Celebrating 90 Years 1919 - 2009

M.A. FORD

High Performance Cutting Tools

- Twister® Drills
- TuffCut® End Mills
- TrueSize® Reamers
- Countersinks
- Edge Hog® Carbide Burs
- Boring Tools
- Micro Tools
- Custom Tools

Innovation for Today's Industries

M.A. FORD
High Performance Cutting Tools

Innovation for Today's Industries

Since 1919 M.A. Ford® has grown from a small midwest maker of rotary files to a leading manufacturer of Standard, High Performance and Custom Cutting Tools with manufacturing and distribution facilities all over the world.

Our Innovation....

Is Your High Performance Cutting Tool Solution.

ISO 9001:2000 Certified

An ESOP Company

SERIES NUMBER BY PAGE

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Twister® Drills

	Series	Page	Drill Length	Coolant Fed	DIN	Coating	TEMA* Sizes	Low Carbon Steel	Alloy Steel (up to 35 Rc)	Alloy Steel (36-45Rc)	Austenitic Stainless Steel	High Temp Alloys	Precipitation Hardened Stainless	Titanium	Gray Cast Iron	Ductile Cast Iron	Non-Ferrous	Hardened Materials	Plastics	Glass/Ceramic
	Intro	11																		
Twister® XD	2XDSS	14	3X	N		ALtima®		1st	1st	1st	1st	1st	1st	1st	1st	1st				
	2XDSR	18	5X	N		ALtima®		1st	1st	1st	1st	1st	1st	1st	1st	1st				
	2XDCR	22	5X	Y		ALtima®		1st	1st	1st	1st	1st	1st	1st	1st	1st				
	2XDCL	26	7X+	Y		ALtima®		1st	1st	1st	1st	1st	1st	1st	1st	1st				
	2XDCE	29	12X+	Y		ALtima®		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		
	200S	30	3X Spot Drill	N		ALtima®		1st	1st	1st	1st	1st	1st	1st	1st	1st				
High Performance	2MDCL	32	10X Micro	Y		ALtima®		1st	1st	1st	1st	1st		1st						
	229	33	5X-3 Flute	N	6537L	None											1st		2nd	
	265	36	3X	N	6539	ALtima®		2nd	2nd	2nd	1st	1st	1st	1st						
	267	38	5X	N	338	ALtima®		2nd	2nd	2nd	1st	1st	1st	1st						
	269	40	3X	Y	6537K	ALtima®		2nd	2nd	2nd	1st	1st	1st	1st						
	271	42	5X	Y	6537L	ALtima®		2nd	2nd	2nd	1st	1st	1st	1st						
	273	44	7X	Y		ALtima®		2nd	2nd	2nd	1st	1st	1st	1st						
	280	46	3X	N		ALtima®									1st	1st				
	282	48	5X	Y		ALtima®									1st	1st				
	284	50	8X	Y		ALtima®									1st	1st				
General Purpose	200/200 Sets	53	3X	N		Uncoated/ ALtima®				2nd	1st	1st	1st	1st				1st		1st
	204	60	5X Jobbers/ inch	N		None									2nd	2nd	2nd		2nd	
	205	62	Screw Mach	N		Uncoated/ TiN				1st	1st	1st	1st	1st	2nd	2nd		2nd	2nd	2nd
	206	69	3X Stub/inch	N		None									2nd	2nd	2nd		2nd	
	207	71	3X	N		None											2nd		1st	
	209	74	5X	Y		None					1st	1st	1st	1st						
	210	77	3X-3 Flute	N		None					2nd				2nd					
	224	81	5X Jobbers/ mm	N	338	None									2nd	2nd	2nd		2nd	
	226	83	3X Stub/mm	N	6539	None									2nd	2nd	2nd		2nd	
	300	85	5X	N		None									2nd	2nd	2nd		2nd	
Misc. Drills	302	89	Std./ Long X-Long	N		None		1st	1st	1st	2nd	1st	2nd	1st	1st	1st				
	306	93	Standard	N		None		1st	1st	1st	2nd	1st	2nd	1st	1st	1st				
	402	96	Center Drill	N	333A	None		1st	1st	1st	1st	1st	1st	1st	1st	1st		1st		
	403	97	Spot Drill 120°	N		None		1st	1st	1st	1st	1st	1st	1st	1st	1st				
	404	97	Spot Drill 90°	N		None		1st	1st	1st	1st	1st	1st	1st	1st	1st				
	405	98	Ctr. Drill 5" OAL	N		None		1st	1st	1st	1st	1st	1st	1st	1st	1st		1st		

Technical Information		
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1st 1st Choice
2nd 2nd Choice

*Tubular Exchange Manufacturer's Association

TuffCut® High Performance End Mills

	Series	Page	# of Flutes	Square End	Ball Nose	Corner Radius	Neck Relief	Coating	Low Carbon Steel	Alloy Steel (up to 35 Rc)	Alloy Steel (36-45Rc)	Austenitic Stainless Steel	High Temp Alloys	Precipitation Hardened Stainless	Titanium	Gray Cast Iron	Ductile Cast Iron	Non-Ferrous	Hardened Materials	Plastics	Glass/Ceramic
	Intro	120																			
TuffCut® XR	177	122	4	x		x		ALtima®	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	177L	126	4	x		x	x	ALtima®	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	177S	127	4	x		x	x	ALtima®	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	179	129	4		x			ALtima®	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	179L	130	4		x		x	ALtima®	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	178	131	5	x		x		ALtima®	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	178N	134	5	x		x	x	ALtima®	1st	1st	1st	1st	1st	1st	1st	1st	1st				
TuffCut® XR7	180	135	7	x		x		ALtima® Blaze	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	180N	137	7	x		x	x	ALtima® Blaze	1st	1st	1st	1st	1st	1st	1st	1st	1st				
TuffCut® AL	135	138	2			x												1st			
	135N	140	2	x		x	x											1st			
	135B	143	2		x													1st			
	135BN	144	2		x		x											1st			
	136	145	2	x														1st			
	134	147	3	x														1st			
TuffCut® X-AL	137	148	3			x												1st			
	137N	149	3			x	x											1st			
	138	150	3	x		x												1st			
	138N	153	3	x			x											1st			
	138B	154	3		x													1st			
	138BN	155	3		x		x											1st			
TuffCut® DM	156	156	2		x		x	ALtima® 52	1st	1st	1st	1st							1st		
	198	157	3	x					1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	199	158	3		x				1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	158	159	4	x		x	x	ALtima® 52	1st	1st	1st								1st		
	157	160	Multi	x		x		ALtima® 52							1st				1st		
	192	163	Multi	x				ALtima®/TiN	1st	1st	1st	1st	1st	1st	1st	1st	1st				
TuffCut® SS	112	164	3	x				Uncoated/TiN				2nd	2nd		2nd						
	172	165	3	x				ALtima®/ TiCN	1st	1st	1st	1st	1st	1st	1st						
	174	166	3			x		ALtima®/ TiCN	1st	1st	1st	1st	1st	1st	1st						
	175	167	5			x		ALtima®/ TiCN	1st	1st	1st	1st	1st	1st	1st						
	176	168	5	x				ALtima®/ TiCN	1st	1st	1st	1st	1st	1st	1st						
	113	169	6	x				Uncoated/TiN				2nd	2nd		2nd						

Technical Information		
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	220	Troubleshooting Chart
	240	TuffCut® XR
	224	TuffCut® AL & TuffCut® X-AL
	230/ 246	TuffCut® DM 156
	221/ 238	TuffCut® SS

1st 1st Choice
2nd 2nd Choice

TuffCut®
General Purpose End Mills

	Series	Page	# of Flutes	Square End	Ball Nose	Corner Radius	Length	Coating	Low Carbon Steel	Alloy Steel (up to 35 Rc)	Alloy Steel (36-45Rc)	Austenitic Stainless Steel	High Temp Alloys	Precipitation Hardened Stainless	Titanium	Gray Cast Iron	Ductile Cast Iron	Non-Ferrous	Hardened Materials	Plastics	Glass/Ceramic
	Intro	170																			
TuffCut® GP	**111**	171	4	x		x	Std./Micro		1st	1st	1st					1st	1st				
	111	175	4	x			Standard	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	114	176	4	x			Standard/ Chipbreaker	Uncoated/ TiN	1st							1st	1st				
	117	177	4	x			Standard/ NC Tol.		2nd	2nd						2nd	2nd				
	151	179	4	x			Standard/ Common Shk		2nd	2nd						2nd	2nd				
	163	180	4	x			Stub		1st	1st	1st					1st	1st				
	163	181	4	x			Stub	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	161	182	4	x			Stub/DE		2nd	2nd	2nd										
	122	183	4	x			X-Long		1st	1st	1st					1st	1st				
	132	184	4	x			X-Long/ Chipbreaker		1st							1st	1st				
	181	185	4	x			Ext. Reach		1st	1st	1st					1st	1st				
	116	186	3	x			Standard		1st	1st	1st					1st	1st				
	116	188	3	x			Standard	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	116C	189	3			x	Standard	TiCN	1st	1st	1st					1st	1st				
	169	190	3	x			Stub		1st	1st	1st					1st	1st				
	169	191	3	x			Stub	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	169C	192	3			x	Stub	TiCN	1st	1st	1st					1st	1st				
	121	193	2	x		x	Std./Micro		1st	1st	1st					1st	1st				
	121	198	2	x			Standard	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	164	199	2	x			Stub/Micro		1st	1st	1st					1st	1st				
	164	201	2	x			Stub	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	162	202	2	x			Stub/DE		2nd	2nd	2nd										
	123	203	2	x			X-Long		1st	1st	1st					1st	1st				
	183	204	2	x			Ext. Reach		1st	1st	1st					1st	1st				
	140	205	4		x		Standard		1st	1st	1st					1st	1st				
	140	206	4		x		Standard	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	165	207	4		x		Stub		1st	1st	1st					1st	1st				
	165	208	4		x		Stub	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	167	209	4		x		Stub/DE		2nd	2nd	2nd										
	184	210	4		x		Ext. Reach		1st	1st	1st					1st	1st				
	145	211	3		x		Standard		1st	1st	1st					1st	1st				
	145	211	3		x		Standard	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	150	212	2		x		Std./Micro		1st	1st	1st					1st	1st				
	150	214	2		x		Standard	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	166	215	2		x		Stub		1st	1st	1st					1st	1st				
	166	216	2		x		Stub	TiN/ ALtima®/ TiCN	1st	1st	1st					1st	1st				
	168	217	2		x		Stub/DE		2nd	2nd	2nd										
	186	218	2		x		Ext. Reach		1st	1st	1st					1st	1st				
Technical Information		222	114/132 Series																		
		250	General Purpose End Mills																		

1st 1st Choice 2nd 2nd Choice

TrueSize®
Reamers

	Series	Page	Flutes	Low Carbon Steel	Alloy Steel (up to 35 Rc)	Alloy Steel (36-45Rc)	Austenitic Stainless Steel	High Temp Alloys	Precipitation Hardened Stainless	Titanium	Gray Cast Iron	Ductile Cast Iron	Non-Ferrous	Hardened Materials	Plastics	Glass/Ceramic
True Size®	**Intro**	253														
	270	254	4/6 RHC	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	270L	254	4/6 LHS-RHC	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	272	256	4/6 RHC	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	Technical Information	279	All Reamers													

1st 1st Choice 2nd 2nd Choice

Countersinks

	Series	Page	# of Flutes	Carbide	HSS	Low Carbon Steel	Alloy Steel (up to 35 Rc)	Alloy Steel (36-45Rc)	Austenitic Stainless Steel	High Temp Alloys	Precipitation Hardened Stainless	Titanium	Gray Cast Iron	Ductile Cast Iron	Non-Ferrous	Hardened Materials	Plastics	Glass/Ceramic
Countersinks	**Intro**	284																
	60	286	Uniflute®	x		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	61	286	Uniflute®		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	61B	287	Uniflute®		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	61T	288	Uniflute®		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	64 Set	289	Uniflute®		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	62	289	Uniflute®		x	1st	1st	1st	1st	1st	1st	1st						
	65	290	Uniflute® Fixture															
	66	290	3		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	67	291	1		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	78	291	6	x		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	79	292	6		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	79B	293	6		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	79T	294	6		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	79 Set	295	6		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	92	296	3		x					1st		1st		1st		1st	1st	1st
	92 Set	296	3		x					1st		1st		1st		1st	1st	1st
Metric Countersinks	**880**	297	1		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	882	297	1		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	883	297	1		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	890	298	3		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	892	298	3		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	893	298	3		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
Micro-Stops	**83**	299	2		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	83TC	299	2	x		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	84	300	2		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	84TC	300	2	x		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	86	301	3		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
	87	301	3		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
Pilots	**850**	302			x													
	851	302			x													
	80	303	Fixtures and Non-Marking Pads															
Technical Information		304	All Countersinks															

1st 1st Choice 2nd 2nd Choice

Edge Hog® Burs

	Series	Page	Shape	Low Carbon Steel	Alloy Steel (up to 35 Rc)	Alloy Steel (36-45Rc)	Austenitic Stainless Steel	High Temp Alloys	Precipitation Hardened Stainless	Titanium	Gray Cast Iron	Ductile Cast Iron	Non-Ferrous	Hardened Materials	Plastics	Glass/Ceramic
	Intro	306														
Edge Hog® Burs	SA	308	Cylindrical Flat End	1st	1st	1st	1st	1st	1st	1st	1st	1st	Shear Cut		Shear Cut	
	SB	310	Cylindrical Flat End With End Cut	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SC	312	Cylindrical Radius End	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SD	314	Spherical	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SE	316	Elliptical	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SF	318	Tree Shape Radius End	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SG	320	Tree Shape Pointed End	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SH	322	Flame	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SJ	324	60° Angle Tool	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SK	325	90° Angle Tool	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SL	326	Conical Radius End	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SM	328	Conical	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	SN	330	Backtaper	1st	1st	1st	1st	1st	1st	1st	1st	1st				
	71 Sets	331		1st	1st	1st	1st	1st	1st	1st	1st	1st				
Grinding Tools	290	332	Lead Chamfer											1st		
	291	332	Square End											1st		
	291E	333	End Cut Square End											1st		
Technical Information		334	All Burs	1st 1st Choice 2nd 2nd Choice												
SCTI		335	Cross Reference Chart													

Boring Tools

	Series	Page	Stub	Standard	Long	Shank	Shank Flat	Low Carbon Steel	Alloy Steel (up to 35 Rc)	Alloy Steel (36-45Rc)	Austenitic Stainless Steel	High Temp Alloys	Precipitation Hardened Stainless	Titanium	Gray Cast Iron	Ductile Cast Iron	Non-Ferrous	Hardened Materials	Plastics	Glass/Ceramic
	Intro	341																		
Carbide Boring Tools	308	342		x	x	3/8" Steel		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		1st	
	308W	342		x	x	3/8" Steel	x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		1st	
	309	343		x	x	1/2" Steel		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		1st	
	309W	343		x	x	1/2" Steel	x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		1st	
	310	344	x	x	x			1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		1st	
	310W	345	x	x	x		x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		1st	
	330	346	x	x		10mm Steel		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		1st	
	330W	347	x	x		10 mm Steel	x	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st		1st	
	Technical Information	341	All Boring Tools					1st 1st Choice 2nd 2nd Choice												

Diamond Grind Routers

	Series	Page	End Grind	Low Carbon Steel	Alloy Steel (up to 35 Rc)	Alloy Steel (36-45Rc)	Austenitic Stainless Steel	High Temp Alloys	Precipitation Hardened Stainless	Titanium	Gray Cast Iron	Ductile Cast Iron	Non-Ferrous	Hardened Materials	Plastics	Glass/Ceramic
	Intro	348														
Diamond Grind Routers	230	349	Safe End										1st		1st	1st
	231	349	End Mill										1st		1st	1st
	231B	349	Bur End										1st		1st	1st
	231D	349	Drill Point										1st		1st	1st
	231F	349	Fishtail										1st		1st	1st
	Technical Information	348	All Diamond Grind Routers	1st 1st Choice 2nd 2nd Choice												

Custom Tools / Coatings / Forms

	Page	Description
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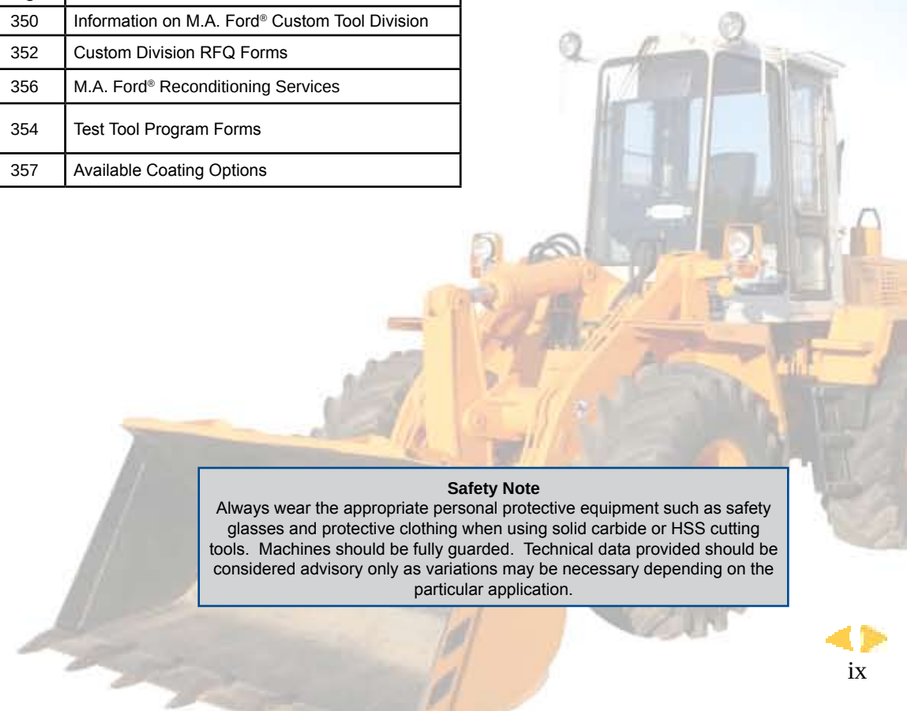
Coatings	357	Available Coating Options

Designed and Manufactured in the USA



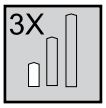
Safety Note
Always wear the appropriate personal protective equipment such as safety glasses and protective clothing when using solid carbide or HSS cutting tools. Machines should be fully guarded. Technical data provided should be considered advisory only as variations may be necessary depending on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

Icon Glossary

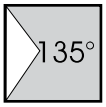
Drill Icons


Solid Carbide


Coolant Fed



Drill Length



Drill Point Angle

Helix Angle

Coatings

DIN Specs

Workpiece Material Group


Steels


Hardened Steels (35-65Rc)


Stainless Steels

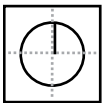

Cast Iron


Special Alloys


Non-Ferrous

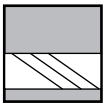
End Mill Icons

Number of Flutes

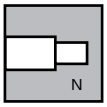

Center Cutting


Lengths

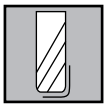
Coatings

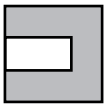

Helix Angle

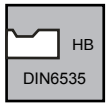

Ball Nose



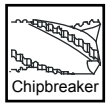
Neck Relief


Corner Radius


Shank



Shank/DIN



Chipbreaker

Workpiece Material Group


Steels


Hardened Steels (35-65Rc)


Stainless Steels


Cast Iron


Special Alloys


Non-Ferrous

Twister XD® Xtreme Drilling

Xtreme High Performance Drilling

- Twister XD® Series 2XDSS
- Twister XD® Series 2XDSR
- Twister XD® Series 2XDCR
- Twister XD® Series 2XDCL
- NEW Twister XD® Series 2XDCE
- NEW Twister® Series 200S - Spot Drills

Twister XD® Drill shanks are manufactured to h6 nominal diameters for heat shrink shank applications.

Designed and Manufactured in the USA

Twister XD® Xtreme Drilling

Xtreme High Performance Drilling with Xtended Tool Life in a Broad Range of Materials!

Includes the 2XDCE Series of Coolant Fed Extra Long Drills - 12X+ Drilling Lengths

See Page 29

Reduced “Cost /Hole”

Celebrating 90 Years 1919 - 2009

M.A. Ford®

“I would like to introduce you to our new solid carbide drill, Twister XD®. This drill was developed by the same M.A. Ford® engineering team that produced our highly successful TuffCut® XR family of carbide end mills. We believe the Twister XD® will reinforce our commitment to provide our distributors and their end user customers with high performance cutting tool solutions.

The XD drill is the result of a lengthy research and development effort. We have incorporated a new flute profile, a unique drill point, and the latest surface coating technology, to produce a drill that can be applied in a broad range of materials. The XD has undergone extensive field-testing and we are convinced that it will significantly reduce manufacturer’s “cost per hole”.

We have a network of M.A. Ford® factory trained application and technical specialists ready to show you why the Twister XD® should be your #1 choice when it comes to high performance drilling.

Thank you for your support, and thank you for your business.”

Steve Morency

Steve Morency
CEO, M.A. Ford®

Twister XD® Xtreme Drilling

Xtreme High Performance Drilling

Features

- Advanced “Active Cut” Geometric Design
- Redefined Critical Cut Zone Characteristics
- High-Efficiency Flute Profile
- “State-of-the-Art” Proprietary Coating
- Stable Low-Thrust Point Form
- Coolant-Fed or Solid
- Diameter Range - .5mm to 20.0mm, 1/64” to 3/4”
- Stub (3X), Regular (5X), Long (7X+) and Extra Long (12X+)
- Engineered and Produced in the USA

Benefits

- Extended Tool Life
- Elevated Metal Removal Rates (MRR)
- Lower cost Per Hole
- Improved Hole/Part Quality
- Increased Tool Reliability
- Factory Trained Network of Application & Technical Specialists
- Factory Reconditioning Service
- Ideal Platform for Modification or an Engineered “Special” Tool
- Compatibility to a Wide Range of Standard Toolholder Systems

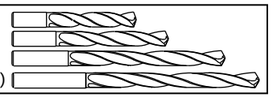
New Easy Read Numbering of Twister XD® Series

First Character	Second Character	Third Character	Fourth Character	Fifth Character	Sixth Character	Seventh Character	Eighth Character	Ninth Character	Tenth Character
Product Type	Platform	Platform	Coolant Fed or Solid	Length	Nominal Cutting Diameter	Nominal Cutting Diameter	Nominal Cutting Diameter	Nominal Cutting Diameter	Coating Grade
2	**X**	**D**	**C**	**R**	**2**	**5**	**0**	**0**	**A**

2=Holemaking

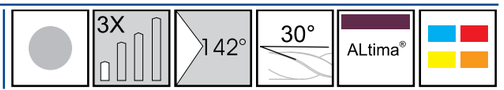
C=Coolant or S=Solid

S=Stub (3X)
R=Regular (5X)
L=Long (7X+)
E=Extra Long (12X+)

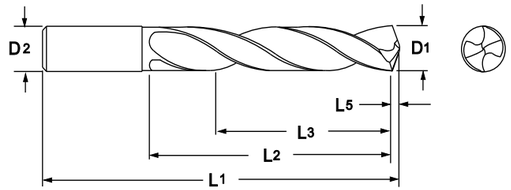


A=ALtima®

Twister XD 2XDSS



Designed for high performance drilling in a broad range of materials.



Tool No.	EDP	Diameter D1 (h7) Fraction	Diameter D1 (h7) Letter/ Wire	Diameter D1 (h7) mm	Diameter D1 (h7) Decimal	Shank D2 (h6) Inch	Shank D2 (h6) mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
2XDSS0984A	22601			2.5	.0984		2.5		43		14		11		0.39
2XDSS1142A	22602			2.9	.1142		2.9		46		16		12		0.45
2XDSS1181A	02100			3.0	.1181		3.0		57		16		13		0.46
2XDSS1200A	02102		31		.1200	1/8		2.25		0.750		0.60		0.019	
2XDSS1220A	02103			3.1	.1220		4.0		63		22		18		0.48
2XDSS1250A	02104	1/8			.1250	1/8		2.25		0.750		0.60		0.019	
2XDSS1260A	02106			3.2	.1260		4.0		63		22		18		0.50
2XDSS1285A	02108		30		.1285	5/32		2.50		0.875		0.70		0.020	
2XDSS1299A	02110			3.3	.1299		4.0		63		22		18		0.51
2XDSS1339A	02112			3.4	.1339		4.0		63		22		18		0.53
2XDSS1360A	02114		29		.1360	5/32		2.50		0.875		0.70		0.021	
2XDSS1378A	02116			3.5	.1378		4.0		63		22		18		0.54
2XDSS1406A	02118	9/64			.1406	5/32		2.50		0.875		0.70		0.022	
2XDSS1417A	02119			3.6	.1417		4.0		63		22		18		0.56
2XDSS1457A	02120			3.7	.1457		4.0		63		22		18		0.57
2XDSS1496A	02122			3.8	.1496		4.0		63		22		18		0.59
2XDSS1520A	02121		24		.1520	5/32		2.50		0.875		0.70		0.024	
2XDSS1535A	02123			3.9	.1535		4.0		63		22		18		0.60
2XDSS1562A	02124	5/32			.1562	5/32		2.50		0.875		0.70		0.024	
2XDSS1575A	02126			4.0	.1575		4.0		63		22		18		0.62
2XDSS1590A	02127		21		.1590	3/16		2.50		1.000		0.80		0.025	
2XDSS1614A	04000			4.1	.1614		5.0		63		26		21		0.64
2XDSS1654A	02128			4.2	.1654		5.0		63		26		21		0.65
2XDSS1693A	02129			4.3	.1693		5.0		63		26		21		0.67
2XDSS1719A	02130	11/64			.1719	3/16		2.50		1.000		0.80		0.027	
2XDSS1732A	02131			4.4	.1732		5.0		63		26		21		0.68
2XDSS1772A	02132			4.5	.1772		5.0		63		26		21		0.70
2XDSS1811A	02134			4.6	.1811		5.0		63		26		21		0.71

Technical information on page 100. Spot Drills on page 30.

Inch D1	Inch Tolerance (h7)
.0000 - .1181	+0/-.00039
.1182 - .2362	+0/-.00047
.2363 - .3937	+0/-.00059
.3938 - .7087	+0/-.00071
.7088 - .7500	+0/-.00083

Inch D2	Inch Tolerance (h6)
.0000 - .1181	+0/-.00024
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7500	+0/-.00051

Metric (mm) D1	Metric (mm) Tolerance (h7)
0 - 3.0	+0/-.010
3.01 - 6.0	+0/-.012
6.01 - 10.0	+0/-.015
10.01 - 18.0	+0/-.018
18.01 - 20.0	+0/-.021

Metric (mm) D2	Metric (mm) Tolerance (h6)
0 - 3.0	+0/-.006
3.01 - 6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 18.0	+0/-.011
18.01 - 20.0	+0/-.013

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Series 2XDSS Continued

Tool No.	EDP	Diameter D1 (h7) Fraction	Diameter D1 (h7) Letter/ Wire	Diameter D1 (h7) mm	Diameter D1 (h7) Decimal	Shank D2 (h6) Inch	Shank D2 (h6) mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
2XDSS1850A	02135			4.7	.1850		5.0		63		26		21		0.73
2XDSS1875A	02136	3/16			.1875	3/16		2.50		1.000		0.80		0.029	
2XDSS1890A	02138			4.8	.1890		5.0		63		26		21		0.74
2XDSS1929A	02140			4.9	.1929		5.0		63		26		21		0.76
2XDSS1968A	02142			5.0	.1968		5.0		63		26		21		0.77
2XDSS2008A	02144			5.1	.2008		6.0		76		30		24		0.79
2XDSS2031A	02146	13/64			.2031	15/64		3.00		1.125		0.90		0.031	
2XDSS2047A	02148			5.2	.2047		6.0		76		30		24		0.81
2XDSS2087A	02150			5.3	.2087		6.0		76		30		24		0.82
2XDSS2126A	02152			5.4	.2126		6.0		76		30		24		0.84
2XDSS2165A	02154			5.5	.2165		6.0		76		30		24		0.85
2XDSS2187A	02156	7/32			.2187	15/64		3.00		1.125		0.90		0.034	
2XDSS2210A	02158		2		.2210	15/64		3.00		1.125		0.90		0.034	
2XDSS2244A	02160			5.7	.2244		6.0		76		30		24		0.88
2XDSS2283A	02162			5.8	.2283		6.0		76		30		24		0.90
2XDSS2323A	02164			5.9	.2323		6.0		76		30		24		0.91
2XDSS2344A	02166	15/64			.2344	15/64		3.00		1.125		0.90		0.036	
2XDSS2362A	02168			6.0	.2362		6.0		76		30		24		0.93
2XDSS2402A	02170			6.1	.2402		8.0		82		35		28		0.95
2XDSS2420A	02172		C		.2420	1/4		3.00		1.250		1.00		0.037	
2XDSS2441A	02174			6.2	.2441		8.0		82		35		28		0.96
2XDSS2460A	02176		D		.2460	1/4		3.00		1.250		1.00		0.038	
2XDSS2480A	02178			6.3	.2480		8.0		82		35		28		0.98
2XDSS2500A	02180	1/4			.2500	1/4		3.00		1.250		1.00		0.039	
2XDSS2520A	02182			6.4	.2520		8.0		82		35		28		0.99
2XDSS2559A	02184			6.5	.2559		8.0		82		35		28		1.01
2XDSS2570A	02186		F		.2570	5/16		3.25		1.375		1.10		0.040	
2XDSS2598A	02185			6.6	.2598		8.0		82		35		28		1.03
2XDSS2610A	02188		G		.2610	5/16		3.25		1.375		1.10		0.040	
2XDSS2638A	02189			6.7	.2638		8.0		82		35		28		1.04
2XDSS2656A	02190	17/64			.2656	5/16		3.25		1.375		1.10		0.041	
2XDSS2677A	02192			6.8	.2677		8.0		82		35		28		1.05
2XDSS2717A	02194			6.9	.2717		8.0		82		35		28		1.07
2XDSS2756A	02196			7.0	.2756		8.0		82		35		28		1.08
2XDSS2795A	02197			7.1	.2795		8.0		82		38		31		1.10
2XDSS2812A	02198	9/32			.2812	5/16		3.25		1.500		1.20		0.044	
2XDSS2835A	02200			7.2	.2835		8.0		82		38		31		1.12
2XDSS2874A	02201			7.3	.2874		8.0		82		38		31		1.13
2XDSS2913A	02202			7.4	.2913		8.0		82		38		31		1.15
2XDSS2953A	02204			7.5	.2953		8.0		82		38		31		1.16
2XDSS2969A	02206	19/64			.2969	5/16		3.25		1.500		1.20		0.046	
2XDSS2992A	02208			7.6	.2992		8.0		82		38		31		1.18
2XDSS3031A	02210			7.7	.3031		8.0		82		38		31		1.19
2XDSS3071A	02212			7.8	.3071		8.0		82		38		31		1.21
2XDSS3110A	02213			7.9	.3110		8.0		82		38		31		1.22
2XDSS3125A	02214	5/16			.3125	5/16		3.25		1.500		1.20		0.048	
2XDSS3150A	02216			8.0	.3150		8.0		82		38		31		1.24
2XDSS3189A	02218			8.1	.3189		10.0		89		43		35		1.26
2XDSS3228A	02220			8.2	.3228		10.0		89		43		35		1.27
2XDSS3268A	02222			8.3	.3268		10.0		89		43		35		1.29
2XDSS3281A	02224	21/64			.3281	25/64		3.50		1.687		1.35		0.051	
2XDSS3307A	02223			8.4	.3307		10.0		89		43		35		1.31

Technical information on page 100. Spot Drills on page 30.

