0.07	0.10	0.14	0.19	0.24	0.29	0.38
			8D-10D	0.04	0.05	0.07	0.11	0.14	0.18	0.22	0.29
Cast Irons	K	GG, GGG	3D-4D	0.06	0.09	0.12	0.18	0.24	0.30	0.36	0.48
			5D-6D	0.05	0.07	0.10	0.14	0.19	0.24	0.29	0.38
			8D-10D	0.04	0.05	0.07	0.11	0.14	0.18	0.22	0.29
Hardened Steels	H	Hardened Steels Rc45-50	3D-4D	0.05	0.08	0.10	0.15	0.20	0.25	0.30	0.40
			5D-6D	0.04	0.06	0.08	0.12	0.16	0.20	0.24	0.32
			8D-10D	0.03	0.05	0.06	0.09	0.12	0.15	0.18	0.24
		Hardened Steels Rc50-55	3D-4D	0.04	0.06	0.08	0.12	0.16	0.20	0.24	0.32
			5D-6D	0.03	0.05	0.06	0.10	0.13	0.16	0.19	0.26
			8D-10D	0.02	0.04	0.05	0.07	0.10	0.12	0.14	0.19

Notes:

For profile machining
adjust radial cut (Ae)

OH	Ae (x Ø)
3D-4D	0.10
5D-6D	0.07
8D-10D	0.05

For slotting
adjust axial cut (Ap)

OH	Ap (x Ø)
3D-4D	0.10
5D-6D	0.07
8D-10D	0.05

Radial Cut (Ae)	Chip thickness Compensation factor
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

QUALITY

intertek
Total Quality. Assured.

CERTIFICATE
OF REGISTRATION

This is to certify that the management system of:

M.A. Ford Mfg. Co., Inc.

Main Site: 7737 N.W. Boulevard
Davenport, Iowa 52808
United States

has been registered by Intertek as conforming to the requirements of:

ISO 9001:2015

The management system is applicable to:

The design and manufacture of precision rotary cutting tools.

Certificate Number:
98-1247g

Initial Certification Date:
30 October 1998

Date of Certification Decision:
02 September 2021

Issuing Date:
02 September 2021

Valid Until:
10 September 2024

ANAB
ACCREDITED
MANAGEMENT SYSTEMS CERTIFICATION BODY

Calin Moldovean
President, Business Assurance

Intertek Testing Services NA, Inc.
900 Chelmsford Street, Lowell
MA 01851, USA

In the issuance of this certificate, Intertek assumes no liability to any party other than to the Client, and then only in accordance with the agreed upon Certification Agreement. This certificate's validity is subject to the organization maintaining their system in accordance with Intertek's requirements for systems certification. Validity may be confirmed via email at certificate.validation@intertek.com or by scanning the code to the right with a smartphone. The certificate remains the property of Intertek, to whom it must be returned upon request.

The M.A. Ford® Quality Policy is:

Know our customers.
Know their requirements.
Make continual improvements in satisfying those requirements.

These are the responsibilities of every individual who works at M.A. Ford®.

Robert Hill, CEO

ALtima®
Aluminum Titanium Nitride (AlTiN). ALtima® is the original high performance coating. This coating allows tools to be run at higher speeds and feeds in a wide array of materials. Also, it allows the option of running tools dry due to the high oxidation temperature of the coating.

ALtima® Plus
This Aluminum Titanium Nitride (AlTiN) multi-layer coating has optimized coating structure, with pre and post treatment of the coating for optimized high performance drilling in any ferrous material.

ALtima® Blaze
Aluminum Chromium Nitride (AlCrN). ALtima® Blaze is designed to allow higher material removal rates. This coating has a higher oxidation temperature than a typical TiAlN coating. It has shown very good results in nickel alloys, titanium, and other difficult to machine materials. Tools coated with ALtima® Blaze can be used in dry machining.

ALtima® Micro
An ultra thin, nano structured, AlCrN coating developed specifically for micro tool applications.

ALtima® Xtreme
Designed for high speed and dry machining.

ALtima® Q
A proprietary coating designed to allow for extreme metal removal rates in a broad range of materials such as steels, stainless steels,titanium, & exotic alloys.

Fordlube
Titanium DiBoride (TiB_2) is a unique coating with low Aluminum affinity, smooth surface finish and high hardness. It is ideal for Aluminum and Magnesium alloys as it prevents build-up on cutting edge, provides superior chip flow along with extended wear resistance.

Gem+
Recommended for aluminum and aluminum alloys up to 12% Si, non-ferrous metals and composites. Gem+ provides excellent wear resistance and maintains sharp cutting edges.

GemX
A CVD diamond coating for composites and aluminum that offers the maximum hardness and wear resistance of any of our coatings.

TiN
Titanium Nitride (TiN). TiN coating has shown good results in low carbon steels and many iron-based applications. It is a very popular coating used in the industry today.

TiCN
Titanium Carbonitride (TiCN). TiCN is a multi-layer coating. Because of the multi-layer composition, TiCN is tougher than TiN, even though TiCN is harder. The added toughness of the TiCN coating makes it a good choice for mechanically stressed edges like in end mill applications. The higher hardness makes TiCN a good choice for abrasive applications where higher wear resistance is required.

