

Including



ADVANCED PRODUCT GROUP



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



*Integrated Manufacturing Solutions*



**Product Catalog 2016**

[www.maford.com](http://www.maford.com)



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



For more than 95 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.

**M.A. FORD® – Where high performance is the standard.®**



## Series Number by Page

Series No.	Page No.
60	409
61	409
61B	410
61T	411
64 Sets	412
67	413
71 Sets	452
78	413
79	414
79B	415
79T	416
79 Sets	417
80	424
83	421
84	421
86	422
87	422
92	418
92 Sets	418
111	253
112	248
113	249
114	259
116	268
116C	271
117	260
121	276
122	266
123	286
132	267
134	222
134N	223
134S	222
135	212
135B	218
135BN	219

Series No.	Page No.
135N	214
136	220
138 / 138R	224
138B	237
138BN	238
138CE	235
138N / 138NR	231
140	287
145	291
150	292
156	239
157	244
158	243
163	262
164	282
165	289
166	295
169	272
169C	275
177 / 177W	199
177L	204
177S	205
178 / 178W	206
178N	209
179	210
179L	211
180	194
180CB	198
180N	197
192	247
200	88
200 Sets	95
200S	68, 132
204	96
205	98
206	105

Series No.	Page No.
207	107
207CE	75
209	111
210	114
224	115
226	117
229	77
230	463
230CE	460
231	463
231B	463
231BCE	460
231CE	460
231D	463
231DCE	460
231F	463
239	457
270	376
270L	376
270P	378
272	379
277 / 277W	174
277N	178
277 Sets	180
278 / 278W	181
278N	191
279	193
2MDCL	74
2XDCE	67
2XDCL	64
2XDCCR	59
2XDSCR	55
2XDSS	45
300	119
302	123

Series No.	Page No.
305	81
306	128
402	131
403	69, 133
404	69, 133
405	134
850	423
851	423
880 / 882 / 883	419
890 / 892 / 893	420
CDACR	41
CXDCL	37
CXDSCR	32
CXDSCS	28
CXDSSR	24
CXDSS	19
HPDCR	70
HPDSR	70
SA	429
SB	431
SC	433
SD	435
SE	437
SF	439
SG	441
SH	443
SJ	445
SK	446
SL	447
SM	449
SN	451

## Diamond Grind Routers Page 455-464

Series	Tool Illustration	End Grind	Cut	Coating	Material Group	Page
230		Safe	Down	—		463
231		End Mill	Down	—		463
231B		Bur	Down	—		463
231D		Drill	Down	—		463
231F		Fishtail	Down	—		463
239		Bur End Mill Safe Fishtail	Up	GemX		457-458
230CE		Safe	Down	CERAedge®		460
231CE		End Mill	Down	CERAedge®		460
231BCE		Bur	Down	CERAedge®		460
231DCE		Drill	Down	CERAedge®		460
Technical Information						459, 461, 464



# Diamond Coated Routers The “Black Diamond”

## Series 239

- GemX coating and uncoated options available
- Up cut router
- Excellent for composite materials and fiberglass applications

## Diamond Grind Routers

### Series 230CE / 231CE / 231BCE / 231DCE

#### Featuring **CERAE** coating

- Down cut routers
- Excellent for glass reinforced printed circuit boards, phenolic–epoxy and other highly abrasive materials

## Diamond Grind Routers

### Series 230 / 231 / 231B / 231D / 231F

- Uncoated
- Down cut routers
- Excellent for glass reinforced printed circuit boards, phenolic–epoxy and other highly abrasive materials

Routers are available with a non-cutting safe end or in three popular end-cutting styles.



# M.A. Ford®'s New Diamond Coated Routers

## Series 239 Coated with GemX Diamond Coating

M.A. Ford® Coating	M.A. Ford® Tool Number Designation	Microhardness (HV)	Maximum Service Temp.	Friction Coefficient
GemX	GX	10,000	600° C / 1100° F	0.10

### Benefits

- Excellent for composite materials and fiberglass applications
- Long Tool life
- Cut more linear inches
- Faster cycle times
- High routing rate
- Delivers great edge quality
- No delamination or flaking

### Features

- Rake angles specially designed to reduce cutting forces
- Cutting edges specially treated for optimized tool life
- Carbide substrate uniquely compatible to GemX coating
- GemX coating specifically designed for maximum tool life in composites

### Applications

- Trimming
- Routing
- Pocketing
- Interpolation of holes
- Low plastic content CFRP

## Series 239 Case Studies

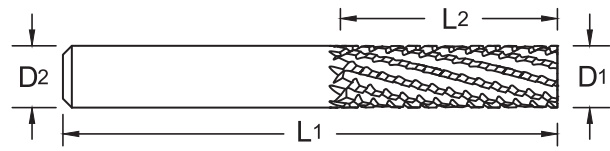
Roughing	
<b>Tool:</b>	0.5" 14-Flute Router 0.5"Ø x 1" LOC x 3" OAL
<b>Chuck:</b>	HSK63A Haimer Shrink Fit Chuck P/N A63.140.1/2Z
<b>Spindle Speed:</b>	12,000 RPM
<b>Feed Rate:</b>	2,500 mm/min (98in/min)

