



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



**Tools For Graphite,
Composites, and
Similar Materials**

www.maford.com



High Performance Tooling For Graphite And Advanced Composites

During the 1960s, M.A. Ford® developed the first solid carbide drill for machining the abrasive materials used in PCBs. Since then, we have been focused on the development of innovative tooling solutions for graphite and composite machining.

Today, with our GemX coated end mills and routers, as well as our PCD ranges of end mills, we're setting new performance standards for machining graphite, CFRP, and other high performance composite materials.



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.

End Mills

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M.A. Ford® PCD End Mills

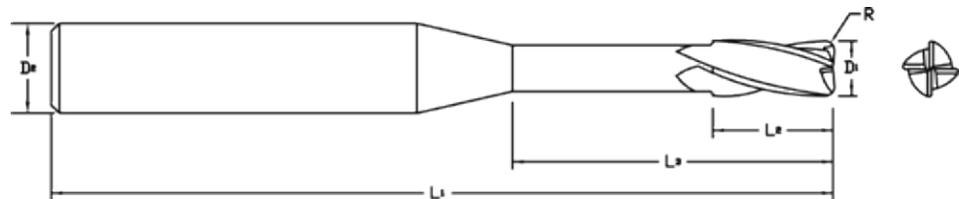
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TuffCut® GX GemX Coated



- 4 Flute, center cutting.
- Stub, standard and long lengths.
- Square end, corner radii and ball nose options.
- Neck relief available.
- GemX coated for longer tool life.
- Excellent for high performance milling of graphite and similar materials.

NEW



GemX		Diameter		Shank	OAL	Flute Length	Neck Length	Corner Radius
Tool No.	EDP	D1	Decimal	D2 h6	L1	L2	L3	R
1110312N12GX	03665	1/32	.0312	1/8	3	3/32	.400	-
1110312R.005N20GX	03663	1/32	.0312	1/8	3	3/32	5/8	.005
163S062R.010N8GX	03658	1/16	.0625	1/8	2-1/2	3/32	1/2	.010
1110625N12GX	03667	1/16	.0625	1/8	3	3/16	3/4	-
1110625R.010N12GX	03668	1/16	.0625	1/8	3	3/16	3/4	.010
1110625N16GX	03670	1/16	.0625	1/8	3	3/16	1	-
163S078R.010N5GX	03659	5/64	.0781	1/8	2-1/2	1/8	13/32	.010
163S125R.015N5GX	03672	1/8	.1250	1/8	3	1/8	5/8	.015
163S125R.015N12GX	03660	1/8	.1250	1/8	3	3/16	1-1/2	.015
11112500GX	03640	1/8	.1250	1/8	1-1/2	3/8	-	-
163S187R.030N8GX	03661	3/16	.1875	3/16	3	7/32	1-1/2	.030
16318750GX	03641	3/16	.1875	3/16	2	3/8	-	-
163S250R.015N3GX	03674	1/4	.2500	1/4	4	1/4	3/4	.015
163S2500GX	03642	1/4	.2500	1/4	2-1/2	3/8	-	-
163S250R.030N5GX	03662	1/4	.2500	1/4	4	3/8	1-1/4	.030
111L2500GX	03643	1/4	.2500	1/4	2-1/2	1	-	-
163S3750GX	03644	3/8	.3750	3/8	2-1/2	3/8	-	-
11137500GX	03645	3/8	.3750	3/8	2-1/2	1	-	-
163S5000GX	03646	1/2	.5000	1/2	3	3/8	-	-
163S500R.015N2.5GX	03675	1/2	.5000	1/2	6	1/2	1-1/4	.015
11150000GX	03647	1/2	.5000	1/2	3	1	-	-

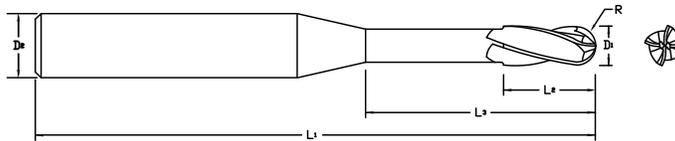
Inch	
D1	Tolerance
1/32 - 1/2	+0.000/-0.001

Inch	
R Corner Rad.	Tolerance
1/32 - 1/2	+0.002/-0.002

Inch	
D2	Tolerance (h6)
1/8 - 3/16	+0/-0.00031
1/4 - 3/8	+0/-0.00035
1/2	+0/-0.00043