CERAedge®
CERAedge® is a unique coating that provides excellent performance in high Si Aluminum, Copper, and other abrasive, non-ferrous materials.

Special Coatings
Upon request, M.A. Ford® can provide any commercially available coating. **Any standard uncoated M.A. Ford® cutting tool can be provided with coating if requested.**

Coating Properties

M.A. Ford® Coating	M.A. Ford® Tool Number Designation	Microhardness (HV)	Maximum Service Temp.	Friction Coefficient
ALtima®	A	3100	1100° C / 2012° F	0.42
ALtima® Plus	AP	3200	1100° C / 2012° F	0.25
ALtima® Blaze	B	3200	1100° C / 2012° F	0.35
ALtima® Micro	AM	3300	900° C / 1652° F	0.30-0.35
ALtima® Xtreme	AX/A/AH	3800	1100° C / 2012° F	0.30-0.50
ALtima® Q	AQ	4500	900° C / 1652° F	0.40
Fordlube	F	4000	700° C / 1292° F	0.30
Gem+	GP	4710	500° C / 932° F	0.10
GemX	GX	10000	600° C / 1100° F	0.10
TiN	T	2300	600° C / 1112° F	0.40
TiCN	C	3000	400° C / 752° F	0.40
CERAedge®	CE	3400	1100° C / 2012° F	0.25

Material Conversion Chart

Tableau De Conversion Des Matériaux | Tabla De Conversión De Materiales

	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
FREE MACHINING STEEL	12L13	S250Pb		1.0718	9SMnPB28		F.2112 -	
	1108	10F1		1.0721	10S20	210M15	F.2121 -	
	11L08	10PbF2		1.0722	10SPb20		F.2122 -	
				1.0723	15S20	210A15	F.210F.	
	1215	S300	1215	1.0736	9SMn36	240M07 EN 1B	F.2113-	
	12L14	S300Pb		1.0737	9MnPb36		F.2114 -	
LOW CARBON STEEL	1010	AF34C10/XC10	1010	1.0301	C10	045M10		
	1015	AF37C12/XC18	1015	1.0401	C15	080M15;040A15	F.111	
	1020	AF42C20/XC25	1020	1.0402	C22	055M15 EN2C	F.112	
	1025	AF50C30		1.0406	C25	070M26	F.221	
	1212			1.0711	9S20	220M07		
	1213	S250	1213	1.0715	9SMn28	230M07	F.2111 -	
	1010	XC10	1010	1.1121	Ck10	040A10	F.1510 -	
	1022/1518	20M5		1.1133	20Mn5	120M19	F.1515 -	
	1015	XC15 / C15E	1015	1.1141	Ck15	080M15 EN 32C	F.1511 -	
	10201023	XC25 / C22E	1020	1.1151	Ck22	050A20	F.1120 -	
	1025	XC25 / C25E		1.1158	Ck25	070M26	F.1120 -	
	A350-LF5	15N6 / 15Ni6		1.5622	14Ni6		F.2641 -	
	3310/9314	12NC15		1.5752	14NiCr14	655M13/A12 EN 36A		
MEDIUM CARBON STEEL	1035	AF55C35 /XC38	1035	1.0501	C35	060A35	F.113	
	1045	AF65C45 /C45	1045	1.0503	C45	080M46	F.114	
	1040	AF60C40 C40	1040	1.0511	C40		F.114.A	
	1055	C55	1055	1.0535	C55	070M55		
	1060	AF70C55 / C60	1060	1.0601	C60	080A62 EN 43D	F.115	
	1140	35MF6	1140	1.0726	35S20	212M36 EN 8M	F.210G.	
	1146	45MF4		1.0727	45S20	212M44		
	9255	51S7		1.0903	51Si7	250A53 EN 45	F.1450 -	
	9255	55S7	9254	1.0904	55Si7		F.1440-	
	9260	60S7		1.0909	60Si7	250A58	F.1441 -	
	9262	60SC7		1.0961	60SiCr7	250A61	F.1442 -	
	1330/1536	35M5 / 30Mn5		1.1165/66	30Mn5/34Mn5	120M36/150M28	F.1203	
	1335	40M5 / 36Mn5	1541	1.1167	36Mn5	150M36 EN 15	F.1203 -	
	1330	20M5 / 28Mn6	1330	1.117	28Mn6	150M28 EN 14A		
	1035	XC32 / C35R	1035	1.118	Cm35	080M36	F.1135 -	
	1040	XC42H1 / C40E	1040	1.1186	Ck40	060A40/080A40		S 40 C
	1045	XC42H1 / C45/XC45	1045	1.1191	Ck45	080M46/060A47	F.1140 -	S 45 C
	1045	XC42H1 /C45R	1045	1.1201	Cm45	080M46	F.1145 -	
	1055	XC55H1 / C55E	1055	1.1203	Ck55	060A57/070M55	F.1150 -	S55C
	1050	XC48H1 / C50E	1050	1.1206	Ck50	080M50		
	1050	XC48H1TS	1050	1.1213	Cf53	060A52		
	1060	XC60 / C60E/2C60	1060	1.1221	Ck60	060A62	F.511/F.512	S58C
	1070	XC68	1070	1.1231	Ck67	060A67		
ALLOY STEEL	1080/1078/1086	XC75 / C75E/XC90	1074	1.1248/1269	Ck75	060A78	F.513/514/515	
	1095	XC100	1095	1.1274	Ck101	060A96		
	4135/4142	34CD4 /42CD4		1.233	35CrMo4/47CrMo4	708A37/M40		SCM435TK
	3135/3140	35NC6		1.571/.5711	36NiCr6/40NiCr6	640A35/M40 EN111A		
	8620/8720	20NCD2	8620	1.6523/43	21NiCrMo2	805M20/A20 EN 362	F.1522 -	SNCM220(H)
	8740	40NCD2	8640	1.6546	40NiCrMo22	311-Type7	F.1204 -	SNCM240
		18NCD6		1.6587	17CrNiMo8	820A16	F.1560 -	
	5132	32C4 / 34Cr4		1.7033	34Cr4	530A32 EN18B	F.8221 /F.224	SCR430(H)
	5135	38C4 / 37Cr4	5135	1.7034	37Cr4	530A36	F.1201 -	
	5140	42C4 / 41Cr4	5140	1.7035	41Cr4	530M40/A40 EN 18	F.1202 -	SCR440(H)
	5140	42C4TS	5140	1.7045	42Cr4	530A40	F.1202 -	SCR440
	5115	16MC5	5115	1.7131	16MnCr5	527M17	F.1515 -	
	5155	55C3		1.7176	55Cr3	527A60 EN 48	F.1431 -	SUP9(A)
	4130	25CD4 / 25CrMo4	4130	1.7218	25CrMo4	1717CDS110	F.8330 -	SCM420/430
	4135/4137	35CD4 / 34CrMo4		1.722	34CrMo4	708A37 EN 19B	F.8231 -	
	4140/4142	42CD4 / 42CrMo4	4140	1.7225	42CrMo4	708M40 EN 19A	F.8232 -	
	4150	50CrMo4	4150	1.7228	50CrMo4	708A47		
	6150	50CV4 / 51CrV4	6151	1.8159	50CrV4	735A50 EN 47	F.1430 -	