Finishing	
<b>Tool:</b>	0.5" 14-Flute Router 0.5"Ø x 1" LOC x 3" OAL
<b>Chuck:</b>	HSK63A Haimer Shrink Fit Chuck P/N A63.140.1/2Z
<b>Spindle Speed:</b>	15,000 RPM
<b>Feed Rate:</b>	3,000 mm/min (118in/min)

# Diamond Grind Routers Series 239



Diamond grind GemX coated or uncoated



Bur End



End Mill



Safe End



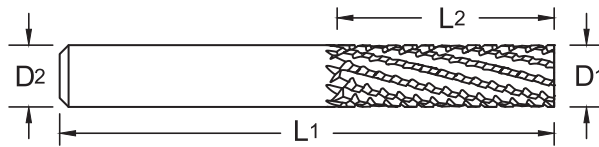
Fishtail

Uncoated		GemX		Diameter			Shank		OAL		Flute Length		# Flutes (RHC)	End Cut
Tool Number	EDP	Tool Number	EDP	D1			D2		L1		L2			
				Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm		
239M0300	24039				3.0	.1181		3.0		38		12.0	6	Safe
239M0300B	23945	239M0300BGX	23969		3.0	.1181		3.0		38		12.0	6	Bur
239M0300E	23946	239M0300EGX	23970		3.0	.1181		3.0		38		12.0	6	End Mill
239M0300F	23947	239M0300FGX	23971		3.0	.1181		3.0		38		12.0	6	Fishtail
23912500	23994			1/8		.1250	1/8		1-1/2		1/4		6	Safe
23912500B	23901	23912500BGX	23900	1/8		.1250	1/8		1-1/2		1/4		6	Bur
23912510	23996			1/8		.1250	1/8		1-1/2		3/8		6	Safe
23912510E	23903	23912510EGX	23902	1/8		.1250	1/8		1-1/2		3/8		6	End Mill
23912520	23997			1/8		.1250	1/8		1-1/2		1/2		8	Safe
23912520E	23905	23912520EGX	23904	1/8		.1250	1/8		1-1/2		1/2		8	End Mill
239M0400	24021				4.0	.1575		4.0		50		15.0	6	Safe
239M0400B	23948	239M0400BGX	23972		4.0	.1575		4.0		50		15.0	6	Bur
239M0400E	23949	239M0400EGX	23973		4.0	.1575		4.0		50		15.0	6	End Mill
239M0400F	23950	239M0400FGX	23974		4.0	.1575		4.0		50		15.0	6	Fishtail
23918700	23998			3/16		.1875	3/16		2		3/8		6	Safe
23918700B	23907	23918700BGX	23906	3/16		.1875	3/16		2		3/8		6	Bur
23918710	23999			3/16		.1875	3/16		2		9/16		6	Safe
23918710E	23909	23918710EGX	23908	3/16		.1875	3/16		2		9/16		6	End Mill
23918720	24000			3/16		.1875	3/16		2		3/4		8	Safe
23918720E	23911	23918720EGX	23910	3/16		.1875	3/16		2		3/4		8	End Mill
239M0500	24041				5.0	.1968		5.0		50		20.0	6	Safe
239M0500B	23951	239M0500BGX	23975		5.0	.1968		5.0		50		20.0	6	Bur
239M0500E	23952	239M0500EGX	23976		5.0	.1968		5.0		50		20.0	6	End Mill
239M0500F	23953	239M0500FGX	23977		5.0	.1968		5.0		50		20.0	6	Fishtail
239M0600	24043				6.0	.2362		6.0		63		20.0	10	Safe
239M0600B	23954	239M0600BGX	23978		6.0	.2362		6.0		63		20.0	10	Bur
239M0600E	23955	239M0600EGX	23979		6.0	.2362		6.0		63		20.0	10	End Mill
239M0600F	23956	239M0600FGX	23980		6.0	.2362		6.0		63		20.0	10	Fishtail
239M0601	24027				6.0	.2362		6.0		75		25.0	10	Safe
239M0601B	23957	239M0601BGX	23981		6.0	.2362		6.0		75		25.0	10	Bur
239M0601E	23958	239M0601EGX	23982		6.0	.2362		6.0		75		25.0	10	End Mill
239M0601F	23959	239M0601FGX	23983		6.0	.2362		6.0		75		25.0	10	Fishtail
23925000	24001			1/4		.2500	1/4		2-1/2		1/2		8	Safe
23925000B	23913	23925000BGX	23912	1/4		.2500	1/4		2-1/2		1/2		8	Bur

\*Stock available for desired end features with a quicker turnaround than most manufacturing suppliers!