TuffCut® GX
GemX Coated



NEW

Inch	
R Ball Rad.	Tolerance
≤ 1/16	+ .001/- .001
> 1/16 - 1/8	+ .002/- .002
> 1/8	+ .003/- .003



GemX		Diameter		Shank	OAL	Flute Length	Neck Length
Tool No.	EDP	D1	Decimal	D2 h6	L1	L2	L3
1400312N12GX	03664	1/32	.0312	1/8	3	3/32	.400
1400312N28GX	03666	1/32	.0312	1/8	3	3/32	.900
1400625N12GX	03669	1/16	.0625	1/8	3	3/16	3/4
1400625N16GX	03677	1/16	.0625	1/8	3	3/16	1
140L0625GX	03649	1/16	.0625	1/8	1-1/2	3/8	-
165S1250N5GX	03671	1/8	.1250	1/8	3	1/8	5/8
14012500GX	03650	1/8	.1250	1/8	1-1/2	3/8	-
14012501GX	03673	1/8	.1250	1/8	3	3/8	-
16515620GX	03651	5/32	.1562	3/16	2	3/8	-
140L1562GX	03652	5/32	.1562	3/16	2-1/2	1	-
16518750GX	03653	3/16	.1875	3/16	2	3/8	-
140L1875GX	03654	3/16	.1875	3/16	2-1/2	1	-
165S2500N3GX	03676	1/4	.2500	1/4	4	1/4	3/4
165S2500GX	03655	1/4	.2500	1/4	2-1/2	3/8	-
140L2500GX	03656	1/4	.2500	1/4	2-1/2	1	-

TuffCut® GX

Recommended Cutting Data - Inch

TuffCut® GX																	
Workpiece Material Group	ISO	Coolant			Application	Depth of Cut Per Application		vc - SFM	End Mill Diameter (inch)								
		• Preferred ○ Possible x Not Possible				Radial (Ae)	Axial (Ap)		1/16	5/64	3/32	1/8	5/32	3/16	1/4	3/8	1/2
		Max.	Air	MMS					fz - in/tooth by Cutter Diameter								
Aluminum > 10% Si	N	•	X	○	Slotting	-	≤ .25 x D	800	.0003	.0004	.0005	.0006	.0008	.0009	.0013	.0019	.0025
					Profiling	.2 x D	Max.	1200	.0006	.0008	.0009	.0013	.0016	.0019	.0025	.0038	.0050
Graphite	N	○	•	○	Slotting	-	≤ 1.5 x D	1200	.0006	.0008	.0009	.0013	.0016	.0019	.0025	.0038	.0050
					Profiling	.5 x D	Max.	1500	.0010	.0012	.0015	.0020	.0025	.0030	.0040	.0060	.0080
Composites	N	○	•	○	Slotting	-	≤ 1 x D	600	.0003	.0004	.0005	.0006	.0008	.0009	.0013	.0019	.0025
					Profiling	.2 x D	Max.	800	.0005	.0006	.0008	.0010	.0012	.0015	.0020	.0030	.0040

Note:

- Cutting data is for tools with a flute length that is ≤ 3xD, and for tools with a neck length that is ≤ 5xD.
- Cutting conditions may need to be reduced for tools that exceed these limits.



Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:
(Calculated Feed x Spindle Maximum)/Calculated Speed. Above 20,000 RPM, tool balancing required.

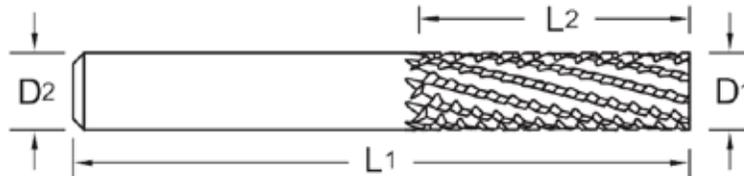
Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Routers Series 239



Extreme Roughing End Mill

- High material removal rates.
- Profiling and pocketing.
- GemX Coated for longer tool life.
- Licensed for Boeing U.S. Patent 7,090,442*.