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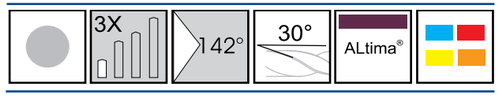
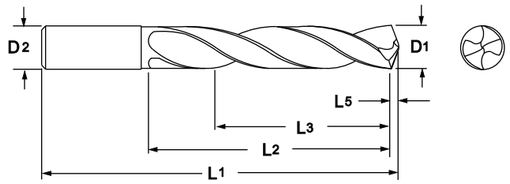
Series 2XDSS Continued





Tool No.	EDP	Diameter D1 (h7) Fraction	Letter/ Wire	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDSS3320A	02225		Q		.3320	25/64		3.50		1.687		1.35		0.051	
2XDSS3346A	02226			8.5	.3346		10.0		89		43		35		1.32
2XDSS3386A	02227			8.6	.3386		10.0		89		43		35		1.33
2XDSS3425A	04001			8.7	.3425		10.0		89		43		35		1.35
2XDSS3438A	02228	11/32			.3438	25/64		3.50		1.687		1.35		0.053	
2XDSS3465A	02230			8.8	.3465		10.0		89		43		35		1.36
2XDSS3504A	02232			8.9	.3504		10.0		89		43		35		1.38
2XDSS3543A	02234			9.0	.3543		10.0		89		43		35		1.39
2XDSS3583A	02235			9.1	.3583		10.0		89		43		35		1.41
2XDSS3594A	02236	23/64			.3594	25/64		3.50		1.687		1.35		0.056	
2XDSS3622A	02238			9.2	.3622		10.0		89		43		35		1.43
2XDSS3642A	02240			9.25	.3642		10.0		89		43		35		1.43
2XDSS3661A	02242			9.3	.3661		10.0		89		43		35		1.44
2XDSS3701A	02243			9.4	.3701		10.0		89		43		35		1.46
2XDSS3740A	02244			9.5	.3740		10.0		89		43		35		1.47
2XDSS3750A	02246	3/8			.3750	25/64		3.50		1.687		1.35		0.058	
2XDSS3780A	02247			9.6	.3780		10.0		89		43		35		1.49
2XDSS3819A	02248			9.7	.3819		10.0		89		43		35		1.50
2XDSS3858A	02250			9.8	.3858		10.0		89		43		35		1.52
2XDSS3898A	02251			9.9	.3898		10.0		89		43		35		1.53
2XDSS3906A	02252	25/64			.3906	25/64		3.50		1.687		1.35		0.061	
2XDSS3937A	02254			10.0	.3937		10.0		89		43		35		1.55
2XDSS3976A	02255			10.1	.3976		12.0		101		51		41		1.56
2XDSS4016A	02256			10.2	.4016		12.0		101		51		41		1.58
2XDSS4055A	02257			10.3	.4055		12.0		101		51		41		1.60
2XDSS4062A	02258	13/32			.4062	15/32		4.00		2.000		1.60		0.063	
2XDSS4094A	02259			10.4	.4094		12.0		101		51		41		1.61
2XDSS4134A	02260			10.5	.4134		12.0		101		51		41		1.63
2XDSS4173A	02261			10.6	.4173		12.0		101		51		41		1.64
2XDSS4213A	04002			10.7	.4213		12.0		101		51		41		1.66
2XDSS4219A	02262	27/64			.4219	15/32		4.00		2.000		1.60		0.065	
2XDSS4252A	02263			10.8	.4252		12.0		101		51		41		1.67
2XDSS4291A	04003			10.9	.4291		12.0		101		51		41		1.69
2XDSS4331A	02264			11.0	.4331		12.0		101		51		41		1.70
2XDSS4370A	02265			11.1	.4370		12.0		101		51		41		1.72
2XDSS4375A	02266	7/16			.4375	15/32		4.00		2.000		1.60		0.068	
2XDSS4409A	02268			11.2	.4409		12.0		101		51		41		1.74
2XDSS4449A	02269			11.3	.4449		12.0		101		51		41		1.75
2XDSS4488A	04004			11.4	.4488		12.0		101		51		41		1.77
2XDSS4527A	02270			11.5	.4527		12.0		101		51		41		1.78
2XDSS4567A	02271			11.6	.4567		12.0		101		51		41		1.80
2XDSS4606A	02272			11.7	.4606		12.0		101		51		41		1.81
2XDSS4646A	02273			11.8	.4646		12.0		101		51		41		1.83
2XDSS4685A	04005			11.9	.4685		12.0		101		51		41		1.84
2XDSS4688A	02274	15/32			.4688	15/32		4.00		2.000		1.60		0.073	

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Series 2XDSS Solid Stub

Series 2XDSS Continued

Tool No.	EDP	Diameter D1 (h7) Fraction	Letter/ Wire	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDSS4724A	02276			12.0	.4724		12.0		101		51		41		1.86
2XDSS4764A	02278			12.1	.4764		14.0		107		54		43		1.87
2XDSS4844A	02280	31/64			.4844	1/2		4.00		2.000		1.60		0.075	
2XDSS4921A	02282			12.5	.4921		14.0		107		54		43		1.94
2XDSS5000A	02284	1/2			.5000	1/2		4.00		2.000		1.60		0.077	
2XDSS5039A	02286			12.8	.5039		14.0		107		54		43		1.98
2XDSS5051A	02285			12.83	.5051		14.0		107		54		43		1.99
2XDSS5079A	02287			12.9	.5079		14.0		107		54		43		2.00
2XDSS5118A	02288			13.0	.5118		14.0		107		54		43		2.01
2XDSS5156A	02290	33/64			.5156	35/64		4.25		2.125		1.70		0.080	
2XDSS5312A	02291	17/32			.5312	35/64		4.25		2.125		1.70		0.082	
2XDSS5315A	02292			13.5	.5315		14.0		107		54		43		2.09
2XDSS5394A	02294			13.7	.5394		14.0		107		54		43		2.12
2XDSS5469A	02296	35/64			.5469	35/64		4.25		2.125		1.70		0.085	
2XDSS5512A	02298			14.0	.5512		14.0		107		54		43		2.17
2XDSS5625A	02300	9/16			.5625	5/8		4.625		2.375		1.90		0.087	
2XDSS5709A	02302			14.5	.5709		16.0		117		60		48		2.25
2XDSS5787A	02304			14.7	.5787		16.0		117		60		48		2.28
2XDSS5905A	02306			15.0	.5905		16.0		117		60		48		2.32
2XDSS5938A	02308	19/32			.5938	5/8		4.625		2.375		1.90		0.092	
2XDSS6024A	02309			15.3	.6024		16.0		117		60		48		2.37
2XDSS6102A	02310			15.5	.6102		16.0		117		60		48		2.40
2XDSS6181A	02312			15.7	.6181		16.0		117		60		48		2.43
2XDSS6250A	02314	5/8			.6250	5/8		4.625		2.375		1.90		0.097	
2XDSS6299A	02316			16.0	.6299		16.0		117		60		48		2.48
2XDSS6331A	02318			16.08	.6331		18.0		122		63		51		2.49
2XDSS6417A	02319			16.3	.6417		18.0		122		63		51		2.53
2XDSS6496A	02320			16.5	.6496		18.0		122		63		51		2.56
2XDSS6562A	02322	21/32			.6562	45/64		4.81		2.500		2.00		0.102	
2XDSS6693A	02324			17.0	.6693		18.0		122		63		51		2.63
2XDSS6875A	02326	11/16			.6875	45/64		4.81		2.500		2.00		0.107	
2XDSS6890A	02328			17.5	.6890		18.0		122		63		51		2.71
2XDSS7087A	02330			18.0	.7087		18.0		122		63		51		2.79
2XDSS7283A	02332			18.5	.7283		20.0		133		70		56		2.87
2XDSS7500A	02334	3/4			.7500	3/4		5.25		2.750		2.20		0.116	
2XDSS7543A	02336			19.16	.7543		20.0		133		70		56		2.97
2XDSS7579A	02338			19.25	.7579		20.0		133		70		56		2.98
2XDSS7598A	02340			19.3	.7598		20.0		133		70		56		2.99
2XDSS7677A	02342			19.5	.7677		20.0		133		70		56		3.02
2XDSS7874A	02344			20.0	.7874		20.0		133		70		56		3.10

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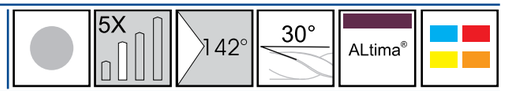
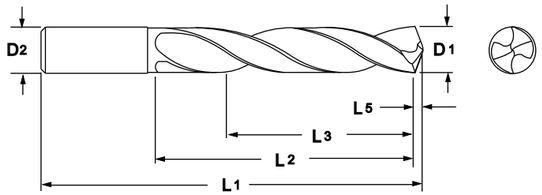
Twister XD
2XDSR



Designed for high performance drilling in a broad range of materials.



Tool No.	EDP	Diameter D1 (h7) Fraction	Letter/ Wire	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDSR0156A	22201	1/64			.0156	1/64		1.50		0.187		0.140		0.002	
2XDSR0197A	28001			0.5	.0197		0.50		26		6		5		0.08
2XDSR0236A	28006			0.6	.0236		0.60		26		7		5		0.09
2XDSR0256A	28011			0.65	.0256		0.65		26		8		6		0.10
2XDSR0312A	22221	1/32			.0312	1/32		1.50		0.375		0.281		0.005	
2XDSR0374A	28016			0.95	.0374		0.95		32		11		8		0.15
2XDSR0394A	28021			1.0	.0394		1.00		34		12		9		0.16
2XDSR0413A	28026			1.05	.0413		1.05		34		12		9		0.16
2XDSR0469A	22241	3/64			.0469	3/64		1.50		0.750		0.562		0.007	
2XDSR0492A	28031			1.25	.0492		1.25		38		16		12		0.19
2XDSR0590A	28036			1.5	.0590		1.50		40		18		14		0.23
2XDSR0625A	22256	1/16			.0625	1/16		1.50		0.750		0.562		0.010	
2XDSR0630A	28041			1.6	.0630		1.60		43		20		15		0.25
2XDSR0708A	28046			1.8	.0708		1.80		46		22		17		0.28
2XDSR0748A	28051			1.9	.0748		1.90		46		22		17		0.29
2XDSR0781A	22276	5/64			.0781	5/64		1.75		0.875		0.656		0.012	
2XDSR0787A	28056			2.0	.0787		2.00		49		24		18		0.31
2XDSR0807A	28058			2.05	.0807		2.05		49		24		18		0.32
2XDSR0906A	28061			2.3	.0906		2.30		53		27		20		0.36
2XDSR0938A	22291	3/32			.0938	3/32		2.00		1.000		0.750		0.015	
2XDSR0945A	28066			2.4	.0945		2.40		57		30		23		0.37
2XDSR0984A	28071			2.5	.0984		2.50		57		30		23		0.39
2XDSR1094A	22306	7/64			.1094	7/64		2.25		1.250		0.937		0.017	
2XDSR1142A	28073			2.9	.1142		2.90		61		33		25		0.45
2XDSR1181A	02346			3.0	.1181		3.00		63		24		19		0.46
2XDSR1200A	02348		31		.1200	1/8		2.50		1.125		0.900		0.019	
2XDSR1220A	02349			3.1	.1220		4.00		69		32		26		0.48
2XDSR1250A	02350	1/8			.1250	1/8		2.50		1.125		0.900		0.019	
2XDSR1260A	02352			3.2	.1260		4.00		69		32		26		0.50
2XDSR1285A	02354		30		.1285	5/32		2.75		1.260		1.000		0.020	
2XDSR1299A	02356			3.3	.1299		4.00		69		32		26		0.51

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Inch D1	Inch Tolerance (h7)
.0000 - .1181	+0/-.00039
.1182 - .2362	+0/-.00047
.2363 - .3937	+0/-.00059
.3938 - .6250	+0/-.00071

Inch D2	Inch Tolerance (h6)
.0000 - .1181	+0/-.00024
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .6250	+0/-.00043

Metric (mm) D1	Metric (mm) Tolerance (h7)
0 - 3.0	+0/-.010
3.01 - 6.0	+0/-.012
6.01 - 10.0	+0/-.015
10.01 - 16.0	+0/-.018

Metric (mm) D2	Metric (mm) 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

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Series 2XDSR Continued

Tool No.	EDP	Diameter D1 (h7) Fraction	Letter/ Wire	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDSR1339A	02358			3.4	.1339		4.0		69		32		26		0.53
2XDSR1360A	02360		29		.1360	5/32		2.75		1.260		1.000		0.021	
2XDSR1378A	02362			3.5	.1378		4.0		69		32		26		0.54
2XDSR1406A	02364	9/64			.1406	5/32		2.75		1.260		1.000		0.022	
2XDSR1417A	02365			3.6	.1417		4.0		69		32		26		0.56
2XDSR1457A	02366			3.7	.1457		4.0		69		32		26		0.57
2XDSR1496A	02368			3.8	.1496		4.0		69		32		26		0.59
2XDSR1520A	02367		24		.1520	5/32		2.75		1.260		1.000		0.024	
2XDSR1535A	02369			3.9	.1535		4.0		69		32		26		0.60
2XDSR1562A	02370	5/32			.1562	5/32		2.75		1.260		1.000		0.024	
2XDSR1575A	02372			4.0	.1575		4.0		69		32		26		0.62
2XDSR1590A	02373		21		.1590	3/16		3.15		1.500		1.200		0.025	
2XDSR1614A	04006			4.1	.1614		5.0		80		38		30		0.64
2XDSR1654A	02374			4.2	.1654		5.0		80		38		30		0.65
2XDSR1693A	02375			4.3	.1693		5.0		80		38		30		0.67
2XDSR1719A	02376	11/64			.1719	3/16		3.15		1.500		1.200		0.027	
2XDSR1732A	02377			4.4	.1732		5.0		80		38		30		0.68
2XDSR1772A	02378			4.5	.1772		5.0		80		38		30		0.70
2XDSR1811A	02380			4.6	.1811		5.0		80		38		30		0.71
2XDSR1850A	02381			4.7	.1850		5.0		80		38		30		0.73
2XDSR1875A	02382	3/16			.1875	3/16		3.15		1.500		1.200		0.029	
2XDSR1890A	02384			4.8	.1890		5.0		80		38		30		0.74
2XDSR1929A	02386			4.9	.1929		5.0		80		38		30		0.76
2XDSR1968A	02388			5.0	.1968		5.0		80		38		30		0.77
2XDSR2008A	02390			5.1	.2008		6.0		82		40		32		0.79
2XDSR2031A	02392	13/64			.2031	15/64		3.23		1.580		1.260		0.031	
2XDSR2047A	02394			5.2	.2047		6.0		82		40		32		0.81
2XDSR2087A	02396			5.3	.2087		6.0		82		40		32		0.82
2XDSR2126A	02398			5.4	.2126		6.0		82		40		32		0.84
2XDSR2165A	02400			5.5	.2165		6.0		82		40		32		0.85
2XDSR2187A	02402	7/32			.2187	15/64		3.23		1.580		1.260		0.034	
2XDSR2210A	02404		2		.2210	15/64		3.23		1.580		1.260		0.034	
2XDSR2244A	02406			5.7	.2244		6.0		82		40		32		0.88
2XDSR2283A	02408			5.8	.2283		6.0		82		40		32		0.90
2XDSR2323A	02410			5.9	.2323		6.0		82		40		32		0.91
2XDSR2344A	02412	15/64			.2344	15/64		3.23		1.580		1.260		0.036	
2XDSR2362A	02414			6.0	.2362		6.0		82		40		32		0.93
2XDSR2402A	02416			6.1	.2402		8.0		91		48		38		0.95
2XDSR2420A	02418		C		.2420	1/4		3.25		1.740		1.390		0.037	
2XDSR2441A	02420			6.2	.2441		8.0		91		48		38		0.96
2XDSR2460A	02422		D		.2460	1/4		3.25		1.740		1.390		0.038	
2XDSR2480A	02424			6.3	.2480		8.0		91		48		38		0.98
2XDSR2500A	02426	1/4			.2500	1/4		3.25		1.740		1.390		0.039	
2XDSR2520A	02428			6.4	.2520		8.0		91		48		38		0.99
2XDSR2559A	02430			6.5	.2559		8.0		91		48		38		1.01
2XDSR2570A	02432		F		.2570	5/16		3.58		1.890		1.510		0.040	
2XDSR2598A	02433			6.6	.2598		8.0		91		48		38		1.03
2XDSR2610A	02434		G		.2610	5/16		3.58		1.890		1.510		0.040	
2XDSR2638A	02435			6.7	.2638		8.0		91		48		38		1.04
2XDSR2656A	02436	17/64			.2656	5/16		3.58		1.890		1.510		0.041	
2XDSR2677A	02438			6.8	.2677		8.0		91		48		38		1.05
2XDSR2717A	02440			6.9	.2717		8.0		91		48		38		1.07
2XDSR2756A	02442			7.0	.2756		8.0		91		48		38		1.08

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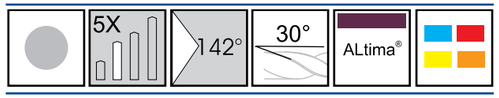

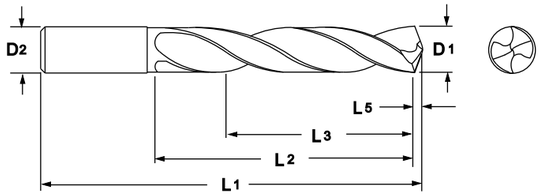

Tool No.	EDP	Diameter				Shank		OAL		Flute Length		Drill Length		Point Length	
		D1 (h7)				D2 (h6)		L1		L2		L3 Ref.		L5	
		Fraction	Letter/ Wire	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
2XDSR2795A	02443			7.1	.2795		8.0		91		48		38		1.10
2XDSR2812A	02444	9/32			.2812	5/16		3.58		1.890		1.510		0.044	
2XDSR2835A	02446			7.2	.2835		8.0		91		48		38		1.12
2XDSR2874A	02447			7.3	.2874		8.0		91		48		38		1.13
2XDSR2913A	02448			7.4	.2913		8.0		91		48		38		1.15
2XDSR2953A	02450			7.5	.2953		8.0		91		48		38		1.16
2XDSR2969A	02452	19/64			.2969	5/16		3.58		1.890		1.510		0.046	
2XDSR2992A	02454			7.6	.2992		8.0		91		48		38		1.18
2XDSR3031A	02456			7.7	.3031		8.0		91		48		38		1.19
2XDSR3071A	02458			7.8	.3071		8.0		91		48		38		1.21
2XDSR3110A	02459			7.9	.3110		8.0		91		48		38		1.22
2XDSR3125A	02460	5/16			.3125	5/16		3.58		1.890		1.510		0.048	
2XDSR3150A	02480			8.0	.3150		8.0		91		48		38		1.24
2XDSR3189A	02482			8.1	.3189		10.0		103		55		44		1.26
2XDSR3228A	02484			8.2	.3228		10.0		103		55		44		1.27
2XDSR3268A	02486			8.3	.3268		10.0		103		55		44		1.29
2XDSR3281A	02488	21/64			.3281	25/64		4.06		2.170		1.740		0.051	
2XDSR3307A	02487			8.4	.3307		10.0		103		55		44		1.31
2XDSR3320A	02489		Q		.3320	25/64		4.06		2.170		1.740		0.051	
2XDSR3346A	02490			8.5	.3346		10.0		103		55		44		1.32
2XDSR3386A	02491			8.6	.3386		10.0		103		55		44		1.33
2XDSR3425A	04007			8.7	.3425		10.0		103		55		44		1.35
2XDSR3438A	02492	11/32			.3438	25/64		4.06		2.170		1.740		0.053	
2XDSR3465A	02494			8.8	.3465		10.0		103		55		44		1.36
2XDSR3504A	02496			8.9	.3504		10.0		103		55		44		1.38
2XDSR3543A	02498			9.0	.3543		10.0		103		55		44		1.39
2XDSR3583A	02499			9.1	.3583		10.0		103		55		44		1.41
2XDSR3594A	02500	23/64			.3594	25/64		4.06		2.170		1.740		0.056	
2XDSR3622A	02502			9.2	.3622		10.0		103		55		44		1.43
2XDSR3642A	02504			9.25	.3642		10.0		103		55		44		1.43
2XDSR3661A	02506			9.3	.3661		10.0		103		55		44		1.44
2XDSR3701A	02507			9.4	.3701		10.0		103		55		44		1.46
2XDSR3740A	02508			9.5	.3740		10.0		103		55		44		1.47
2XDSR3750A	02510	3/8			.3750	25/64		4.06		2.170		1.740		0.058	
2XDSR3780A	02511			9.6	.3780		10.0		103		55		44		1.49
2XDSR3819A	02512			9.7	.3819		10.0		103		55		44		1.50
2XDSR3858A	02514			9.8	.3858		10.0		103		55		44		1.52
2XDSR3898A	02515			9.9	.3898		10.0		103		55		44		1.53
2XDSR3906A	02516	25/64			.3906	25/64		4.06		2.170		1.740		0.061	
2XDSR3937A	02518			10.0	.3937		10.0		103		55		44		1.55
2XDSR3976A	02519			10.1	.3976		12.0		120		60		48		1.56
2XDSR4016A	02520			10.2	.4016		12.0		120		60		48		1.58
2XDSR4055A	02521			10.3	.4055		12.0		120		60		48		1.60
2XDSR4062A	02522	13/32			.4062	15/32		4.72		2.360		1.890		0.063	
2XDSR4094A	02523			10.4	.4094		12.0		120		60		48		1.61

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Series 2XDSR Solid Regular

Series 2XDSR Continued

Tool No.	EDP	Diameter				Shank		OAL		Flute Length		Drill Length		Point Length	
		D1 (h7)				D2 (h6)		L1		L2		L3 Ref.		L5	
		Fraction	Letter/ Wire	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
2XDSR4134A	02524			10.5	.4134		12.0		120		60		48		1.63
2XDSR4173A	02525			10.6	.4173		12.0		120		60		48		1.64
2XDSR4213A	04008			10.7	.4213		12.0		120		60		48		1.66
2XDSR4219A	02526	27/64			.4219	15/32		4.72		2.360		1.890		0.065	
2XDSR4252A	02527			10.8	.4252		12.0		120		60		48		1.67
2XDSR4291A	04009			10.9	.4291		12.0		120		60		48		1.69
2XDSR4331A	02528			11.0	.4331		12.0		120		60		48		1.70
2XDSR4370A	02529			11.1	.4370		12.0		120		66		53		1.72
2XDSR4375A	02530	7/16			.4375	15/32		4.72		2.600		2.080		0.068	
2XDSR4409A	02532			11.2	.4409		12.0		120		66		53		1.74
2XDSR4449A	02533			11.3	.4449		12.0		120		66		53		1.75
2XDSR4488A	04010			11.4	.4488		12.0		120		66		53		1.77
2XDSR4527A	02534			11.5	.4527		12.0		120		66		53		1.78
2XDSR4567A	02535			11.6	.4567		12.0		120		66		53		1.80
2XDSR4606A	02536			11.7	.4606		12.0		120		66		53		1.81
2XDSR4646A	02537			11.8	.4646		12.0		120		66		53		1.83
2XDSR4685A	04011			11.9	.4685		12.0		120		66		53		1.84
2XDSR4688A	02538	15/32			.4688	15/32		4.72		2.600		2.080		0.073	
2XDSR4724A	02540			12.0	.4724		12.0		120		66		53		1.86
2XDSR4764A	02542			12.1	.4764		14.0		126		72		58		1.87
2XDSR4844A	02544	31/64			.4844	1/2		4.75		2.830		2.260		0.075	
2XDSR4921A	02546			12.5	.4921		14.0		126		72		58		1.94
2XDSR5000A	02548	1/2			.5000	1/2		4.75		2.830		2.260		0.077	
2XDSR5039A	02550			12.8	.5039		14.0		126		72		58		1.98
2XDSR5051A	02549			12.83	.5051		14.0		126		72		58		1.99
2XDSR5079A	02551			12.9	.5079		14.0		126		72		58		2.00
2XDSR5118A	02552			13.0	.5118		14.0		126		72		58		2.01
2XDSR5156A	02554	33/64			.5156	35/64		5.28		3.030		2.420		0.080	
2XDSR5312A	02555	17/32			.5312	35/64		5.28		3.030		2.420		0.082	
2XDSR5315A	02556			13.5	.5315		14.0		134		77		62		2.09
2XDSR5394A	02558			13.7	.5394		14.0		134		77		62		2.12
2XDSR5469A	02560	35/64			.5469	35/64		5.28		3.030		2.420		0.085	
2XDSR5512A	02562			14.0	.5512		14.0		134		77		62		2.17
2XDSR5625A	02564	9/16			.5625	5/8		5.51		3.150		2.520		0.087	
2XDSR5709A	02566			14.5	.5709		16.0		140		80		64		2.25
2XDSR5787A	02568			14.7	.5787		16.0		140		80		64		2.28
2XDSR5905A	02570			15.0	.5905		16.0		140		80		64		2.32
2XDSR5938A	02572	19/32			.5938	5/8		5.75		3.230		2.580		0.092	
2XDSR6024A	02573			15.3	.6024		16.0		146		82		66		2.37
2XDSR6102A	02574			15.5	.6102		16.0		146		82		66		2.40
2XDSR6181A	02576			15.7	.6181		16.0		146		82		66		2.43
2XDSR6250A	02578	5/8			.6250	5/8		5.75		3.230		2.580		0.097	
2XDSR6299A	02580			16.0	.6299		16.0		146		82		66		2.48

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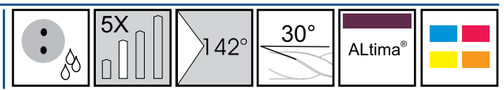
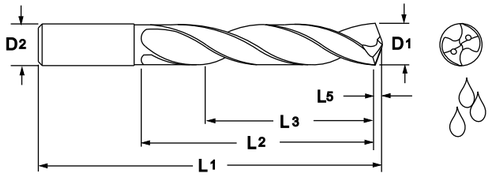
Twister XD 2XDCR



Designed for high performance drilling in a broad range of materials.



Tool No.	EDP	Diameter D1 (h7) Fraction	Letter/ Wire	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDCR1181A	02582			3.0	.1181		3.0		75		24		19		0.46
2XDCR1200A	02584		31		.1200	1/8		3.00		1.125		.90		0.019	
2XDCR1220A	02585			3.1	.1220		4.0		80		32		26		0.48
2XDCR1250A	02586	1/8			.1250	1/8		3.00		1.125		.90		0.019	
2XDCR1260A	02590			3.2	.1260		4.0		80		32		26		0.50
2XDCR1285A	02592		30		.1285	5/32		3.15		1.260		1.00		0.020	
2XDCR1299A	02594			3.3	.1299		4.0		80		32		26		0.51
2XDCR1339A	02596			3.4	.1339		4.0		80		32		26		0.53
2XDCR1360A	02598		29		.1360	5/32		3.15		1.260		1.00		0.021	
2XDCR1378A	02600			3.5	.1378		4.0		80		32		26		0.54
2XDCR1406A	02602	9/64			.1406	5/32		3.15		1.260		1.00		0.022	
2XDCR1417A	02603			3.6	.1417		4.0		80		32		26		0.56
2XDCR1457A	02604			3.7	.1457		4.0		80		32		26		0.57
2XDCR1496A	02606			3.8	.1496		4.0		80		32		26		0.59
2XDCR1520A	02605		24		.1520	5/32		3.15		1.260		1.00		0.024	
2XDCR1535A	02607			3.9	.1535		4.0		80		32		26		0.60
2XDCR1562A	02608	5/32			.1562	5/32		3.15		1.260		1.00		0.024	
2XDCR1575A	02610			4.0	.1575		4.0		80		32		26		0.62
2XDCR1590A	02611		21		.1590	3/16		3.23		1.500		1.20		0.025	
2XDCR1614A	04012			4.1	.1614		5.0		82		38		30		0.64
2XDCR1654A	02612			4.2	.1654		5.0		82		38		30		0.65
2XDCR1693A	02613			4.3	.1693		5.0		82		38		30		0.67
2XDCR1719A	02614	11/64			.1719	3/16		3.23		1.500		1.20		0.027	
2XDCR1732A	02615			4.4	.1732		5.0		82		38		30		0.68
2XDCR1772A	02616			4.5	.1772		5.0		82		38		30		0.70
2XDCR1811A	02618			4.6	.1811		5.0		82		38		30		0.71
2XDCR1850A	02619			4.7	.1850		5.0		82		38		30		0.73
2XDCR1875A	02620	3/16			.1875	3/16		3.23		1.500		1.20		0.029	
2XDCR1890A	02622			4.8	.1890		5.0		82		38		30		0.74
2XDCR1929A	02624			4.9	.1929		5.0		82		38		30		0.76
2XDCR1968A	02626			5.0	.1968		5.0		82		38		30		0.77
2XDCR2008A	02628			5.1	.2008		6.0		82		40		32		0.79

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Inch D1	Inch Tolerance (h7)
.0000 - .1181	+0/-.00039
.1182 - .2362	+0/-.00047
.2363 - .3937	+0/-.00059
.3938 - .7087	+0/-.00071
.7088 - .7500	+0/-.00083

Inch D2	Inch Tolerance (h6)
.0000 - .1181	+0/-.00024
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .7087	+0/-.00043
.7088 - .7500	+0/-.00051

Metric (mm) D1	Metric (mm) Tolerance (h7)
0 - 3.0	+0/-.010
3.01 - 6.0	+0/-.012
6.01 - 10.0	+0/-.015
10.01 - 18.0	+0/-.018
18.01 - 20.0	+0/-.021

Metric (mm) D2	Metric (mm) Tolerance (h6)
0 - 3.0	+0/-.006
3.01 - 6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 18.0	+0/-.011
18.01 - 20.0	+0/-.013

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Series 2XDCR Continued

Tool No.	EDP	Diameter D1 (h7) Fraction	Letter/ Wire	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDCR2031A	02630	13/64			.2031	15/64		3.23		1.580		1.26		0.031	
2XDCR2047A	02632			5.2	.2047		6.0		82		40		32		0.81
2XDCR2087A	02634			5.3	.2087		6.0		82		40		32		0.82
2XDCR2126A	02636			5.4	.2126		6.0		82		40		32		0.84
2XDCR2165A	02638			5.5	.2165		6.0		82		40		32		0.85
2XDCR2187A	02640	7/32			.2187	15/64		3.23		1.580		1.26		0.034	
2XDCR2210A	02642		2		.2210	15/64		3.23		1.580		1.26		0.034	
2XDCR2244A	02644			5.7	.2244		6.0		82		40		32		0.88
2XDCR2283A	02646			5.8	.2283		6.0		82		40		32		0.90
2XDCR2323A	02648			5.9	.2323		6.0		82		40		32		0.91
2XDCR2344A	02650	15/64			.2344	15/64		3.23		1.580		1.26		0.036	
2XDCR2362A	02652			6.0	.2362		6.0		82		40		32		0.93
2XDCR2402A	02654			6.1	.2402		8.0		91		48		38		0.95
2XDCR2420A	02656		C		.2420	1/4		3.30		1.740		1.39		0.037	
2XDCR2441A	02658			6.2	.2441		8.0		91		48		38		0.96
2XDCR2460A	02660		D		.2460	1/4		3.30		1.740		1.39		0.038	
2XDCR2480A	02662			6.3	.2480		8.0		91		48		38		0.98
2XDCR2500A	02664	1/4			.2500	1/4		3.30		1.740		1.39		0.039	
2XDCR2520A	02666			6.4	.2520		8.0		91		48		38		0.99
2XDCR2559A	02668			6.5	.2559		8.0		91		48		38		1.01
2XDCR2570A	02670		F		.2570	5/16		3.58		1.890		1.51		0.040	
2XDCR2598A	02671			6.6	.2598		8.0		91		48		38		1.03
2XDCR2610A	02672		G		.2610	5/16		3.58		1.890		1.51		0.040	
2XDCR2638A	02673			6.7	.2638		8.0		91		48		38		1.04
2XDCR2656A	02674	17/64			.2656	5/16		3.58		1.890		1.51		0.041	
2XDCR2677A	02676			6.8	.2677		8.0		91		48		38		1.05
2XDCR2717A	02678			6.9	.2717		8.0		91		48		38		1.07
2XDCR2756A	02680			7.0	.2756		8.0		91		48		38		1.08
2XDCR2795A	02681			7.1	.2795		8.0		91		48		38		1.10
2XDCR2812A	02682	9/32			.2812	5/16		3.58		1.890		1.51		0.044	
2XDCR2835A	02684			7.2	.2835		8.0		91		48		38		1.12
2XDCR2874A	02685			7.3	.2874		8.0		91		48		38		1.13
2XDCR2913A	02686			7.4	.2913		8.0		91		48		38		1.15
2XDCR2953A	02688			7.5	.2953		8.0		91		48		38		1.16
2XDCR2969A	02690	19/64			.2969	5/16		3.58		1.890		1.51		0.046	
2XDCR2992A	02692			7.6	.2992		8.0		91		48		38		1.18
2XDCR3031A	02694			7.7	.3031		8.0		91		48		38		1.19
2XDCR3071A	02696			7.8	.3071		8.0		91		48		38		1.21
2XDCR3110A	02697			7.9	.3110		8.0		91		48		38		1.22
2XDCR3125A	02698	5/16			.3125	5/16		3.58		1.890		1.51		0.048	
2XDCR3150A	02700			8.0	.3150		8.0		91		48		38		1.24
2XDCR3189A	02702			8.1	.3189		10.0		103		55		44		1.26
2XDCR3228A	02704			8.2	.3228		10.0		103		55		44		1.27
2XDCR3268A	02706			8.3	.3268		10.0		103		55		44		1.29
2XDCR3281A	02708	21/64			.3281	25/64		4.06		2.170		1.74		0.051	
2XDCR3307A	02707			8.4	.3307		10.0		103		55		44		1.31
2XDCR3320A	02709		Q		.3320	25/64		4.06		2.170		1.74		0.051	
2XDCR3346A	02710			8.5	.3346		10.0		103		55		44		1.32
2XDCR3386A	02711			8.6	.3386		10.0		103		55		44		1.33
2XDCR3425A	04013			8.7	.3425		10.0		103		55		44		1.35
2XDCR3438A	02712	11/32			.3438	25/64		4.06		2.170		1.74		0.053	

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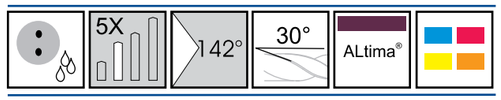