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	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
HIGH STRENGTH ALLOY STEEL	A355Cl.D	30CAD6.12		1.8507	34CrAlMo5	905M31	F.1741 -	
	A355Cl.A	40CAD6.12		1.8509	41CrAlMo7	905M39 EN 41B	F.1740 -	
		18NC13		1.5755	31NiCr14	653M31	F.123	
	9840	40NCD3		1.6511	36CrNiMo4	816M40 EN 110	F.1280	
	4340		4340	1.6562	40NiCrMo73	817M40		SNCM 447
		30CND8		1.658	30CrNiMo8	823M30		
	4340	35NCD6	4340	1.6582	34CrNiMo8	817M40 EN 24	F.1272	SNCM 447
		35NCD14		1.6746	32NiCrMo145	830M31	F.1262	
		35NCD16		1.6747	30NiCrMo166	835M30	F.1260	
		30CD12		1.8515	31CrMoV139	722M24 EN 40B	F.1712	
				1.8523	39CrMoV139	897M39 EN 40C		
STRUCTURAL STEEL	A570 (36)	E24-2NE / S235JRG2	A36	1.0038	RSt37-2	4360-40C		STKM 12A
	A570 (40)	E28-2 / S275JR		1.0044	St44-2	4360-43A/B	A 430B	SM 400 A;B;C
	A570 (50)	A50-2 / E295		1.005	St50-2	4360-50B		SS490
		A60-2 / E335-A70-2/E360		1.006/.007	St60-2/St70-2	4360-55E		
	A284/A573/A611	E24-3;-4 / S235J2G3		1.0116	St37-3	4360-40C/D-1449-37C	A360 C;D	
	A366/1012/A619	DC01		1.033/.0333	St12/13	1449 -2/3/4CR	AP 00/02	
	A620	DC04		1.0338	St14	1449 1CR; 2CR	AP 04	
	A516Gr.65;-55;	A37CP;AP / P235GH		1.0345	H I	1501Gr.161-360/400	A 37 RC I;RA II	
		A42CP;AP / P265GH		1.0425	H II	161-400;	A42 RC I	
	A537	A52CP;AP / P335GH		1.0473	19Mn6		A 47 RB II	
	A516 (70)	A48CP;AP / P295GH		1.0481	17Mn4		A 47 RC I; RA II	
		E36-3/4 / S355J2G3		1.057	St52-3	4360-50B;50C;50D	A 510 C;D	
	A204 (A)	15D3 / 15Mo3		1.5415	15Mo3	1501-240	F.2601 -	
	4520			1.5423	16Mo5	1503-245-420	F.2602 -	
	A350-LF3	12N14 / 12Ni14		1.5637	10Ni14	1501-503-690	F.152	
	3115	10NC6		1.5713	13NiCr6			
	3415	14NC11		1.5732	14NiCr10		F.1540	
	A182-F11;F12	15CD3.05		1.7335	13CrMo44	620Gr.27;31	F.2631	
	A387 (12)	15CD4.5		1.7337	16CrMo44	620Gr.27		
	A182F22	10CrMo9-10		1.738	10CrMo910	622Gr.31;45	TU.H	
	A633Gr.E	E420RIFP / S420N		1.8902	StE420	4360-55E	AE 420 KG	
	A633Gr.E	E460RIFP / S460N		1.8905	StE460		AE 460 KG	
HIGH TEMPERATURE ALLOYS	330	Z12NCS37.18		1.4864	X12NiCrSi3616	NA17	F.3313	
				1.4865	G-X40NiCrSi3818	330C40		
	B163	Z8NC3221		1.4876	X10NiCrAlTi3320	NA15(H)	F.3545	
	4544/SB127/164	NU30		2.436	NiCu30Fe	3072-76/NA13		
	4676			2.4375	NiCu30Al	3072-76/NA18/3146		
	5388 C	NC 17 DWY		2.4602	NiCr17Mo17FeW			
		NC 20 T		2.463	Ni-Cr20Ti	HR5/203-4/703-B		
		NC 20 TA		2.4631	NiCr20TiAl	HR 401HR601/736B		
		NCKD 20 ATV		2.4634	NiCo20Cr15MoAlTi	HR 3/5007		
	687	NCKD 20 AT		2.4636	NiCo15Cr15MoAlTi			
		NCK 20 D		2.465	NiCr20Co19MoTi	HR 10		
	5660C	Z8 NCDT 42		2.4662	NiCr15MoTi			
	5536E	Nc 22 FeD		2.4665	NiCr22Fe18Mo	HR 6/204		
		NC 19 FeNb		2.4668	NiCr19Fe19NbMo	HR 8		
	5542G	NC 15 Fe TNb		2.4669	NiCr16FeTi	HR 505		
	5391A	NC 13 AD		2.467	G-NiCr13Al6MoNb	HC 203		
		NK 15 CAT		2.4674	NiCo15Cr10MoAlTi	HC 204		
	5540	NC 15 Fe		2.4816	NiCr15Fe	3072-76		
	5581	NC 22 FeDNB		2.4856	NiCr22Mo9Nb			
		NC 21 FeDU		2.4858	NiCr21Mo	3072-76		
		NC 19 KDT		2.4973	NiCr19Co11MoTi			
	684	NCK 19 DAT		2.4983	NiCr18Co18MoAlTi			
TITANIUM TITANIUM ALLOYS		T-35		3.7024/25	Ti 99,8	TA.1	Ti-PO1	
		T-U2		3.7124	TiCu2	TA.21-24/52-55/58	Ti-P11	
		T-A6ZD		3.7154	TiAl6Zr5Mo0,5Si0,2	TA.43/44	Ti-P67	
		T-A4DE		3.7184	TiAl4Mo4Sn2Si0,5	TA.45-51/57	Ti-P68	
	4941/42/51/4902	T-40		3.7034/35	Ti 99,7	TA.2/3/4/5	Ti-PO2	
	4901/21	T-60		3.7064/65	Ti99,5	TA.6/7/8/9	Ti-PO4	
	491128/35/54/65/67	T-A6V		3.7164/65	TiAl6V4	TA.10-13/28/56	Ti-P63	
	4900	T-50				DTD 5023/5283		