GemX		Diameter			Shank		OAL		Flute Length		# Flutes (RHC)	End Cut
Tool Number	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm		
239M0300EGX	23970		3.0	.1181		3.0		38		12.0	6	End Mill
23912510EGX	23902	1/8		.1250	1/8		1-1/2		3/8		6	End Mill
23912520EGX	23904	1/8		.1250	1/8		1-1/2		1/2		8	End Mill
239M0400EGX	23973		4.0	.1575		4.0		50		15.0	6	End Mill
23918710EGX	23908	3/16		.1875	3/16		2		9/16		6	End Mill
23918720EGX	23910	3/16		.1875	3/16		2		3/4		8	End Mill
239M0500EGX	23976		5.0	.1968		5.0		50		20.0	6	End Mill
239M0600EGX	23979		6.0	.2362		6.0		63		20.0	10	End Mill
239M0601EGX	23982		6.0	.2362		6.0		75		25.0	10	End Mill
23925010EGX	23916	1/4		.2500	1/4		2-1/2		3/4		10	End Mill
23925020EGX	23920	1/4		.2500	1/4		3		1		10	End Mill
23931200EGX	23924	5/16		.3125	5/16		2-1/2		1		10	End Mill
239M0800EGX	23985		8.0	.3150		8.0		75		25.0	10	End Mill
23937510EGX	23930	3/8		.3750	3/8		3		1-1/8		12	End Mill
23937520EGX	23934	3/8		.3750	3/8		4		1-1/2		12	End Mill
239M1000EGX	23988		10.0	.3937		10.0		90		30.0	12	End Mill
239M1200EGX	23991		12.0	.4724		12.0		100		40.0	14	End Mill
23950000EGX	23940	1/2		.5000	1/2		3		1		14	End Mill

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

Inch	
D1	Tolerance
1/8 - 1/2	+0.00/-0.003

Metric (mm)	
D1	Tolerance
3 - 12	+0/-0.076

Inch	
D2	Tolerance (h6)
1/8 - 3/16	+0/-0.00031
1/4 - 3/8	+0/-0.00035
1/2	+0/-0.00043

Metric (mm)	
D2	Tolerance (h6)
3.0	+0/-0.006
4.0 - 6.0	+0/-0.008
8.0 - 10.0	+0/-0.009
12.0	+0/-0.011



ISO 9001:2015 Certified

*M.A. Ford® has an agreement with The Boeing Company and has been granted license rights to use Boeing patents and proprietary data.

Routers Series 239



Recommended Cutting Data - Inch

Series 239 GemX Coated Router End Mill End														
Workpiece Material Group	ISO	Coolant			Application	Depth of Cut Per Application		vc - SFM	Router Diameter (Inch)					
		● Preferred ○ Possible x Not Possible				Radial (Ae)	Axial (Ap)		1/8	3/16	1/4	5/16	3/8	1/2
		Max.	Air	MMS					fz - in/rev. by Cutter Diameter					
Graphite	N	○	●	○	Slotting	-	≤ 1.5 x D	1200	.0029	.0056	.0066	.0100	.0132	.0200
					Profiling	.5 x D	Max.	1500	.0045	.0086	.0100	.0140	.0200	.0334
Composites	N	○	●	○	Slotting	-	≤ 1 x D	600	.0011	.0021	.0033	.0050	.0066	.0100
					Profiling	.2 x D	Max.	800	.0017	.0032	.0050	.0070	.0100	.0167

Note:

- Cutting data is for tools with a flute length that is ≤ 2xD, and for tools with a neck length that is ≤ 3xD.
- Cutting conditions may need to be reduced for tools that exceed these limits.

Recommended Cutting Data - Metric

Series 239 GemX Coated Router End Mill End														
Workpiece Material Group	ISO	Coolant			Application	Depth of Cut Per Application		vc - M/Min	Router Diameter (mm)					
		● Preferred ○ Possible x Not Possible				Radial (Ae)	Axial (Ap)		3	5	6	8	10	12
		Max.	Air	MMS					fz - mm/rev. by Cutter Diameter					
Graphite	N	○	●	○	Slotting	-	≤ 1.5 x D	365	.074	.142	.168	.254	.335	.508
					Profiling	.5 x D	Max.	460	.114	.218	.254	.356	.508	.848
Composites	N	○	●	○	Slotting	-	≤ 1 x D	185	.028	.053	.084	.127	.168	.254
					Profiling	.2 x D	Max.	245	.043	.081	.127	.178	.254	.424

Note:

- Cutting data is for tools with a flute length that is ≤ 2xD, and for tools with a neck length that is ≤ 3xD.
- Cutting conditions may need to be reduced for tools that exceed these limits.