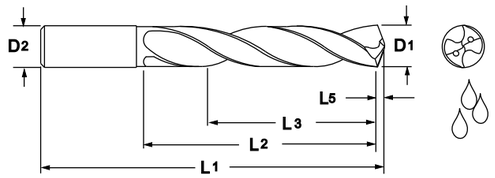

Tool No.	EDP	Diameter D1 (h7) Fraction	Letter/ Wire	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDCR3465A	02714			8.8	.3465		10.0		103		55		44		1.36
2XDCR3504A	02716			8.9	.3504		10.0		103		55		44		1.38
2XDCR3543A	02718			9.0	.3543		10.0		103		55		44		1.39
2XDCR3583A	02719			9.1	.3583		10.0		103		55		44		1.41
2XDCR3594A	02720	23/64			.3594	25/64		4.06		2.170		1.74		0.056	
2XDCR3622A	02722			9.2	.3622		10.0		103		55		44		1.43
2XDCR3642A	02724			9.25	.3642		10.0		103		55		44		1.43
2XDCR3661A	02726			9.3	.3661		10.0		103		55		44		1.44
2XDCR3701A	02727			9.4	.3701		10.0		103		55		44		1.46
2XDCR3740A	02728			9.5	.3740		10.0		103		55		44		1.47
2XDCR3750A	02730	3/8			.3750	25/64		4.06		2.170		1.74		0.058	
2XDCR3780A	02731			9.6	.3780		10.0		103		55		44		1.49
2XDCR3819A	02732			9.7	.3819		10.0		103		55		44		1.50
2XDCR3858A	02734			9.8	.3858		10.0		103		55		44		1.52
2XDCR3898A	02735			9.9	.3898		10.0		103		55		44		1.53
2XDCR3906A	02736	25/64			.3906	25/64		4.06		2.170		1.74		0.061	
2XDCR3937A	02738			10.0	.3937		10.0		103		55		44		1.55
2XDCR3976A	02739			10.1	.3976		12.0		120		60		48		1.56
2XDCR4016A	02740			10.2	.4016		12.0		120		60		48		1.58
2XDCR4055A	02741			10.3	.4055		12.0		120		60		48		1.60
2XDCR4062A	02742	13/32			.4062	15/32		4.72		2.360		1.89		0.063	
2XDCR4094A	02743			10.4	.4094		12.0		120		60		48		1.61
2XDCR4134A	02744			10.5	.4134		12.0		120		60		48		1.63
2XDCR4173A	02745			10.6	.4173		12.0		120		60		48		1.64
2XDCR4213A	04014			10.7	.4213		12.0		120		60		48		1.66
2XDCR4219A	02746	27/64			.4219	15/32		4.72		2.360		1.89		0.065	
2XDCR4252A	02747			10.8	.4252		12.0		120		60		48		1.67
2XDCR4291A	04015			10.9	.4291		12.0		120		60		48		1.69
2XDCR4331A	02748			11.0	.4331		12.0		120		60		48		1.70
2XDCR4370A	02749			11.1	.4370		12.0		120		66		53		1.72
2XDCR4375A	02750	7/16			.4375	15/32		4.72		2.600		2.08		0.068	
2XDCR4409A	02752			11.2	.4409		12.0		120		66		53		1.74
2XDCR4449A	02753			11.3	.4449		12.0		120		66		53		1.75
2XDCR4488A	04016			11.4	.4488		12.0		120		66		53		1.77
2XDCR4527A	02754			11.5	.4527		12.0		120		66		53		1.78
2XDCR4567A	02755			11.6	.4567		12.0		120		66		53		1.80
2XDCR4606A	02756			11.7	.4606		12.0		120		66		53		1.81
2XDCR4646A	02757			11.8	.4646		12.0		120		66		53		1.83
2XDCR4685A	04017			11.9	.4685		12.0		120		66		53		1.84
2XDCR4688A	02758	15/32			.4688	15/32		4.72		2.600		2.08		0.073	
2XDCR4724A	02760			12.0	.4724		12.0		120		66		53		1.86
2XDCR4764A	02762			12.1	.4764		14.0		126		72		58		1.87
2XDCR4844A	02764	31/64			.4844	1/2		4.75		2.830		2.26		0.075	
2XDCR4921A	02766			12.5	.4921		14.0		126		72		58		1.94

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Series 2XDCR Continued

Tool No.	EDP	Diameter D1 (h7) Fraction	Letter/ Wire	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDCR5000A	02768	1/2			.5000	1/2		4.75		2.830		2.26		0.077	
2XDCR5039A	02770			12.8	.5039		14.0		126		72		58		1.98
2XDCR5051A	02769			12.83	.5051		14.0		126		72		58		1.99
2XDCR5079A	02771			12.9	.5079		14.0		126		72		58		2.00
2XDCR5118A	02772			13.0	.5118		14.0		126		72		58		2.01
2XDCR5156A	02774	33/64			.5156	35/64		5.28		3.03		2.42		0.080	
2XDCR5312A	02775	17/32			.5312	35/64		5.28		3.03		2.42		0.082	
2XDCR5315A	02776			13.5	.5315		14.0		134		77		62		2.09
2XDCR5394A	02778			13.7	.5394		14.0		134		77		62		2.12
2XDCR5469A	02780	35/64			.5469	35/64		5.28		3.03		2.42		0.085	
2XDCR5512A	02782			14.0	.5512		14.0		134		77		62		2.17
2XDCR5625A	02784	9/16			.5625	5/8		5.51		3.15		2.52		0.087	
2XDCR5709A	02786			14.5	.5709		16.0		140		80		64		2.25
2XDCR5787A	02788			14.7	.5787		16.0		140		80		64		2.28
2XDCR5905A	02790			15.0	.5905		16.0		140		80		64		2.32
2XDCR5938A	02792	19/32			.5938	5/8		5.75		3.23		2.58		0.092	
2XDCR6024A	02793			15.3	.6024		16.0		146		82		66		2.37
2XDCR6102A	02794			15.5	.6102		16.0		146		82		66		2.40
2XDCR6181A	02796			15.7	.6181		16.0		146		82		66		2.43
2XDCR6250A	02798	5/8			.6250	5/8		5.75		3.23		2.58		0.097	
2XDCR6299A	02800			16.0	.6299		16.0		146		82		66		2.48
2XDCR6331A	02802			16.08	.6331		18.0		158		90		72		2.49
2XDCR6417A	02803			16.3	.6417		18.0		158		90		72		2.53
2XDCR6496A	02804			16.5	.6496		18.0		158		90		72		2.56
2XDCR6562A	02806	21/32			.6562	45/64		6.22		3.54		2.83		0.102	
2XDCR6693A	02808			17.0	.6693		18.0		158		90		72		2.63
2XDCR6875A	02810	11/16			.6875	45/64		6.22		3.74		3.00		0.107	
2XDCR6890A	02812			17.5	.6890		18.0		158		95		76		2.71
2XDCR7087A	02814			18.0	.7087		18.0		158		95		76		2.79
2XDCR7283A	02816			18.5	.7283		20.0		160		100		80		2.87
2XDCR7500A	02818	3/4			.7500	3/4		6.30		3.94		3.15		0.116	
2XDCR7543A	02820			19.16	.7543		20.0		160		100		80		2.97
2XDCR7579A	02822			19.25	.7579		20.0		160		100		80		2.98
2XDCR7598A	02824			19.3	.7598		20.0		160		100		80		2.99
2XDCR7677A	02826			19.5	.7677		20.0		160		100		80		3.02
2XDCR7874A	02828			20.0	.7874		20.0		160		100		80		3.10

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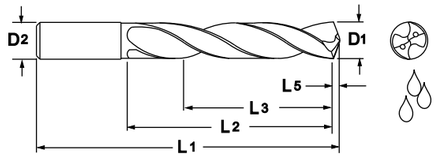
Twister XD 2XDCL

Designed for high performance drilling in a broad range of materials.



Tool No.	EDP	Diameter D1 (h7) Fraction	Wire/ Letter	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDCL1181A	02830			3.0	.1181		3.0		81		33		26		0.46
2XDCL1200A	02832		31		.1200	1/8		3.500		1.500		1.2		0.019	
2XDCL1220A	02833			3.1	.1220		4.0		92		44		35		0.48
2XDCL1250A	02834	1/8			.1250	1/8		3.500		1.500		1.2		0.019	
2XDCL1260A	02836			3.2	.1260		4.0		92		44		35		0.50
2XDCL1285A	02838		30		.1285	5/32		3.625		1.750		1.4		0.020	
2XDCL1299A	02840			3.3	.1299		4.0		92		44		35		0.51
2XDCL1339A	02842			3.4	.1339		4.0		92		44		35		0.53
2XDCL1360A	02844		29		.1360	5/32		3.625		1.750		1.4		0.021	
2XDCL1378A	02846			3.5	.1378		4.0		92		44		35		0.54
2XDCL1406A	02848	9/64			.1406	5/32		3.625		1.750		1.4		0.022	
2XDCL1417A	02849			3.6	.1417		4.0		92		44		35		0.56
2XDCL1457A	02850			3.7	.1457		4.0		92		44		35		0.57
2XDCL1496A	02852			3.8	.1496		4.0		92		44		35		0.59
2XDCL1520A	02851		24		.1520	5/32		3.625		1.750		1.4		0.024	
2XDCL1535A	02853			3.9	.1535		4.0		92		44		35		0.60
2XDCL1562A	02854	5/32			.1562	5/32		3.625		1.750		1.4		0.024	
2XDCL1575A	02856			4.0	.1575		4.0		92		44		35		0.62
2XDCL1590A	02857		21		.1590	3/16		3.940		1.750		1.4		0.025	
2XDCL1614A	04018			4.1	.1614		5.0		100		45		36		0.64
2XDCL1654A	02858			4.2	.1654		5.0		100		45		36		0.65
2XDCL1693A	02859			4.3	.1693		5.0		100		45		36		0.67
2XDCL1719A	02860	11/64			.1719	3/16		3.940		1.750		1.4		0.027	
2XDCL1732A	02861			4.4	.1732		5.0		100		45		36		0.68
2XDCL1772A	02862			4.5	.1772		5.0		100		45		36		0.70
2XDCL1811A	02864			4.6	.1811		5.0		100		45		36		0.71
2XDCL1850A	02865			4.7	.1850		5.0		100		45		36		0.73

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Inch D1	Inch Tolerance (h7)
.0000 - .1181	+0/-.00039
.1182 - .2362	+0/-.00047
.2363 - .3937	+0/-.00059
.3938 - .5000	+0/-.00071

Inch D2	Inch Tolerance (h6)
.0000 - .1181	+0/-.00024
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .5000	+0/-.00043

Metric (mm) D1	Metric (mm) Tolerance (h7)
0 - 3.0	+0/-.010
3.01 - 6.0	+0/-.012
6.01 - 10.0	+0/-.015
10.01 - 12.0	+0/-.018

Metric (mm) D2	Metric (mm) Tolerance (h6)
0 - 3.0	+0/-.006
3.01 - 6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 12.0	+0/-.011

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Tool No.	EDP	Diameter D1 (h7) Fraction	Wire/ Letter	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDCL1875A	02866	3/16			.1875	3/16		3.940		1.750		1.4		0.029	
2XDCL1890A	02868			4.8	.1890		5.0		100		45		36		0.74
2XDCL1929A	02870			4.9	.1929		5.0		100		45		36		0.76
2XDCL1968A	02872			5.0	.1968		5.0		100		45		36		0.77
2XDCL2008A	02874			5.1	.2008		6.0		100		51		41		0.79
2XDCL2031A	02876	13/64			.2031	15/64		3.940		2.000		1.60		0.031	
2XDCL2047A	02878			5.2	.2047		6.0		100		51		41		0.81
2XDCL2087A	02880			5.3	.2087		6.0		100		51		41		0.82
2XDCL2126A	02882			5.4	.2126		6.0		100		51		41		0.84
2XDCL2165A	02884			5.5	.2165		6.0		100		51		41		0.85
2XDCL2187A	02886	7/32			.2187	15/64		3.940		2.000		1.60		0.034	
2XDCL2210A	02888		2		.2210	15/64		3.940		2.000		1.60		0.034	
2XDCL2244A	02890			5.7	.2244		6.0		100		51		41		0.88
2XDCL2283A	02892			5.8	.2283		6.0		100		51		41		0.90
2XDCL2323A	02894			5.9	.2323		6.0		100		51		41		0.91
2XDCL2344A	02896	15/64			.2344	15/64		3.940		2.000		1.60		0.036	
2XDCL2362A	02898			6.0	.2362		6.0		100		51		41		0.93
2XDCL2402A	02900			6.1	.2402		8.0		109		60		48		0.95
2XDCL2420A	02902		C		.2420	1/4		4.310		2.250		1.80		0.037	
2XDCL2441A	02904			6.2	.2441		8.0		109		60		48		0.96
2XDCL2460A	02906		D		.2460	1/4		4.310		2.250		1.80		0.038	
2XDCL2480A	02908			6.3	.2480		8.0		109		60		48		0.98
2XDCL2500A	02910	1/4			.2500	1/4		4.310		2.250		1.80		0.039	
2XDCL2520A	02912			6.4	.2520		8.0		109		60		48		0.99
2XDCL2559A	02914			6.5	.2559		8.0		109		60		48		1.01
2XDCL2570A	02916		F		.2570	5/16		4.310		2.375		1.90		0.040	
2XDCL2598A	02917			6.6	.2598		8.0		109		60		48		1.03
2XDCL2610A	02918		G		.2610	5/16		4.310		2.375		1.90		0.040	
2XDCL2638A	02919			6.7	.2638		8.0		109		60		48		1.04
2XDCL2656A	02920	17/64			.2656	5/16		4.310		2.375		1.90		0.041	
2XDCL2677A	02922			6.8	.2677		8.0		109		60		48		1.05
2XDCL2717A	02924			6.9	.2717		8.0		109		60		48		1.07
2XDCL2756A	02926			7.0	.2756		8.0		109		60		48		1.08
2XDCL2795A	02927			7.1	.2795		8.0		118		70		56		1.10
2XDCL2812A	02928	9/32			.2812	5/16		4.625		2.750		2.20		0.044	
2XDCL2835A	02930			7.2	.2835		8.0		118		70		56		1.12
2XDCL2874A	02931			7.3	.2874		8.0		118		70		56		1.13
2XDCL2913A	02932			7.4	.2913		8.0		118		70		56		1.15
2XDCL2953A	02934			7.5	.2953		8.0		118		70		56		1.16
2XDCL2969A	02936	19/64			.2969	5/16		4.625		2.750		2.20		0.046	
2XDCL2992A	02938			7.6	.2992		8.0		118		70		56		1.18
2XDCL3031A	02940			7.7	.3031		8.0		118		70		56		1.19
2XDCL3071A	02942			7.8	.3071		8.0		118		70		56		1.21
2XDCL3110A	02943			7.9	.3110		8.0		118		70		56		1.22
2XDCL3125A	02944	5/16			.3125	5/16		4.625		2.750		2.20		0.048	
2XDCL3150A	02946			8.0	.3150		8.0		118		70		56		1.24
2XDCL3189A	02948			8.1	.3189		10.0		127		80		64		1.26
2XDCL3228A	02950			8.2	.3228		10.0		127		80		64		1.27
2XDCL3268A	02952			8.3	.3268		10.0		127		80		64		1.29
2XDCL3281A	02954	21/64			.3281	25/64		5.000		3.150		2.52		0.051	

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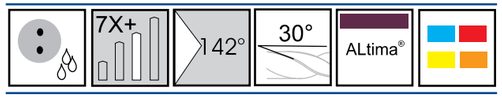
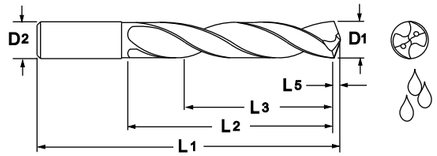


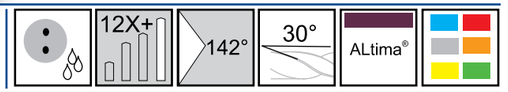


Tool No.	EDP	Diameter D1 (h7) Fraction	Wire/ Letter	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
2XDCL3307A	02953			8.4	.3307		10.0		127		80		64		1.31
2XDCL3320A	02955		Q		.3320	25/64		5.000		3.150		2.52		0.051	
2XDCL3346A	02956			8.5	.3346		10.0		127		80		64		1.32
2XDCL3386A	02957			8.6	.3386		10.0		127		80		64		1.33
2XDCL3425A	04019			8.7	.3425		10.0		127		80		64		1.35
2XDCL3438A	02958	11/32			.3438	25/64		5.000		3.150		2.52		0.053	
2XDCL3465A	02960			8.8	.3465		10.0		127		80		64		1.36
2XDCL3504A	02962			8.9	.3504		10.0		127		80		64		1.38
2XDCL3543A	02964			9.0	.3543		10.0		127		80		64		1.39
2XDCL3583A	02965			9.1	.3583		10.0		136		85		68		1.41
2XDCL3594A	02966	23/64			.3594	25/64		5.312		3.340		2.67		0.056	
2XDCL3622A	02968			9.2	.3622		10.0		136		85		68		1.43
2XDCL3642A	02970			9.25	.3642		10.0		136		85		68		1.43
2XDCL3661A	02972			9.3	.3661		10.0		136		85		68		1.44
2XDCL3701A	02973			9.4	.3701		10.0		136		85		68		1.46
2XDCL3740A	02974			9.5	.3740		10.0		136		85		68		1.47
2XDCL3750A	02976	3/8			.3750	25/64		5.312		3.340		2.67		0.058	
2XDCL3780A	02977			9.6	.3780		10.0		136		85		68		1.49
2XDCL3819A	02978			9.7	.3819		10.0		136		85		68		1.50
2XDCL3858A	02980			9.8	.3858		10.0		136		85		68		1.52
2XDCL3898A	04024			9.9	.3898		10.0		136		85		68		1.53
2XDCL3906A	02981	25/64			.3906	25/64		5.312		3.340		2.67		0.061	
2XDCL3937A	02982			10.0	.3937		10.0		136		85		68		1.55
2XDCL3976A	04025			10.1	.3976		12.0		149		93		74		1.56
2XDCL4016A	02983			10.2	.4016		12.0		149		93		74		1.58
2XDCL4055A	04026			10.3	.4055		12.0		149		93		74		1.60
2XDCL4062A	02984	13/32			.4062	15/32		5.875		3.625		2.90		0.063	
2XDCL4094A	02979			10.4	.4094		12.0		149		93		74		1.61
2XDCL4134A	02986			10.5	.4134		12.0		149		93		74		1.63
2XDCL4173A	02985			10.6	.4173		12.0		149		93		74		1.64
2XDCL4213A	04020			10.7	.4213		12.0		149		93		74		1.66
2XDCL4219A	02987	27/64			.4219	15/32		5.875		3.625		2.90		0.065	
2XDCL4252A	96600			10.8	.4252		12.0		149		93		74		1.67
2XDCL4291A	04021			10.9	.4291		12.0		149		93		74		1.69
2XDCL4331A	02988			11.0	.4331		12.0		149		93		74		1.70
2XDCL4370A	04027			11.1	.4370		12.0		155		102		82		1.72
2XDCL4375A	02989	7/16			.4375	15/32		6.100		4.000		3.20		0.068	
2XDCL4409A	02990			11.2	.4409		12.0		155		102		82		1.74
2XDCL4449A	04028			11.3	.4449		12.0		155		102		82		1.75
2XDCL4488A	04022			11.4	.4488		12.0		155		102		82		1.77
2XDCL4527A	02991			11.5	.4527		12.0		155		102		82		1.78
2XDCL4567A	04029			11.6	.4567		12.0		155		102		82		1.80
2XDCL4606A	02992			11.7	.4606		12.0		155		102		82		1.81
2XDCL4646A	96602			11.8	.4646		12.0		155		102		82		1.83
2XDCL4685A	04023			11.9	.4685		12.0		155		102		82		1.84
2XDCL4688A	02993	15/32			.4688	15/32		6.100		4.000		3.20		0.073	
2XDCL4724A	02994			12.0	.4724		12.0		155		102		82		1.86
2XDCL4844A	02995	31/64			.4844	1/2		6.299		4.312		3.45		0.075	
2XDCL5000A	02996	1/2			.5000	1/2		6.299		4.312		3.45		0.077	

Technical information on page 102. Spot Drills on page 30.

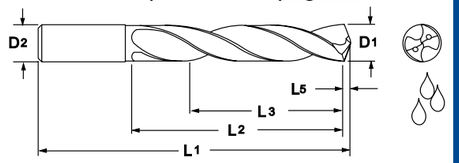
NEW

Twister XD 2XDCE



Developed to drill water lines in molds, the new 2XDCE drill works exceptionally well in all deep hole drilling applications. With the 2XD drilling geometry, this drill provides productivity increases and reduced cycle time by eliminating the need for a peck drilling cycle.

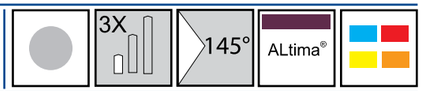
Technical information on page 104.
Spot Drills on page 30.



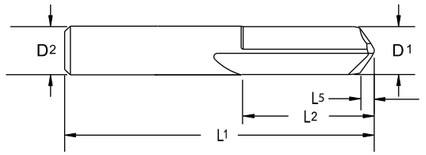
For h7 and h6 Tolerance, see page 26.

Tool No.	EDP	Diameter D1 (h7) Inch	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm	Fl. Lgth./ Diam. L2/D1
2XDCE1181A	04300		3.00	.1181		3.0		125		75		60		0.46	25
2XDCE1250A	04302	1/8	3.18	.1250	.1575	4.0	6.4	163	3.94	100	3.15	80	0.019	0.49	31
2XDCE1260A	04304		3.20	.1260		4.0		163		100		80		0.50	31
2XDCE1299A	04306		3.30	.1299		4.0		163		100		80		0.51	30
2XDCE1339A	04308		3.40	.1339		4.0		163		100		80		0.53	29
2XDCE1417A	04310		3.60	.1417		4.0		163		100		80		0.56	28
2XDCE1496A	04312		3.80	.1496		4.0		163		100		80		0.59	26
2XDCE1535A	04314		3.90	.1535		4.0		163		100		80		0.60	26
2XDCE1575A	04316		4.00	.1575		4.0		163		100		80		0.62	25
2XDCE1654A	04318		4.20	.1654		5.0		163		105		84		0.65	25
2XDCE1693A	04320		4.30	.1693		5.0		163		105		84		0.67	24
2XDCE1732A	04322		4.40	.1732		5.0		163		105		84		0.68	24
2XDCE1811A	04324		4.60	.1811		5.0		163		105		84		0.71	23
2XDCE1875A	04326	3/16	4.76	.1875	.1968	5.0	6.4	163	4.13	105	3.31	84	0.029	0.74	22
2XDCE1890A	04328		4.80	.1890		5.0		163		105		84		0.74	22
2XDCE1929A	04330		4.90	.1929		5.0		163		105		84		0.76	21
2XDCE1968A	04332		5.00	.1968		5.0		163		105		84		0.77	21
2XDCE2047A	04334		5.20	.2047		6.0		163		110		88		0.81	21
2XDCE2126A	04336		5.40	.2126		6.0		163		110		88		0.84	20
2XDCE2205A	04338		5.60	.2205		6.0		163		110		88		0.87	20
2XDCE2283A	04340		5.80	.2283		6.0		163		110		88		0.90	19
2XDCE2362A	04342		6.00	.2362		6.0		163		110		88		0.93	18
2XDCE2441A	04344		6.20	.2441		8.0		163		110		88		0.96	18
2XDCE2480A	04346		6.30	.2480		8.0		163		110		88		0.98	17
2XDCE2500A	04348	1/4	6.35	.2500	.3150	8.0	6.4	163	4.33	110	3.46	88	0.039	0.98	17
2XDCE2677A	04350		6.80	.2677		8.0		163		110		88		1.05	16
2XDCE2756A	04352		7.00	.2756		8.0		163		110		88		1.08	16
2XDCE2992A	04354		7.60	.2992		8.0		163		120		96		1.18	16
2XDCE3071A	04356		7.80	.3071		8.0		163		120		96		1.21	15
2XDCE3125A	04358	5/16	7.94	.3125	.3150	8.0	6.4	163	4.72	120	3.78	96	0.048	1.23	15
2XDCE3150A	04360		8.00	.3150		8.0		163		120		96		1.24	15
2XDCE3228A	04362		8.20	.3228		10.0		180		135		108		1.27	16
2XDCE3346A	04364		8.50	.3346		10.0		180		135		108		1.32	16
2XDCE3425A	04366		8.70	.3425		10.0		180		135		108		1.35	16
2XDCE3543A	04368		9.00	.3543		10.0		180		135		108		1.39	15
2XDCE3701A	04370		9.40	.3701		10.0		195		150		120		1.46	16
2XDCE3750A	04372	3/8	9.53	.3750	.3937	10.0	7.7	195	5.90	150	4.72	120	0.058	1.48	16
2XDCE3858A	04374		9.80	.3858		10.0		195		150		120		1.52	15
2XDCE3937A	04376		10.00	.3937		10.0		195		150		120		1.55	15
2XDCE4055A	04378		10.30	.4055		12.0		210		160		128		1.60	16
2XDCE4134A	04380		10.50	.4134		12.0		210		160		128		1.63	15
2XDCE4252A	04382		10.80	.4252		12.0		210		160		128		1.67	15
2XDCE4331A	04384		11.00	.4331		12.0		210		160		128		1.70	15
2XDCE4375A	04386	7/16	11.11	.4375	.4724	12.0	8.3	210	6.30	160	5.04	128	0.068	1.72	14
2XDCE4527A	04388		11.50	.4527		12.0		210		160		128		1.78	14
2XDCE4646A	04390		11.80	.4646		12.0		210		160		128		1.83	14
2XDCE4724A	04392		12.00	.4724		12.0		210		160		128		1.86	13
2XDCE5000A	04394	1/2	12.70	.5000	.5512	14.0	9.1	230	7.09	180	5.67	144	0.077	1.97	14

Twister® Series 200S



• Spot Drills for Twister XD®



NEW SIZES

Tool No.	EDP	Diameter D1 (h7) Inch	mm	Decimal	Shank D2 (h6) Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Point Length L5 Inch	mm
200S11810A	20221		3.0	.1181		3.0		38		16		0.41
200S12500A	20230	1/8		.1250	1/8		1-1/2		5/8		0.017	
200S23620A	20431		6.0	.2362		6.0		51		19		0.83
200S25000A	20452	1/4		.2500	1/4		2		3/4		0.034	
200S31250A	20542	5/16		.3125	5/16		2-1/2		3/4		0.043	
200S31500A	20545		8.0	.3150		8.0		64		19		1.10
200S37500A	20623	3/8		.3750	3/8		2-1/2		1		0.052	
200S39370A	20647		10.0	.3937		10.0		70		25		1.38
200S47240A	20731		12.0	.4724		12.0		76		25		1.65
200S50000A	20740	1/2		.5000	1/2		3		1		0.069	
200S62500A	20782	5/8		.6250	5/8		3-1/2		1-1/4		0.086	
200S62990A	20785		16.0	.6299		16.0		89		32		2.20

Technical information on page 107.

Inch D1	Tolerance (h7)
.1182 - .2362	+0/-.00047
.2363 - .3937	+0/-.00059
.3938 - .6250	+0/-.00071

Inch D2	Tolerance (h6)
.1182 - .2362	+0/-.00031
.2363 - .3937	+0/-.00035
.3938 - .6250	+0/-.00043

Metric (mm) D1	Tolerance (h7)
3.0	+0/-.010
3.01 - 6.0	+0/-.012
6.01 - 10.0	+0/-.015
10.01 - 16.0	+0/-.018

Metric (mm) D2	Tolerance (h6)
3.0	+0/-.006
3.01 - 6.0	+0/-.008
6.01 - 10.0	+0/-.009
10.01 - 16.0	+0/-.011

See page 97 for Series 403/404 Spotting Drills.

High Performance Drills

Coolant Fed Drills Available in a Wide Range of Styles and Sizes.

Extremely High Drilling Speed, Hole Quality and Tool Life.

Drills are Designed to be Repointed for Longer Productive Life.

Designed for Rapid and Effective Chip Evacuation.

Standard TiN and ALtima® Coatings for Reduced Wear/Longer Life and Higher Speeds.

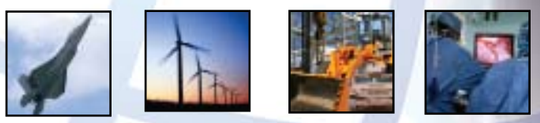
Available in Stub, Jobbers, and Screw Machine Lengths, 3X, 5X, 7X, 8X Drilling Depths; Micro, Inch, Metric and DIN Standard Sizes Available.

Full Factory Reconditioning Available. ***See Red Box Reconditioning Program, page 356.***

Twister® High Performance Drills

NEW
Twister® MD Series 2MDCL
Twister® AL Series 229
Twister® SS Series 265
Twister® SS Series 267
Twister® SS Series 269
Twister® SS Series 271
Twister® SS Series 273
Twister® CI Series 280
Twister® CI Series 282
Twister® CI Series 284

Designed and Manufactured in the USA



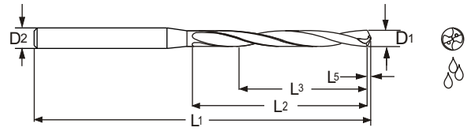
INNOVATION FOR TODAY'S INDUSTRIES

NEW

Twister® MD
Series 2MDCL

Designed for high performance drilling in a broad range of materials.

mm sizes only



Tool No.	EDP	Diameter D1 (h8) mm	Diameter D1 (h8) Decimal	Shank D2 (h6)	OAL L1	Flute Length L2	Drill Length L3 Ref.	Point Length L5
2MDCL0787A	04198	2.00	.0787	3.0	74	24	18.0	0.31
2MDCL0807A	04200	2.05	.0807	3.0	74	28	21.0	0.32
2MDCL0827A	04202	2.10	.0827	3.0	74	28	21.0	0.33
2MDCL0846A	04204	2.15	.0846	3.0	74	28	21.0	0.33
2MDCL0866A	04206	2.20	.0866	3.0	74	28	21.0	0.34
2MDCL0886A	04208	2.25	.0886	3.0	74	28	21.0	0.35
2MDCL0906A	04210	2.30	.0906	3.0	74	28	21.0	0.36
2MDCL0925A	04212	2.35	.0925	3.0	74	28	21.0	0.36
2MDCL0945A	04214	2.40	.0945	3.0	74	28	21.0	0.37
2MDCL0965A	04216	2.45	.0965	3.0	74	28	21.0	0.38
2MDCL0984A	04218	2.50	.0984	3.0	74	28	21.0	0.39
2MDCL1004A	04220	2.55	.1004	3.0	81	34	25.5	0.40
2MDCL1024A	04222	2.60	.1024	3.0	81	34	25.5	0.40
2MDCL1043A	04224	2.65	.1043	3.0	81	34	25.5	0.41
2MDCL1063A	04226	2.70	.1063	3.0	81	34	25.5	0.42
2MDCL1083A	04228	2.75	.1083	3.0	81	34	25.5	0.43
2MDCL1102A	04230	2.80	.1102	3.0	81	34	25.5	0.43
2MDCL1122A	04232	2.85	.1122	3.0	81	34	25.5	0.44
2MDCL1142A	04234	2.90	.1142	3.0	81	34	25.5	0.45
2MDCL1161A	04236	2.95	.1161	3.0	81	34	25.5	0.46

Inch sizes available as specials.

Technical information on page 108.

Inch	
D1	Tolerance (h8)
.0787-.1161	+.0000/-.00055

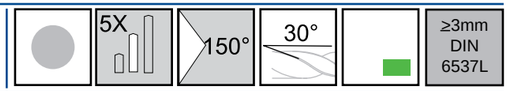
Inch	
D2	Tolerance (h6)
.0787-.1161	+.0000/-.00024

Metric (mm)	
D1	Tolerance (h8)
2.00-2.95	+.0000/-.0140

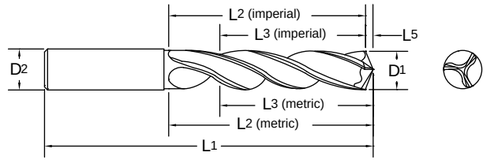
Metric (mm)	
D2	Tolerance (h6)
2.00-2.95	+.0000/-.0060

Table of Contents

Twister® AL
Series 229



Twister® AL series 229 recommended for increased speeds and feeds when drilling aluminum, cast iron and other easy to machine materials.



- Easily re-ground point design.
- Special 3 flute parabolic flute form for increased chip evacuation.
- Metric sizes 3mm and above manufactured to DIN 6537L.
- Coolant fed style available as a special.