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Material Conversion Chart

Tableau De Conversion Des Matériaux | Tabla De Conversión De Materiales

	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
STAINLESS STEELS	410S	Z3014		1.4001	X7Cr14	403S17	F.8401	
	405	Z6CA13 / Z6CrAl13		1.4002	X6CrAl13	405S17	F.3111	
	416	Z12CF13 / Z12CrS13		1.4005	X12CrS13	416S21	F.3411	SUS 416
	410/CA-15	Z12C13 / Z12Cr13	410	1.4006	X10Cr13	410S21 ENEN 56A	F.3401	SUS 410
	430	Z8C17 / Z6Cr17		1.4016	X6Cr17	430S15 EN 60	F.3113	SUS 430
	420	Z20C13 / Z20Cr13	420	1.4021	X20Cr13	420S37	F.3402	SUS 420
		Z40C14 / Z40Cr14		1.4034	X46Cr13	420S45 EN 56D	F.3405	
	431	Z15CN16.02		1.4057	X20CrNi172	431S29 EN 57	F.3427	
	430F	Z10CF17		1.4104	X12CrMoS17		F.3117	
	434	Z8CD17.01		1.4113	X6CrMo17	434S17		
	440C	Z100CD17		1.4125	X105CrMo17			
	304/304H	Z6CN18.09	304	1.4301	X5CrNi1810	304S15 EN 58E	F.3451	SUS304
	308; 305	Z8CN18.12		1.4303	X5CrNi1812	305S19	F.3513	
	303	Z10CNF18.09	303	1.4305	X10CrNiS189	303S21 EN 58M	F.3508	SUS303
	304L	Z2CN18.10/Z3CN19.10M		1.4306	G-X2CrNi189/1911	304S12/S11/C12	F.3503	SCS19
	CF-8	Z6CN18.10M		1.4308	G-X6CrNi189	304C15		
	301	Z12CN17.07	302	1.431	X12CrNi177	301S21	F.3517	
	304LN	Z2CN18.10Az		1.4311	X2CrNiN1810	304S62		
		Z10CN18.9M		1.4312	G-X10CrNi188	302C25		
	CA6-NM	Z4CND13.4M		1.4313	G-X5CrNi134	425C11		
	316/316L	Z6CND17.11	316	1.4401	X5CrNiMo17122	316S16/S31 EN 58J	F.3543	SUS316
	316L	Z2CND 18.13	316L	1.4404	X2CrNiMo17132	316S11/S12	F.3533	SUS316 L
	316LN	Z2CND 17.12Az		1.4406	2CrNiMoN17122	316S61		SUS316LN
	CF-8M			1.4408	G-X6CrNiMo1810	316C16	F.8414	
	316LN	Z2CND17.13Az		1.4429	X2CrNiMo17133	316S62		SUS316LN
	316L	Z2CND17.13		1.4435	X2CrNiMo18143	316S11/S12	F.3533	SUS316LN
	316	Z6CND17.12		1.4436	X5CrNiMo17133	316S16	F.3534	SUS316
	317L	Z2CND19.15		1.4438	X2CrNiMo18164	317S12		SUS317L
	329		329 (DUPLEX)	1.446	X8CrNiMo275		F.3309	SUS329
	XM8/430Ti	Z8CT17		1.451	X6CrTi17		F.3114	
	409	Z6CT12		1.4512	X5CrTi12	409S19		
	321	Z6CNT18.10	321	1.4541	X6CrNiTi1810	321S12/S31 EN 58B	F.3523	SUS321
	630	Z6CNU17.04		1.4542	X5CrNiCuNb1714			SUS630
	347	Z6CNNb18.10		1.455	X6CrNiNb1810	347S17/S31 EN 58F	F.3552	SUS347
	316Ti	Z6CNDT17.12		1.4571	X6CrNiMoTi17122	320S31/S17 EN 58J	F.3552	
	316Ti			1.4573	X10CrNiMoTi1812	320S33		
	316Cb	Z6CNDNb17.12/19.13		1.458	X6CrNiMoNb17122	318S17		
	HNV3	Z45CS9		1.4718	X45CrSi93	401S45 EN52	F.3220	
		Z10C13		1.4724	X10CrAl13	403S17	F.13152	
		Z40CSD10		1.4731	X40CrSiMo102		F.3221	
	430	Z10CAS18		1.4742	X10CrAl18	430S15	F.3153	SUS430
	HNV6	Z80CSN20.02		1.4747	X80CrNiSi20	443S65 EN 59	F.3222	
	446	Z10CAS24		1.4762	X10CrAl24		F.3154	SUH446
	309	Z15CNS20.12		1.4828	X15CrNiSi2012	309S24		
	309S	Z15CN24.13		1.4833	X7CrNi2314	309S24		
	314/310	Z15CNS25.20	314	1.4841	X15CrNiSi2520		F.3310	
	310S	Z12CN25.20	310	1.4845	X12CrNi2521	310S24	F.331	
	HK			1.4848	G-X40CrNiSi2520	310C40	F.8452	
	EV8	Z52CMN21.09		1.4871	X53CrMnNiN219	349S54	F.3217	
		Z35CNWS14.14		1.4873	X45CrNiW189	331S40	F.3211	
	321	T6CNT18.12(B)		1.4878	X12CrNiTi189	321S20	F.3523	SUS321
	A353	Z8N9		1.5662	X8Ni9	1501-509;510	F.2645	
	2515	Z18N5		1.568	12Ni19			