## Series 239 Continued



Uncoated		GemX		Diameter			Shank		OAL		Flute Length		# Flutes (RHC)	End Cut
Tool Number	EDP	Tool Number	EDP	D1			D2		L1		L2			
				Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm		
23925010	24003			1/4		.2500	1/4		2-1/2		3/4		10	Safe
23925010B	23915	23925010BGX	23914	1/4		.2500	1/4		2-1/2		3/4		10	Bur
23925010E	23917	23925010EGX	23916	1/4		.2500	1/4		2-1/2		3/4		10	End Mill
23925020	24005			1/4		.2500	1/4		3		1		10	Safe
23925020B	23919	23925020BGX	23918	1/4		.2500	1/4		3		1		10	Bur
23925020E	23921	23925020EGX	23920	1/4		.2500	1/4		3		1		10	End Mill
23925030	23923	23925030GX	23922	1/4		.2500	1/4		4		1-1/4		12	Safe
23931200	24009			5/16		.3125	5/16		2 1/2		1		10	Safe
23931200E	23925	23931200EGX	23924	5/16		.3125	5/16		2-1/2		1		10	End Mill
239M0800	24045				8.0	.3150		8.0		75		25.0	10	Safe
239M0800B	23960	239M0800BGX	23984		8.0	.3150		8.0		75		25.0	10	Bur
239M0800E	23961	239M0800EGX	23985		8.0	.3150		8.0		75		25.0	10	End Mill
239M0800F	23962	239M0800FGX	23986		8.0	.3150		8.0		75		25.0	10	Fishtail
23937500	24011			3/8		.3750	3/8		2-1/2		3/4		12	Safe
23937500B	23927	23937500BGX	23926	3/8		.3750	3/8		2-1/2		3/4		12	Bur
23937510	24035			3/8		.3750	3/8		3		1-1/8		12	Safe
23937510B	23929	23937510BGX	23928	3/8		.3750	3/8		3		1-1/8		12	Bur
23937510E	23931	23937510EGX	23930	3/8		.3750	3/8		3		1-1/8		12	End Mill
23937520	24015			3/8		.3750	3/8		4		1-1/2		12	Safe
23937520B	23933	23937520BGX	23932	3/8		.3750	3/8		4		1-1/2		12	Bur
23937520E	23935	23937520EGX	23934	3/8		.3750	3/8		4		1-1/2		12	End Mill
23937530	23937	23937530GX	23936	3/8		.3750	3/8		4		2		12	Safe
239M1000	24047				10.0	.3937		10.0		90		30.0	12	Safe
239M1000B	23963	239M1000BGX	23987		10.0	.3937		10.0		90		30.0	12	Bur
239M1000E	23964	239M1000EGX	23988		10.0	.3937		10.0		90		30.0	12	End Mill
239M1000F	23965	239M1000FGX	23989		10.0	.3937		10.0		90		30.0	12	Fishtail
239M1200	24033				12.0	.4724		12.0		100		40.0	14	Safe
239M1200B	23966	239M1200BGX	23990		12.0	.4724		12.0		100		40.0	14	Bur
239M1200E	23967	239M1200EGX	23991		12.0	.4724		12.0		100		40.0	14	End Mill
239M1200F	23968	239M1200FGX	23992		12.0	.4724		12.0		100		40.0	14	Fishtail
23950000	24037			1/2		.5000	1/2		3		1		14	Safe
23950000B	23939	23950000BGX	23938	1/2		.5000	1/2		3		1		14	Bur
23950000E	23941	23950000EGX	23940	1/2		.5000	1/2		3		1		14	End Mill
23950010	23943	23950010GX	23942	1/2		.5000	1/2		4		2		16	Safe
23950010B	23993	23950010BGX	23944	1/2		.5000	1/2		4		2		16	Bur

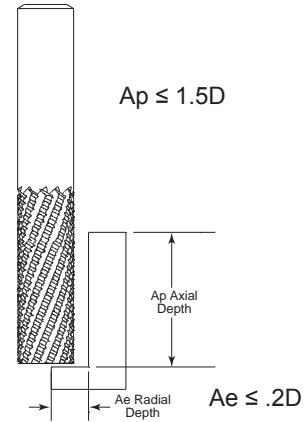
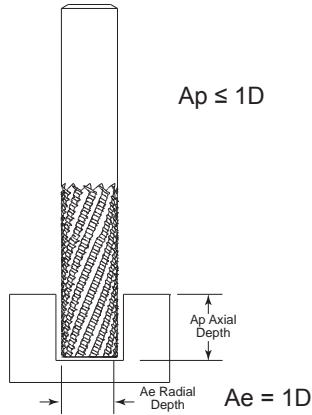
\*Stock available for desired end features with a quicker turnaround than most manufacturing suppliers!





# Diamond Grind Routers Series 239

## Recommended Cutting Data - Inch



Slotting 300 (Sfm)		
Tool Diameter	RPM	IPM
1/8	9000	10
3/16	6000	12
1/4	5000	15
5/16	4000	18
3/8	3000	20
1/2	2000	25

Slotting 600 (Sfm)		
Tool Diameter	RPM	IPM
1/8	18000	20
3/16	12000	25
1/4	9000	30
5/16	7000	35
3/8	6000	40
1/2	5000	50

Feed adjustment to part thickness	
≤ 0.5D	x 150%
0.5D - 1D	x 120%
1D - 2D	x 80%
3D-4D	x 50%

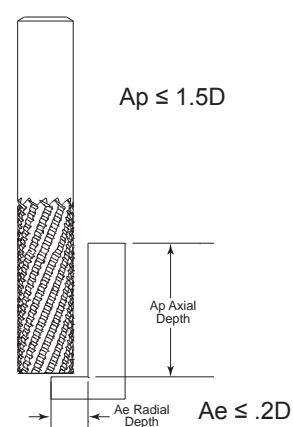
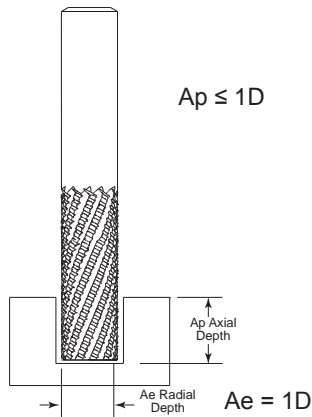
Side Milling 400 (Sfm)		
Tool Diameter	RPM	IPM
1/8	12000	20
3/16	8000	25
1/4	6000	30
5/16	5000	35
3/8	4000	40
1/2	3000	50

Side Milling 800 (Sfm)		
Tool Diameter	RPM	IPM
1/8	24000	40
3/16	16000	50
1/4	12000	60
5/16	10000	70
3/8	8000	80
1/2	6000	100

\*\* Tool must have end grind to slot.