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



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



DES (M.A. Ford® PCD End Mill Square) Series

A straight flute PCD tipped end mill available with 1 or 2 flutes depending on tool size and configuration. These end mills combine a PCD tip with a carbide body for maximum rigidity and optimal performance. Offers excellent results in CFRP (Carbon-Fiber-Reinforced Polymer), fiberglass, aluminum and other very abrasive materials.



Standard Flute PCD Flat End Mills - Inch

Center Cutting

Tool No.	EDP	D1	D2	L1	L2	L3	C	# of Flutes
DE1S1250	90100	1/8	1/8	1-1/2	1/4	.625	.005	1
DE1S1875	90101	3/16	3/16	2	5/16	.875	.005	1
DE2S2500	90102	1/4	1/4	2	3/8	.875	.010	2
DE2S3750	90103	3/8	3/8	2-1/2	1/2	1	.010	2
DE2S5000	90104	1/2	1/2	3	5/8	1-3/8	.010	2
DE2S6250	90105	5/8	5/8	3-1/2	7/8	1-3/4	.010	2
DE2S7500	90106	3/4	3/4	4	1	2	.015	2

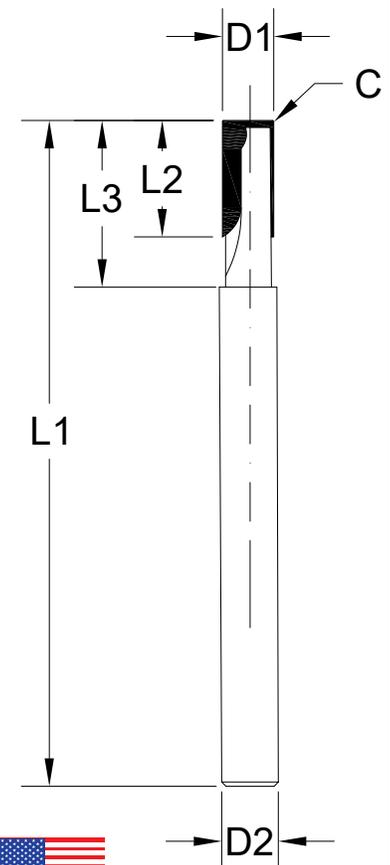
Additional sizes available upon request.

Standard Flute PCD Flat End Mills - Metric

Center Cutting

Tool No.	EDP	D1	D2	L1	L2	L3	C	# of Flutes
DE1SM0300	90107	3	3	38	6	14	.130	1
DE1SM0400	90108	4	4	50	6	15	.130	1
DE2SM0500	90109	5	5	50	8	18	.250	2
DE2SM0600	90110	6	6	64	10	22	.250	2
DE2SM0601	90111	6	6	64	15	26	.250	2
DE2SM0800	90112	8	8	64	10	24	.250	2
DE2SM0801	90113	8	8	64	15	29	.250	2
DE2SM1000	90114	10	10	75	15	30	.250	2
DE2SM1200	90115	12	12	75	15	30	.250	2
DE2SM1201	90116	12	12	75	25	40	.250	2
DE2SM1600	90117	16	16	92	20	42	.250	2
DE2SM2000	90118	20	20	100	25	50	.250	2

Additional sizes available upon request.



Inch	
D1	Tolerance
1/8 - 3/16	+0/-.001
1/4 & above	+0/-.002

Inch	
L1	Tolerance
All Sizes	+/- .040

Inch	
L2	Tolerance
All Sizes	+0.040/-.000

Inch	
D2	Tolerance (h6)
1/8 - 3/16	+0/-.00031
1/4 - 3/8	+0/-.00035
1/2 - 5/8	+0/-.00043
3/4	+0/-.00051

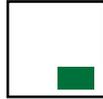
Metric (mm)	
D2	Tolerance (h6)
3.0	+0/-.006
4.0 - 6.0	+0/-.008
8.0 - 10.0	+0/-.009
12.0 - 16.0	+0/-.011
20.0	+0/-.013

Metric (mm)	
D1	Tolerance
3.0 - 20.0	+0/-.050

Metric (mm)	
L1	Tolerance
All Sizes	+/- 1

Metric (mm)	
L2	Tolerance
All Sizes	+1/-0

M.A. FORD® PCD Series DES



DES (M.A. Ford® PCD End Mill Square) Series

A straight flute PCD tipped end mill available from 3 flutes to 9 flutes depending on tool size and configuration. These end mills combine a PCD tip with a carbide body for maximum rigidity and optimal performance. Offers excellent results in CFRP (Carbon-Fiber-Reinforced Polymer), fiberglass, aluminum and other very abrasive materials.