Inch	
D1	Tolerance (m7)
.0469-.1250	+.0001/+.0004
.1251-.2500	+.0002/+.0006
.2501-.3750	+.0003/+.0008
.3751-.7500	+.0003/+.0010

Metric (mm)	
D1	Tolerance (m7)
2.00-3.00	+002/+.012
3.01-6.00	+.004/+.016
6.01-10.00	+.006/+.021
10.01-16.00	+.007/+.025

Tool No.	EDP	Diameter D1 (m7) Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
22904690	23050	3/64			.0469	3/64		1-1/2		3/4		9/16		0.006	
22905500	23051		54		.0550	.0550		1-1/2		3/4		9/16		0.007	
22905950	23052		53		.0595	.0595		1-1/2		3/4		9/16		0.007	
22906250	22900	1/16			.0625	1/16		1-1/2		3/4		9/16		0.008	
22906700	23054		51		.0670	.0670		1-1/2		3/4		9/16		0.008	
22907000	23055		50		.0700	.0700		1-3/4		7/8		11/16		0.008	
22907300	23056		49		.0730	.0730		1-3/4		7/8		11/16		0.009	
22907870	22950			2.00	.0787		2.0		38		16.0		12		0.24
22908200	23057		45		.0820	.0820		1-3/4		7/8		11/16		0.010	
22908900	22901		43		.0890	.0890		2		1		3/4		0.011	
22909060	23058			2.3	.0906		2.3		43		20.5		15		0.28
22909380	22902	3/32			.0938	3/32		2		1		3/4		0.011	
22909600	22903		41		.0960	.0960		2		1		3/4		0.012	
22909800	22904		40		.0980	.0980		2		1		3/4		0.012	
22909840	22951			2.50	.0984		2.5		43		20.5		15		0.30
22909950	23059		39		.0995	.0995		2-1/4		1-1/4		15/16		0.012	
22910150	22942		38		.1015	.1015		2-1/4		1-1/4		15/16		0.012	
22910400	23060		37		.1040	.1040		2-1/4		1-1/4		15/16		0.013	
22910650	22943		36		.1065	.1065		2-1/4		1-1/4		15/16		0.013	
22911000	23061		35		.1100	.1100		2-1/4		1-1/4		15/16		0.013	
22911300	22944		33		.1130	.1130		2-1/4		1-1/4		15/16		0.014	
22911420	22952			2.90	.1142		2.9		46		25.0		19		0.35
22911810	22953			3.00	.1181		6.0		66		28.0		23		0.36
22912000	22905		31		.1200	.1200		2-1/4		1-1/4		15/16		0.014	
22912200	23063			3.10	.1220		6.0		66		28.0		23		0.37
22912500	22906	1/8			.1250	1/8		2-1/4		1-1/4		15/16		0.015	
22912600	22945			3.20	.1260		6.0		66		28.0		23		0.39
22912850	22935		30		.1285	.1285		2-1/4		1-1/4		15/16		0.015	
22912990	22954			3.30	.1299		6.0		66		28.0		23		0.40
22913390	22949			3.40	.1339		6.0		66		28.0		23		0.41
22913600	22907		29		.1360	.1360		2-1/2		1-3/8		1-1/32		0.016	
22913780	22955			3.50	.1378		6.0		66		28.0		23		0.42
22914060	22908	9/64			.1406	9/64		2-1/2		1-3/8		1-1/32		0.017	
22914170	22992			3.60	.1417		6.0		66		28.0		23		0.43

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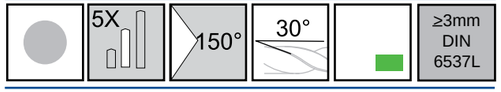

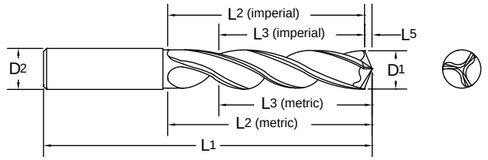

Tool No.	EDP	Diameter D1 (m7) Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
22914400	22946		27		.1440	.1440		2-1/2		1-3/8		1-1/32		0.017	
22914570	22994			3.70	.1457		6.0		66		28.0		23		0.45
22914950	22973		25		.1495	.1495		2-1/2		1-3/8		1-1/32		0.018	
22914960	22996			3.80	.1496		6.0		74		36.0		29		0.46
22915200	23064		24		.1520	.1520		2-1/2		1-3/8		1-1/32		0.018	
22915350	22997			3.90	.1535		6.0		74		36.0		29		0.47
22915620	22909	5/32			.1562	5/32		2-1/2		1-3/8		1-1/32		0.019	
22915750	22956			4.00	.1575		6.0		74		36.0		29		0.48
22915900	22936		21		.1590	.1590		2-1/2		1-3/8		1-1/32		0.019	
22916100	22937		20		.1610	.1610		2-1/2		1-3/8		1-1/32		0.019	
22916140	22998			4.10	.1614		6.0		74		36.0		29		0.49
22916540	22957			4.20	.1654		6.0		74		36.0		29		0.51
22916600	22947		19		.1660	.1660		2-1/2		1-3/8		1-1/32		0.020	
22916950	22948		18		.1695	.1695		2-3/4		1-5/8		1-7/32		0.020	
22917190	22939	11/64			.1719	11/64		2-3/4		1-5/8		1-7/32		0.021	
22917300	22972		17		.1730	.1730		2-3/4		1-5/8		1-7/32		0.021	
22917320	22999			4.40	.1732		6.0		74		36.0		29		0.53
22917700	22910		16		.1770	.1770		2-3/4		1-5/8		1-7/32		0.021	
22917720	22958			4.50	.1772		6.0		74		36.0		29		0.54
22918110	23000			4.60	.1811		6.0		74		36.0		29		0.55
22918500	22911		13		.1850	.1850		2-3/4		1-5/8		1-7/32		0.022	
22918750	22912	3/16			.1875	3/16		2-3/4		1-5/8		1-7/32		0.023	
22918890	23001			4.80	.1889		6.0		82		44.0		35		0.58
22918900	22974		12		.1890	.1890		2-3/4		1-5/8		1-7/32		0.023	
22919100	22976		11		.1910	.1910		2-3/4		1-5/8		1-7/32		0.023	
22919290	23002			4.90	.1929		6.0		82		44.0		35		0.59
22919350	22938		10		.1935	.1935		2-3/4		1-5/8		1-7/32		0.023	
22919680	22959			5.00	.1968		6.0		82		44.0		35		0.60
22920100	22975		7		.2010	.2010		3		1-3/4		1-5/16		0.024	
22920470	23003			5.20	.2047		6.0		82		44.0		35		0.63
22921300	22977		3		.2130	.2130		3		1-3/4		1-5/16		0.026	
22921650	22960			5.50	.2165		6.0		82		44.0		35		0.66
22921870	22913	7/32			.2187	7/32		3		1-3/4		1-5/16		0.026	
22922050	23004			5.60	.2205		6.0		82		44.0		35		0.68
22922800	22978		1		.2280	.2280		3		1-3/4		1-5/16		0.027	
22923400	23065		A		.2340	.2340		3-1/4		2		1-1/2		0.028	
22923620	22961			6.00	.2362		6.0		82		44.0		35		0.72
22924410	22980			6.20	.2441		8.0		91		53.0		43		0.75
22925000	22914	1/4			.2500	1/4		3-1/4		2		1-1/2		0.030	
22925590	22962			6.50	.2559		8.0		91		53.0		43		0.78
22925700	22915		F		.2570	.2570		3-1/4		2		1-1/2		0.031	
22926380	22979			6.70	.2638		8.0		91		53.0		43		0.81
22926560	22916	17/64			.2656	17/64		3-1/2		2-1/8		1-19/32		0.032	
22926770	22963			6.80	.2677		8.0		91		53.0		43		0.82
22927200	22981		I		.2720	.2720		3-1/2		2-1/8		1-19/32		0.033	
22927560	22964			7.00	.2756		8.0		91		53.0		43		0.84

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Series 229 Continued

Tool No.	EDP	Diameter D1 (m7) Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
22928120	22917	9/32			.2812	9/32		3-1/2		2-1/8		1-19/32		0.034	
22928350	23005			7.20	.2835		8.0		91		53.0		43		0.87
22928740	22940			7.30	.2874		8.0		91		53.0		43		0.88
22929130	22965			7.40	.2913		8.0		91		53.0		43		0.89
22929530	22966			7.50	.2953		8.0		91		53.0		43		0.90
22929690	22982	19/64			.2969	19/64		3-3/4		2-3/8		1-25/32		0.036	
22930710	23006			7.80	.3071		8.0		91		53.0		43		0.94
22931250	22918	5/16			.3125	5/16		3-3/4		2-3/8		1-25/32		0.038	
22931500	22967			8.00	.3150		8.0		91		53.0		43		0.96
22931890	23008			8.10	.3189		10.0		103		61.0		49		0.98
22932810	22919	21/64			.3281	21/64		4		2-1/2		1-7/8		0.040	
22933070	22985			8.40	.3307		10.0		103		61.0		49		1.01
22933200	22983		Q		.3320	.3320		4		2-1/2		1-7/8		0.040	
22933460	22968			8.50	.3346		10.0		103		61.0		49		1.02
22934380	22987	11/32			.3438	11/32		4		2-1/2		1-7/8		0.041	
22935430	22989			9.00	.3543		10.0		103		61.0		49		1.09
22935940	22984	23/64			.3594	23/64		4-1/4		2-3/4		2-1/16		0.043	
22936800	22991		U		.3680	.3680		4-1/4		2-3/4		2-1/16		0.044	
22937400	23009			9.50	.3740		10.0		103		61.0		49		1.15
22937500	22920	3/8			.3750	3/8		4-1/4		2-3/4		2-1/16		0.045	
22938190	23011			9.70	.3819		10.0		103		61.0		49		1.17
22939060	22921	25/64			.3906	25/64		4-1/2		2-7/8		2-5/32		0.047	
22939370	22969			10.00	.3937		10.0		103		61.0		49		1.21
22940160	22970			10.20	.4016		12.0		118		71.0		56		1.23
22940620	22922	13/32			.4062	13/32		4-1/2		2-7/8		2-5/32		0.049	
22940940	23012			10.40	.4094		12.0		118		71.0		56		1.25
22941340	22986			10.50	.4134		12.0		118		71.0		56		1.27
22941730	23013			10.60	.4173		12.0		118		71.0		56		1.28
22942190	22923	27/64			.4219	27/64		4-1/2		2-7/8		2-5/32		0.051	
22943310	22993			11.00	.4331		12.0		118		71.0		56		1.33
22943750	22924	7/16			.4375	7/16		4-1/2		2-7/8		2-5/32		0.053	
22945280	23014			11.50	.4528		12.0		118		71.0		56		1.39
22945310	22941	29/64			.4531	29/64		4-3/4		3		2-1/4		0.055	
22946880	22995	15/32			.4688	15/32		4-3/4		3		2-1/4		0.057	
22947240	22971			12.00	.4724		12.0		118		71.0		56		1.45
22948440	22925	31/64			.4844	31/64		4-3/4		3		2-1/4		0.058	
22949210	22988			12.50	.4921		14.0		124		77.0		60		1.51
22950000	22926	1/2			.5000	1/2		4-3/4		3		2-1/4		0.060	
22951180	23015			13.00	.5118		14.0		124		77.0		60		1.57
22951560	22927	33/64			.5156	33/64		5		3-1/4		2-7/16		0.062	
22953120	22928	17/32			.5312	17/32		5		3-1/4		2-7/16		0.064	
22953150	23017			13.50	.5315		14.0		124		77.0		60		1.63
22954690	22929	35/64			.5469	35/64		5		3-1/4		2-7/16		0.066	
22955120	23018			14.00	.5512		14.0		124		77.0		60		1.69
22956250	22930	9/16			.5625	9/16		5		3-1/4		2-7/16		0.068	
22957090	23020			14.50	.5709		16.0		133		83.0		63		1.75
22959060	23021			15.00	.5906		16.0		133		83.0		63		1.81
22961020	23022			15.50	.6102		16.0		133		83.0		63		1.87
22962200	23023			15.80	.6220		16.0		133		83.0		63		1.90
22962500	22931	5/8			.6250	5/8		5-1/4		3-1/2		2-5/8		0.075	
22962990	23024			16.00	.6299		16.0		133		83.0		63		1.93
22965620	22932	21/32			.6562	21/32		5-1/2		3-5/8		2-23/32		0.079	
22968750	22933	11/16			.6875	11/16		5-1/2		3-5/8		2-23/32		0.083	
22975000	22934	3/4			.7500	3/4		5-3/4		3-7/8		2-29/32		0.090	

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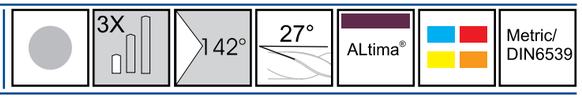
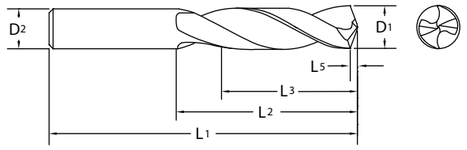
Twister® SS Series 265



Recommended for stainless steel and high temperature alloy materials.



- Rapid chip evacuation.
- Advanced material and geometry.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/ Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
26518750A	95041	3/16			.1875	3/16		2-7/16		1		3/4		0.029	
26519680A	95000			5.00	.1968		5.0		62		26		20		0.77
26520080A	95001			5.10	.2008		5.1		62		26		20		0.79
26521300A	95255		3		.2130	.213		2-1/2		1		3/4		0.033	
26521650A	95002			5.50	.2165		5.5		66		28		21		0.85
26521880A	95042	7/32			.2188	7/32		2-9/16		1-1/8		7/8		0.034	
26522830A	95003			5.80	.2283		5.8		66		28		21		0.90
26523620A	95004			6.00	.2362		6.0		66		28		21		0.93
26524020A	95005			6.10	.2402		6.1		70		31		23		0.95
26525000A	95043	1/4			.2500	1/4		2-3/4		1-1/4		15/16		0.039	
26525590A	95006			6.50	.2559		6.5		70		31		23		1.01
26526560A	95044	17/64			.2656	17/64		3		1-3/8		1-1/32		0.041	
26526770A	95007			6.80	.2677		6.8		74		34		25		1.05
26527170A	95008			6.90	.2717		6.9		74		34		25		1.07
26527560A	95009			7.00	.2756		7.0		74		34		25		1.08
26528120A	95045	9/32			.2812	9/32		3		1-3/8		1-1/32		0.044	
26529530A	95010			7.50	.2953		7.5		74		34		25		1.16
26529690A	95046	19/64			.2969	19/64		3-1/8		1-1/2		1-1/8		0.046	
26530710A	95011			7.80	.3071		7.8		79		37		27		1.21
26531250A	95047	5/16			.3125	5/16		3-1/8		1-1/2		1-1/8		0.048	
26531500A	95012			8.00	.3150		8.0		79		37		27		1.24
26531890A	95013			8.10	.3189		8.1		79		37		27		1.26
26532810A	95048	21/64			.3281	21/64		3-1/8		1-1/2		1-1/8		0.051	
26533070A	95014			8.40	.3307		8.4		79		37		27		1.30
26533460A	95015			8.50	.3346		8.5		79		37		27		1.32
26533860A	95016			8.60	.3386		8.6		84		40		29		1.33
26534250A	95017			8.70	.3425		8.7		84		40		29		1.35
26534380A	95049	11/32			.3438	11/32		3-5/16		1-9/16		1-3/16		0.053	
26534640A	95245			8.80	.3464		8.8		84		40		29		1.36
26535430A	95018			9.00	.3543		9.0		84		40		29		1.39
26535940A	95050	23/64			.3594	23/64		3-5/16		1-9/16		1-3/16		0.056	
26537400A	95019			9.50	.3740		9.5		84		40		29		1.47

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Inch	
D1	Tolerance
.1875-.6250	+.0000/-.0005

Metric (mm)	
D1	Tolerance (h7)
5.00-6.00	+.000/-.012
6.01-10.00	+.000/-.015
10.01-16.00	+.000/-.018

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/ Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
26537500A	95051	3/8			.3750	3/8		3-1/2		1-11/16		1-9/32		0.058	
26537790A	95760			9.60	.3779		9.6		89		43		31		1.49
26538580A	95020			9.80	.3858		9.8		89		43		31		1.52
26539060A	95052	25/64			.3906	25/64		3-1/2		1-11/16		1-9/32		0.061	
26539370A	95021			10.00	.3937		10.0		89		43		31		1.55
26540160A	95022			10.20	.4016		10.2		89		43		31		1.58
26540620A	95053	13/32			.4062	13/32		3-1/2		1-11/16		1-9/32		0.063	
26540940A	95023			10.40	.4094		10.4		89		43		31		1.61
26541340A	95024			10.50	.4134		10.5		89		43		31		1.63
26542190A	95054	27/64			.4219	27/64		3-3/4		1-7/8		1-13/32		0.065	
26543310A	95025			11.00	.4331		11.0		95		47		33		1.70
26543750A	95055	7/16			.4375	7/16		3-3/4		1-7/8		1-13/32		0.068	
26544090A	95026			11.20	.4409		11.2		95		47		33		1.74
26545270A	95027			11.50	.4527		11.5		95		47		33		1.78
26545310A	95056	29/64			.4531	29/64		3-3/4		1-7/8		1-13/32		0.070	
26546450A	95246			11.80	.4645		11.8		95		47		33		1.83
26546880A	95057	15/32			.4688	15/32		4		2		1-1/2		0.073	
26547240A	95028			12.00	.4724		12.0		102		51		35		1.86
26548030A	95029			12.20	.4803		12.2		102		51		35		1.89
26548440A	95058	31/64			.4844	31/64		4		2		1-1/2		0.075	
26549210A	95030			12.50	.4921		12.5		102		51		35		1.94
26550000A	95059	1/2			.5000	1/2		4		2		1-1/2		0.077	
26550001A	95031			12.70	.5000		12.7		102		51		35		1.97
26551180A	95032			13.00	.5118		13.0		102		51		35		2.01
26553150A	95033			13.50	.5315		13.5		107		54		37		2.09
26555120A	95034			14.00	.5512		14.0		107		54		37		2.17
26555510A	95035			14.10	.5551		14.1		111		56		38		2.18
26555910A	95036			14.20	.5591		14.2		111		56		38		2.20
26556250A	95060	9/16			.5625	9/16		4-3/8		2-1/4		1-11/16		0.087	
26557090A	95037			14.50	.5709		14.5		111		56		38		2.25
26559050A	95038			15.00	.5905		15.0		111		56		38		2.32
26560040A	95247			15.25	.6004		15.25		115		58		38		2.36
26561020A	95039			15.50	.6102		15.5		115		58		38		2.40
26562500A	95061	5/8			.6250	5/8		4-1/2		2-5/16		1-3/4		0.097	
26562990A	95040			16.00	.6299		16.0		115		58		38		2.48

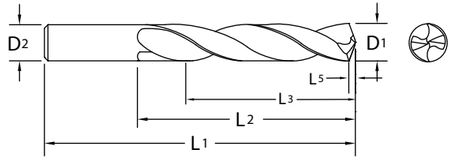
Technical information on page 110.

Designed and Manufactured in the USA

Twister® SS Series 267

5X | 142° | 27° | ALtima® | Metric/ DIN 338

Recommended for stainless steel and high temperature alloy materials.



- Rapid chip evacuation.
- Advanced material and geometry.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/ Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
26718750A	95102	3/16			.1875	3/16		2-3/4		1-5/8		1-7/32		0.029	
26719680A	95062			5.00	.1968		5.0		86		52		39		0.77
26720080A	95063			5.10	.2008		5.1		86		52		39		0.79
26721650A	95064			5.50	.2165		5.5		93		57		43		0.85
26721880A	95103	7/32			.2188	7/32		3		1-3/4		1-5/16		0.034	
26722830A	95065			5.80	.2283		5.8		93		57		43		0.90
26723620A	95066			6.00	.2362		6.0		93		57		43		0.93
26724020A	95067			6.10	.2402		6.1		101		63		47		0.95
26725000A	95104	1/4			.2500	1/4		3-1/4		2		1-1/2		0.039	
26725590A	95068			6.50	.2559		6.5		101		63		47		1.01
26725700A	95256		F		.2570	.257		3-1/4		2		1-1/2		0.040	
26726560A	95105	17/64			.2656	17/64		3-1/2		2-1/8		1-19/32		0.041	
26726770A	95069			6.80	.2677		6.8		109		69		52		1.05
26727170A	95070			6.90	.2717		6.9		109		69		52		1.07
26727560A	95071			7.00	.2756		7.0		109		69		52		1.08
26728120A	95106	9/32			.2812	9/32		3-1/2		2-1/8		1-19/32		0.044	
26729530A	95072			7.50	.2953		7.5		109		69		52		1.16
26729690A	95107	19/64			.2969	19/64		3-3/4		2-3/8		1-13/16		0.046	
26730710A	95073			7.80	.3071		7.8		117		75		56		1.21
26731250A	95108	5/16			.3125	5/16		3-3/4		2-3/8		1-13/16		0.048	
26731500A	95074			8.00	.3150		8.0		117		75		56		1.24
26731890A	95075			8.10	.3189		8.1		117		75		56		1.26
26732810A	95109	21/64			.3281	21/64		4		2-1/2		1-7/8		0.051	
26733070A	95076			8.40	.3307		8.4		117		75		56		1.30
26733460A	95077			8.50	.3346		8.5		117		75		56		1.32
26733860A	95078			8.60	.3386		8.6		125		81		61		1.33
26734250A	95079			8.70	.3425		8.7		125		81		61		1.35
26734380A	95110	11/32			.3438	11/32		4		2-1/2		1-7/8		0.053	
26735430A	95080			9.00	.3543		9.0		125		81		61		1.39
26735940A	95111	23/64			.3594	23/64		4-1/4		2-3/4		2-1/16		0.056	
26737400A	95081			9.50	.3740		9.5		125		81		61		1.47
26737500A	95112	3/8			.3750	3/8		4-1/4		2-3/4		2-1/16		0.058	
26737790A	95761			9.60	.3779		9.6		133		87		65		1.49
26738580A	95082			9.80	.3858		9.8		133		87		65		1.52
26739060A	95113	25/64			.3906	25/64		4-1/2		2-7/8		2-5/32		0.061	
26739370A	95083			10.00	.3937		10.0		133		87		65		1.55
26740160A	95084			10.20	.4016		10.2		133		87		65		1.58
26740620A	95114	13/32			.4062	13/32		4-1/2		2-7/8		2-5/32		0.063	
26740940A	95085			10.40	.4094		10.4		133		87		65		1.61
26741340A	95086			10.50	.4134		10.5		133		87		65		1.63
26742190A	95115	27/64			.4219	27/64		4-1/2		2-7/8		2-5/32		0.065	

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Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/ Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
26743310A	95087			11.00	.4331		11.0		142		94		71		1.70
26743750A	95116	7/16			.4375	7/16		4-1/2		2-7/8		2-5/32		0.068	
26744090A	95088			11.20	.4409		11.2		142		94		71		1.74
26745270A	95089			11.50	.4527		11.5		142		94		71		1.78
26745310A	95117	29/64			.4531	29/64		4-3/4		3		2-1/4		0.070	
26746880A	95118	15/32			.4688	15/32		4-3/4		3		2-1/4		0.073	
26747240A	95090			12.00	.4724		12.0		151		101		76		1.86
26748030A	95091			12.20	.4803		12.2		151		101		76		1.89
26748440A	95119	31/64			.4844	31/64		4-3/4		3		2-1/4		0.075	
26749210A	95092			12.50	.4921		12.5		151		101		76		1.94
26750000A	95120	1/2			.5000	1/2		4-3/4		3		2-1/4		0.077	
26751180A	95093			13.00	.5118		13.0		151		101		76		2.01
26753150A	95094			13.50	.5315		13.5		160		108		81		2.09
26755120A	95095			14.00	.5512		14.0		160		108		81		2.17
26755510A	95096			14.10	.5551		14.1		169		114		86		2.18
26755910A	95097			14.20	.5591		14.2		169		114		86		2.20
26756250A	95121	9/16			.5625	9/16		5		3-1/4		2-7/16		0.087	
26757090A	95098			14.50	.5709		14.5		169		114		86		2.25
26759050A	95099			15.00	.5905		15.0		169		114		86		2.32
26761020A	95100			15.50	.6102		15.5		178		120		90		2.40
26762500A	95122	5/8			.6250	5/8		5-1/4		3-1/2		2-5/8		0.097	
26762990A	95101			16.00	.6299		16.0		178		120		90		2.48

Technical information on page 110.

Inch	
D1	Tolerance
.1875-.6250	+.0000-.0005

Metric (mm)	
D1	Tolerance (h7)
5.00-6.00	+.000/-.012
6.01-10.00	+.000/-.015
10.01-16.00	+.000/-.018

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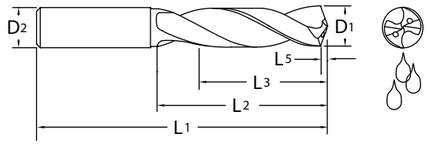
Twister® SS Series 269

3X | 142° | 27° | ALtima® | Metric/ DIN 6537K



• Advanced material and geometry.

Tool No.	EDP	Diameter D1 (m7) Fraction	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
26918750A	95123	3/16		.1875	3/16		2-1/2		1-1/16		3/4		0.029	
26919680A	95124		5.00	.1968		6.0		66		28		20		0.77
26920080A	95125		5.10	.2008		6.0		66		28		20		0.79
26921650A	95126		5.50	.2165		6.0		66		28		20		0.85
26921870A	95127	7/32		.2187	1/4		2-5/8		1-1/8		3/4		0.034	
26922830A	95128		5.80	.2283		6.0		66		28		20		0.90
26923620A	95129		6.00	.2362		6.0		66		28		20		0.93
26924020A	95130		6.10	.2402		8.0		79		34		24		0.95
26925000A	95131	1/4		.2500	1/4		2-5/8		1-5/16		15/16		0.039	
26925590A	95132		6.50	.2559		8.0		79		34		24		1.01
26926560A	95133	17/64		.2656	5/16		3-1/8		1-5/16		15/16		0.041	
26926770A	95134		6.80	.2677		8.0		79		34		24		1.05
26927160A	95135		6.90	.2716		8.0		79		34		24		1.07
26927560A	95136		7.00	.2756		8.0		79		34		24		1.08
26928120A	95137	9/32		.2812	5/16		3-1/8		1-5/8		1-1/8		0.044	
26929530A	95138		7.50	.2953		8.0		79		41		29		1.16
26929690A	95139	19/64		.2969	5/16		3-1/8		1-5/8		1-1/8		0.046	
26930710A	95140		7.80	.3071		8.0		79		41		29		1.21
26931250A	95141	5/16		.3125	5/16		3-1/8		1-5/8		1-1/8		0.048	
26931500A	95142		8.00	.3150		8.0		79		41		29		1.24
26931890A	95143		8.10	.3189		10.0		89		47		35		1.26
26932810A	95144	21/64		.3281	3/8		3-1/2		1-7/8		1-3/8		0.051	
26933070A	95145		8.40	.3307		10.0		89		47		35		1.30
26933460A	95146		8.50	.3346		10.0		89		47		35		1.32
26933860A	95147		8.60	.3386		10.0		89		47		35		1.33
26934250A	95148		8.70	.3425		10.0		89		47		35		1.35
26934380A	95149	11/32		.3438	3/8		3-1/2		1-7/8		1-3/8		0.053	
26934640A	95248		8.80	.3464		10.0		89		47		35		1.36
26935430A	95150		9.00	.3543		10.0		89		47		35		1.39
26935940A	95151	23/64		.3594	3/8		3-1/2		1-7/8		1-3/8		0.056	
26937400A	95152		9.50	.3740		10.0		89		47		35		1.47
26937500A	95153	3/8		.3750	3/8		3-1/2		1-7/8		1-3/8		0.058	
26937790A	95762		9.60	.3779		10.0		89		47		35		1.49
26938580A	95154		9.80	.3858		10.0		89		47		35		1.52
26939060A	95155	25/64		.3906	7/16		4		1-7/8		1-3/8		0.061	
26939370A	95156		10.00	.3937		10.0		89		47		35		1.55
26940160A	95157		10.20	.4016		12.0		102		55		40		1.58
26940620A	95158	13/32		.4062	7/16		4		2-3/16		1-9/16		0.063	
26940940A	95159		10.40	.4094		12.0		102		55		40		1.61
26941340A	95160		10.50	.4134		12.0		102		55		40		1.63
26942190A	95161	27/64		.4219	7/16		4		2-3/16		1-9/16		0.065	
26943310A	95162		11.00	.4331		12.0		102		55		40		1.70
26943750A	95163	7/16		.4375	7/16		4		2-3/16		1-9/16		0.068	
26944090A	95164		11.20	.4409		12.0		102		55		40		1.74

Technical information on page 110.

Series 269 Continued

Tool No.	EDP	Diameter D1 (m7) Fraction	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Drill Length L3 Ref. Inch	mm	Point Length L5 Inch	mm
26945270A	95165		11.50	.4527		12.0		102		55		40		1.78
26945310A	95166	29/64		.4531	1/2		4		2-3/16		1-9/16		0.070	
26946450A	95249		11.80	.4645		12.0		102		55		40		1.83
26946880A	95167	15/32		.4688	1/2		4		2-3/16		1-9/16		0.073	
26947240A	95168		12.00	.4724		12.0		102		55		40		1.86
26948030A	95169		12.20	.4803		14.0		107		60		43		1.89
26948440A	95170	31/64		.4844	1/2		4		2-3/16		1-9/16		0.075	
26949210A	95171		12.50	.4921		14.0		107		60		43		1.94
26950000A	95172	1/2		.5000	1/2		4		2-3/16		1-9/16		0.077	
26951180A	95173		13.00	.5118		14.0		107		60		43		2.01
26953150A	95174		13.50	.5315		14.0		107		60		43		2.09
26955120A	95175		14.00	.5512		14.0		107		60		43		2.17
26955510A	95176		14.10	.5551		16.0		115		65		45		2.18
26955900A	95177		14.20	.5590		16.0		115		65		45		2.20
26956250A	95178	9/16		.5625	5/8		4-1/2		2-9/16		1-3/4		0.087	
26957090A	95179		14.50	.5709		16.0		115		65		45		2.25
26959050A	95180		15.00	.5905		16.0		115		65		45		2.32
26960040A	95250		15.25	.6004		16.0		115		65		45		2.36
26961020A	95181		15.50	.6102		16.0		115		65		45		2.40
26962500A	95182	5/8		.6250	5/8		4-1/2		2-9/16		1-3/4		0.097	
26962990A	95183		16.00	.6299		16.0		115		65		45		2.48

Technical information on page 110.

Inch	
D1	Tolerance (m7)
.1875-.2500	+.0002/+.0006
.2501-.3750	+.0003/+.0008
.3751-.6250	+.0003/+.0010

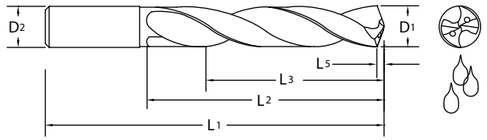
Metric (mm)	
D1	Tolerance (m7)
5.00-6.00	+.004/+.016
6.01-10.00	+.006/+.021
10.01-16.00	+.007/+.025

Twister® SS
Series 271

5X | 142° | 27° | ALtima® | Metric/ DIN 6537L

Inch	
D1	Tolerance (m7)
.1875-.2500	+.0002/+.0006
.2501-.3750	+.0003/+.0008
.3751-.6330	+.0003/+.0010

Metric (mm)	
D1	Tolerance (m7)
4.90-6.00	+.004/+.016
6.01-10.00	+.006/+.021
10.01-16.00	+.007/+.025



• Advanced material and geometry.