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Back to Table of Contents

	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
TOOL STEELS	A532IBNiCr-LC			0.962	G-X260NiCr42	Grade2A		
	A532IANiCr-HC			0.9625	G-X330NiCr42	Grade2B		
	A532IDNi-HiCr			0.963	G-X300CrNiSi952	Grade2C;D;E		
	A532IID20%CrMo-LC			0.9645	G-X260CrMoNi2021	Grade3C		
	A532IIIA25%Cr			0.965	G-X260Cr27	Grade3D		
	A532IIIA25%Cr			0.9655	G-X300CrMo271	Grade3E		
	W108	Y190;Y180		1.1525	C80W1			
	W110	Y1105		1.1545	C105W1			SK3
	W112	Y2120		1.1663	C125W		F.5123	
	W1			1.175/.1625	C75W/C80W1	BW1A/BW1B	F.1507	
	L3	Y100C6	52100	1.2067	100Cr6	BL3	F.5230	
	D3	Z200C12	420 (1.2083)	1.208	X210Cr12	BD3	F.5212	
	L2			1.221	115CrV3			
	H11	Z38CDV5	H11	1.2343	X38CrMoV51	BH11	F.5317	
	H13	Z40CDV5	H13	1.2344	X40CrMoV51	BH13	F.5318	SKD61
	A2	Z100CDV5	A2	1.2363	X100CrMoV51	BA2	F.5227	SKD12
	H10	32DCV28	H10	1.2365	X32CrMoV33	BH10	F.5313	
	D2	Z160CDV12	D2	1.2379	X155CrVMo121	BD2		
		105WC13		1.2419	105WCr6		F.5233	
			D6 (VC131)	1.2436	X210CrW12		F.5213	
	O1		O1 (VND)	1.251	100MnCrW4	BO1	F.5220	SKS 31
	S1		S1 (VW3)	1.2542	45WCrV7	BS1	F.5241	
		55WC20		1.255	60WCrV7			
	H21	Z30WCV9	H20/H21	1.2581	X30WCrV93	BH21	F.5323	SKD5
				1.2601	X165CrMoV12		F.5211	
	H12	Z35CWDV5	H12	1.2606	X37CrMoW51	BH12		
	L6	55NCDV7	(VMO)	1.2713	55NiCrMoV6		F.528	
	W210	Y1105V		1.2833	100V1	BW2		
	2	90MV8		1.2842	90MnCrV8	BO2		
	T15			1.3202	S12-1-4-5	BT15	F.5563	
		Z130WKCDV10-10-04-03		1.3207	S10-4-3-10		F.553	
		Z85WDKCV06-05-05-04-02	M35	1.3243	S6-5-2-5		F.5613	
	M41	Z110WKCDV07-05-04-04-02		1.3246	S7-4-2-5		F.5613	
	M42	Z110DKCWV09-08-04-02-01	M42	1.3247	S2-10-1-8	BT42	F.5615	
	M33/M34			1.3249	S2-9-2-8	BM34	F.5611	
	T4	Z80WKCV18-05-04-01		1.3255	S18-1-2-5	BT4	F.5530	
	T5			1.3265	S18-1-2-10	BT5	F.5540	
	M3	Z90WDCV06-05-04-03		1.3342	SC6-5-2			
	M2	Z85WDCV06-05-04-02	M2	1.3343	S6-5-2	BM2	F.5603	
	M3Class2	Z130WDCV06-05-04-04	M3:2	1.3344	S6-5-3		F.5605	
	H41/M1	Z85DCWV08-04-02-01		1.3346	S2-9-1	BM1		
	M7	Z100DCWV09-04-02-02	M7	1.3348	S2-9-2		F.5607	
	T1	Z80WCV18-04-01		1.3355	S18-0-1	BT1	F.5520	
	A128(A)	Z120M12 / Z120Mn12		1.3401	X120Mn12		F.82551	
	52100	100C6	52100	1.3505	100Cr6	534A99	F.1310	
HARDENED STEEL								
CAST ALUMINIUM	319,2	A-S5U		3.2151	G-AlSi6Cu4	LM4/LM22	L-2660	
	380,1	A-S9U3		3.2161	G-AlSi8Cu3	LM24	L-2630	
		A-S4G		3.2341	G-AlSi5Mg	DTD716B		
	A356.2	A-S7G0,3		3.2371	G-AlSi7Mg	2L99/LM25		
		A7-S10G		3.2373	G-AlSi9Mg			
	A360	A-S10G		3.2381	G-AlSi10Mg	LM9	L-2560	
	413,1	A-S12U		3.2583	G-AlSi12Cu	LM20	L-2530	
	514.1	A-G6		3.3561	G-AlMg5	LM5		
	A413	A-S13		3.3581	G-AlSi12	LM6	L-2520	
	520	A-G10-Y4		3.3591	G-AlMg10	LM10	L-2310	
	390				AlSi17Cu4			
	393				AlSi18-25CuNiMg	LM28/LM29		