**Note:** The parameters in this table are for common material thickness of 1/4". You must use the Radial Depth (Ae) of 20% or less for Side Milling. For best surface finish conventional mill is recommended. Higher feed rates are possible but surface finish may change.

## Recommended Cutting Data - Metric



Slotting 90 (m/min)		
Tool Diameter	RPM	mm/min
3	9000	254
5	6000	304
6	5000	381
8	4000	457
10	3000	508
12	2000	635

Slotting 182 (m/min)		
Tool Diameter	RPM	mm/min
3	18000	508
5	12000	635
6	9000	762
8	7000	889
10	6000	1016
12	5000	1270

Feed adjustment to part thickness	
≤ 0.5D	x 150%
0.5D - 1D	x 120%
1D - 2D	x 80%
3D-4D	x 50%

Side Milling 120(m/min)		
Tool Diameter	RPM	mm/min
3	12000	508
5	8000	635
6	6000	762
8	5000	889
10	4000	1016
12	3000	1270

Side Milling 240 (m/min)		
Tool Diameter	RPM	mm/min
3	24000	1016
5	16000	1270
6	12000	1524
8	10000	1778
10	8000	2032
12	6000	2540

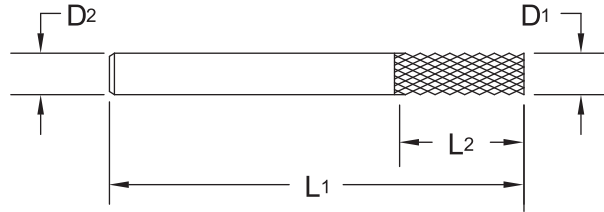
\*\* Tool must have end grind to slot.

**Note:** The parameters in this table are for common material thickness of 6mm. You must use the Radial Depth (Ae) of 20% or less for Side Milling. For best surface finish conventional mill is recommended. Higher feed rates are possible but surface finish may change.

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

For product information, call your local distributor.

**CERAAedge® Coated Routers  
Diamond Grind Routers  
Series 230CE / 231CE  
231BCE / 231DCE**



**Diamond Grind**

- Designed for routing of glass-reinforced printed circuit boards, phenolic-epoxy, composites and other highly abrasive materials.
- Ultra fine micrograin carbide.

**Series 230CE**

Down Cut  
Safe End



**Series 231CE**

Down Cut  
End Mill Type Point



**Series 231BCE**

Down Cut  
Bur End Point



**Series 231DCE**

Down Cut  
Drill Point



Series 230CE		Series 231CE		Diameter			Shank		OAL		Flute Length	
Tool No.	EDP	Tool No.	EDP	D1			D2		L1		L2	
				Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
23011810CE	90839	23111810CE	91047		3.0	.1181		3.0		38		12.5
23012500CE	90845	23112500CE	91071	1/8		.1250	1/8		1-1/2		1/2	
23018750CE	90847	23118750CE	91082	3/16		.1875	3/16		2		5/8	
23019680CE	90850	23119680CE	91094		5.0	.1968		5.0		51		16.0
23023620CE	90853	23123620CE	91106		6.0	.2362		6.0		51		19.0
23025010CE	90859	23125010CE	91130	1/4		.2500	1/4		2-1/2		3/4	

Series 231BCE		Series 231DCE		Diameter			Shank		OAL		Flute Length	
Tool No.	EDP	Tool No.	EDP	D1			D2		L1		L2	
				Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
23111810BCE	91050	23111810DCE	91053		3.0	.1181		3.0		38		12.5
23112500BCE	91074	23112500DCE	91077	1/8		.1250	1/8		1-1/2		1/2	
23118750BCE	91085	23118750DCE	91088	3/16		.1875	3/16		2		5/8	
23119680BCE	91097	23119680DCE	91100		5.0	.1968		5.0		51		16.0
23123620BCE	91109	23123620DCE	91112		6.0	.2362		6.0		51		19.0
23125010BCE	91133	23125010DCE	91136	1/4		.2500	1/4		2-1/2		3/4	

Routers are available with color coded depth setting rings upon request for 1/8" shanks.