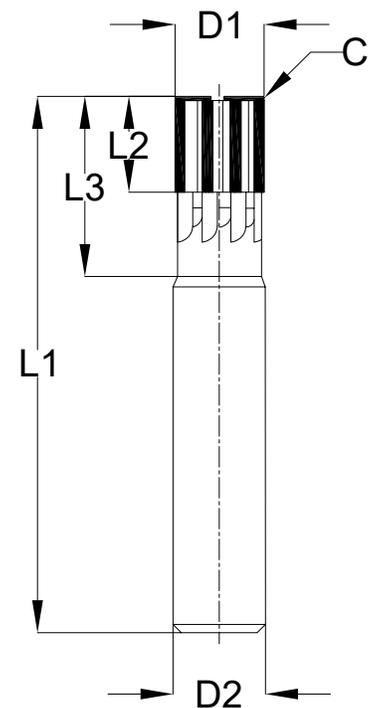


Standard Multi-Flute PCD Flat End Mills - Inch

Non-Center Cutting

Tool No.	EDP	D1	D2	L1	L2	L3	C	# of Flutes
DE3S3750	90143	3/8	3/8	2-1/2	1/2	1	.010	3
DE5S3750	90144	3/8	3/8	2-1/2	1/2	1.15	.010	5
DE3S5000	90145	1/2	1/2	3	1/2	1-1/4	.010	3
DE5S5000	90146	1/2	1/2	3	1/2	1-1/4	.010	5
DE7S5000	90147	1/2	1/2	3	1/2	1-1/4	.010	7
DE9S5000	90148	1/2	1/2	3	1/2	1-1/4	.010	9
DE3S6250	90149	5/8	5/8	3-1/2	5/8	1-1/2	.010	3
DE5S6250	90150	5/8	5/8	3-1/2	5/8	1-3/8	.010	5
DE7S6250	90151	5/8	5/8	3-1/2	5/8	1-3/8	.015	7
DE9S6250	90152	5/8	5/8	3-1/2	5/8	1-3/8	.015	9

Additional sizes available upon request.



Standard Multi-Flute PCD Flat End Mills - Metric

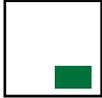
Non-Center Cutting

Tool No.	EDP	D1	D2	L1	L2	L3	C	# of Flutes
DE3SM0800	90153	8	8	64	11	26	.250	3
DE3SM1000	90154	10	10	75	13	30	.250	3
DE5SM1000	90155	10	10	75	13	30	.250	5
DE3SM1200	90156	12	12	75	13	32	.250	3
DE5SM1200	90157	12	12	75	13	32	.250	5
DE7SM1200	90158	12	12	75	13	32	.250	7
DE9SM1200	90159	12	12	75	13	32	.250	9
DE3SM1600	90160	16	16	92	16	38	.250	3
DE5SM1600	90161	16	16	92	16	42	.250	5
DE7SM1600	90162	16	16	92	16	42	.250	7
DE9SM1600	90163	16	16	92	16	37	.250	9

Additional sizes available upon request.



M.A. Ford® PCD Series DEB



DEB (M.A. Ford® PCD End Mill Ball) Series

A straight flute PCD tipped ball nose end mill available in 1 or 2 flutes depending on tool size. These end mills combine a PCD tip with a carbide body for maximum rigidity and optimal performance. Offers excellent results in CFRP (Carbon-Fiber- Reinforced Polymer), fiberglass, aluminum and other very abrasive materials.

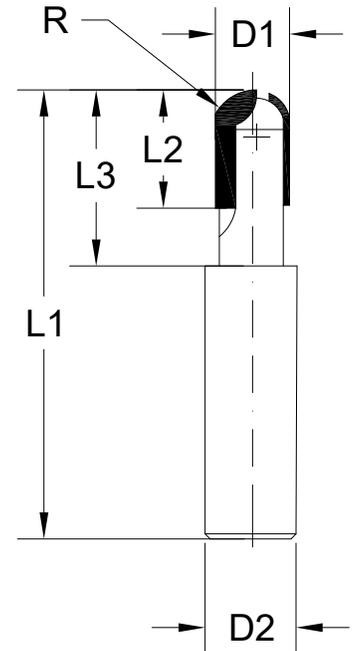


Standard Flute PCD Ball End Mills - Inch

Center Cutting

Tool No.	EDP	D1	D2	L1	L2	L3	# of Flutes
DE1B1250	90119	1/8	1/8	1-1/2	1/4	.625	1
DE1B1875	90120	3/16	3/16	2	5/16	.875	1
DE2B2500	90121	1/4	1/4	2	3/8	.875	2
DE2B3750	90122	3/8	3/8	2-1/2	1/2	1	2
DE2B5000	90123	1/2	1/2	3	5/8	1-1/2	2
DE2B6250	90124	5/8	5/8	3-1/4	7/8	1-3/4	2
DE2B7500	90125	3/4	3/4	4	1	2	2

Additional sizes available upon request.