Tool No.	EDP	Diameter D1 (m7) Fraction	Diameter D1 (m7) Letter/ Wire	Diameter D1 (m7) mm	Diameter D1 (m7) Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
27118750A	95184	3/16			.1875	3/16		2-3/4		1-3/4		1-3/8		0.029	
27118900A	96020		12		.1890	15/64		3-1/4		1-3/4		1-3/8		0.029	
27119290A	96021			4.90	.1929		6.00		82		44.0		35		0.76
27119350A	96022		10		.1935	15/64		3-1/4		1-3/4		1-3/8		0.030	
27119680A	95185			5.00	.1968		6.00		82		44.0		35		0.77
27120080A	95186			5.10	.2008		6.00		82		44.0		35		0.79
27120100A	96023		7		.2010	15/64		3-1/4		1-3/4		1-3/8		0.031	
27120310A	96024	13/64			.2031	15/64		3-1/4		1-3/4		1-3/8		0.031	
27120470A	96025			5.20	.2047		6.00		82		44.0		35		0.81
27120550A	96026		5		.2055	15/64		3-1/4		1-3/4		1-3/8		0.032	
27120870A	96027			5.30	.2087		6.00		82		44.0		35		0.82
27120900A	96028		4		.2090	15/64		3-1/4		1-3/4		1-3/8		0.032	
27121260A	96029			5.40	.2126		6.00		82		44.0		35		0.84
27121300A	96030		3		.2130	15/64		3-1/4		1-3/4		1-3/8		0.033	
27121650A	95187			5.50	.2165		6.00		82		44.0		35		0.85
27121870A	95188	7/32			.2187	1/4		3-1/4		1-3/4		1-3/8		0.034	
27122100A	96031		2		.2210	1/4		3-1/4		1-3/4		1-3/8		0.034	
27122440A	96032			5.70	.2244		6.00		82		44.0		35		0.88
27122800A	96033		1		.2280	1/4		3-1/4		1-3/4		1-3/8		0.035	
27122830A	95189			5.80	.2283		6.00		82		44.0		35		0.90
27123230A	96034			5.90	.2323		6.00		82		44.0		35		0.91
27123440A	96035	15/64			.2344	1/4		3-1/4		1-3/4		1-3/8		0.036	
27123620A	95190			6.00	.2362		6.00		82		44.0		35		0.93
27124020A	95191			6.10	.2402		8.00		91		53.0		43		0.95
27124200A	96036		C		.2420	1/4		3-1/4		1-3/4		1-3/8		0.037	
27124410A	96037			6.20	.2441		8.00		91		53.0		43		0.96
27124600A	96038		D		.2460	1/4		3-1/4		1-3/4		1-3/8		0.038	
27124800A	96039			6.30	.2480		8.00		91		53.0		43		0.98
27125000A	95192	1/4			.2500	1/4		3-1/4		1-3/4		1-3/8		0.039	
27125200A	96040			6.40	.2520		8.00		91		53.0		43		0.99
27125590A	95193			6.50	.2559		8.00		91		53.0		43		1.01
27125700A	95251		F		.2570	5/16		3-9/16		2-3/32		1-5/8		0.040	
27126100A	96041		G		.2610	5/16		3-9/16		2-3/32		1-5/8		0.040	
27126560A	95194	17/64			.2656	5/16		3-9/16		2-3/32		1-5/8		0.041	
27126600A	96042		H		.2660	5/16		3-9/16		2-3/32		1-5/8		0.041	
27126770A	95195			6.80	.2677		8.00		91		53.0		43		1.05
27127160A	95196			6.90	.2716		8.00		91		53.0		43		1.07
27127200A	96043		I		.2720	5/16		3-9/16		2-3/32		1-5/8		0.042	
27127560A	95197			7.00	.2756		8.00		91		53.0		43		1.08
27128100A	96044		K		.2810	5/16		3-9/16		2-3/32		1-5/8		0.044	
27128120A	95198	9/32			.2812	5/16		3-9/16		2-3/32		1-5/8		0.044	
27128350A	96045			7.20	.2835		8.00		91		53.0		43		1.12
27129130A	96046			7.40	.2913		8.00		91		53.0		43		1.15

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Series 271 Continued

Tool Nol	EDP	Diameter D1 (m7) Fraction	Diameter D1 (m7) Letter/ Wire	Diameter D1 (m7) mm	Diameter D1 (m7) Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
27129530A	95199			7.50	.2953		8.00		91		53.0		43		1.16
27129690A	95200	19/64			.2969	5/16		3-9/16		2-3/32		1-5/8		0.046	
27130710A	95201			7.80	.3071		8.00		91		53.0		43		1.21
27131250A	95202	5/16			.3125	5/16		3-9/16		2-3/32		1-5/8		0.048	
27131500A	95203			8.00	.3150		8.00		91		53.0		43		1.24
27131890A	95204			8.10	.3189		10.00		103		61.0		49		1.26
27132680A	96047			8.30	.3268		10.00		103		61.0		49		1.29
27132810A	95205	21/64			.3281	3/8		4		2-3/8		1-7/8		0.051	
27133070A	95206			8.40	.3307		10.00		103		61.0		49		1.30
27133460A	95207			8.50	.3346		10.00		103		61.0		49		1.32
27133860A	95208			8.60	.3386		10.00		103		61.0		49		1.33
27134250A	95209			8.70	.3425		10.00		103		61.0		49		1.35
27134380A	95210	11/32			.3438	3/8		4		2-3/8		1-7/8		0.053	
27134640A	96048			8.80	.3464		10.00		103		61.0		49		1.36
27135430A	95211			9.00	.3543		10.00		103		61.0		49		1.39
27135940A	95212	23/64			.3594	3/8		4		2-3/8		1-7/8		0.056	
27137400A	95213			9.50	.3740		10.00		103		61.0		49		1.47
27137500A	95214	3/8			.3750	3/8		4		2-3/8		1-7/8		0.058	
27137790A	95763			9.60	.3779		10.00		103		61.0		49		1.49
27138200A	95252	.3820			.3820	7/16		4-5/8		2-3/4		2-3/16		0.059	
27138580A	95215			9.80	.3858		10.00		103		61.0		49		1.52
27139060A	95216	25/64			.3906	7/16		4-5/8		2-3/4		2-3/16		0.061	
27139370A	95217			10.00	.3937		10.00		103		61.0		49		1.55
27140160A	95218			10.20	.4016		12.00		118		71.0		56		1.58
27140620A	95219	13/32			.4062	7/16		4-5/8		2-3/4		2-3/16		0.063	
27140940A	95220			10.40	.4094		12.00		118		71.0		56		1.61
27141340A	95221			10.50	.4134		12.00		118		71.0		56		1.63
27142190A	95222	27/64			.4219	7/16		4-5/8		2-3/4		2-3/16		0.065	
27143310A	95223			11.00	.4331		12.00		118		71.0		56		1.70
27143750A	95224	7/16			.4375	7/16		4-5/8		2-3/4		2-3/16		0.068	
27144090A	95225			11.20	.4409		12.00		118		71.0		56		1.74
27145270A	95226			11.50	.4527		12.00		118		71.0		56		1.78
27145310A	95227	29/64			.4531	1/2		4-5/8		3		2-3/8		0.070	
27146880A	95228	15/32			.4688	1/2		4-5/8		3		2-3/8		0.073	
27147240A	95229			12.00	.4724		12.00		118		71.0		56		1.86
27148030A	95230			12.20	.4803		14.00		124		77.0		60		1.89
27148440A	95231	31/64			.4844	1/2		4-5/8		3		2-3/8		0.075	
27149210A	95232			12.50	.4921		14.00		124		77.0		60		1.94
27150000A	95233	1/2			.5000	1/2		4-5/8		3		2-3/8		0.077	
27150800A	95253	.5080			.5080	1/2		4-5/8		3		2-3/8		0.079	
27151180A	95234			13.00	.5118		14.00		124		77.0		60		2.01
27151560A	96049	33/64			.5156	35/64		4-7/8		3		2-3/8		0.080	
27153120A	96050	17/32			.5312	35/64		4-7/8		3		2-3/8		0.082	
27153150A	95235			13.50	.5315		14.00		124		77.0		60		2.09
27154690A	96051	35/64			.5469	35/64		4-7/8		3		2-3/8		0.085	
27155120A	95236			14.00	.5512		14.00		124		77.0		60		2.17
27155510A	95237			14.10	.5551		16.00		133		83.0		63		2.18
27155900A	95238			14.20	.5590		16.00		133		83.0		63		2.20
27156250A	95239	9/16			.5625	5/8		5-1/4		3-1/4		2-1/2		0.087	
27157090A	95240			14.50	.5709		16.00		133		83.0		63		2.25
27159050A	95241			15.00	.5905		16.00		133		83.0		63		2.32
27159380A	96052	19/32			.5938	5/8		5-1/4		3-1/4		2-1/2		0.092	
27161020A	95242			15.50	.6102		16.00		133		83.0		63		2.40
27162500A	95243	5/8			.6250	5/8		5-1/4		3-1/4		2-1/2		0.097	
27162990A	95244			16.00	.6299		16.00		133		83.0		63		2.48
27163300A	95254	.6330			.6330	5/8		5-1/4		3-1/4		2-1/2		0.098	

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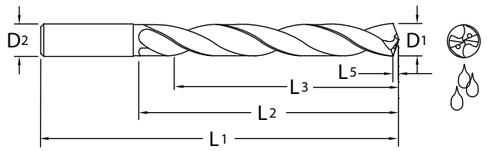


• Advanced material and geometry.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/ Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
27318750A	96055	3/16			.1875	3/16		3-7/8		1-13/16		1-23/64		0.03	
27319680A	96056			5.00	.1968		5.0		98		45		34		0.77
27320100A	96057		7		.2010	15/64		4-13/64		1-59/64		1-7/16		0.03	
27320470A	96058			5.20	.2047		6.0		107		50		38		0.81
27321300A	96059		3		.2130	15/64		4-13/64		1-59/64		1-7/16		0.03	
27321650A	96060			5.50	.2165		6.0		107		50		38		0.85
27321870A	96061	7/32			.2187	15/64		4-13/64		2-1/8		1-19/32		0.03	
27322100A	96062		2		.2210	15/64		4-13/64		2-1/8		1-19/32		0.03	
27322800A	96063		1		.2280	15/64		4-13/64		2-1/8		1-19/32		0.04	
27323440A	96064	15/64			.2344	15/64		4-13/64		2-1/8		1-19/32		0.04	
27323620A	96065			6.00	.2362		6.0		107		55		41		0.93
27324020A	96066			6.10	.2402		8.0		127		57		43		0.95
27324200A	96067		C		.2420	1/4		4-3/8		2-1/4		1-11/16		0.04	
27324410A	96068			6.20	.2441		8.0		127		57		43		0.96
27324600A	96069		D		.2460	1/4		4-3/8		2-1/4		1-11/16		0.04	
27324800A	96070			6.30	.2480		8.0		127		57		43		0.98
27325000A	96071	1/4			.2500	1/4		4-3/8		2-1/4		1-11/16		0.04	
27325590A	96072			6.50	.2559		8.0		127		62		47		1.01
27325700A	96073		F		.2570	5/16		5		2-3/8		1-25/32		0.04	
27325980A	96074			6.60	.2598		8.0		127		62		47		1.02
27326370A	96075			6.70	.2637		8.0		127		62		47		1.04
27326560A	96076	17/64			.2656	5/16		5		2-17/32		1-7/8		0.04	
27326600A	96077		H		.2660	5/16		5		2-17/32		1-7/8		0.04	
27326770A	96078			6.80	.2677		8.0		127		62		47		1.05
27327200A	96079		I		.2720	5/16		5		2-17/32		1-7/8		0.04	
27327560A	96080			7.00	.2756		8.0		127		67		50		1.08
27328120A	96081	9/32			.2812	5/16		5		2-17/32		1-7/8		0.04	
27328350A	96082			7.20	.2835		8.0		127		67		50		1.12
27328740A	96083			7.30	.2874		8.0		127		67		50		1.13
27329000A	96084		L		.2900	5/16		5		2-13/16		2-7/64		0.04	
27329130A	96085			7.40	.2913		8.0		127		67		50		1.15
27329530A	96086			7.50	.2953		8.0		127		73		55		1.16
27329690A	96087	19/64			.2969	5/16		5		2-13/16		2-7/64		0.05	
27330710A	96088			7.80	.3071		8.0		127		73		55		1.21
27331250A	96089	5/16			.3125	5/16		5		2-13/16		2-7/64		0.05	
27331500A	96386			8.00	.3150		8.0		127		73		55		1.24
27331890A	96090			8.10	.3189		10.0		147		78		59		1.26
27332280A	96091			8.20	.3228		10.0		147		78		59		1.27
27332680A	96092			8.30	.3268		10.0		147		78		59		1.29
27332810A	96093	21/64			.3281	3/8		5-25/32		3-1/8		2-11/32		0.05	
27333070A	96094			8.40	.3307		10.0		147		78		59		1.30

Spot drilling recommended when 7X drilling. Spot drill to 1/2 the diameter of the finish hole size. Spotting drill point angle should be equal or greater than drill point angle.

Technical information on page 110.

Series 273 Continued

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/ Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
27333200A	96095		Q		.3320	3/8		5-25/32		3-1/8		2-11/32		0.05	
27333460A	96096			8.50	.3346		10.0		147		78		59		1.32
27333860A	96097			8.60	.3386		10.0		147		78		59		1.33
27334250A	96098			8.70	.3425		10.0		147		83		62		1.35
27334380A	96099	11/32			.3438	3/8		5-25/32		3-1/8		2-11/32		0.05	
27334640A	96100			8.80	.3464		10.0		147		83		62		1.36
27335040A	96101			8.90	.3504		10.0		147		83		62		1.38
27335430A	96102			9.00	.3543		10.0		147		83		62		1.39
27336610A	96103			9.30	.3661		10.0		147		91		68		1.44
27337010A	96104			9.40	.3701		10.0		147		91		68		1.46
27337400A	96105			9.50	.3740		10.0		147		91		68		1.47
27337500A	96106	3/8			.3750	3/8		5-25/32		3-3/8		2-1/2		0.06	
27337790A	96107			9.60	.3779		10.0		147		91		68		1.49
27338190A	96108			9.70	.3819		10.0		147		91		68		1.50
27338980A	96109			9.90	.3898		10.0		147		91		68		1.53
27339060A	96110	25/64			.3906	7/16		6-3/4		3-11/16		2-3/4		0.06	
27339370A	96111			10.00	.3937		10.0		147		91		68		1.55
27340160A	96112			10.20	.4016		12.0		171		94		71		1.58
27340620A	96113	13/32			.4062	7/16		6-3/4		3-11/16		2-3/4		0.06	
27340940A	96114			10.40	.4094		12.0		171		94		71		1.61
27341340A	96115			10.50	.4134		12.0		171		102		77		1.63
27341730A	96116			10.60	.4173		12.0		171		102		77		1.64
27342190A	96117	27/64			.4219	7/16		6-3/4		3-15/16		3		0.07	
27343310A	96118			11.00	.4331		12.0		171		102		77		1.70
27343750A	96119	7/16			.4375	7/16		6-3/4		3-15/16		3		0.07	
27345270A	96120			11.50	.4527		12.0		171		109		82		1.78
27346450A	96121			11.80	.4645		12.0		171		109		82		1.83
27347240A	96122			12.00	.4724		12.0		171		109		82		1.86
27348030A	96123			12.20	.4803		14.0		185		109		82		1.89
27349210A	96124			12.50	.4921		14.0		185		109		82		1.94
27350000A	96125	1/2			.5000	1/2		7		4-1/2		3-3/8		0.08	
27350390A	96126			12.80	.5039		14.0		185		121		91		1.98
27351180A	96127			13.00	.5118		14.0		185		121		91		2.01
27351560A	96128	33/64			.5156	35/64		7-9/32		4-11/16		3-1/2		0.08	
27353120A	96129	17/32			.5312	35/64		7-9/32		4-11/16		3-1/2		0.08	
27353150A	96130			13.50	.5315		14.0		185		121		91		2.09
27354330A	96131			13.80	.5433		14.0		185		121		91		2.14
27354720A	96132			13.90	.5472		14.0		185		121		91		2.15
27355120A	96133			14.00	.5512		14.0		185		121		91		2.17
27355900A	96134			14.20	.5590		16.0		206		128		96		2.20
27356250A	96135	9/16			.5625	5/8		8-1/8		5		3-3/4		0.09	
27357090A	96136			14.50	.5709		16.0		206		128		96		2.25
27359050A	96137			15.00	.5905		16.0		206		137		103		2.32
27361020A	96138			15.50	.6102		16.0		206		137		103		2.40
27362500A	96139	5/8			.6250	5/8		8-1/8		5-7/16		4-5/64		0.10	
27362990A	96140			16.00	.6299		16.0		206		137		103		2.48

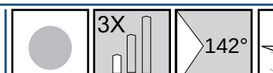
Technical information on page 110.

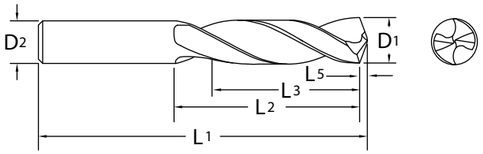
Spot drilling recommended when 7X drilling. Spot drill to 1/2 the diameter of the finish hole size. Spotting drill point angle should be equal or greater than drill point angle.

Inch	
D1	Tolerance
.1875-.6250	+.0000/-.0005

Metric (mm)	
D1	Tolerance (h7)
5.00-6.00	+.000/-.012
6.01-10.00	+.000/-.015
10.01-16.00	+.000/-.018

Twister® CI Series 280





- Advanced material and geometry.
- Double margin.
- Self centering point.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
28018750A	96145	3/16			.1875	3/16		3-1/32		1		0.80		0.029	
28020100A	96146		7		.2010	.201		3-7/32		1-1/16		0.85		0.031	
28020470A	96147			5.20	.2047		5.2		82		28		22		0.81
28021300A	96148		3		.2130	.213		3-7/32		1-3/16		0.95		0.033	
28021870A	96149	7/32			.2187	7/32		3-7/32		1-3/16		0.95		0.034	
28022100A	96150		2		.2210	.221		3-7/32		1-3/16		0.95		0.034	
28023440A	96151	15/64			.2344	15/64		3-7/32		1-3/16		0.95		0.036	
28023620A	96152			6.00	.2362		6.0		82		30		24		0.93
28024020A	96153			6.10	.2402		6.1		94		35		28		0.95
28024200A	96154		C		.2420	.242		3-3/8		1-1/4		1.00		0.037	
28024410A	96155			6.20	.2441		6.2		94		35		28		0.96
28024600A	96156		D		.2460	.246		3-3/8		1-1/4		1.00		0.038	
28024800A	96157			6.30	.2480		6.3		94		35		28		0.98
28025000A	96158	1/4			.2500	1/4		3-3/8		1-1/4		1.00		0.039	
28025700A	96159		F		.2570	.257		3-45/64		1-3/8		1.10		0.040	
28025980A	96160			6.60	.2598		6.6		94		35		28		1.02
28026370A	96161			6.70	.2637		6.7		94		35		28		1.04
28026560A	96162	17/64			.2656	17/64		3-45/64		1-3/8		1.10		0.041	
28026600A	96163		H		.2660	.266		3-45/64		1-3/8		1.10		0.041	
28026770A	96164			6.80	.2677		6.8		94		35		28		1.05
28027200A	96165		I		.2720	.272		3-45/64		1-9/16		1.25		0.042	
28027560A	96166			7.00	.2756		7.0		94		40		32		1.08
28028120A	96167	9/32			.2812	9/32		3-45/64		1-9/16		1.25		0.044	
28028350A	96168			7.20	.2835		7.2		94		40		32		1.12
28029130A	96169			7.40	.2913		7.4		94		40		32		1.15
28029690A	96170	19/64			.2969	19/64		3-45/64		1-9/16		1.25		0.046	
28030710A	96171			7.80	.3071		7.8		94		40		32		1.21
28031250A	96172	5/16			.3125	5/16		3-45/64		1-9/16		1.25		0.048	
28031500A	96390			8.00	.3150		8.0		94		40		32		1.24
28031890A	96173			8.10	.3189		8.1		106		44		35		1.26
28032280A	96174			8.20	.3228		8.2		106		44		35		1.27
28032680A	96175			8.30	.3268		8.3		106		44		35		1.29
28032810A	96176	21/64			.3281	21/64		4-11/64		1-7/8		1.50		0.051	
28033070A	96177			8.40	.3307		8.4		106		44		35		1.30
28033200A	96178		Q		.3320	.332		4-11/64		1-7/8		1.50		0.051	
28033460A	96179			8.50	.3346		8.5		106		44		35		1.32
28033860A	96180			8.60	.3386		8.6		106		44		35		1.33
28034250A	96181			8.70	.3425		8.7		106		50		40		1.35
28034380A	96182	11/32			.3438	11/32		4-11/64		1-7/8		1.50		0.053	
28035040A	96183			8.90	.3504		8.9		106		50		40		1.38
28035430A	96184			9.00	.3543		9.0		106		50		40		1.39

Technical information on page 110.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
28036610A	96185			9.30	.3661		9.3		106		50		40		1.44
28037010A	96186			9.40	.3701		9.4		106		50		40		1.46
28037400A	96187			9.50	.3740		9.5		106		50		40		1.47
28037500A	96188	3/8			.3750	3/8		4-11/64		1-7/8		1.50		0.058	
28037790A	96189			9.60	.3779		9.6		106		50		40		1.49
28038190A	96190			9.70	.3819		9.7		106		50		40		1.50
28038980A	96191			9.90	.3898		9.9		106		50		40		1.53
28039060A	96192	25/64			.3906	25/64		4-51/64		2-3/16		1.75		0.061	
28039370A	96193			10.00	.3937		10.0		106		50		40		1.55
28040160A	96194			10.20	.4016		10.2		122		55		44		1.58
28040620A	96195	13/32			.4062	13/32		4-51/64		2-3/16		1.75		0.063	
28040940A	96196			10.40	.4094		10.4		122		55		44		1.61
28041730A	96197			10.60	.4173		10.6		122		60		48		1.64
28042190A	96198	27/64			.4219	27/64		4-51/64		2-3/16		1.75		0.065	
28043310A	96199			11.00	.4331		11.0		122		60		48		1.70
28043750A	96200	7/16			.4375	7/16		4-51/64		2-3/16		1.75		0.068	
28045270A	96201			11.50	.4527		11.5		122		60		48		1.78
28046450A	96202			11.80	.4645		11.8		122		60		48		1.83
28047240A	96203			12.00	.4724		12.0		122		60		48		1.86
28048030A	96204			12.20	.4803		12.2		128		64		51		1.89
28049210A	96205			12.50	.4921		12.5		128		64		51		1.94
28050000A	96206	1/2			.5000	1/2		5		2-1/2		2.00		0.077	
28050390A	96207			12.80	.5039		12.8		128		64		51		1.98
28051180A	96208			13.00	.5118		13.0		128		64		51		2.01
28051560A	96209	33/64			.5156	33/64		5-1/32		2-1/2		2.00		0.080	
28053120A	96210	17/32			.5312	17/32		5-1/32		2-1/2		2.00		0.082	
28054330A	96211			13.80	.5433		13.8		128		64		51		2.14
28054720A	96212			13.90	.5472		13.9		128		64		51		2.15
28055120A	96213			14.00	.5512		14.0		128		64		51		2.17
28055900A	96214			14.20	.5590		14.2		140		74		59		2.20
28056250A	96215	9/16			.5625	9/16		5-33/64		3		2.40		0.087	
28057090A	96216			14.50	.5709		14.5		140		74		59		2.25
28059050A	96217			15.00	.5905		15.0		140		74		59		2.32
28061020A	96218			15.50	.6102		15.5		140		74		59		2.40
28062500A	96219	5/8			.6250	5/8		5-33/64		3		2.40		0.097	
28062990A	96220			16.00	.6299		16.0		140		74		59		2.48

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Inch	
D1	Tolerance
.1875-.6250	+.0000/-.0005

Metric (mm)	
D1	Tolerance (h7)
5.20-6.00	+.000/-.012
6.01-10.00	+.000/-.015
10.01-16.00	+.000/-.018

Machining Note: Flood coolants are recommended when machining cast iron with carbide tools to both improve workpiece quality and tool life. Light cutting fluid or water-soluble oil is recommended. Use a heavy flood, directed on the cutting edges to minimize intermittent cooling, which can cause chipping or flaking of the carbide.

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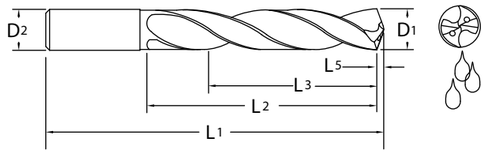

- Advanced material and geometry.
- Double margin.
- Self centering point.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/ Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
28218750A	96221	3/16			.1875	3/16		3-27/64		1-3/8		1.10		0.029	
28220100A	96222		7		.2010	15/64		3-45/64		1-1/2		1.20		0.031	
28220470A	96223			5.20	.2047		6		94		38		30		0.81
28221300A	96224		3		.2130	15/64		3-45/64		1-1/2		1.20		0.033	
28221870A	96225	7/32			.2187	15/64		3-45/64		1-11/16		1.35		0.034	
28222100A	96226		2		.2210	15/64		3-45/64		1-11/16		1.35		0.034	
28223440A	96227	15/64			.2344	15/64		3-45/64		1-11/16		1.35		0.036	
28223620A	96228			6.00	.2362		6		94		42		34		0.93
28224020A	96229			6.10	.2402		8		110		46		37		0.95
28224200A	96230		C		.2420	1/4		3-7/8		1-3/4		1.40		0.037	
28224410A	96231			6.20	.2441		8		110		46		37		0.96
28224600A	96232		D		.2460	1/4		3-7/8		1-3/4		1.40		0.038	
28224800A	96233			6.30	.2480		8		110		46		37		0.98
28225000A	96234	1/4			.2500	1/4		3-7/8		1-3/4		1.40		0.039	
28225700A	96235		F		.2570	5/16		4-5/16		2		1.60		0.040	
28225980A	96236			6.60	.2598		8		110		48		38		1.02
28226370A	96237			6.70	.2637		8		110		48		38		1.04
28226560A	96238	17/64			.2656	5/16		4-5/16		2		1.60		0.041	
28226600A	96239		H		.2660	5/16		4-5/16		2		1.60		0.041	
28226770A	96240			6.80	.2677		8		110		52		42		1.05
28227200A	96241		I		.2720	5/16		4-5/16		2		1.60		0.042	
28227560A	96242			7.00	.2756		8		110		52		42		1.08
28228120A	96243	9/32			.2812	5/16		4-5/16		2-3/16		1.75		0.044	
28228350A	96244			7.20	.2835		8		110		52		42		1.12
28229130A	96245			7.40	.2913		8		110		56		45		1.15
28229690A	96246	19/64			.2969	5/16		4-5/16		2-3/16		1.75		0.046	
28230710A	96247			7.80	.3071		8		110		56		45		1.21
28231250A	96248	5/16			.3125	5/16		4-5/16		2-3/16		1.75		0.048	
28231500A	96391			8.00	.3150		8		110		56		45		1.24
28231890A	96249			8.10	.3189		10		126		62		50		1.26
28232280A	96250			8.20	.3228		10		126		62		50		1.27
28232680A	96251			8.30	.3268		10		126		62		50		1.29
28232810A	96252	21/64			.3281	3/8		4-61/64		2-3/8		1.90		0.051	
28233070A	96253			8.40	.3307		10		126		62		50		1.30
28233200A	96254		Q		.3320	3/8		4-61/64		2-3/8		1.90		0.051	
28233460A	96255			8.50	.3346		10		126		62		50		1.32
28233860A	96256			8.60	.3386		10		126		62		50		1.33
28234250A	96257			8.70	.3425		10		126		62		50		1.35

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Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/ Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
28234380A	96258	11/32			.3438	3/8		4-61/64		2-5/8		2.10		0.053	
28235040A	96259			8.90	.3504		10		126		62		50		1.38
28235430A	96260			9.00	.3543		10		126		70		56		1.39
28236610A	96261			9.30	.3661		10		126		70		56		1.44
28237010A	96262			9.40	.3701		10		126		70		56		1.46
28237400A	96263			9.50	.3740		10		126		70		56		1.47
28237500A	96264	3/8			.3750	3/8		4-61/64		2-5/8		2.10		0.058	
28237790A	96265			9.60	.3779		10		126		70		56		1.49
28238190A	96266			9.70	.3819		10		126		70		56		1.50
28238980A	96267			9.90	.3898		10		126		70		56		1.53
28239060A	96268	25/64			.3906	7/16		5-47/64		2-7/8		2.30		0.061	
28239370A	96269			10.00	.3937		10		126		70		56		1.55
28240160A	96270			10.20	.4016		12		146		74		59		1.58
28240620A	96271	13/32			.4062	7/16		5-47/64		3-1/16		2.45		0.063	
28240940A	96272			10.40	.4094		12		146		74		59		1.61
28241730A	96273			10.60	.4173		12		146		78		62		1.64
28242190A	96274	27/64			.4219	7/16		5-47/64		3-1/16		2.45		0.065	
28243310A	96275			11.00	.4331		12		146		78		62		1.70
28243750A	96276	7/16			.4375	7/16		5-47/64		3-1/16		2.45		0.068	
28245270A	96277			11.50	.4527		12		146		84		67		1.78
28246450A	96278			11.80	.4645		12		146		84		67		1.83
28247240A	96279			12.00	.4724		12		146		84		67		1.86
28248030A	96280			12.20	.4803		14		156		88		70		1.89
28249210A	96281			12.50	.4921		14		156		88		70		1.94
28250000A	96282	1/2			.5000	1/2		5-7/8		3-1/4		2.60		0.077	
28250390A	96283			12.80	.5039		14		156		92		74		1.98
28251180A	96284			13.00	.5118		14		156		92		74		2.01
28251560A	96285	33/64			.5156	35/64		6-9/64		3-3/4		3.00		0.080	
28253120A	96286	17/32			.5312	35/64		6-9/64		3-3/4		3.00		0.082	
28254330A	96287			13.80	.5433		14		156		92		74		2.14
28254720A	96288			13.90	.5472		14		156		92		74		2.15
28255120A	96289			14.00	.5512		14		156		92		74		2.17
28255900A	96290			14.20	.5590		16		170		104		83		2.20
28256250A	96291	9/16			.5625	5/8		6-11/16		4-1/16		3.25		0.087	
28257090A	96292			14.50	.5709		16		170		104		83		2.25
28259050A	96293			15.00	.5905		16		170		104		83		2.32
28261020A	96294			15.50	.6102		16		170		104		83		2.40
28262500A	96295	5/8			.6250	5/8		6-11/16		4-1/16		3.25		0.097	
28262990A	96296			16.00	.6299		16		170		104		83		2.48

Technical information on page 110.

Inch	
D1	Tolerance
.1875-.6250	+.0000/-.0005

Metric (mm)	
D1	Tolerance (h7)
5.20-6.00	+.000/-.012
6.01-10.00	+.000/-.015
10.01-16.00	+.000/-.018

Machining Note: Flood coolants are recommended when machining cast iron with carbide tools to both improve workpiece quality and tool life. Light cutting fluid or water-soluble oil is recommended. Use a heavy flood, directed on the cutting edges to minimize intermittent cooling, which can cause chipping or flaking of the carbide.

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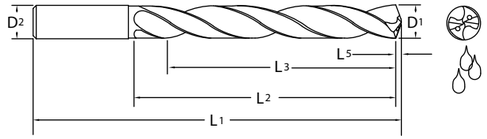


- Advanced material and geometry.
- Double margin.
- Self centering point.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
28418750A	96297	3/16			.1875	3/16		4		2		1.60		0.029	
28420100A	96298		7		.2010	15/64		4-13/32		2-1/8		1.70		0.031	
28420470A	96299			5.20	.2047		6		112		55		44		0.81
28421300A	96300		3		.2130	15/64		4-13/32		2-1/8		1.70		0.033	
28421870A	96301	7/32			.2187	15/64		4-13/32		2-11/32		1.08		0.034	
28422100A	96302		2		.2210	15/64		4-13/32		2-11/32		1.08		0.034	
28423440A	96303	15/64			.2344	15/64		4-13/32		2-11/32		1.08		0.036	
28423620A	96304			6.00	.2362		6		112		60		48		0.93
28424020A	96305			6.10	.2402		8		134		63		50		0.95
28424200A	96306		C		.2420	1/4		4-5/8		2-1/2		2.00		0.037	
28424410A	96307			6.20	.2441		8		134		63		50		0.96
28424600A	96308		D		.2460	1/4		4-5/8		2-1/2		2.00		0.038	
28424800A	96309			6.30	.2480		8		134		63		50		0.98
28425000A	96310	1/4			.2500	1/4		4-5/8		2-1/2		2.00		0.039	
28425700A	96311		F		.2570	5/16		5-9/32		2-5/8		2.10		0.040	
28425980A	96312			6.60	.2598		8		134		68		54		1.02
28426370A	96313			6.70	.2637		8		134		68		54		1.04
28426560A	96314	17/64			.2656	5/16		5-9/32		2-13/16		2.25		0.041	
28426600A	96315		H		.2660	5/16		5-9/32		2-13/16		2.25		0.041	
28426770A	96316			6.80	.2677		8		134		68		54		1.05
28427200A	96317		I		.2720	5/16		5-9/32		2-13/16		2.25		0.042	
28427560A	96318			7.00	.2756		8		134		74		59		1.08
28428120A	96319	9/32			.2812			5-9/32		2-13/16		2.25		0.044	
28428350A	96320			7.20	.2835		8		134		74		59		1.12
28429130A	96321			7.40	.2913		8		134		74		59		1.15
28429690A	96322	19/64			.2969	5/16		5-9/32		3-1/8		2.50		0.046	
28430710A	96323			7.80	.3071		8		134		80		64		1.21
28431250A	96324	5/16			.3125	5/16		5-9/32		3-1/8		2.50		0.048	
28431500A	96392			8.00	.3150		8		134		80		64		1.24
28431890A	96325			8.10	.3189		10		156		86		69		1.26
28432280A	96326			8.20	.3228		10		156		86		69		1.27
28432680A	96327			8.30	.3268		10		156		86		69		1.29
28432810A	96328	21/64			.3281	3/8		6-5/32		3-1/2		2.80		0.051	
28433070A	96329			8.40	.3307		10		156		86		69		1.30
28433200A	96330		Q		.3320	3/8		6-5/32		3-1/2		2.80		0.051	
28433460A	96331			8.50	.3346		10		156		86		69		1.32
28433860A	96332			8.60	.3386		10		156		86		69		1.33
28434250A	96333			8.70	.3425		10		156		92		74		1.35
28434380A	96334	11/32			.3438	3/8		6-5/32		3-1/2		2.80		0.053	
28435040A	96335			8.90	.3504		10		156		92		74		1.38
28435430A	96336			9.00	.3543		10		156		92		74		1.39

Spot drilling recommended when 8X drilling. Spot drill to 1/2 the diameter of the finish hole size. Spotting drill point angle should be equal or greater than drill point angle.

Technical information on page 110.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Drill Length L3 Ref. Inch	Drill Length L3 Ref. mm	Point Length L5 Inch	Point Length L5 mm
28436610A	96337			9.30	.3661		10		156		100		80		1.44
28437010A	96338			9.40	.3701		10		156		100		80		1.46
28437400A	96339			9.50	.3740		10		156		100		80		1.47
28437500A	96340	3/8			.3750	3/8		6-5/32		3-3/4		3.00		0.058	
28437790A	96341			9.60	.3779		10		156		100		80		1.49
28438190A	96342			9.70	.3819		10		156		100		80		1.50
28438980A	96343			9.90	.3898		10		156		100		80		1.53
28439060A	96344	25/64			.3906	7/16		7-5/32		4-1/16		3.25		0.061	
28439370A	96345			10.00	.3937		10		156		100		80		1.55
28440160A	96346			10.20	.4016		12		182		104		83		1.58
28440620A	96347	13/32			.4062	7/16		7-5/32		4-1/16		3.25		0.063	
28440940A	96348			10.40	.4094		12		182		104		83		1.61
28441730A	96349			10.60	.4173		12		182		112		90		1.64
28442190A	96350	27/64			.4219	7/16		7-5/32		4-3/8		3.50		0.065	
28443310A	96351			11.00	.4331		12		182		112		90		1.70
28443750A	96352	7/16			.4375	7/16		7-5/32		4-3/8		3.50		0.068	
28445270A	96353			11.50	.4527		12		182		120		96		1.78
28446450A	96354			11.80	.4645		12		182		120		96		1.83
28447240A	96355			12.00	.4724		12		182		120		96		1.86
28448030A	96356			12.20	.4803		14		198		120		96		1.89
28449210A	96357			12.50	.4921		14		198		120		96		1.94
28450000A	96358	1/2			.5000	1/2		7-1/2		5		4.00		0.077	
28450390A	96359			12.80	.5039		14		198		134		107		1.98
28451180A	96360			13.00	.5118		14		198		134		107		2.01
28451560A	96361	33/64			.5156	35/64		7-51/64		5-3/16		4.15		0.080	
28453120A	96362	17/32			.5312	35/64		7-51/64		5-3/16		4.15		0.082	
28454330A	96363			13.80	.5433		14		198		134		107		2.14
28454720A	96364			13.90	.5472		14		198		134		107		2.15
28455120A	96365			14.00	.5512		14		198		134		107		2.17
28455900A	96366			14.20	.5590		16		218		142		114		2.20
28456250A	96367	9/16			.5625	5/8		8-37/64		5-5/8		4.50		0.087	
28457090A	96368			14.50	.5709		16		218		142		114		2.25
28459050A	96369			15.00	.5905		16		218		152		122		2.32
28461020A	96370			15.50	.6102		16		218		152		122		2.40
28462500A	96371	5/8			.6250	5/8		8-37/64		6		4.80		0.097	
28462990A	96372			16.00	.6299		16		218		152		122		2.48

Technical information on page 110.