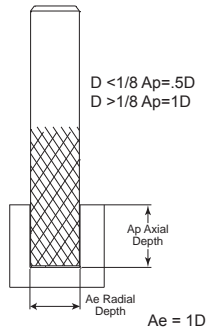
**CERAedge® Coated Routers  
Diamond Grind Routers  
Series 230CE / 231CE  
231BCE / 231DCE**

230CE / 231CE / 231BCE / 231DCE

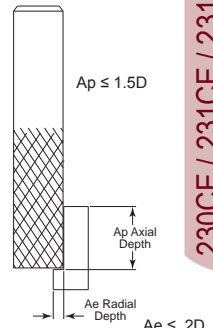
Diamond Grind Routers

**Recommended Cutting Data - Inch**

Slotting 300 (Sfm)			Slotting 600 (Sfm)		
Tool Diameter	RPM	IPM	Tool Diameter	RPM	IPM
1/32	36000	29	1/32	73000	58
3/64	24000	24	3/64	48000	48
1/16	18000	27	1/16	36000	54
3/32	12000	24	3/32	24000	48
1/8	9100	22	1/8	18000	45
3/16	6100	18	3/16	12000	36
1/4	4500	16	1/4	9000	32
5/16	3600	14	5/16	7000	28



Side Milling 400 (Sfm)			Side Milling 900 (Sfm)		
Tool Diameter	RPM	IPM	Tool Diameter	RPM	IPM
1/32	48000	39	1/32	90000	72
3/64	32000	32	3/64	73000	73
1/16	24000	36	1/16	55000	83
3/32	16000	32	3/32	36000	72
1/8	12000	30	1/8	27000	68
3/16	8100	24	3/16	18000	54
1/4	6100	21	1/4	13000	46
5/16	4800	19	5/16	11000	44

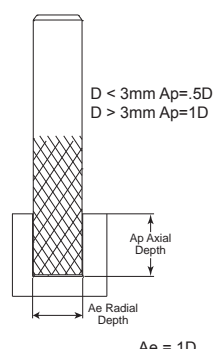


\*\* Tool must have end grind in order to slot.

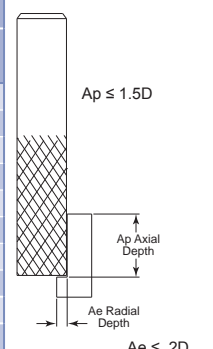
**Note:** The parameters in this table are for common material thickness of 1/4". You must use the Radial Depth (Ae) of 20% or less for Side Milling. For best surface finish conventional mill is recommended. Higher feed rates are possible but surface finish may change.

**Recommended Cutting Data - Metric**

Slotting 90 (m/min)			Slotting 182 (m/min)		
Tool Diameter	RPM	mm/min	Tool Diameter	RPM	mm/min
0.8	35000	141	0.8	72000	289
1	28000	226	1	57000	463
1.2	23000	306	1.2	48000	627
1.5	18000	376	1.5	38000	771
1.6	17000	388	1.6	36000	795
2	14000	423	2	28000	868
2.4	11000	447	2.4	24000	916
3	9400	480	3	19000	984
5	5600	395	5	11000	810
6	4700	423	6	9600	868
8	3500	353	8	7200	723



Side Milling 120(m/min)			Side Milling 240 (m/min)		
Tool Diameter	RPM	mm/min	Tool Diameter	RPM	mm/min
0.8	47000	190	0.8	95000	381
1	38000	305	1	76000	610
1.2	31000	413	1.2	63000	826
1.5	25000	508	1.5	50000	1017
1.6	23000	524	1.6	47000	1049
2	19000	572	2	38000	1145
2.4	15000	604	2.4	31000	1208
3	12000	648	3	25000	1297
5	7600	534	5	15000	1068
6	6300	572	6	12000	1145
8	4700	477	8	9500	954



\*\* Tool must have end grind in order to slot.

**Note:** The parameters in this table are for common material thickness of 6mm. You must use the Radial Depth (Ae) of 20% or less for Side Milling. For best surface finish conventional mill is recommended. Higher feed rates are possible but surface finish may change.



**Made in USA**

**ISO 9001:2008 Certified**

**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 necessary depending on the particular application.

## Diamond Grind Routers

Diamond Grind Routers are designed specifically for routing printed circuit boards. These tools are available with a non-cutting safe end, or in four popular end-cutting styles all with down cut geometries.

### Router Application Data

When machining circuit boards, board stack height should be limited to 2-1/2 times the router diameter. In general, as total stack height increases, cutting speed RPM (n) should be decreased.

Polyamid or Teflon circuit boards should not be stacked.

When routing outside edges, the router should be fed counterclockwise. Conversely, for inside edges, the router should be fed clockwise.

### Speeds and Feeds

Diamond Grind Routers are designed to operate between 600 and 900 surface-feet-per-minute (180-275 vc-m/min) - Approximately 30,000 RPM (n) for a 3/32-inch (2.4mm) router and 23,000 RPM (n) for a 1/8-inch (3.175mm) router. Speeds must be reduced for Teflon circuit boards. See recommended cutting data charts on page 464.

Diamond Grind Routers should be fed approximately .002 inch-per-revolution (.05 mm/rev.). For a 3/32-inch (2.4mm) router, this is 60-80 IPM (1524-2032 mm/min.). A 1/8-inch (3.175mm) router should be fed approximately 40-50 IPM (1016-1270 mm/min.). See recommended cutting data charts on page 464.

If the feed rate is too low, heat will cause melting of epoxy materials, causing the router flutes to load up, reducing tool life. For multi-layer boards, feed rates should be reduced, depending on the number of inner layers. The higher the number of inner layers, the slower the feed rate must be. See recommended cutting data charts on page 464.