Standard Flute PCD Ball End Mills - Metric

Center Cutting

Tool No.	EDP	D1	D2	L1	L2	L3	# of Flutes
DE1BM0300	90126	3	3	38	6	15	1
DE1BM0400	90127	4	4	50	6	17	1
DE1BM0500	90128	5	5	50	8	20	1
DE2BM0600	90129	6	6	64	10	24	2
DE2BM0800	90130	8	8	64	10	27	2
DE2BM1000	90131	10	10	75	15	35	2
DE2BM1200	90132	12	12	75	15	35	2
DE2BM1600	90133	16	16	92	20	42	2
DE2BM2000	90134	20	20	100	25	50	2

Additional sizes available upon request.



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.

Inch	
R	Tolerance
All Sizes	+0/- .001

Metric (mm)	
R	Tolerance
All Sizes	+0/- .025

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



Recommended Cutting Data - Inch

Series DES/DEB PCD End Mill															
Workpiece Material Group	ISO	Coolant			Application	Depth of Cut Per Application		vc - SFM	PCD End Mill Diameter (Inch)						
		• Preferred ○ Possible x Not Possible				Radial (Ae)	Axial (Ap)		1/8	3/16	1/4	3/8	1/2	5/8	3/4
		Max.	Air	MMS					fz - in/tooth by Cutter Diameter						
Aluminum > 10% Si	N	•	x	○	Slotting	-	≤ .25 x D	800	.0006	.0009	.0013	.0019	.0025	.0031	.0038
					Profiling	.2 x D	Max.	1200	.0013	.0019	.0025	.0038	.0050	.0063	.0075
Graphite	N	○	•	○	Slotting	-	≤ 1.5 x D	1200	.0013	.0019	.0025	.0038	.0050	.0063	.0075
					Profiling	.5 x D	Max.	1500	.0020	.0030	.0040	.0060	.0080	.0100	.0120
Composites	N	○	•	○	Slotting	-	≤ 1 x D	600	.0006	.0009	.0013	.0019	.0025	.0031	.0038
					Profiling	.2 x D	Max.	800	.0010	.0015	.0020	.0030	.0040	.0050	.0060

Note:

- Cutting data is for tools with a flute length that is ≤ 3xD, and for tools with a neck length that is ≤ 5xD.
- Cutting conditions may need to be reduced for tools that exceed these limits.
- Slotting not recommended with tools that consist of more than 3 flutes.

Recommended Cutting Data - Metric

Series DES/DEB PCD End Mill															
Workpiece Material Group	ISO	Coolant			Application	Depth of Cut Per Application		vc - M/Min	PCD End Mill Diameter (mm)						
		• Preferred ○ Possible x Not Possible				Radial (Ae)	Axial (Ap)		3	5	6	10	12	16	20
		Max.	Air	MMS					fz - mm/tooth by Cutter Diameter						
Aluminum > 10% Si	N	•	x	○	Slotting	-	≤ .25 x D	245	.015	.025	.030	.050	.060	.080	.100
					Profiling	.2 x D	Max.	365	.030	.050	.060	.100	.120	.160	.200
Graphite	N	○	•	○	Slotting	-	≤ 1.5 x D	365	.030	.050	.060	.100	.120	.160	.200
					Profiling	.5 x D	Max.	460	.048	.080	.096	.160	.192	.256	.320
Composites	N	○	•	○	Slotting	-	≤ 1 x D	185	.015	.025	.030	.050	.060	.080	.100
					Profiling	.2 x D	Max.	245	.024	.040	.048	.080	.096	.128	.160

Note:

- Cutting data is for tools with a flute length that is ≤ 3xD, and for tools with a neck length that is ≤ 5xD.
- Cutting conditions may need to be reduced for tools that exceed these limits.
- Slotting not recommended with tools that consist of more than 3 flutes.



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

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