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Material Conversion Chart

Tableau De Conversion Des Matériaux | Tabla De Conversión De Materiales

	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
WROUGHT ALUMINIUM	1200	A4		3.0205	Al99	1C	L-3001	
	1050A	A5		3.0255	Al99,5	1B	L-3051	
	1350A	A5/L		3.0257	E-Al	1E	L-3052	
	1080A	A8		3.0285	Al99,8	1A	L-3081	
	1199	A99		3.0385	Al99,98R	1		
	3004	A-M1G		3.0526	AlMnMg1	N4	L-3820	
	2014	A-U4SG		3.1255	AlCuSiMn	H15	L-3130	
	2117	A-U2G		3.1305	AlCu2,5Mg0,5	3L86/HR13	L-3180	
	2017A	A-U4G		3.1325	AlCuMg1	H14	L-3120	
	2024	A-U4G1		3.1355	AlCuMg2	2L98	L3140	
	2003	A-U4Pb		3.1645	AlCuMgPb		L-3121	
	2011	A-U5PbBi		3.1655	AlCuBiPb	FC1	L-3182	
	6101B			3.2305	E-AlMgSi	91E	L-3431	
	6463	A85-GS		3.2307	Al99,85MGsl	BTR6		
	6181	A-SGMO,7		3.2315	Al-Si1 Mg	H30	L-3451	
	6060			3.3206	AlMGSi0,5	H9	L-3441	
	6101C	A-GS/L		3.3207	E-AlMgSi0,5	BTRE6		
	5005A	A-G0,6		3.3315	AlMg1	N41	L-3350	
	5050B	A-G1,5		3.3316	AlMg1,5	3L44	L-3380	
	5052	A-G2,5C		3.3523	AlMg2,5	N5Mg3,5	L-3360	
	5251	A-G2M		3.3525	AlMg2Mn0,3	N4		
	5754	A-G3M		3.3535	AlMg3		L-3390	
	5454	A-G2,5MC		3.3537	AlMg2,7Mn	N51		
	5083	5083		3.3547	AlMg4,5Mn	N8	L-3321	
	5056A			3.3555	AlMg5	N6	L-3320	
	7020	A-Z5G		3.4335	AlZn4,5Mg1	H17	L-3741	
	7075	A-Z5GU		3.4365	AlZnMgCu1,5	2L95	L-3710	
SG / NODULAR CAST IRON	60-40-18	FGS-400-12		0.704	GGG-40	420/12		
		FGS370-17		0.7043	GGG-40.3	370/17		
	65-45-12	FGS500-7		0.705	GGG-50	500/7		FDC500
	80-55-06	FGS 600-3		0.706	GGG-60	600/3		
	100-70-03	FGS 700-2		0.707	GGG-70	700/2		FDC700
	120-90-02	FGS 800-2		0.708	GGG-80	800/2		
		MB 35-7		0.8035	GTW-35-04	W 340/3		
		MB 40-10		0.804	GTW-40-05	W 410/4		
				0.8045	GTW-45-07			
	32 510	MN 35-10		0.8135	GTS-35-10	B 340/12		
		MP 50-5		0.8145	GTS-45-06	P 440/7		
		MP 60-3		0.8155	GTS-55-04	P 540/5		
				0.8165	GTS 65-02			
	70 003	MP 70-2		0.817	GTS 70-02	P 690/2		
GREY / WHITE CAST IRON	A48-40B	Ft25D / FGL250		0.6025	GG25	Grade 260	FG 25	
	A48-20B	Ft10D / FGL100		0.601	GG10		FG 10	
	A48-25B	Ft15D / FGL150		0.6015	GG15	Grade 150	FG 15	
	A48-30B	Ft20D / FGL200		0.602	GG20	Grade 220	FG20	
	A48-45B	Ft30D / FGL300		0.603	GG30	Grade 300	FG 30	