#### 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.

## Diamond Grind Routers Series

Series 230

Series 231

Series 231B

Series 231D

Series 231F

ISO 9001:2008 Certified

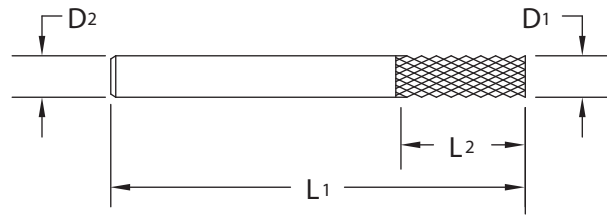


Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

# Diamond Grind Routers

## Series 230 / 231

### 231B / 231D / 231F



Designed for routing of glass-reinforced printed circuit boards, phenolic-epoxy and other highly abrasive materials.

#### Series 230

Down Cut  
Safe End



- Ultra fine micrograin carbide.
- Routers are available with color coded depth setting rings upon request.

#### Series 231

Down Cut  
End Mill Type Point



#### Series 231B

Down Cut  
Bur End Point



#### Series 231D

Down Cut  
Drill Point



#### Series 231F

Down Cut  
Fishtail Point



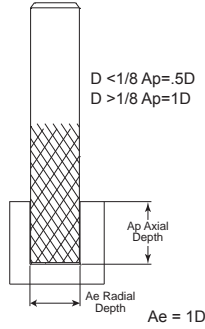
Page 464

Series 230		Series 231		Series 231B		Series 231D		Series 231F		Diameter			Shank		OAL		Flute Length	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1			D2		L1		L2	
										Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
23003120	90801	23103120	90901	23103120B	90904	23103120D	90907	23103120F	90910	1/32		.0312	1/8		1-1/2		1/8	
23003150	90804	23103150	90913	23103150B	90916	23103150D	90919	23103150F	90922		0.8	.0315		3.175		38		3.0
23003940	90807	23103940	90925	23103940B	90928	23103940D	90931	23103940F	90934		1.0	.0394		3.175		38		4.0
23004690	90810	23104690	90937	23104690B	90940	23104690D	90943	23104690F	90946	3/64		.0469	1/8		1-1/2		5/32	
23004720	90813	23104720	90949	23104720B	90952	23104720D	90955	23104720F	90958		1.2	.0472		3.175		38		4.0
23005910	90816	23105910	90961	23105910B	90964	23105910D	90967	23105910F	90970		1.5	.0591		3.000		38		5.0
23005911	90819	23105911	90973	23105911B	90976	23105911D	90979	23105911F	90982		1.5	.0591		3.175		38		5.0
23006251	90822	23106251	90985	23106251B	90988	23106251D	90991	23106251F	90994	1/16		.0625	1/8		1-1/2		3/16	
23006300	90825	23106300	90997	23106300B	91000	23106300D	91003	23106300F	91006		1.6	.0630		3.175		38		5.0
23007870	90828	23107870	91009	23107870B	91012	23107870D	91015	23107870F	91018		2.0	.0787		3.175		38		8.0
23009370	90831	23109370	91021	23109370B	91024	23109370D	91027	23109370F	91030	3/32		.0937	1/8		1-1/2		3/8	
23009450	90834	23109450	91033	23109450B	91036	23109450D	91039	23109450F	91042		2.4	.0945		3.175		38		9.5
23011810	90837	23111810	91045	23111810B	91048	23111810D	91051	23111810F	91054		3.0	.1181		3.000		38		12.5
23011811	90840	23111811	91057	23111811B	91060	23111811D	91063	23111811F	91066		3.0	.1181		3.175		38		12.5
23012500	90843	23112500	91069	23112500B	91072	23112500D	91075	23112500F	91078	1/8		.1250	1/8		1-1/2		1/2	
23018750	90846	23118750	91081	23118750B	91084	23118750D	91087	23118750F	91090	3/16		.1875	3/16		2		5/8	
23019680	90849	23119680	91093	23119680B	91096	23119680D	91099	23119680F	91102		5.0	.1968		5.000		51		16.0
23023620	90852	23123620	91105	23123620B	91108	23123620D	91111	23123620F	91114		6.0	.2362		6.000		51		19.0
23025000	90855	23125000	91117	23125000B	91120	23125000D	91123	23125000F	91126	1/4		.2500	1/4		2		3/4	
23025010	90858	23125010	91129	23125010B	91132	23125010D	91135	23125010F	91138	1/4		.2500	1/4		2-1/2		3/4	
23025020	90861	23125020	91141	23125020B	91144	23125020D	91147	23125020F	91150	1/4		.2500	1/4		3		3/4	
23031250	90864	23131250	91153	23131250B	91156	23131250D	91159	23131250F	91162	5/16		.3125	5/16		2-1/2		7/8	
23031500	90867	23131500	91165	23131500B	91168	23131500D	91171	23131500F	91174		8.0	.3150		8.000		64		22.0
23037500	90870	23137500	91177	23137500B	91180	23137500D	91183	23137500F	91186	3/8		.3750	3/8		2-1/2		7/8	

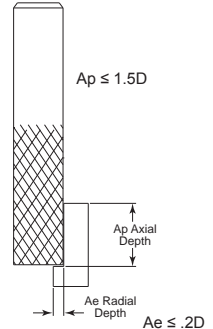
# Diamond Grind Routers Series 230 / 231 231B / 231D / 231F

## Recommended Cutting Data - Inch

Slotting 300 (Sfm)			Slotting 600 (Sfm)		
Tool Diameter	RPM	IPM	Tool Diameter	RPM	IPM
1/32	36000	29	1/32	73000	58
3/64	24000	24	3/64	48000	48
1/16	18000	27	1/16	36000	54
3/32	12000	24	3/32	24000	48
1/8	9100	22	1/8	18000	45
3/16	6100	18	3/16	12000	36
1/4	4500	16	1/4	9000	32
5/16	3600	14	5/16	7000	28