Inch	
D1	Tolerance
.1875-.6250	+.0000/-.0005

Metric (mm)	
D1	Tolerance (h7)
5.20-6.00	+.000/-.012
6.01-10.00	+.000/-.015
10.01-16.00	+.000/-.018

Machining Note: Flood coolants are recommended when machining cast iron with carbide tools to both improve workpiece quality and tool life. Light cutting fluid or water-soluble oil is recommended. Use a heavy flood, directed on the cutting edges to minimize intermittent cooling, which can cause chipping or flaking of the carbide.

Twister® GP

General Purpose Drills

M.A. Ford® drills are designed for maximum flexibility and performance when drilling a wide variety of materials, ranging from soft, non-ferrous materials to hardened steels.
Twister® GP drills are an excellent choice for all general purpose hole-making and provide these high performance benefits:

- High feed rates with excellent chip evacuation.
- Accurate hole size in a wide range of materials.
- Pre-drilling and follow-up operations can often be eliminated because of the quality and performance of M.A. Ford® drills.
- Minimal wander produces maximum precision, productivity and drill life.
- Web-thinned drill designs are available for reduced power requirements, lower temperatures and extended drill life.
- Three-flute geometries are available to reduce chip load/tooth and increase tool life in highly alloyed steels.
- Available in a wide range of styles, sizes, lengths and coatings.

Designed and Manufactured in the USA

Twister® GP Series 302
Twister® GP Series 306
Twister® GP Series 402
Twister® GP Series 403
Twister® GP Series 404
Twister® GP Series 405

Twister® General Purpose Drills

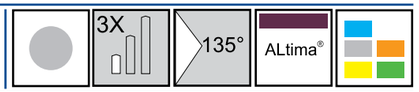
Twister® GP Series 200/200 Sets
Twister® GP Series 204
Twister® GP Series 205
Twister® GP Series 206
Twister® GP Series 207
Twister® GP Series 209
Twister® GP Series 210
Twister® GP Series 224
Twister® GP Series 226
Twister® GP Series 300



ISO 9001:2000 Certified

An ESOP Company

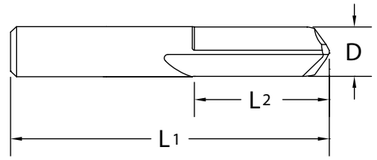
Hi-Roc® Series 200



Inch	
D	Tolerance
.0310-.7812	+.0000/-.0005

Metric (mm)	
D	Tolerance
0.80-20.00	+.000/-.013

Designed to drill hardened steel in the 42-65 Rockwell "C" range.



- Produces chips without generating excessive heat.
- Accurately sized holes are produced without annealing or softening the workpiece.
- Reamer type finishes are easily produced.
- Both a production drill and salvage or reclaim tool.
- Straight Flute.

Uncoated		ALtima®		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Letter/ Wire	mm	Decimal	Inch	mm	Inch	mm
20003100	20001				68		.0310	1-1/2		3/16	
20003120	20004			1/32			.0312	1-1/2		3/16	
20003150	20007					0.80	.0315		38		5.0
20003200	20010				67		.0320	1-1/2		7/32	
20003300	20013				66		.0330	1-1/2		7/32	
20003350	20016					0.85	.0335		38		5.5
20003500	20019				65		.0350	1-1/2		7/32	
20003540	20022					0.90	.0354		38		5.5
20003600	20025				64		.0360	1-1/2		7/32	
20003700	20028				63		.0370	1-1/2		1/4	
20003740	20031					0.95	.0374		38		6.0
20003800	20034				62		.0380	1-1/2		1/4	
20003900	20037				61		.0390	1-1/2		1/4	
20003940	20040					1.00	.0394		38		6.5
20004000	20043				60		.0400	1-1/2		1/4	
20004100	20046				59		.0410	1-1/2		1/4	
20004130	20049					1.05	.0413		38		6.5
20004200	20052				58		.0420	1-1/2		1/4	
20004300	20055				57		.0430	1-1/2		1/4	
20004330	20058					1.10	.0433		38		6.5
20004520	20061					1.15	.0452		38		6.5
20004650	20064				56		.0465	1-1/2		1/4	
20004680	20067			3/64			.0468	1-1/2		1/4	
20004720	20070					1.20	.0472		38		8.0
20004920	20073					1.25	.0492		38		8.0
20005110	20076					1.30	.0511		38		8.0
20005200	20079				55		.0520	1-1/2		5/16	
20005310	20082					1.35	.0531		38		8.0
20005500	20085				54		.0550	1-1/2		5/16	
20005510	20088					1.40	.0551		38		8.0
20005710	20091					1.45	.0571		38		8.0
20005900	20094					1.50	.0590		38		8.0
20005950	20097				53		.0595	1-1/2		5/16	
20006250	20100			1/16			.0625	1-1/2		5/16	
20006300	20103					1.60	.0630		38		8.0
20006350	20106				52		.0635	1-1/2		5/16	
20006690	20109					1.70	.0669		38		9.5
20006700	20112				51		.0670	1-1/2		3/8	
20007000	20115				50		.0700	1-1/2		3/8	
20007080	20118					1.80	.0708		38		9.5

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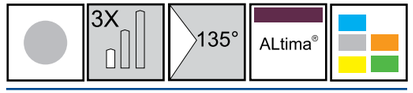

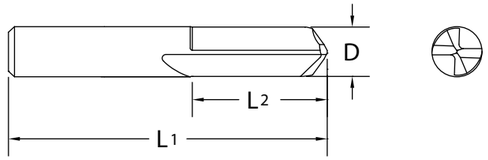

Uncoated		ALtima®		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Letter/ Wire	mm	Decimal	Inch	mm	Inch	mm
20007300	20121				49		.0730	1-1/2		3/8	
20007480	20124					1.90	.0748		38		9.5
20007600	20127				48		.0760	1-1/2		3/8	
20007810	20130			5/64			.0781	1-1/2		3/8	
20007850	20133				47		.0785	1-1/2		3/8	
20007870	20136					2.00	.0787		38		9.5
20008100	20139				46		.0810	1-1/2		1/2	
20008200	20142				45		.0820	1-1/2		1/2	
20008270	20145					2.10	.0827		38		12.5
20008600	20148				44		.0860	1-1/2		1/2	
20008660	20151					2.20	.0866		38		12.5
20008900	20154				43		.0890	1-1/2		1/2	
20009060	20157					2.30	.0906		38		12.5
20009350	20160				42		.0935	1-1/2		1/2	
20009370	20163			3/32			.0937	1-1/2		1/2	
20009450	20166					2.40	.0945		38		12.5
20009600	20169				41		.0960	1-1/2		1/2	
20009800	20172				40		.0980	1-1/2		1/2	
20009840	20175					2.50	.0984		38		12.5
20009950	20178				39		.0995	1-1/2		1/2	
20010150	20184				38		.1015	1-1/2		1/2	
20010240	20187					2.60	.1024		38		16.0
20010400	20190				37		.1040	1-1/2		5/8	
20010630	20193					2.70	.1063		38		16.0
20010650	20196				36		.1065	1-1/2		5/8	
20010930	20199			7/64			.1093	1-1/2		5/8	
20011000	20202				35		.1100	1-1/2		5/8	
20011020	20205					2.80	.1102		38		16.0
20011100	20208				34		.1110	1-1/2		5/8	
20011300	20211				33		.1130	1-1/2		5/8	
20011420	20214					2.90	.1142		38		16.0
20011600	20217				32		.1160	1-1/2		5/8	
20011810	20220	20011810A	96400			3.00	.1181		38		16.0
20012000	20223				31		.1200	1-1/2		5/8	
20012200	20226	20012200A	96401			3.10	.1220		38		16.0
20012500	20229			1/8			.1250	1-1/2		5/8	
20012600	20232	20012600A	96402			3.20	.1260		38		16.0
20012850	20235				30		.1285	2		5/8	
20012990	20238	20012990A	96403			3.30	.1299		38		16.0
20013390	20241	20013390A	96404			3.40	.1339		51		16.0
20013600	20244				29		.1360	2		5/8	
20013780	20247	20013780A	96405			3.50	.1378		51		16.0
20014050	20250				28		.1405	2		5/8	
20014060	20253			9/64			.1406	2		5/8	
20014170	20256	20014170A	96406			3.60	.1417		51		16.0
20014400	20259				27		.1440	2		5/8	
20014570	20262	20014570A	96407			3.70	.1457		51		16.0
20014700	20265				26		.1470	2		5/8	

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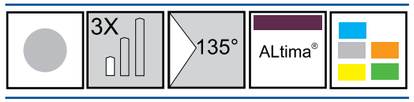
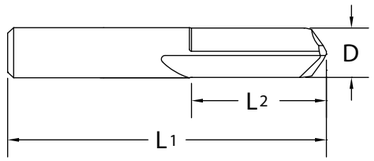
Series 200 Continued

Uncoated		ALtima®		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Letter/ Wire	mm	Decimal	Inch	mm	Inch	mm
20014950	20268				25		.1495	2		5/8	
20014960	20271	20014960A	96408			3.80	.1496		51		16.0
20015200	20274				24		.1520	2		5/8	
20015350	20277	20015350A	96409			3.90	.1535		51		16.0
20015400	20280				23		.1540	2		5/8	
20015620	20283			5/32			.1562	2		5/8	
20015700	20286				22		.1570	2		5/8	
20015750	20289	20015750A	96410			4.00	.1575		51		16.0
20015900	20292				21		.1590	2		5/8	
20016100	20295				20		.1610	2		5/8	
20016140	20298	20016140A	96411			4.10	.1614		51		16.0
20016540	20301	20016540A	96412			4.20	.1654		51		16.0
20016600	20304				19		.1660	2		5/8	
20016930	20307	20016930A	96413			4.30	.1693		51		16.0
20016950	20310				18		.1695	2		5/8	
20017180	20313			11/64			.1718	2		5/8	
20017300	20316				17		.1730	2		5/8	
20017320	20319	20017320A	96414			4.40	.1732		51		16.0
20017700	20322				16		.1770	2		5/8	
20017720	20325	20017720A	96415			4.50	.1772		51		16.0
20018000	20328				15		.1800	2		5/8	
20018110	20331	20018110A	96416			4.60	.1811		51		16.0
20018200	20334				14		.1820	2		5/8	
20018500	20337	20018500A	96417		13	4.70	.1850	2	51	5/8	16.0
20018750	20340			3/16			.1875	2		5/8	
20018890	20343	20018890A	96418			4.80	.1889		51		16.0
20018900	20346				12		.1890	2		5/8	
20019100	20349				11		.1910	2		5/8	
20019290	20352	20019290A	96419			4.90	.1929		51		16.0
20019350	20355				10		.1935	2		5/8	
20019600	20358				9		.1960	2		3/4	
20019680	20361	20019680A	96420			5.00	.1968		51		19.0
20019900	20364				8		.1990	2		3/4	
20020080	20370	20020080A	96421			5.10	.2008		51		19.0
20020100	20373				7		.2010	2		3/4	
20020310	20376			13/64			.2031	2		3/4	
20020400	20379				6		.2040	2		3/4	
20020470	20382	20020470A	96422			5.20	.2047		51		19.0
20020550	20385				5		.2055	2		3/4	
20020860	20388	20020860A	96423			5.30	.2086		51		19.0
20020900	20391				4		.2090	2		3/4	
20021260	20394	20021260A	96424			5.40	.2126		51		19.0
20021300	20397				3		.2130	2		3/4	
20021650	20400	20021650A	96425			5.50	.2165		51		19.0
20021870	20403			7/32			.2187	2		3/4	
20022050	20406	20022050A	96426			5.60	.2205		51		19.0
20022100	20409				2		.2210	2		3/4	
20022440	20412	20022440A	96427			5.70	.2244		51		19.0
20022800	20415				1		.2280	2		3/4	
20022830	20418	20022830A	96428			5.80	.2283		51		19.0
20023230	20421	20023230A	96429			5.90	.2323		51		19.0
20023400	20424				A		.2340	2		3/4	

Technical information on page 112.

Series 200 Continued





Uncoated		ALtima®		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Letter/ Wire	mm	Decimal	Inch	mm	Inch	mm
20023430	20427			15/64			.2343	2		3/4	
20023620	20430	20023620A	96430			6.00	.2362		51		19.0
20023800	20433				B		.2380	2		3/4	
20024020	20436	20024020A	96431			6.10	.2402		51		19.0
20024200	20439				C		.2420	2		3/4	
20024410	20442	20024410A	96432			6.20	.2441		51		19.0
20024600	20445				D		.2460	2		3/4	
20024800	20448	20024800A	96433			6.30	.2480		51		19.0
20025000	20451			1/4	E		.2500	2		3/4	
20025190	20454	20025190A	96434			6.40	.2519		51		19.0
20025590	20457	20025590A	96435			6.50	.2559		51		19.0
20025700	20460				F		.2570	2		3/4	
20025980	20463	20025980A	96436			6.60	.2598		64		19.0
20026100	20466				G		.2610	2-1/2		3/4	
20026370	20469	20026370A	96437			6.70	.2637		64		19.0
20026560	20472			17/64			.2656	2-1/2		3/4	
20026600	20475				H		.2660	2-1/2		3/4	
20026770	20478	20026770A	96438			6.80	.2677		64		19.0
20027160	20481	20027160A	96439			6.90	.2716		64		19.0
20027200	20484				I		.2720	2-1/2		3/4	
20027560	20487	20027560A	96440			7.00	.2756		64		19.0
20027700	20490				J		.2770	2-1/2		3/4	
20027950	20493	20027950A	96441			7.10	.2795		64		19.0
20028100	20496				K		.2810	2-1/2		3/4	
20028120	20499			9/32			.2812	2-1/2		3/4	
20028340	20502	20028340A	96442			7.20	.2834		64		19.0
20028740	20505	20028740A	96443			7.30	.2874		64		19.0
20029000	20508				L		.2900	2-1/2		3/4	
20029130	20511	20029130A	96444			7.40	.2913		64		19.0
20029500	20514				M		.2950	2-1/2		3/4	
20029530	20517	20029530A	96445			7.50	.2953		64		19.0
20029680	20520			19/64			.2968	2-1/2		3/4	
20029920	20523	20029920A	96446			7.60	.2992		64		19.0
20030200	20529				N		.3020	2-1/2		3/4	
20030310	20532	20030310A	96447			7.70	.3031		64		19.0
20030710	20535	20030710A	96448			7.80	.3071		64		19.0
20031100	20538	20031100A	96449			7.90	.3110		64		19.0
20031250	20541			5/16			.3125	2-1/2		3/4	
20031500	20544	20031500A	96450			8.00	.3150		64		19.0
20031600	20547				O		.3160	2-1/2		3/4	
20031890	20550	20031890A	96451			8.10	.3189		64		19.0
20032280	20553	20032280A	96452			8.20	.3228		64		25.5
20032300	20556				P		.3230	2-1/2		1	
20032670	20559	20032670A	96453			8.30	.3267		64		25.5
20032810	20562			21/64			.3281	2-1/2		1	
20033070	20565	20033070A	96454			8.40	.3307		64		25.5
20033200	20568				Q		.3320	2-1/2		1	
20033460	20571	20033460A	96455			8.50	.3346		64		25.5

Technical information on page 112.

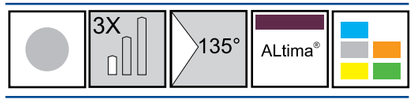
Series 200 Continued

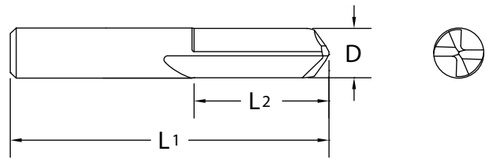
Uncoated		ALtima®		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Letter/ Wire	mm	Decimal	Inch	mm	Inch	mm
20033850	20574	20033850A	96456			8.60	.3385		64		25.5
20033900	20577				R		.3390	2-1/2		1	
20034250	20580	20034250A	96457			8.70	.3425		64		25.5
20034370	20583			11/32			.3437	2-1/2		1	
20034640	20586	20034640A	96458			8.80	.3464		64		25.5
20034800	20589				S		.3480	2-1/2		1	
20035040	20592	20035040A	96459			8.90	.3504		64		25.5
20035430	20595	20035430A	96460			9.00	.3543		64		25.5
20035800	20598				T		.3580	2-1/2		1	
20035820	20601	20035820A	96461			9.10	.3582		64		25.5
20035930	20604			23/64			.3593	2-1/2		1	
20036220	20607	20036220A	96462			9.20	.3622		64		25.5
20036610	20610	20036610A	96463			9.30	.3661		64		25.5
20036800	20613				U		.3680	2-1/2		1	
20037000	20616	20037000A	96464			9.40	.3700		64		25.5
20037400	20619	20037400A	96465			9.50	.3740		64		25.5
20037500	20622			3/8			.3750	2-1/2		1	
20037700	20625				V		.3770	2-1/2		1	
20037790	20628	20037790A	96466			9.60	.3779		64		25.5
20038190	20631	20038190A	96467			9.70	.3819		70		25.5
20038580	20634	20038580A	96468			9.80	.3858		70		25.5
20038600	20637				W		.3860	2-3/4		1	
20038970	20640	20038970A	96469			9.90	.3897		70		25.5
20039060	20643			25/64			.3906	2-3/4		1	
20039370	20646	20039370A	96470			10.00	.3937		70		25.5
20039700	20649				X		.3970	2-3/4		1	
20039760	20652	20039760A	96471			10.10	.3976		70		25.5
20040150	20655	20040150A	96472			10.20	.4015		70		25.5
20040400	20658				Y		.4040	2-3/4		1	
20040550	20661	20040550A	96473			10.30	.4055		70		25.5
20040620	20664			13/32			.4062	2-3/4		1	
20040940	20667	20040940A	96474			10.40	.4094		70		25.5
20041300	20670				Z		.4130	2-3/4		1	
20041340	20673	20041340A	96475			10.50	.4134		70		25.5
20041730	20676	20041730A	96476			10.60	.4173		70		25.5
20042120	20679	20042120A	96477			10.70	.4212		70		25.5
20042180	20682			27/64			.4218	2-3/4		1	
20042520	20685	20042520A	96478			10.80	.4252		70		25.5
20042910	20688	20042910A	96479			10.90	.4291		70		25.5
20043310	20691	20043310A	96480			11.00	.4331		70		25.5
20043700	20694	20043700A	96481			11.10	.4370		70		25.5
20043750	20697			7/16			.4375	2-3/4		1	
20044090	20700	20044090A	96482			11.20	.4409		70		25.5
20044490	20703	20044490A	96483			11.30	.4449		76		25.5
20044880	20706	20044880A	96484			11.40	.4488		76		25.5
20045270	20709	20045270A	96485			11.50	.4527		76		25.5
20045310	20712			29/64			.4531	3		1	
20045670	20715	20045670A	96486			11.60	.4567		76		25.5
20046060	20718	20046060A	96487			11.70	.4606		76		25.5
20046450	20721	20046450A	96488			11.80	.4645		76		25.5
20046850	20724	20046850A	96489			11.90	.4685		76		25.5
20046870	20727			15/32			.4687	3		1	

Technical information on page 112.

Series 200
Twister® Hi-Roc®

Series 200 Continued





Uncoated		ALtima®		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Letter/ Wire	mm	Decimal	Inch	mm	Inch	mm
20047240	20730	20047240A	96490			12.00	.4724		76		25.5
20048440	20733			31/64			.4844	3		1	
20049210	20736	20049210A	96491			12.50	.4921		76		25.5
20050000	20739			1/2			.5000	3		1	
20051180	20742	20051180A	96492			13.00	.5118		89		28.5
20051560	20745			33/64			.5156	3-1/2		1-1/8	
20053120	20748			17/32			.5312	3-1/2		1-1/8	
20053150	20751	20053150A	96493			13.50	.5315		89		28.5
20054690	20754			35/64			.5469	3-1/2		1-1/8	
20055120	20757	20055120A	96494			14.00	.5512		89		28.5
20056250	20760			9/16			.5625	3-1/2		1-1/8	
20057080	20763	20057080A	96495			14.50	.5708		89		32.0
20057810	20766			37/64			.5781	3-1/2		1-1/4	
20059050	20769	20059050A	96496			15.00	.5905		89		32.0
20059380	20772			19/32			.5938	3-1/2		1-1/4	
20060940	20775			39/64			.6094	3-1/2		1-1/4	
20061020	20778	20061020A	96497			15.50	.6102		89		32.0
20062500	20781			5/8			.6250	3-1/2		1-1/4	
20062990	20784	20062990A	96498			16.00	.6299		89		32.0
20064060	20787			41/64			.6406	4		1-1/2	
20064960	20790	20064960A	96499			16.50	.6496		102		38.0
20065620	20793			21/32			.6562	4		1-1/2	
20066930	20796	20066930A	96500			17.00	.6693		102		38.0
20067190	20799			43/64			.6719	4		1-1/2	
20068750	20802			11/16			.6875	4		1-1/2	
20068900	20805	20068900A	96501			17.50	.6890		102		38.0
20070310	20808			45/64			.7031	4		1-1/2	
20070870	20811	20070870A	96502			18.00	.7087		102		38.0
20071880	20814			23/32			.7188	4		1-1/2	
20072830	20817	20072830A	96503			18.50	.7283		102		38.0
20073440	20820			47/64			.7344	4		1-1/2	
20074800	20823	20074800A	96504			19.00	.7480		102		38.0
20075000	20826			3/4			.7500	4		1-1/2	
20076560	20829			49/64			.7656	4		1-1/2	
20078120	20832			25/32			.7812	4		1-1/2	
20078740	20835	20078740A	96505			20.00	.7874		102		38.0

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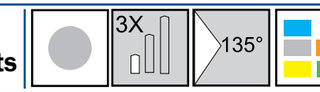
Hi-Roc® Series 200 Sets



Available in five popular sets. Each set contains a selection of more frequently used drills.

- Packed in a plastic case.
- Used for drilling bolt studs, welds and other hard materials.
- Ideal for tool box.

Sets											
Tool No.	EDP	Sizes per Set									
20010000	20181	1/8"	3/16"	1/4"	5/16"	3/8"					
20020000	20367	1/16"	3/32"	1/8"	5/32"	3/16"	7/32"	1/4"			
20030000	20526	3/64"	1/16"	5/64"	3/32"	7/64"	1/8"	9/64"	5/32"	11/64"	3/16"
20040000	20653	2.0mm	3.0mm	4.0mm	5.0mm	6.0mm					
20060000	20773	2.0mm	2.5mm	3.0mm	4.0mm	5.0mm	6.0mm	8.0mm			

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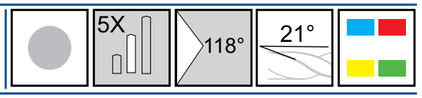
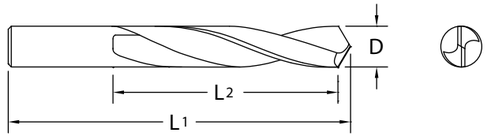
Celebrating 90 Years 1919 - 2009 M.A. Ford®

Twister® GP Series 204



Inch	
D	Tolerance
.0135-.7812	+.0000-.0005

Metric (mm)	
D	Tolerance
0.30-20.00	+.000/-.013



- Designed to allow high feed rates with good chip flow.
- Four facet drill point minimizes drill wander and assures accurately sized holes.

See Series 224 on page 81 for mm size Jobber Drills.

Tool No.	EDP	Diameter D Fraction	Wire	Decimal	OAL L1	Flute Length L2
20401350	24004		80	.0135	1-1/2	1/4
20401450	24010		79	.0145	1-1/2	1/4
20401560	24013	1/64		.0156	1-1/2	1/4
20401600	24019		78	.0160	1-1/2	1/4
20401800	24025		77	.0180	1-1/2	1/4
20402000	24031		76	.0200	1-1/2	1/4
20402100	24034		75	.0210	1-1/2	1/4
20402250	24040		74	.0225	1-1/2	1/4
20402400	24046		73	.0240	1-1/2	1/4
20402500	24049		72	.0250	1-1/2	5/16
20402600	24055		71	.0260	1-1/2	5/16
20402800	24061		70	.0280	1-1/2	5/16
20402920	24064		69	.0292	1-1/2	5/16
20403100	24070		68	.0310	1-1/2	3/8
20403120	24073	1/32		.0312	1-1/2	3/8
20403200	24079		67	.0320	1-1/2	3/8
20403300	24082		66	.0330	1-1/2	3/8
20403500	24088		65	.0350	1-1/2	3/8
20403600	24094		64	.0360	1-1/2	1/2
20403700	24097		63	.0370	1-1/2	1/2
20403800	24103		62	.0380	1-1/2	1/2
20403900	24106		61	.0390	1-1/2	1/2
20404000	24112		60	.0400	1-1/2	3/4
20404100	24115		59	.0410	1-1/2	3/4
20404200	24121		58	.0420	1-1/2	3/4
20404300	24124		57	.0430	1-1/2	3/4
20404650	24133		56	.0465	1-1/2	3/4
20404690	24136	3/64		.0469	1-1/2	3/4
20405200	24148		55	.0520	1-1/2	3/4
20405500	24154		54	.0550	1-1/2	3/4
20405950	24166		53	.0595	1-1/2	3/4
20406250	24169	1/16		.0625	1-1/2	3/4
20406350	24175		52	.0635	1-1/2	3/4
20406700	24181		51	.0670	1-1/2	3/4
20407000	24184		50	.0700	1-3/4	7/8
20407300	24190		49	.0730	1-3/4	7/8
20407600	24196		48	.0760	1-3/4	7/8
20407810	24199	5/64		.0781	1-3/4	7/8
20407850	24202		47	.0785	1-3/4	7/8
20408100	24208		46	.0810	1-3/4	7/8
20408200	24211		45	.0820	1-3/4	7/8
20408600	24217		44	.0860	2	1
20408900	24223		43	.0890	2	1
20409350	24229		42	.0935	2	1
20409380	24232	3/32		.0938	2	1
20409600	24238		41	.0960	2	1
20409800	24241		40	.0980	2	1
20409950	24247		39	.0995	2-1/4	1-1/4
20410150	24250		38	.1015	2-1/4	1-1/4
20410400	24256		37	.1040	2-1/4	1-1/4
20410650	24262		36	.1065	2-1/4	1-1/4
20410940	24265	7/64		.1094	2-1/4	1-1/4
20411000	24268		35	.1100	2-1/4	1-1/4
20411100	24274		34	.1110	2-1/4	1-1/4
20411300	24277		33	.1130	2-1/4	1-1/4
20411600	24283		32	.1160	2-1/4	1-1/4
20412000	24289		31	.1200	2-1/4	1-1/4
20412500	24295	1/8		.1250	2-1/4	1-1/4
20412850	24301		30	.1285	2-1/4	1-1/4
20413600	24310		29	.1360	2-1/2	1-3/8
20414050	24316		28	.1405	2-1/2	1-3/8
20414060	24319	9/64		.1406	2-1/2	1-3/8
20414400	24325		27	.1440	2-1/2	1-3/8
20414700	24331		26	.1470	2-1/2	1-3/8
20414950	24334		25	.1495	2-1/2	1-3/8
20415200	24340		24	.1520	2-1/2	1-3/8
20415400	24346		23	.1540	2-1/2	1-3/8
20415620	24349	5/32		.1562	2-1/2	1-3/8
20415700	24352		22	.1570	2-1/2	1-3/8
20415900	24358		21	.1590	2-1/2	1-3/8
20416100	24361		20	.1610	2-1/2	1-3/8
20416600	24370		19	.1660	2-3/4	1-5/8
20416950	24376		18	.1695	2-3/4	1-5/8
20417190	24379	11/64		.1719	2-3/4	1-5/8
20417300	24382		17	.1730	2-3/4	1-5/8
20417700	24388		16	.1770	2-3/4	1-5/8
20418000	24394		15	.1800	2-3/4	1-5/8
20418200	24400		14	.1820	2-3/4	1-5/8
20418500	24403		13	.1850	2-3/4	1-5/8
20418750	24406	3/16		.1875	2-3/4	1-5/8
20418900	24412		12	.1890	2-3/4	1-5/8
20419100	24415		11	.1910	2-3/4	1-5/8

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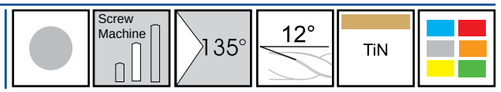
Tool No.	EDP	Diameter D Fraction	Wire	Decimal	OAL L1	Flute Length L2
20419350	24421		10	.1935	2-3/4	1-5/8
20419600	24424		9	.1960	3	1-3/4
20419900	24430		8	.1990	3	1-3/4
20420100	24436		7	.2010	3	1-3/4
20420310	24439	13/64		.2031	3	1-3/4
20420400	24442		6	.2040	3	1-3/4
20420550	24448		5	.2055	3	1-3/4
20420900	24454		4	.2090	3	1-3/4
20421300	24460		3	.2130	3	1-3/4
20421870	24466	7/32		.2187	3	1-3/4
20422100	24472		2	.2210	3	1-3/4
20422800	24478		1	.2280	3	1-3/4
20423400	24487		A	.2340	3-1/4	2
20423440	24490	15/64		.2344	3-1/4	2
20423800	24496		B	.2380	3-1/4	2
20424200	24502		C	.2420	3-1/4	2
20424600	24508		D	.2460	3-1/4	2
20425000	24514	1/4	E	.2500	3-1/4	2
20425700	24523		F	.2570	3-1/4	2
20426100	24529		G	.2610	3-1/2	2-1/8
20426560	24535	17/64		.2656	3-1/2	2-1/8
20426600	24538		H	.2660	3-1/2	2-1/8
20427200	24547		I	.2720	3-1/2	2-1/8
20427700	24553		J	.2770	3-1/2	2-1/8
20428100	24559		K	.2810	3-1/2	2-1/8
20428120	24562	9/32		.2812	3-1/2	2-1/8
20429000	24571		L	.2900	3-1/2	2-1/8
20429500	24577		M	.2950	3-3/4	2-3/8
20429690	24583	19/64		.2969	3-3/4	2-3/8
20430200	24589		N	.3020	3-3/4	2-3/8
20431250	24601	5/16		.3125	3-3/4	2-3/8
20431600	24607		O	.3160	3-3/4	2-3/8
20432300	24616		P	.3230	3-3/4	2-3/8
20432810	24622	21/64		.3281	4	2-1/2
20433200	24628		Q	.3320	4	2-1/2
20433900	24637		R	.3390	4	2-1/2
20434380	24643	11/32		.3438	4	2-1/2
20434800	24649		S	.3480	4	2-1/2
20435800	24658		T	.3580	4-1/4	2-3/4
20435940	24664	23/64		.3594	4-1/4	2-3/4
20436800	24673		U	.3680	4-1/4	2-3/4
20437500	24682	3/8		.3750	4-1/4	2-3/4
20437700	24685		V	.3770	4-1/2	2-7/8
20438600	24697		W	.3860	4-1/2	2-7/8
20439060	24703	25/64		.3906	4-1/2	2-7/8
20439700	24709		X	.3970	4-1/2	2-7/8
20440400	24718		Y	.4040	4-1/2	2-7/8
20440620	24724	13/32		.4062	4-1/2	2-7/8
20441300	24730		Z	.4130	4-1/2	2-7/8
20442190	24742	27/64		.4219	4-1/2	2-7/8
20443750	24757	7/16		.4375	4-1/2	2-7/8
20445310	24772	29/64		.4531	4-3/4	3
20446880	24787	15/32		.4688	4-3/4	3
20448440	24793	31/64		.4844	4-3/4	3
20450000	24799	1/2		.5000	4-3/4	3
20451560	24805	33/64		.5156	5	3-1/4
20453120	24808	17/32		.5312	5	3-1/4
20454690	24814	35/64		.5469	5	3-1/4
20456250	24820	9/16		.5625	5	3-1/4
20457810	24826	37/64		.5781	5-1/4	3-1/2
20459380	24832	19/32		.5938	5-1/4	3-1/2
20460940	24835	39/64		.6094	5-1/4	3-1/2
20462500	24841	5/8		.6250	5-1/4	3-1/2
20464060	24847	41/64		.6406	5-1/2	3-5/8
20465620	24853	21/32		.6562	5-1/2	3-5/8
20467190	24859	43/64		.6719	5-1/2	3-5/8
20468750	24862	11/16		.6875	5-1/2	3-5/8
20470310	24868	45/64		.7031	5-3/4	3-7/8
20471880	24874	23/32		.7188	5-3/4	3-7/8
20473440	24880	47/64		.7344	5-3/4	3-7/8
20475000	24886	3/4		.7500	5-3/4	3-7/8
20476560	24889	49/64		.7656	6	4
20478120	24892	25/32		.7812	6	4

See Series 224 on page 81 for mm size Jobber Drills.

Technical information on page 113.

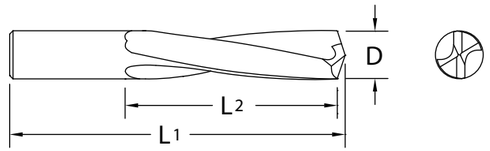
Hi-Tuff® Series 205



Inch	
D	Tolerance
.0135-.7812	+.0000-.0005

Metric (mm)	
D	Tolerance
0.30-20.00	+.000/-.013

Designed for drilling stainless steel, tool steels, titanium, nickel based alloys and other high strength ferrous metals.



- Screw machine lengths and a heavy web provide extra rigidity and strength.
- Web-thinned drill point reduces power requirements, lowers drilling temperatures and extends tool life.
- Slow spiral.
- ALtima® coating upon request.