	A48-50B	Ft35D / FGL350		0.6035	GG35	Grade 350	FG35	
	A48-60B	Ft40D / FGL400		0.604	GG40	Grade 400		
BRONZE ALUMINIUM- BRONZE TIN BRONZE	C 60 800	CuAl6		2.0918	CuAl5As			
	C 61 000	CuAl8		2.092	CuAl8			
	C 61 400	CuAl7Fe2		2.0932	CuAl8Fe3	CA 106		
	C 62 300	CuAl9Fe3Mn2		2.0936	CuAl10Fe3Mn2	CA 105		
	C 95 200	CuAl9Fe3		2.094	CuAl10Fe	AB 1		
	B 505	CuAl9Fe3		2.094	G-FeAlBzF50	AB 1		
		CuAl9Mn2		2.096	CuAl9Mn2			
	C 63 200	CuAl9Ni5Fe3Mn		2.0966	CuAl10Ni5Fe4	CA 104		
	C 95 800	CuAl9Ni5Fe		2.097	G-NiAlBzF50	AB 2		
		CuAl11Ni5Fe5		2.0978	CuA11Ni6Fe5			
	C 94100	CuPb20Sn5		2.1188	G-CuPb20Sn	LB5		

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	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
BRASS	C 21000/34500	CuZn5		2.022/2.032	CuZn5	CZ 125/101		
	C 85700	CuZn40-Y30		2.034	G-CuZn37Pb	PCB 3		
	C 28000/38500	CuZn40/44Pb2		2.036/2.041	CuZn40/44Pb2	CZ 109/CZ130		
	C 68700	CuZn22Al2		2.046	CuZn20Al2	CZ 110		
	C 44300			2.047	CuZn28Sn1	CZ 111		
	C 46400			2.053	CuZn38Sn1	CZ 112		
	C 67400			2.055	CuZn40Al2	CZ 114		
	C 86400			2.0591	G-CuZn38Al	PCB1, DCB 3		
	C 86400	CuZn40-Y30		2.0592	G-CuZn35Al1	HTB 1		
	C 86300			2.0598	G-CuZn25Al5	HTB 3		
	C 90500			2.105	G-CuSn10Zn	G1		
	C 90800	CuSn12		2.1052	G-CuSn12	Pb2		
	C 91700			2.106	G-CuSn12Ni	CT2		
	C 90250			2.1086	G-CuSn10	CT1		
	C 93200	CuSn7Pb6Zn4		2.109	G-CuSn7ZnPb			
	C 92410			2.1093	G-CuSn6ZnNi	LG4		
	C 83600	CuPb5Sn5Zn5		2.1096	G-CuSn5ZnPb/RG5	LG2		
	C 93700	CuPb10Sn10		2.1176	G-CuPb10Sn	LB2		
	C 93800			2.1182	G-CuPb15Sn	LB1		
COPPER COPPER/NICKEL ALLOYS	C 96200			2.0815	G-CuNi10			
	C 71300	CiNi25		2.083	CuNi25	CN 105		
	C 96400			2.0835	G-CuNi30	CN 2		
	C 72150	CuNi44		2.0842	CuNi44Mn1			
	C 70600	CuNi10Fe1Mn		2.0872	CuNi10Fe1Mn	CN 102		
	C 71500	CuNi30Mn1Fe		2.0882	CuNi30Mn1Fe	CN 107		
	C 17000	CuBe1,7		2.1245	CuBe1,7	CB 101		
	C 17200	CuBe1,9		2.1247	CuBe2			
	C 17500			2.1285	CuCo2Be	C 112		
	C 71640	CuNi30Fe2Mn2			CuNi30Fe2Mn2	CN 108		
	OF	Cu-c1/C2		2.004	OF-Cu	Cu-OF C 103/110		
	C 11000	Cu-a1/A2		2.006	E-Cu57	Cu-ETP-2 C 101		
	C 11000	Cu-a1		2.0065	E-Cu58	Cu-ETP-2 C 101		
	C 1200	Cu-b2		2.0076	SW-Cu			
	C 12200	Cu-b1		2.009	SF-Cu	Cu-DHP C 106		