Side Milling 400 (Sfm)			Side Milling 900 (Sfm)		
Tool Diameter	RPM	IPM	Tool Diameter	RPM	IPM
1/32	48000	39	1/32	90000	72
3/64	32000	32	3/64	73000	73
1/16	24000	36	1/16	55000	83
3/32	16000	32	3/32	36000	72
1/8	12000	30	1/8	27000	68
3/16	8100	24	3/16	18000	54
1/4	6100	21	1/4	13000	46
5/16	4800	19	5/16	11000	44

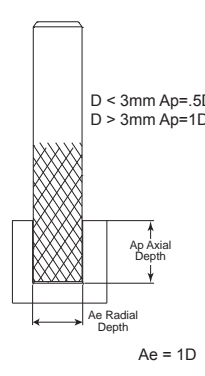


\*\* Tool must have end grind in order to slot.

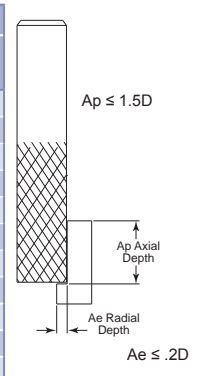
**Note:** The parameters in this table are for common material thickness of 1/4". You must use the Radial Depth (Ae) of 20% or less for Side Milling. For best surface finish conventional mill is recommended. Higher feed rates are possible but surface finish may change.

## Recommended Cutting Data - Metric

Slotting 90 (m/min)			Slotting 182 (m/min)		
Tool Diameter	RPM	mm/min	Tool Diameter	RPM	mm/min
0.8	35000	141	0.8	72000	289
1	28000	226	1	57000	463
1.2	23000	306	1.2	48000	627
1.5	18000	376	1.5	38000	771
1.6	17000	388	1.6	36000	795
2	14000	423	2	28000	868
2.4	11000	447	2.4	24000	916
3	9400	480	3	19000	984
5	5600	395	5	11000	810
6	4700	423	6	9600	868
8	3500	353	8	7200	723



Side Milling 120(m/min)			Side Milling 240 (m/min)		
Tool Diameter	RPM	mm/min	Tool Diameter	RPM	mm/min
0.8	47000	190	0.8	95000	381
1	38000	305	1	76000	610
1.2	31000	413	1.2	63000	826
1.5	25000	508	1.5	50000	1017
1.6	23000	524	1.6	47000	1049
2	19000	572	2	38000	1145
2.4	15000	604	2.4	31000	1208
3	12000	648	3	25000	1297
5	7600	534	5	15000	1068
6	6300	572	6	12000	1145
8	4700	477	8	9500	954



\*\* Tool must have end grind in order to slot.

**Note:** The parameters in this table are for common material thickness of 6mm. You must use the Radial Depth (Ae) of 20% or less for Side Milling. For best surface finish conventional mill is recommended. Higher feed rates are possible but surface finish may change.



ISO 9001:2008 Certified

### 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 necessary depending on the particular application.

# QUALITY



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®.

Steve Morency, CEO



## Coatings

### 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® 52

Aluminum Titanium Nitride (AlTiN). ALtima® 52 is specially designed for milling hardened steels 52 Rc and above. It has very high hardness and the oxidation temperature of the coating makes this the absolute best choice for hardened steel milling. ALtima® 52 is designed to allow for dry machining.

### 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, TiAlN coating developed specifically for micro tool applications.

### Fordlube

Titanium DiBoride (TiB<sub>2</sub>) 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.

### 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.

### CERAEedge®

CERAEedge® is a unique coating that provides excellent performance in titanium, aluminium, and composites.

### HP AlTiN

An economical version of Aluminum Titanium Nitride (AlTiN). This coating provides the benefits of AlTiN with a lower overall cost.

### Special Coatings

Upon request, M.A. Ford® can provide any commercially available coating. Any standard 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® 52	A	3600	1200° C / 2192° F	0.40
ALtima® Blaze	B	3200	1100° C / 2012° F	0.35
ALtima® Micro	AM	3300	900° C / 1652° F	0.30-0.35
Fordlube	F	4000	700° C / 1292° F	0.30
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
CERAEedge®	CE	3400	1100° C / 2012° F	0.25
HP AlTiN	A	3000	927° C / 1700° F	0.25



# CERAedge®

## Ceramic Coating with Extreme Properties

- 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.

## Coating Properties

M.A. Ford® Coating	Microhardness (HV)	Maximum Service Temp.	Friction Coefficient	Coating Thickness	Color
CERAedge®	3400	1100° C / 2012° F	.25	2-3 Microns	Light Gray

## CERAedge® Applications

### Titanium-clad composite material:

Hardness and lubricity ideal for composites  
 Toughness that allows excellent machining of Titanium  
 CERAedge® is perfect for machining of Titanium-clad composites!

### Aluminum and high silicon aluminum materials:

Hardness and lubricity extend tool life by increasing wear and resistance.