Uncoated		TiN		Diameter				OAL		Flute Length	
				D				L1		L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Wire	mm	Decimal	Inch	mm	Inch	mm
20501180	25001					0.30	.0118		38		5.0
20501350	25004				80		.0135	1-1/2		3/16	
20501380	25007					0.35	.0138		38		5.0
20501450	25010				79		.0145	1-1/2		3/16	
20501560	25013			1/64			.0156	1-1/2		3/16	
20501570	25016					0.40	.0157		38		5.0
20501600	25019				78		.0160	1-1/2		3/16	
20501770	25022					0.45	.0177		38		500
20501800	25025				77		.0180	1-1/2		3/16	
20501970	25028					0.50	.0197		38		6.5
20502000	25031				76		.0200	1-1/2		1/4	
20502100	25034				75		.0210	1-1/2		1/4	
20502170	25037					0.55	.0217		38		6.5
20502250	25040				74		.0225	1-1/2		1/4	
20502360	25043					0.60	.0236		38		6.5
20502400	25046				73		.0240	1-1/2		1/4	
20502500	25049				72		.0250	1-1/2		5/16	
20502560	25052					0.65	.0256		38		8.0
20502600	25055				71		.0260	1-1/2		5/16	
20502760	25058					0.70	.0276		38		8.0
20502800	25061				70		.0280	1-1/2		5/16	
20502920	25064				69		.0292	1-1/2		5/16	
20502950	25067					0.75	.0295		38		8.0
20503100	25070				68		.0310	1-1/2		3/8	
20503120	25073	20503120T	25074	1/32			.0312	1-1/2		3/8	
20503150	25076					0.80	.0315		38		9.5
20503200	25079				67		.0320	1-1/2		3/8	
20503300	25082				66		.0330	1-1/2		3/8	
20503350	25085					0.85	.0335		38		9.5
20503500	25088				65		.0350	1-1/2		7/16	
20503540	25091					0.90	.0354		38		11.0
20503600	25094				64		.0360	1-1/2		7/16	
20503700	25097				63		.0370	1-1/2		7/16	
20503740	25100					0.95	.0374		38		11.0
20503800	25103				62		.0380	1-1/2		7/16	
20503900	25106				61		.0390	1-1/2		7/16	

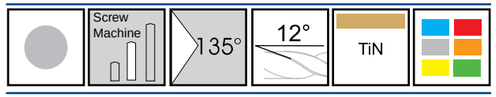
Technical information on page 113.

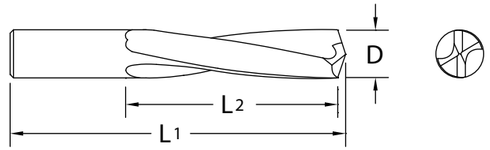
Series 205 Continued

Uncoated		TiN		Diameter				OAL		Flute Length	
				D				L1		L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Wire	mm	Decimal	Inch	mm	Inch	mm
20503940	25109	20503940T	25110			1.00	.0394		38		12.5
20504000	25112				60		.0400	1-1/2		1/2	
20504100	25115				59		.0410	1-1/2		1/2	
20504130	25118					1.05	.0413		38		12.5
20504200	25121				58		.0420	1-1/2		1/2	
20504300	25124				57		.0430	1-1/2		1/2	
20504330	25127					1.10	.0433		38		12.5
20504520	25130					1.15	.0452		38		12.5
20504650	25133				56		.0465	1-1/2		1/2	
20504690	25136	20504690T	25137	3/64			.0469	1-1/2		1/2	
20504720	25139					1.20	.0472		38		12.5
20504920	25142					1.25	.0492		41		16.0
20505110	25145					1.30	.0511		41		16.0
20505200	25148				55		.0520	1-5/8		5/8	
20505310	25151					1.35	.0531		41		16.0
20505500	25154				54		.0550	1-5/8		5/8	
20505510	25157					1.40	.0551		41		16.0
20505710	25160					1.45	.0571		41		16.0
20505900	25163	20505900T	25164			1.50	.0590		41		16.0
20505950	25166				53		.0595	1-5/8		5/8	
20506250	25169	20506250T	25170	1/16			.0625	1-5/8		5/8	
20506300	25172					1.60	.0630		41		16.0
20506350	25175				52		.0635	1-11/16		11/16	
20506690	25178					1.70	.0669		43		17.5
20506700	25181				51		.0670	1-11/16		11/16	
20507000	25184	20507000T	20507		50		.0700	1-11/16		11/16	
20507080	25187					1.80	.0708		43		17.5
20507300	25190				49		.0730	1-11/16		11/16	
20507480	25193					1.90	.0748		43		17.5
20507600	25196				48		.0760	1-11/16		11/16	
20507810	25199	20507810T	25200	5/64			.0781	1-11/16		11/16	
20507850	25202				47		.0785	1-3/4		3/4	
20507870	25205	20507870T	25206			2.00	.0787		44		19.0
20508100	25208				46		.0810	1-3/4		3/4	
20508200	25211				45		.0820	1-3/4		3/4	
20508270	25214					2.10	.0827		44		19.0
20508600	25217				44		.0860	1-3/4		3/4	
20508660	25220					2.20	.0866		44		19.0
20508900	25223	20508900T	25224		43		.0890	1-3/4		3/4	
20509060	25226					2.30	.0906		44		19.0
20509350	25229				42		.0935	1-3/4		3/4	
20509380	25232	20509380T	25233	3/32			.0938	1-3/4		3/4	
20509450	25235					2.40	.0945		44		19.0
20509600	25238				41		.0960	1-13/16		13/16	
20509800	25241				40		.0980	1-13/16		13/16	
20509840	25244	20509840T	25245			2.50	.0984		46		20.5
20509950	25247				39		.0995	1-13/16		13/16	
20510150	25250				38		.1015	1-13/16		13/16	
20510240	25253					2.60	.1024		46		20.5
20510400	25256				37		.1040	1-13/16		13/16	
20510630	25259					2.70	.1063		46		20.5
20510650	25262				36		.1065	1-13/16		13/16	
20510940	25265	20510940T	25266	7/64			.1094	1-13/16		13/16	
20511000	25268				35		.1100	1-7/8		7/8	

Technical information on page 113.

Series 205 Continued





Uncoated		TiN		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Wire	mm	Decimal	Inch	mm	Inch	mm
20511020	25271					2.80	.1102		48		22.0
20511100	25274				34		.1110	1-7/8		7/8	
20511300	25277				33		.1130	1-7/8		7/8	
20511420	25280					2.90	.1142		48		22.0
20511600	25283				32		.1160	1-7/8		7/8	
20511810	25286	20511810T	25287			3.00	.1181		48		22.0
20512000	25289				31		.1200	1-7/8		7/8	
20512200	25292					3.10	.1220		48		22.0
20512500	25295	20512500T	25296	1/8			.1250	1-7/8		7/8	
20512600	25298					3.20	.1260		48		22.0
20512850	25301				30		.1285	1-15/16		15/16	
20512990	25304					3.30	.1299		49		24.0
20513390	25307					3.40	.1339		49		24.0
20513600	25310				29		.1360	1-15/16		15/16	
20513780	25313	20513780T	25314			3.50	.1378		49		24.0
20514050	25316				28		.1405	1-15/16		15/16	
20514060	25319	20514060T	25320	9/64			.1406	1-15/16		15/16	
20514170	25322					3.60	.1417		49		24.0
20514400	25325				27		.1440	2-1/16		1	
20514570	25328					3.70	.1457		52		25.5
20514700	25331				26		.1470	2-1/16		1	
20514950	25334				25		.1495	2-1/16		1	
20514960	25337					3.80	.1496		52		25.5
20515200	25340				24		.1520	2-1/16		1	
20515350	25343					3.90	.1535		52		25.5
20515400	25346				23		.1540	2-1/16		1	
20515620	25349	20515620T	25350	5/32			.1562	2-1/16		1	
20515700	25352				22		.1570	2-1/8		1-1/16	
20515750	25355	20515750T	25356			4.00	.1575		54		27.0
20515900	25358				21		.1590	2-1/8		1-1/16	
20516100	25361				20		.1610	2-1/8		1-1/16	
20516140	25364					4.10	.1614		54		27.0
20516540	25367					4.20	.1654		54		27.0
20516600	25370				19		.1660	2-1/8		1-1/16	
20516930	25373					4.30	.1693		54		27.0
20516950	25376				18		.1695	2-1/8		1-1/16	
20517190	25379	20517190T	25380	11/64			.1719	2-1/8		1-1/16	
20517300	25382				17		.1730	2-3/16		1-1/8	
20517320	25385					4.40	.1732		56		28.5
20517700	25388				16		.1770	2-3/16		1-1/8	
20517720	25391	20517720T	25392			4.50	.1772		56		28.5
20518000	25394				15		.1800	2-3/16		1-1/8	
20518110	25397					4.60	.1811		56		28.5
20518200	25400				14		.1820	2-3/16		1-1/8	
20518500	25403				13	4.70	.1850	2-3/16	56	1-1/8	28.5
20518750	25406	20518750T	25407	3/16			.1875	2-3/16		1-1/8	
20518890	25409					4.80	.1889		57		30.0
20518900	25412				12		.1890	2-1/4		1-3/16	

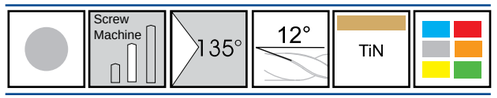
Technical information on page 113.

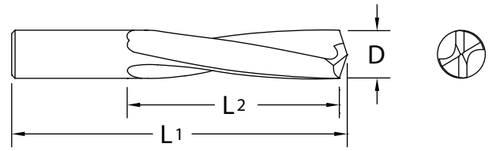
Series 205 Continued

Uncoated		TiN		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Wire	mm	Decimal	Inch	mm	Inch	mm
20519100	25415				11		.1910	2-1/4		1-3/16	
20519290	25418					4.90	.1929		57		30.0
20519350	25421				10		.1935	2-1/4		1-3/16	
20519600	25424				9		.1960	2-1/4		1-3/16	
20519680	25427	20519680T	25428			5.00	.1968		57		30.0
20519900	25430				8		.1990	2-1/4		1-3/16	
20520080	25433					5.10	.2008		57		30.0
20520100	25436				7		.2010	2-1/4		1-3/16	
20520310	25439	20520310T	25440	13/64			.2031	2-1/4		1-3/16	
20520400	25442				6		.2040	2-3/8		1-1/4	
20520470	25445					5.20	.2047		60		32.0
20520550	25448				5		.2055	2-3/8		1-1/4	
20520860	25451					5.30	.2086		60		32.0
20520900	25454				4		.2090	2-3/8		1-1/4	
20521260	25457					5.40	.2126		60		32.0
20521300	25460				3		.2130	2-3/8		1-1/4	
20521650	25463	20521650T	25464			5.50	.2165		60		32.0
20521870	25466	20521870T	25467	7/32			.2187	2-3/8		1-1/4	
20522050	25469					5.60	.2205		62		33.4
20522100	25472				2		.2210	2-7/16		1-5/16	
20522440	25475					5.70	.2244		62		33.4
20522800	25478				1		.2280	2-7/16		1-5/16	
20522830	25481					5.80	.2283		62		33.4
20523230	25484					5.90	.2323		62		33.4
20523400	25487				A		.2340	2-7/16		1-5/16	
20523440	25490	20523440T	25491	15/64			.2344	2-7/16		1-5/16	
20523620	25493	20523620T	25494			6.00	.2362		64		35.0
20523800	25496				B		.2380	2-1/2		1-3/8	
20524020	25499					6.10	.2402		64		35.0
20524200	25502				C		.2420	2-1/2		1-3/8	
20524410	25505					6.20	.2441		64		35.0
20524600	25508				D		.2460	2-1/2		1-3/8	
20524800	25511					6.30	.2480		64		35.0
20525000	25514	20525000T	25515	1/4	E		.2500	2-1/2		1-3/8	
20525190	25517					6.40	.2519		64		35.0
20525590	25520	20525590T	25521			6.50	.2559		67		36.5
20525700	25523				F		.2570	2-5/8		1-7/16	
20525980	25526					6.60	.2598		67		36.5
20526100	25529				G		.2610	2-5/8		1-7/16	
20526370	25532					6.70	.2637		67		36.5
20526560	25535	20526560T	25536	17/64			.2656	2-5/8		1-7/16	
20526600	25538				H		.2660	2-11/16		1-1/2	
20526770	25541					6.80	.2677		68		38.0
20527160	25544					6.90	.2716		68		38.0
20527200	25547				I		.2720	2-11/16		1-1/2	
20527560	25550	20527560T	25551			7.00	.2756		68		38.0
20527700	25553				J		.2770	2-11/16		1-1/2	
20527950	25556					7.10	.2795		68		38.0
20528100	25559				K		.2810	2-11/16		1-1/2	
20528120	25562	20528120T	25563	9/32			.2812	2-11/16		1-1/2	
20528340	25565					7.20	.2834		68		38.0
20528740	25568					7.30	.2874		68		38.0

Technical information on page 113.

Series 205 Continued





Uncoated		TiN		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Wire	mm	Decimal	Inch	mm	Inch	mm
20529000	25571				L		.2900	2-3/4		1-9/16	
20529130	25574					7.40	.2913		70		39.5
20529500	25577				M		.2950	2-3/4		1-9/16	
20529530	25580	20529530T	25581			7.50	.2953		70		39.5
20529690	25583	20529690T	25584	19/64			.2969	2-3/4		1-9/16	
20529920	25586					7.60	.2992		70		39.5
20530200	25589				N		.3020	2-13/16		1-5/8	
20530310	25592					7.70	.3031		71		41.5
20530710	25595					7.80	.3071		71		41.5
20531100	25598					7.90	.3110		71		41.5
20531250	25601	20531250T	25602	5/16			.3125	2-13/16		1-5/8	
20531500	25604	20531500T	25605			8.00	.3150		71		41.5
20531600	25607				O		.3160	2-15/16		1-11/16	
20531890	25610					8.10	.3189		75		43.0
20532280	25613					8.20	.3228		75		43.0
20532300	25616				P		.3230	2-15/16		1-11/16	
20532670	25619					8.30	.3267		75		43.0
20532810	25622	20532810T	25623	21/64			.3281	2-15/16		1-11/16	
20533070	25625					8.40	.3307		75		43.0
20533200	25628				Q		.3320	2-15/16		1-11/16	
20533460	25631	20533460T	25632			8.50	.3346		75		43.0
20533850	25634					8.60	.3385		75		43.0
20533900	25637				R		.3390	2-15/16		1-11/16	
20534250	25640					8.70	.3425		75		43.0
20534380	25643	20534380T	25644	11/32			.3438	2-15/16		1-11/16	
20534640	25646					8.80	.3464		75		43.0
20534800	25649				S		.3480	3-1/16		1-3/4	
20535040	25652					8.90	.3504		78		44.5
20535430	25655	20535430T	25656			9.00	.3543		78		44.5
20535800	25658				T		.3580	3-1/16		1-3/4	
20535820	25661					9.10	.3582		78		44.5
20535940	25664	20535940T	25665	23/64			.3594	3-1/16		1-3/4	
20536220	25667					9.20	.3622		78		44.5
20536610	25670					9.30	.3661		79		46.0
20536800	25673				U		.3680	3-1/8		1-13/16	
20537000	25676					9.40	.3700		79		46.0
20537400	25679	20537400T	25680			9.50	.3740		79		46.0
20537500	25682	20537500T	25683	3/8			.3750	3-1/8		1-13/16	
20537700	25685				V		.3770	3-1/4		1-7/8	
20537790	25688					9.60	.3779		83		47.5
20538190	25691					9.70	.3819		83		47.5
20538580	25694					9.80	.3858		83		47.5
20538600	25697				W		.3860	3-1/4		1-7/8	
20538970	25700					9.90	.3897		83		47.5
20539060	25703	20539060T	25704	25/64			.3906	3-1/4		1-7/8	
20539370	25706	20539370T	25707			10.00	.3937		84		49.0

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Series 205 Continued

Uncoated		TiN		Diameter D				OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Wire	mm	Decimal	Inch	mm	Inch	mm
20539700	25709				X		.3970	3-5/16		1-15/16	
20539760	25712					10.10	.3976		84		49.0
20540150	25715					10.20	.4015		84		49.0
20540400	25718				Y		.4040	3-5/16		1-15/16	
20540550	25721					10.30	.4055		84		49.0
20540620	25724	20540620T	25725	13/32			.4062	3-5/16		1-15/16	
20540940	25727					10.40	.4094		84		49.0
20541300	25730				Z		.4130	3-3/8		2	
20541340	25733	20541340T	25734			10.50	.4134		86		51.0
20541730	25736					10.60	.4173		86		51.0
20542120	25739					10.70	.4212		86		51.0
20542190	25742	20542190T	25743	27/64			.4219	3-3/8		2	
20542520	25745					10.80	.4252		86		51.0
20542910	25748					10.90	.4291		87		52.5
20543310	25751	20543310T	25752			11.00	.4331		87		52.5
20543700	25754					11.10	.4370		87		52.5
20543750	25757	20543750T	25758	7/16			.4375	3-7/16		2-1/16	
20544090	25760					11.20	.4409		87		52.5
20544490	25763					11.30	.4449		92		54.0
20544880	25766					11.40	.4488		92		54.0
20545270	25769	20545270T	25770			11.50	.4527		92		54.0
20545310	25772	20545310T	25773	29/64			.4531	3-5/8		2-1/8	
20545670	25775					11.60	.4567		92		54.0
20546060	25778					11.70	.4606		92		54.0
20546450	25781					11.80	.4645		92		54.0
20546850	25784					11.90	.4685		92		54.0
20546880	25787	20546880T	25788	15/32			.4688	3-5/8		2-1/8	
20547240	25790	20527240T	25791			12.00	.4724		94		55.5
20548440	25793	20548440T	25794	31/64			.4844	3-11/16		2-3/16	
20549210	25796					12.50	.4921		95		57.0
20550000	25799	20550000T	25800	1/2			.5000	3-3/4		2-1/4	
20551180	25802	20551180T	25803			13.00	.5118		98		60.5
20551560	25805			33/64			.5156	3-7/8		2-3/8	
20553120	25808			17/32			.5312	3-7/8		2-3/8	
20553150	25811					13.50	.5315		102		63.5
20554690	25814			35/64			.5469	4		2-1/2	
20555120	25817	20555120T	25818			14.00	.5512		102		63.5
20556250	25820	20556250T	25821	9/16			.5625	4		2-1/2	
20557080	25823					14.50	.5708		105		66.5
20557810	25826			37/64			.5781	4-1/8		2-5/8	
20559050	25829	20559050T	25830			15.00	.5905		105		66.5
20559380	25832			19/32			.5938	4-1/8		2-5/8	
20560940	25835			39/64			.6094	4-1/4		2-3/4	
20561020	25838					15.50	.6102		108		70.0
20562500	25841	20562500T	25842	5/8			.6250	4-1/4		2-3/4	
20562990	25844	20562990T	25845			16.00	.6299		108		70.0
20564060	25847			41/64			.6406	4-1/2		2-7/8	
20564960	25850					16.50	.6496		114		73.0
20565620	25853			21/32			.6562	4-1/2		2-7/8	
20566930	25856	20566930T	25857			17.00	.6693		117		73.0
20567190	25859			43/64			.6719	4-5/8		2-7/8	
20568750	25862	20568750T	25863	11/16			.6875	4-5/8		2-7/8	

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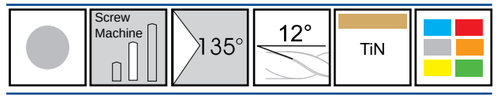
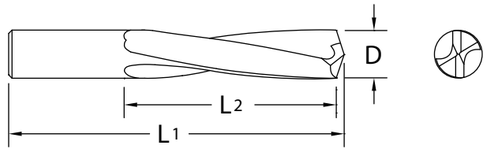
Twister® Hi-Tuff®

Series 205 Continued





Uncoated		TiN		Diameter				OAL		Flute Length	
				D				L1		L2	
Tool No.	EDP	Tool No.	EDP	Fraction	Wire	mm	Decimal	Inch	mm	Inch	mm
20568900	25865					17.50	.6890		121		76.0
20570310	25868			45/64			.7031	4-3/4		3	
20570870	25871	20570870T	25872			18.00	.7087		121		76.0
20571880	25874			23/32			.7188	4-3/4		3	
20572830	25877					18.50	.7283		127		79.5
20573440	25880			47/64			.7344	5		3-1/8	
20574800	25883	20574800T	25884			19.00	.7480		127		79.5
20575000	25886	20575000T	25887	3/4			.7500	5		3-1/8	
20576560	25889			49/64			.7656	5-1/4		3-1/4	
20578120	25892			25/32			.7812	5-1/4		3-1/4	
20578740	25895	20578740T	25896			20.00	.7874		133		82.5

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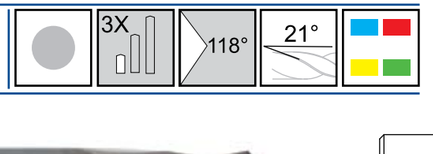
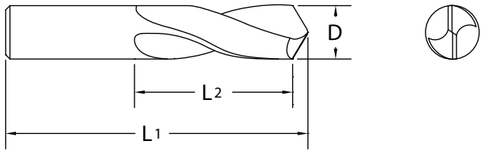


Inch	
D	Tolerance
.0400-.7812	+.0000/-.0005

Metric (mm)	
D	Tolerance
1.00-20.00	+.000/-.013



- Designed to allow high feed rates with good chip flow.
- Four facet drill point minimizes drill wander and assures accurately sized holes.
- Shorter length reduces deflection and vibration, increases drill accuracy and improves tool life.

See Series 226 on page 83 for mm size Stub Drills.

		Diameter			OAL	Flute Length
		D			L1	L2
Tool No.	EDP	Fraction	Wire	Decimal		
20604000	26004		60	.0400	1-1/2	3/8
20604100	26007		59	.0410	1-1/2	3/8
20604200	26013		58	.0420	1-1/2	3/8
20604300	26016		57	.0430	1-1/2	3/8
20604650	26025		56	.0465	1-1/2	3/8
20604690	26028	3/64		.0469	1-1/2	3/8
20605200	26040		55	.0520	1-1/2	3/8
20605500	26046		54	.0550	1-1/2	3/8
20605950	26058		53	.0595	1-1/2	3/8
20606250	26061	1/16		.0625	1-1/2	3/8
20606350	26067		52	.0635	1-1/2	3/8
20606700	26073		51	.0670	1-1/2	3/8
20607000	26076		50	.0700	1-1/2	3/8
20607300	26082		49	.0730	1-1/2	3/8
20607600	26088		48	.0760	1-1/2	1/2
20607810	26091	5/64		.0781	1-1/2	1/2
20607850	26094		47	.0785	1-1/2	1/2
20608100	26100		46	.0810	1-1/2	1/2
20608200	26103		45	.0820	1-1/2	1/2
20608600	26109		44	.0860	2	1/2
20608900	26115		43	.0890	2	1/2
20609350	26121		42	.0935	2	1/2
20609380	26124	3/32		.0938	2	1/2
20609600	26130		41	.0960	2	1/2
20609800	26133		40	.0980	2	5/8
20609950	26139		39	.0995	2	5/8
20610150	26142		38	.1015	2	5/8
20610400	26148		37	.1040	2	5/8
20610650	26154		36	.1065	2	5/8
20610940	26157	7/64		.1094	2	5/8
20611000	26160		35	.1100	2	5/8
20611100	26166		34	.1110	2	5/8
20611300	26169		33	.1130	2	5/8
20611600	26175		32	.1160	2	5/8
20612000	26181		31	.1200	2	5/8
20612500	26187	1/8		.1250	2	5/8
20612850	26193		30	.1285	2	5/8
20613600	26202		29	.1360	2	5/8

		Diameter			OAL	Flute Length
		D			L1	L2
Tool No.	EDP	Fraction	Wire	Decimal		
20614050	26208		28	.1405	2	5/8
20614060	26211	9/64		.1406	2	5/8
20614400	26217		27	.1440	2	5/8
20614700	26223		26	.1470	2	5/8
20614950	26226		25	.1495	2	5/8
20615200	26232		24	.1520	2	5/8
20615400	26238		23	.1540	2	5/8
20615620	26241	5/32		.1562	2	3/4
20615700	26244		22	.1570	2	3/4
20615900	26250		21	.1590	2	3/4
20616100	26253		20	.1610	2	3/4
20616600	26262		19	.1660	2-1/8	3/4
20616950	26268		18	.1695	2-1/8	3/4
20617190	26271	11/64		.1719	2-1/8	3/4
20617300	26274		17	.1730	2-1/8	3/4
20617700	26280		16	.1770	2-1/8	3/4
20618000	26286		15	.1800	2-3/16	3/4
20618200	26292		14	.1820	2-3/16	3/4
20618500	26295		13	.1850	2-3/16	3/4
20618750	26298	3/16		.1875	2-3/16	3/4
20618900	26304		12	.1890	2-3/16	3/4
20619100	26307		11	.1910	2-3/16	3/4
20619350	26313		10	.1935	2-3/16	3/4
20619600	26316		9	.1960	2-1/4	3/4
20619900	26322		8	.1990	2-1/4	3/4
20620100	26328		7	.2010	2-1/4	3/4
20620310	26331	13/64		.2031	2-1/4	3/4
20620400	26334		6	.2040	2-1/4	3/4
20620550	26340		5	.2055	2-1/4	3/4
20620900	26346		4	.2090	2-1/4	3/4
20621300	26352		3	.2130	2-1/2	1
20621870	26358	7/32		.2187	2-1/2	1
20622100	26364		2	.2210	2-1/2	1
20622800	26370		1	.2280	2-1/2	1
20623400	26379		A	.2340	2-1/2	1
20623440	26382	15/64		.2344	2-1/2	1
20623800	26388		B	.2380	2-1/2	1
20624200	26394		C	.2420	2-1/2	1

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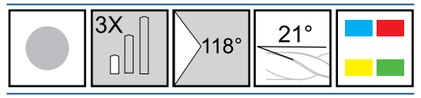
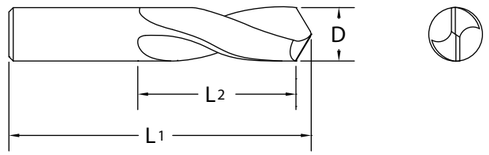




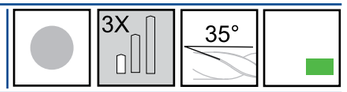
Tool No.	EDP	Diameter D Fraction	Wire	Decimal	OAL L1	Flute Length L2
20624600	26400		D	.2460	2-1/2	1
20625000	26406	1/4	E	.2500	2-1/2	1
20625700	26415		F	.2570	2-1/2	1
20626100	26421		G	.2610	2-1/2	1
20626560	26427	17/64		.2656	2-1/2	1
20626600	26430		H	.2660	2-1/2	1
20627200	26439		I	.2720	2-1/2	1
20627700	26445		J	.2770	2-1/2	1
20628100	26451		K	.2810	2-1/2	1
20628120	26454	9/32		.2812	2-1/2	1
20629000	26463		L	.2900	2-1/2	1
20629500	26469		M	.2950	2-1/2	1-1/4
20629690	26475	19/64		.2969	2-1/2	1-1/4
20630200	26481		N	.3020	2-1/2	1-1/4
20631250	26493	5/16		.3125	2-1/2	1-1/4
20631600	26499		O	.3160	2-1/2	1-1/4
20632300	26508		P	.3230	2-1/2	1-1/4
20632810	26514	21/64		.3281	2-1/2	1-1/4
20633200	26520		Q	.3320	2-1/2	1-1/4
20633900	26529		R	.3390	2-1/2	1-1/4
20634380	26535	11/32		.3438	2-1/2	1-1/4
20634800	26541		S	.3480	2-1/2	1-1/4
20635800	26550		T	.3580	2-1/2	1-1/4
20635940	26556	23/64		.3594	2-1/2	1-1/4
20636800	26565		U	.3680	2-1/2	1-1/4
20637500	26574	3/8		.3750	2-1/2	1-1/4
20637700	26577		V	.3770	2-1/2	1-1/4
20638600	26589		W	.3860	2-3/4	1-1/4
20639060	26595	25/64		.3906	2-3/4	1-1/4
20639700	26601		X	.3970	2-3/4	1-1/4
20640400	26610		Y	.4040	2-3/4	1-1/4
20640620	26616	13/32		.4062	2-3/4	1-1/4
20641300	26622		Z	.4130	2-3/4	1-1/4
20642190	26634	27/64		.4219	2-3/4	1-1/4
20643750	26649	7/16		.4375	2-3/4	1-1/4
20645310	26664	29/64		.4531	3	1-1/4
20646880	26679	15/32		.4688	3	1-1/4
20648440	26685	31/64		.4844	3	1-1/4

Tool No.	EDP	Diameter D Fraction	Wire	Decimal	OAL L1	Flute Length L2
20650000	26691	1/2		.5000	3	1-1/4
20651560	26697	33/64		.5156	3-1/2	1-3/8
20653120	26700	17/32		.5312	3-1/2	1-3/8
20654690	26706	35/64		.5469	3-1/2	1-1/2
20656250	26712	9/16		.5625	3-1/2	1-1/2
20657810	26718	37/64		.5781	3-1/2	1-5/8
20659380	26724	19/32		.5938	3-1/2	1-5/8
20660940	26727	39/64		.6094	3-1/2	1-3/4
20662500	26733	5/8		.6250	3-1/2	1-3/4
20664060	26739	41/64		.6406	4	1-7/8
20665620	26745	21/32		.6562	4	1-7/8
20667190	26751	43/64		.6719	4	1-7/8
20668750	26754	11/16		.6875	4	1-7/8
20670310	26760	45/64		.7031	4	2
20671880	26766	23/32		.7188	4	2-1/8
20673440	26772	47/64		.7344	4	2-1/8
20675000	26778	3/4		.7500	4	2-1/8
20676560	26781	49/64		.7656	4	2-1/4
20678120	26784	25/32		.7812	4	2-1/4

See Series 226 on page 83 for mm size Stub Drills.

Technical information on page 113.

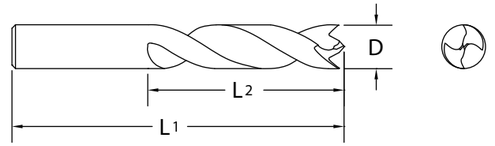
Twister® GP Series 207



Inch D	Inch Tolerance
.0935-.5000	+.0000/-.0005

Metric (mm) D	Metric (mm) Tolerance
2.40-12.00	+.000/-.013

Designed for drilling graphite and aramid fiber (kevlar) reinforced composite materials.

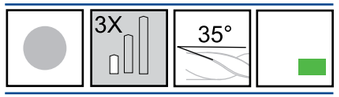


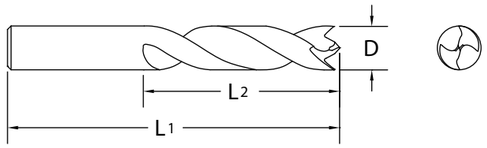
- No delamination.
- Eliminate fuzz or “fray” at exit.
- Brad and spur point.

Tool No.	EDP	Diameter D Fraction	Wire	mm	Decimal	OAL L1 Inch	mm	Flute Length L2 Inch	mm
20709350	27001		42		.0935	1-3/4		1/2	
20709380	27004	3/32			.0938	1-3/4		1/2	
20709450	27007			2.40	.0945		44		12.5
20709600	27010		41		.0960	1-13/16		1/2	
20709800	27013		40		.0980	1-13/16		1/2	
20709840	27016			2.50	.0984		46		12.5
20709950	27019		39		.0995	1-13/16		1/2	
20710150	27022		38		.1015	1-13/16		1/2	
20710240	27025			2.60	.1024		46		12.5
20710400	27028		37		.1040	1-13/16		1/2	
20710630	27031			2.70	.1063		46		12.5
20710650	27034		36		.1065	1-13/16		1/2	
20710940	27037	7/64			.1094	1-13/16		1/2	
20711000	27040		35		.1100	1-7/8		5/8	
20711020	27043			2.80	.1102		48		16.0
20711100	27046		34		.1110	1-7/8		5/8	
20711300	27049		33		.1130	1-7/8		5/8	
20711420	27052			2.90	.1142		48		16.0
20711600	27055		32		.1160	1-7/8		5/8	
20711810	27058			3.00	.1181		48		16.0
20712000	27061		31		.1200	1-7/8		5/8	
20712200	27064			3.10	.1220		48		16.0
20712500	27067	1/8			.1250	1-7/8		5/8	
20712600	27070			3.20	.1260		48		16.0
20712850	27073		30		.1285	1-15/16		11/16	
20712990	27076			3.30	.1299		49		17.5
20713390	27079			3.40	.1339		49		17.5
20713600	27082		29		.1360	1-15/16		11/16	
20713780	27085			3.50	.1378		49		17.5
20714050	27088		28		.1405	1-15/16		11/16	
20714060	27091	9/64			.1406	1-15/16		11/16	
20714170	27094			3.60	.1417		49		17.5
20714400	27097		27		.1440	2-1/16		3/4	
20714570	27100			3.70	.1457		52		19.0
20714700	27103		26		.1470	2-1/16		3/4	
20714950	27106		25		.1495	2-1/16		3/4	
20714960	27109			3.80	.1496		52		19.0
20715200	27112		24		.1520	2-1/16		3/4	
20715350	27115			3.90	.1535		52		19.0
20715400	27118		23		.1540	2-1/16		3/4	

Technical information on page 113.