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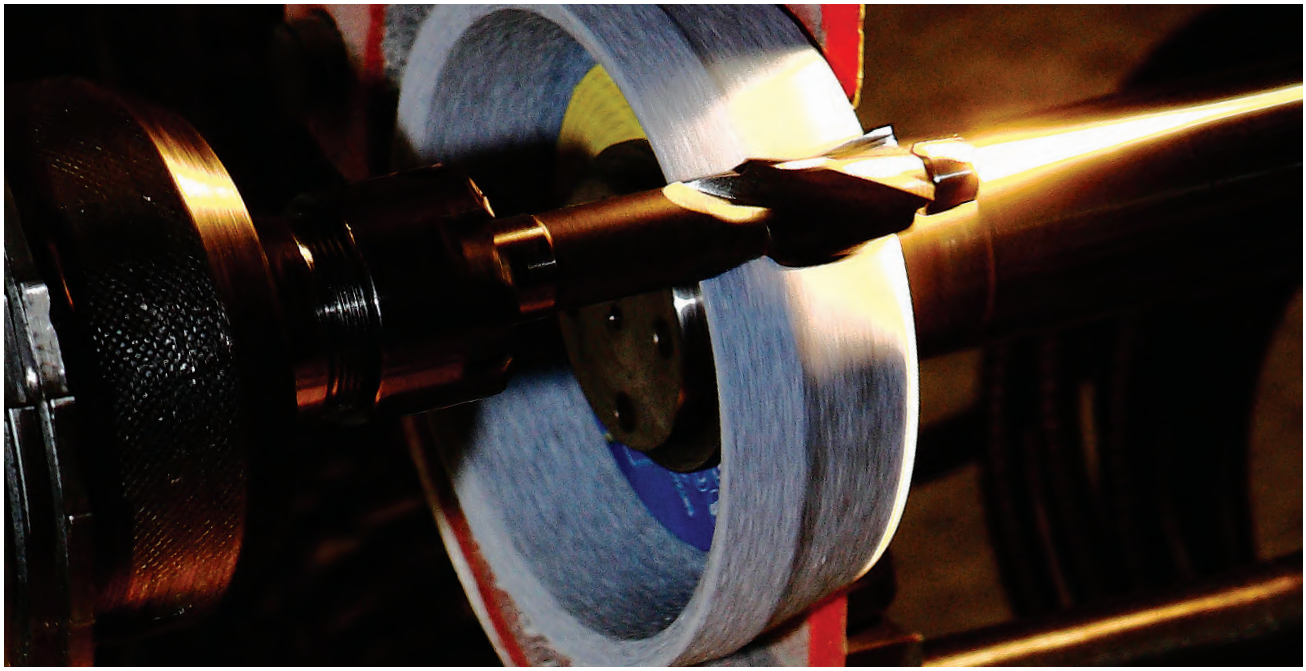

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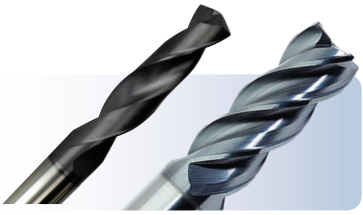

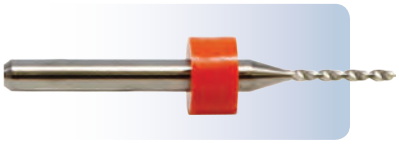

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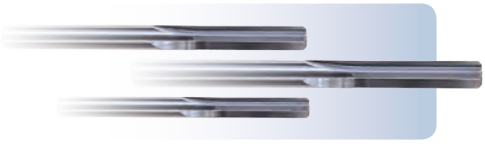

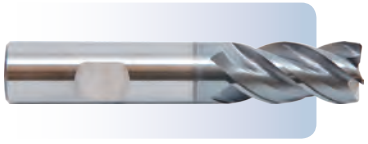

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Back to Table of Contents