See Standard Offering of these Products with CERAedge® coating		See Page
<b>138CE</b>	Series End Mills	235
<b>207CE</b>	Brad and Spur Point Drill	75
<b>230CE</b>	Safe End Diamond Grind Router	460
<b>231CE</b>	End Mill End Diamond Grind Router	460
<b>231BCE</b>	Bur End Diamond Grind Router	460
<b>231DCE</b>	Drill Point Diamond Grind Router	460

## Test Data

Material Machined: 6061 Aluminum Extrusion  
 M.A. Ford® Tool: 138 Series, 3 Flute End Mill, 1/2" (12.7mm) OD  
 RPM: 22,000 RPM  
 IPM: 300 (7,620 mm/minute)









	Competitor's Lubricious Coating	M.A. Ford® CERAedge® Coated
Parts Produced/Tool	5	42
Linear Inches/Tool (Linear m/tool)	10,690 (272)	92,976 (2,360)

# Material Conversion Chart

								
	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 -	
	1215	S300	1215	1.0736	9SMn36	210A15 240M07 EN 1B	F.210F. 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	15Ni6 / 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 -		

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









# Material Conversion Chart

								
	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	RS137-2	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	12Ni14 / 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		

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









For product information, call your local distributor.

# Material Conversion Chart

								
	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	X2CrNi1810	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	Z6CNCNb18.10		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				

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









# Material Conversion Chart

								
	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
<b>TOOL STEELS</b>	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			
	W1			1.175/1625	C75W/C80W1	BW1A/BW1B	F.5123	
	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	Z110DKCWW09-08-04-02-01	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		
<b>HARDENED STEEL</b>								
<b>CAST ALUMINIUM</b>	319,2	A-S5U		3.2151	G-AISI6Cu4	LM4/LM22	L-2660	
	380,1	A-S9U3		3.2161	G-AISI8Cu3	LM24	L-2630	
		A-S4G		3.2341	G-AISI5Mg	DTD716B		
	A356.2	A-S7G0,3		3.2371	G-AISI7Mg	2L99/LM25		
		A7-S10G		3.2373	G-AISI9Mg			
	A360	A-S10G		3.2381	G-AISI10Mg	LM9	L-2560	
	413,1	A-S12U		3.2583	G-AISI12Cu	LM20	L-2530	
	514,1	A-G6		3.3561	G-ALMg5	LM5		
	A413	A-S13		3.3581	G-AISI12	LM6	L-2520	
	520	A-G10-Y4		3.3591	G-ALMg10	LM10	L-2310	
	390				AISI17Cu4			
	393				AISI18-25CuNiMg	LM28/LM29		

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

For product information, call your local distributor.

# Material Conversion Chart

								
	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
<b>WROUGHT ALUMINIUM</b>	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		
<b>SG / NODULAR CAST IRON</b>	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			
<b>GREY / WHITE CAST IRON</b>	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			
<b>BRONZE ALUMINIUM- BRONZE TIN BRONZE</b>	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			

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

# Material Conversion Chart

								
	USA	France	Brazil	German W-nr	German DIN	UK	Spain	Japan JIS
<b>BRASS</b>	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-CuSn5ZnZn/RG5	LG2		
C 93700	CuPb10Sn10		2.1176	G-CuPb10Sn	LB2			
C 93800			2.1182	G-CuPb15Sn	LB1			
<b>COPPER COPPER/NICKEL ALLOYS</b>	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		

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

For product information, call your local distributor.



Corporate  
Headquarters  
Davenport, Iowa



Manufacturing  
Vero Beach, Florida  
Leeds, UK  
Nanjing, China



**Sales Offices**  
Derby, UK  
Hong Kong  
Maharashtra, India



# Worldwide Distribution World Class Service

Centrally located in Davenport, Iowa, with national and international distribution through an extensive network of distributors and manufacturer's representatives, M.A. Ford® responds effectively to customer tooling needs. Our extensive line of standard products are on the shelf for immediate shipping and technical support is just a phone call away.

Visit [www.maford.com](http://www.maford.com) for your local M.A. Ford® representative.

Where *high performance* is the *standard*®

**ISO 9001:2008 Certified**



**Made in USA**



**800-553-8024 • 563-391-6220**  
**[www.maford.com](http://www.maford.com)**



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

Also available:



### **M.A. Ford® Mfg. Co., Inc.**

7737 Northwest Blvd.  
Davenport, IA 52806 USA  
Ph: 563-391-6220 or 800-553-8024  
Fax: 563-386-7660 or 800-892-9522  
e-mail: [sales@maford.com](mailto:sales@maford.com)  
[www.maford.com](http://www.maford.com)

### **M.A. Ford® Asia-Pacific, Ltd.**

Unit 2501, 25/F  
148 Electric Road  
North Point  
Hong Kong  
Ph: + 852-2167-7150  
Fax: +852-2167-8150  
[sales@mafordap.com](mailto:sales@mafordap.com)

### **M.A. Ford Europe Ltd.**

Unit 38, Royal Scot Road  
Pride Park, Derby  
DE24 8AJ UK  
Tel: +44(0) 1332 267960  
Fax: +44(0) 1332 267969  
[sales@mafordeurope.com](mailto:sales@mafordeurope.com)  
[www.mafordeurope.com](http://www.mafordeurope.com)

### **M.A. Ford® Asia-Pacific Ltd. (India)**

412A, Arcadia  
Hiranandani Estate,  
Thane (W) - 400607  
Maharashtra, India  
Ph: +91 22 41237421  
Fax: +91 22 41233387  
[sales@mafordin.com](mailto:sales@mafordin.com)