Series 207 Continued





Tool No.	EDP	Diameter D Fraction	Wire	mm	Decimal	OAL L1 Inch	mm	Flute Length L2 Inch	mm
20715620	27121	5/32			.1562	2-1/16		3/4	
20715700	27124		22		.1570	2-1/8		7/8	
20715750	27127			4.00	.1575		54		22.0
20715900	27130		21		.1590	2-1/8		7/8	
20716100	27133		20		.1610	2-1/8		7/8	
20716140	27136			4.10	.1614		54		22.0
20716540	27139			4.20	.1654		54		22.0
20716600	27142		19		.1660	2-1/8		7/8	
20716930	27145			4.30	.1693		54		22.0
20716950	27148		18		.1695	2-1/8		7/8	
20717190	27151	11/64			.1719	2-1/8		7/8	
20717300	27154		17		.1730	2-3/16		15/16	
20717320	27157			4.40	.1732		56		24.0
20717700	27160		16		.1770	2-3/16		15/16	
20717720	27163			4.50	.1772		56		24.0
20718000	27166		15		.1800	2-3/16		15/16	
20718110	27169			4.60	.1811		56		24.0
20718200	27172		14		.1820	2-3/16		15/16	
20718500	27175		13	4.70	.1850	2-3/16	56	15/16	24.0
20718750	27178	3/16			.1875	2-3/16		15/16	
20718890	27181			4.80	.1889		57		25.5
20718900	27184		12		.1890	2-1/4		1	
20719100	27187		11		.1910	2-1/4		1	
20719290	27190			4.90	.1929		57		25.5
20719350	27193		10		.1935	2-1/4		1	
20719600	27196		9		.1960	2-1/4		1	
20719680	27199			5.00	.1968		57		25.5
20719900	27202		8		.1990	2-1/4		1	
20720080	27205			5.10	.2008		57		25.5
20720100	27208		7		.2010	2-1/4		1	
20720310	27211	13/64			.2031	2-1/4		1	
20720400	27214		6		.2040	2-3/8		1-1/16	
20720470	27217			5.20	.2047		60		27.0
20720550	27220		5		.2055	2-3/8		1-1/16	
20720860	27223			5.30	.2086		60		27.0
20720900	27226		4		.2090	2-3/8		1-1/16	
20721260	27229			5.40	.2126		60		27.0
20721300	27232		3		.2130	2-3/8		1-1/16	
20721650	27235			5.50	.2165		60		27.0
20721870	27238	7/32			.2187	2-3/8		1-1/16	
20722050	27241			5.60	.2205		62		28.5
20722100	27244		2		.2210	2-7/16		1-1/8	
20722440	27247			5.70	.2244		62		28.5
20722800	27250		1		.2280	2-7/16		1-1/8	
20722830	27253			5.80	.2283		62		28.5
20723230	27256			5.90	.2323		62		28.5
20723400	27259		A		.2340	2-7/16		1-1/8	
20723440	27262	15/64			.2344	2-7/16		1-1/8	
20723620	27265			6.00	.2362		64		32.0
20723800	27268		B		.2380	2-1/2		1-1/4	

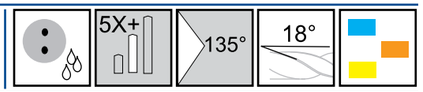
Technical information on page 113.

Series 207 Continued

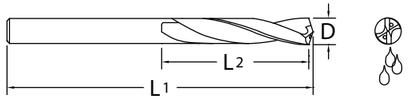
Tool No.	EDP	Diameter D Fraction	Wire	mm	Decimal	OAL L1 Inch	mm	Flute Length L2 Inch	mm
20724020	27271			6.10	.2402		64		32.0
20724200	27274		C		.2420	2-1/2		1-1/4	
20724410	27277			6.20	.2441		64		32.0
20724600	27280		D		.2460	2-1/2		1-1/4	
20724800	27283			6.30	.2480		64		32.0
20725000	27286	1/4	E		.2500	2-1/2		1-1/4	
20725190	27289			6.40	.2519		64		32.0
20725590	27292			6.50	.2559		67		33.5
20725700	27295		F		.2570	2-5/8		1-5/16	
20726100	27298		G		.2610	2-5/8		1-5/16	
20726560	27301	17/64			.2656	2-5/8		1-5/16	
20726600	27304		H		.2660	2-11/16		1-3/8	
20727200	27307		I		.2720	2-11/16		1-3/8	
20727560	27310			7.00	.2756		68		35.0
20727700	27313		J		.2770	2-11/16		1-3/8	
20728100	27316		K		.2810	2-11/16		1-3/8	
20728120	27319	9/32			.2812	2-11/16		1-3/8	
20729000	27322		L		.2900	2-3/4		1-3/8	
20729500	27325		M		.2950	2-3/4		1-3/8	
20729530	27328			7.50	.2953		70		35.0
20729690	27331	19/64			.2969	2-3/4		1-3/8	
20730200	27334		N		.3020	2-13/16		1-1/2	
20731250	27337	5/16			.3125	2-13/16		1-1/2	
20731500	27340			8.00	.3150		71		38.0
20731600	27343		O		.3160	2-15/16		1-9/16	
20732300	27346		P		.3230	2-15/16		1-9/16	
20732810	27349	21/64			.3281	2-15/16		1-9/16	
20733200	27352		Q		.3320	2-15/16		1-9/16	
20733460	27355			8.50	.3346		75		39.5
20733900	27358		R		.3390	2-15/16		1-9/16	
20734380	27361	11/32			.3438	2-15/16		1-9/16	
20734800	27364		S		.3480	3-1/16		1-9/16	
20735430	27367			9.00	.3543		78		39.5
20735800	27370		T		.3580	3-1/16		1-9/16	
20735940	27373	23/64			.3594	3-1/16		1-9/16	
20736800	27376		U		.3680	3-1/8		1-5/8	
20737400	27379			9.50	.3740		79		41.5
20737500	27382	3/8			.3750	3-1/8		1-5/8	
20737700	27385		V		.3770	3-1/4		1-3/4	
20738600	27388		W		.3860	3-1/4		1-3/4	
20739060	27391	25/64			.3906	3-1/4		1-3/4	
20739370	27394			10.00	.3937		84		44.5
20739700	27397		X		.3970	3-5/16		1-3/4	
20740400	27400		Y		.4040	3-5/16		1-3/4	
20740620	27403	13/32			.4062	3-5/16		1-3/4	
20741300	27406		Z		.4130	3-3/8		1-13/16	
20741340	27409			10.50	.4134		86		46.0
20742190	27412	27/64			.4219	3-3/8		1-13/16	
20743310	27415			11.00	.4331		87		47.5
20743750	27418	7/16			.4375	3-7/16		1-7/8	
20745270	27421			11.50	.4527		92		51.0
20745310	27424	29/64			.4531	3-5/8		2	
20746880	27427	15/32			.4688	3-5/8		2	
20747240	27430			12.00	.4724		94		54.0
20748440	27433	31/64			.4844	3-11/16		2-1/8	
20750000	27436	1/2			.5000	3-3/4		2-1/8	

Technical information on page 113.

Twister® GP Series 209



Designed for tougher drilling applications similar to the Hi-Tuff® page 62. Ideal for drilling materials such as stainless steel, tool steel, titanium and other high tensile strength metals. Also well suited for increased efficiency in deep hole drilling of many materials.



- Coolant volume aids in ejecting chips from hole.
- Excellent for increased feed rates, lower drilling temperatures and longer tool life.

Tool No.	EDP	Diameter D Fraction	Diameter D Letter/Wire	Diameter D mm	Diameter D Decimal	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
20918750	29001	3/16			.1875	4-3/16		1-5/8	
20918890	29004			4.8	.1889		106		41.5
20918900	29007		12		.1890	4-3/16		1-5/8	
20919100	29010		11		.1910	4-3/16		1-5/8	
20919290	29013			4.9	.1929		106		41.5
20919350	29016		10		.1935	4-3/16		1-5/8	
20919600	29019		9		.1960	4-3/8		1-3/4	
20919680	29022			5.0	.1968		111		44.5
20919900	29025		8		.1990	4-3/8		1-3/4	
20920080	29028			5.1	.2008		111		44.5
20920100	29031		7		.2010	4-3/8		1-3/4	
20920310	29034	13/64			.2031	4-3/8		1-3/4	
20920400	29037		6		.2040	4-3/8		1-3/4	
20920470	29040			5.2	.2047		111		44.5
20920550	29043		5		.2055	4-3/8		1-3/4	
20920860	29046			5.3	.2086		111		44.5
20920900	29049		4		.2090	4-3/8		1-3/4	
20921260	29052			5.4	.2126		111		44.5
20921300	29055		3		.2130	4-3/8		1-3/4	
20921650	29058			5.5	.2165		111		44.5
20921870	29061	7/32			.2187	4-3/8		1-3/4	
20922050	29064			5.6	.2205		111		44.5
20922100	29067		2		.2210	4-3/8		1-3/4	
20922440	29070			5.7	.2244		111		44.5
20922800	29073		1		.2280	4-3/8		1-3/4	
20922830	29076			5.8	.2283		121		51.0
20923230	29079			5.9	.2323		121		51.0
20923400	29082		A		.2340	4-3/4		2	
20923440	29085	15/64			.2344	4-3/4		2	
20923620	29088			6.0	.2362		121		51.0
20923800	29091		B		.2380	4-3/4		2	
20924020	29094			6.1	.2402		121		51.0
20924200	29097		C		.2420	4-3/4		2	
20924410	29100			6.2	.2441		121		51.0
20924600	29103		D		.2460	4-3/4		2	
20924800	29106			6.3	.2480		121		51.0
20925000	29109	1/4	E		.2500	4-3/4		2	
20925190	29112			6.4	.2519		121		51.0
20925590	29115			6.5	.2559		121		51.0
20925700	29118		F		.2570	4-3/4		2	

Inch	
D	Tolerance
.1875-.7812	+.0000/-.0005

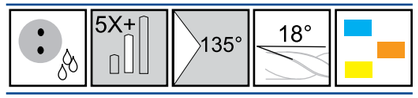
Metric (mm)	
D	Tolerance
4.80-20.00	+.000/-.013

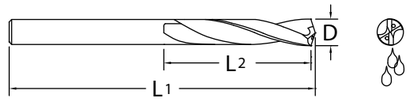
Technical information on page 113.

Tool No.	EDP	Diameter D Fraction	Diameter D Letter/Wire	Diameter D mm	Diameter D Decimal	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
20926100	29121		G		.2610	4-7/8		2-1/8	
20926560	29124	17/64			.2656	4-7/8		2-1/8	
20926600	29127		H		.2660	4-7/8		2-1/8	
20927200	29130		I		.2720	4-7/8		2-1/8	
20927560	29133			7.0	.2756		124		54.0
20927700	29136		J		.2770	4-7/8		2-1/8	
20928100	29139		K		.2810	4-7/8		2-1/8	
20928120	29142	9/32			.2812	4-7/8		2-1/8	
20929000	29145		L		.2900	4-7/8		2-1/8	
20929500	29148		M		.2950	5-3/16		2-3/8	
20929530	29151			7.5	.2953		132		60.5
20929690	29154	19/64			.2969	5-3/16		2-3/8	
20930200	29157		N		.3020	5-3/16		2-3/8	
20931250	29160	5/16			.3125	5-3/16		2-3/8	
20931500	29163			8.0	.3150		132		60.5
20931600	29166		O		.3160	5-3/16		2-3/8	
20932300	29169		P		.3230	5-3/16		2-3/8	
20932810	29172	21/64			.3281	5-3/8		2-1/2	
20933200	29175		Q		.3320	5-3/8		2-1/2	
20933460	29178			8.5	.3346		137		63.5
20933900	29181		R		.3390	5-3/8		2-1/2	
20934380	29184	11/32			.3438	5-3/8		2-1/2	
20934800	29187		S		.3480	5-3/8		2-1/2	
20935430	29190			9.0	.3543		146		70.0
20935800	29193		T		.3580	5-3/4		2-3/4	
20935940	29196	23/64			.3594	5-3/4		2-3/4	
20936800	29199		U		.3680	5-3/4		2-3/4	
20937400	29202			9.5	.3740		146		70.0
20937500	29205	3/8			.3750	5-3/4		2-3/4	
20937700	29208		V		.3770	6		2-7/8	
20938600	29211		W		.3860	6		2-7/8	
20939060	29214	25/64			.3906	6		2-7/8	
20939370	29217			10.0	.3937		152		73.0
20939700	29220		X		.3970	6		2-7/8	
20940400	29223		Y		.4040	6		2-7/8	
20940620	29226	13/32			.4062	6		2-7/8	
20941300	29229		Z		.4130	6		2-7/8	
20941340	29232			10.5	.4134		152		73.0
20942190	29235	27/64			.4219	6		2-7/8	
20943310	29238			11.0	.4331		152		73.0
20943750	29241	7/16			.4375	6		2-7/8	
20945270	29244			11.5	.4527		159		76.0
20945310	29247	29/64			.4531	6-1/4		3	
20946880	29250	15/32			.4688	6-1/4		3	
20947240	29253			12.0	.4724		159		76.0
20948440	29256	31/64			.4844	6-1/4		3	
20949210	29259			12.5	.4921		159		76.0
20950000	29262	1/2			.5000	6-1/4		3	
20951180	29265			13.0	.5118		171		82.5
20951560	29268	33/64			.5156	6-3/4		3-1/4	
20953120	29271	17/32			.5312	6-3/4		3-1/4	
20953150	29274			13.5	.5315		171		82.5

Technical information on page 113.

Series 209 Continued



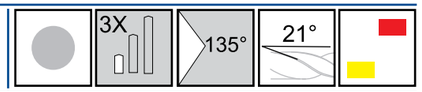


Tool No	EDP	Diameter D Fraction	Letter/Wire	mm	Decimal	OAL L1 Inch	mm	Flute Length L2 Inch	mm
20954690	29277	35/64			.5469	6-3/4		3-1/4	
20955120	29280			14.0	.5512		171		82.5
20956250	29283	9/16			.5625	6-3/4		3-1/4	
20957080	29286			14.5	.5708		187		89.0
20957810	29289	37/64			.5781	7-3/8		3-1/2	
20959050	29292			15.0	.5905		187		89.0
20959380	29295	19/32			.5938	7-3/8		3-1/2	
20960940	29298	39/64			.6094	7-3/8		3-1/2	
20961020	29301			15.5	.6102		187		89.0
20962500	29304	5/8			.6250	7-3/8		3-1/2	
20962990	29307			16.0	.6299		187		89.0
20964060	29310	41/64			.6406	7-3/4		3-5/8	
20964960	29313			16.5	.6496		197		92.0
20965620	29316	21/32			.6562	7-3/4		3-5/8	
20966930	29319			17.0	.6693		197		92.0
20967190	29322	43/64			.6719	7-3/4		3-5/8	
20968750	29325	11/16			.6875	7-3/4		3-5/8	
20968900	29328			17.5	.6890		210		98.5
20970310	29331	45/64			.7031	8-1/4		3-7/8	
20970870	29334			18.0	.7087		210		98.5
20971880	29337	23/32			.7188	8-1/4		3-7/8	
20972830	29340			18.5	.7283		210		98.5
20973440	29343	47/64			.7344	8-1/4		3-7/8	
20974800	29346			19.0	.7480		210		98.5
20975000	29349	3/4			.7500	8-1/4		3-7/8	
20976560	29352	49/64			.7656	8-5/8		4	
20978120	29355	25/32			.7812	8-5/8		4	
20978740	29358			20.0	.7874		219		101.5

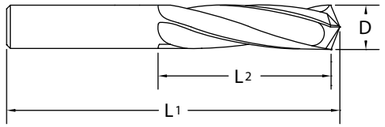
Technical information on page 113.

Designed and Manufactured in the USA

Twister® GP Series 210



Designed for drilling highly alloyed ferrous metals including stainless steel, nickel based alloys and titanium. Also suitable for drilling materials which produce powder like chips such as cast iron. Not recommended for non-ferrous materials.



•3 Flute Drill.

Tool No.	EDP	Diameter D Fraction	Wire	mm	Decimal	OAL L1 Inch	mm	Flute Length L2 Inch	mm
21011000	21001		35		.1100	1-7/8		3/4	
21011020	21004			2.80	.1102		48		19.0
21011100	21007		34		.1110	1-7/8		3/4	
21011300	21010		33		.1130	1-7/8		3/4	
21011420	21013			2.90	.1142		48		19.0
21011600	21016		32		.1160	1-7/8		3/4	
21011810	21019			3.00	.1181		48		19.0
21012000	21022		31		.1200	1-7/8		3/4	
21012200	21025			3.10	.1220		48		19.0
21012500	21028	1/8			.1250	1-7/8		3/4	
21012600	21031			3.20	.1260		48		19.0
21012850	21034		30		.1285	1-15/16		13/16	
21012990	21037			3.30	.1299		49		20.5
21013390	21040			3.40	.1339		49		20.5
21013600	21043		29		.1360	1-15/16		13/16	
21013780	21046			3.50	.1378		49		20.5
21014050	21049		28		.1405	1-15/16		13/16	
21014060	21052	9/64			.1406	1-15/16		13/16	
21014170	21055			3.60	.1417		49		20.5
21014400	21058		27		.1440	2-1/16		27/32	
21014570	21061			3.70	.1457		52		21.5
21014700	21064		26		.1470	2-1/16		27/32	
21014950	21067		25		.1495	2-1/16		27/32	
21014960	21070			3.80	.1496		52		21.5
21015200	21073		24		.1520	2-1/16		27/32	
21015350	21076			3.90	.1535		52		21.5
21015400	21079		23		.1540	2-1/16		27/32	
21015620	21082	5/32			.1562	2-1/16		27/32	
21015700	21085		22		.1570	2-1/8		7/8	
21015750	21088			4.00	.1575		54		22.0
21015900	21091		21		.1590	2-1/8		7/8	
21016100	21094		20		.1610	2-1/8		7/8	
21016140	21097			4.10	.1614		54		22.0
21016540	21100			4.20	.1654		54		22.0
21016600	21103		19		.1660	2-1/8		7/8	
21016930	21106			4.30	.1693		54		22.0
21016950	21109		18		.1695	2-1/8		7/8	
21017190	21112	11/64			.1719	2-1/8		7/8	
21017300	21115		17		.1730	2-3/16		15/16	
21017320	21118			4.40	.1732		56		24.0
21017700	21121		16		.1770	2-3/16		15/16	
21017720	21124			4.50	.1772		56		24.0

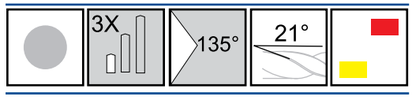
Inch	
D	Tolerance
.1100-.7500	+.0000/-.0005

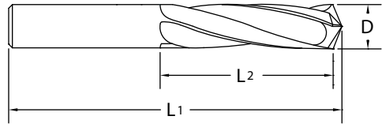
Metric (mm)	
D	Tolerance
2.80-20.00	+.000/-.013

For Drilling Aluminum see Twister® AL Series 229 High Performance Drill on page 33.

Technical information on page 113.

Series 210 Continued





Tool No	EDP	Diameter D Fraction	Wire	mm	Decimal	OAL L1 Inch	mm	Flute Length L2 Inch	mm
21018000	21127		15		.1800	2-3/16		15/16	
21018110	21130			4.60	.1811		56		24.0
21018200	21133		14		.1820	2-3/16		15/16	
21018500	21136		13	4.70	.1850	2-3/16	56	15/16	24.0
21018750	21139	3/16			.1875	2-3/16		15/16	
21018890	21142			4.80	.1889		57		25.5
21018900	21145		12		.1890	2-1/4		1	
21019100	21148		11		.1910	2-1/4		1	
21019290	21151			4.90	.1929		57		25.5
21019350	21154		10		.1935	2-1/4		1	
21019600	21157		9		.1960	2-1/4		1	
21019680	21160			5.00	.1968		57		25.5
21019900	21163		8		.1990	2-1/4		1	
21020080	21166			5.10	.2008		57		25.5
21020100	21169		7		.2010	2-1/4		1	
21020310	21172	13/64			.2031	2-1/4		1	
21020400	21175		6		.2040	2-3/8		1-1/16	
21020470	21178			5.20	.2047		60		27.0
21020550	21181		5		.2055	2-3/8		1-1/16	
21020860	21184			5.30	.2086		60		27.0
21020900	21187		4		.2090	2-3/8		1-1/16	
21021260	21190			5.40	.2126		60		27.0
21021300	21193		3		.2130	2-3/8		1-1/16	
21021650	21196			5.50	.2165		60		27.0
21021870	21199	7/32			.2187	2-3/8		1-1/16	
21022050	21202			5.60	.2205		62		28.5
21022100	21205		2		.2210	2-7/16		1-1/8	
21022440	21208			5.70	.2244		62		28.5
21022800	21211		1		.2280	2-7/16		1-1/8	
21022830	21214			5.80	.2283		62		28.5
21023230	21217			5.90	.2323		62		28.5
21023400	21220		A		.2340	2-7/16		1-1/8	
21023440	21223	15/64			.2344	2-7/16		1-1/8	
21023620	21226			6.00	.2362		64		30.0
21023800	21229		B		.2380	2-1/2		1-3/16	
21024020	21232			6.10	.2402		64		30.0
21024200	21235		C		.2420	2-1/2		1-3/16	
21024410	21238			6.20	.2441		64		30.0
21024600	21241		D		.2460	2-1/2		1-3/16	
21024800	21244			6.30	.2480		64		30.0
21025000	21247	1/4	E		.2500	2-1/2		1-3/16	
21025190	21250			6.40	.2519		64		30.0
21025590	21253			6.50	.2559		67		32.0
21025700	21256		F		.2570	2-5/8		1-1/4	
21026100	21259		G		.2610	2-5/8		1-1/4	
21026560	21262	17/64			.2656	2-5/8		1-1/4	
21026600	21265		H		.2660	2-11/16		1-5/16	
21027200	21268		I		.2720	2-11/16		1-5/16	

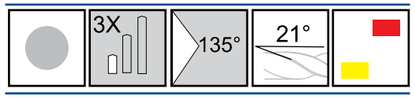
Technical information on page 113.

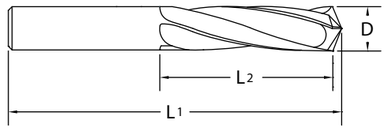
Series 210 Continued

Tool No.	EDP	Diameter D Fraction	Wire	mm	Decimal	OAL L1 Inch	mm	Flute Length L2 Inch	mm
21027560	21271			7.00	.2756		68		33.5
21027700	21274		J		.2770	2-11/16		1-5/16	
21028100	21277		K		.2810	2-11/16		1-5/16	
21028120	21280	9/32			.2812	2-11/16		1-5/16	
21029000	21283		L		.2900	2-3/4		1-3/8	
21029500	21286		M		.2950	2-3/4		1-3/8	
21029530	21289			7.50	.2953		70		35.0
21029690	21292	19/64			.2969	2-3/4		1-3/8	
21030200	21295		N		.3020	2-13/16		1-7/16	
21031250	21298	5/16			.3125	2-13/16		1-7/16	
21031500	21301			8.00	.3150		71		36.5
21031600	21304		O		.3160	2-15/16		1-1/2	
21032300	21307		P		.3230	2-15/16		1-1/2	
21032810	21310	21/64			.3281	2-15/16		1-1/2	
21033200	21313		Q		.3320	2-15/16		1-1/2	
21033460	21316			8.50	.3346		75		38.0
21033900	21319		R		.3390	2-15/16		1-1/2	
21034380	21322	11/32			.3438	2-15/16		1-1/2	
21034800	21325		S		.3480	3-1/16		1-9/16	
21035430	21328			9.00	.3543		78		39.5
21035800	21331		T		.3580	3-1/16		1-9/16	
21035940	21334	23/64			.3594	3-1/16		1-9/16	
21036800	21337		U		.3680	3-1/8		1-19/32	
21037400	21340			9.50	.3740		79		40.5
21037500	21343	3/8			.3750	3-1/8		1-19/32	
21037700	21346		V		.3770	3-1/4		1-5/8	
21038600	21349		W		.3860	3-1/4		1-5/8	
21039060	21352	25/64			.3906	3-1/4		1-5/8	
21039370	21355			10.00	.3937		84		41.5
21039700	21358		X		.3970	3-5/16		1-5/8	
21040400	21361		Y		.4040	3-5/16		1-5/8	
21040620	21364	13/32			.4062	3-5/16		1-5/8	
21041300	21367		Z		.4130	3-3/8		1-21/32	
21041340	21370			10.50	.4134		86		42.0
21042190	21373	27/64			.4219	3-3/8		1-21/32	
21043310	21376			11.00	.4331		87		44.5
21043750	21379	7/16			.4375	3-7/16		1-3/4	
21045270	21382			11.50	.4527		92		47.5
21045310	21385	29/64			.4531	3-5/8		1-7/8	
21046880	21388	15/32			.4688	3-5/8		1-7/8	
21047240	21391			12.00	.4724		94		51.0
21048440	21394	31/64			.4844	3-11/16		2	
21049210	21397			12.50	.4921		95		51.0
21050000	21400	1/2			.5000	3-3/4		2	
21051180	21403			13.00	.5118		98		51.0
21051560	21406	33/64			.5156	3-7/8		2	
21053120	21409	17/32			.5312	3-7/8		2	
21053150	21412			13.50	.5315		102		54.0
21054690	21415	35/64			.5469	4		2-1/8	
21055120	21418			14.00	.5512		102		54.0

Technical information on page 113.

Series 210 Continued

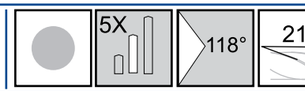




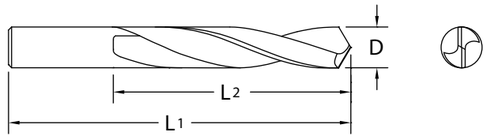
Tool No.	EDP	Diameter D Fraction	Wire	mm	Decimal	OAL L1 Inch	mm	Flute Length L2 Inch	mm
21056250	21421	9/16			.5625	4		2-1/8	
21057080	21424			14.50	.5708		105		54.0
21057810	21427	37/64			.5781	4-1/8		2-1/8	
21059050	21430			15.00	.5905		105		54.0
21059380	21433	19/32			.5938	4-1/8		2-1/8	
21060940	21436	39/64			.6094	4-1/4		2-1/4	
21061020	21439			15.50	.6102		108		57.0
21062500	21442	5/8			.6250	4-1/4		2-1/4	
21062990	21445			16.00	.6299		108		57.0
21064060	21448	41/64			.6406	4-1/2		2-7/8	
21064960	21451			16.50	.6496		114		73.0
21065620	21454	21/32			.6562	4-1/2		2-7/8	
21066930	21457			17.00	.6693		117		73.0
21068750	21463	11/16			.6875	4-5/8		2-7/8	
21070310	21469	45/64			.7031	4-3/4		3	
21070870	21472			18.00	.7087		121		76.0
21071880	21475	23/32			.7188	4-3/4		3	
21073440	21481	47/64			.7344	5		3-1/8	
21074800	21484			19.00	.7480		127		79.5
21075000	21487	3/4			.7500	5		3-1/8	
21078740	21496			20.00	.7874		133		82.5

Technical information on page 113.

Twister® GP Series 224



Inch D	Inch Tolerance	Metric (mm) D	Metric (mm) Tolerance
.0135-.7812	+.0000/-.0005	0.30-20.00	+.000/-.013



- Designed to allow high feed rates with good chip flow.
- Four facet drill point minimizes drill wander and assures accurately sized holes.

Tool No.	EDP	Diameter D mm	Diameter D Decimal	OAL L1	Flute Length L2
22401180	24002	0.30	.0118	26	3
22401380	24008	0.35	.0138	26	4
22401570	24017	0.40	.0157	26	5
22401770	24023	0.45	.0177	26	5
22401970	24029	0.50	.0197	26	6
22402170	24038	0.55	.0217	26	7
22402360	24044	0.60	.0236	26	7
22402560	24053	0.65	.0256	26	8
22402760	24059	0.70	.0276	28	9
22402950	24068	0.75	.0295	28	9
22403150	24077	0.80	.0315	30	10
22403350	24086	0.85	.0335	30	10
22403540	24092	0.90	.0354	32	11
22403740	24101	0.95	.0374	32	11
22403940	24110	1.00	.0394	34	12
22404130	24119	1.05	.0413	34	12
22404330	24128	1.10	.0433	36	14
22404520	24131	1.15	.0452	36	14
22404720	24140	1.20	.0472	38	16
22404920	24143	1.25	.0492	38	16
22405110	24146	1.30	.0511	38	16
22405310	24152	1.35	.0531	40	18
22405510	24158	1.40	.0551	40	18
22405710	24161	1.45	.0571	40	18
22405900	24164	1.50	.0590	40	18
22406300	24173	1.60	.0630	43	20
22406690	24179	1.70	.0669	43	20
22407080	24188	1.80	.0708	46	22
22407480	24194	1.90	.0748	46	22
22407870	24206	2.00	.0787	49	24
22408270	24215	2.10	.0827	49	24
22408660	24221	2.20	.0866	53	27
22409060	24227	2.30	.0906	53	27
22409450	24236	2.40	.0945	57	30
22409840	24245	2.50	.0984	57	30
22410240	24254	2.60	.1024	57	30
22410630	24260	2.70	.1063	61	33
22411020	24272	2.80	.1102	61	33
22411420	24281	2.90	.1142	61	33
22411810	24287	3.00	.1181	61	33
22412200	24293	3.10	.1220	65	36
22412600	24299	3.20	.1260	65	36

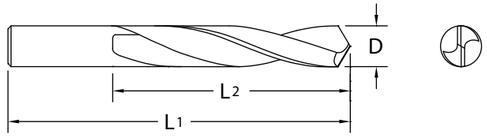
Tool No.	EDP	Diameter D mm	Diameter D Decimal	OAL L1	Flute Length L2
22412990	24305	3.30	.1299	65	36
22413390	24308	3.40	.1339	70	39
22413780	24314	3.50	.1378	70	39
22414170	24323	3.60	.1417	70	39
22414570	24329	3.70	.1457	70	39
22414960	24338	3.80	.1496	75	43
22415350	24344	3.90	.1535	75	43
22415750	24356	4.00	.1575	75	43
22416140	24365	4.10	.1614	75	43
22416540	24368	4.20	.1654	75	43
22416930	24374	4.30	.1693	80	47
22417320	24386	4.40	.1732	80	47
22417720	24392	4.50	.1772	80	47
22418110	24398	4.60	.1811	80	47
22418500	24404	4.70	.1850	80	47
22418890	24410	4.80	.1889	86	52
22419290	24419	4.90	.1929	86	52
22419680	24428	5.00	.1968	86	52
22420080	24434	5.10	.2008	86	52
22420470	24446	5.20	.2047	86	52
22420860	24452	5.30	.2086	86	52
22421260	24458	5.40	.2126	93	57
22421650	24464	5.50	.2165	93	57
22422050	24470	5.60	.2205	93	57
22422440	24476	5.70	.2244	93	57
22422830	24482	5.80	.2283	93	57
22423230	24485	5.90	.2323	93	57
22423620	24494	6.00	.2362	93	57
22424020	24500	6.10	.2402	101	63
22424410	24506	6.20	.2441	101	63
22424800	24512	6.30	.2480	101	63
22425190	24518	6.40	.2519	101	63
22425590	24521	6.50	.2559	101	63
22425980	24527	6.60	.2598	101	63
22426370	24533	6.70	.2637	101	63
22426770	24542	6.80	.2677	109	69
22427160	24545	6.90	.2716	109	69
22427560	24551	7.00	.2756	109	69
22427950	24557	7.10	.2795	109	69
22428340	24566	7.20	.2834	109	69
22428740	24569	7.30	.2874	109	69
22429130	24575	7.40	.2913	109	69

See Series 204 on page 60 for inch size Jobbers Drills.

Technical information on page 113.

Series 224 Continued

5X | 118° | 21° | Metric/ DIN 338



Tool No.	EDP	Diameter D mm	Diameter D Decimal	OAL L1	Flute Length L2
22429530	24581	7.50	.2953	109	69
22429920	24587	7.60	.2992	117	75
22430310	24593	7.70	.3031	117	75
22430710	24596	7.80	.3071	117	75
22431100	24599	7.90	.3110	117	75
22431500	24605	8.00	.3150	117	75
22431890	24611	8.10	.3189	117	75
22432280	24614	8.20	.3228	117	75
22432670	24620	8.30	.3267	117	75
22433070	24626	8.40	.3307	117	75
22433460	24632	8.50	.3346	117	75
22433850	24635	8.60	.3385	125	81
22434250	24641	8.70	.3425	125	81
22434640	24647	8.80	.3464	125	81
22435040	24653	8.90	.3504	125	81
22435430	24656	9.00	.3543	125	81
22435820	24662	9.10	.3582	125	81
22436220	24668	9.20	.3622	125	81
22436610	24671	9.30	.3661	125	81
22437000	24677	9.40	.3700	125	81
22437400	24680	9.50	.3740	125	81
22437790	24689	9.60	.3779	133	87
22438190	24692	9.70	.3819	133	87
22438580	24695	9.80	.3858	133	87
22438970	24701	9.90	.3897	133	87
22439370	24707	10.00	.3937	133	87
22439760	24713	10.10	.3976	133	87
22440150	24716	10.20	.4015	133	87
22440550	24722	10.30	.4055	133	87
22440940	24728	10.40	.4094	133	87
22441340	24734	10.50	.4134	133	87
22441730	24737	10.60	.4173	133	87
22442120	24740	10.70	.4212	142	94
22442520	24746	10.80	.4252	142	94
22442910	24749	10.90	.4291	142	94
22443310	24752	11.00	.4331	142	94
22443700	24755	11.10	.4370	142	94
22444090	24761	11.20	.4409	142	94
22444490	24764	11.30	.4449	142	94
22444880	24767	11.40	.4488	142	94
22445270	24770	11.50	.4527	142	94
22445670	24776	11.60	.4567	142	94
22446060	24779	11.70	.4606	142	94
22446450	24782	11.80	.4645	142	94
22446850	24785	11.90	.4685	151	101
22447240	24791	12.00	.4724	151	101
22449210	24797	12.50	.4921	151	101
22451180	24803	13.00	.5118	151	101

Tool No.	EDP	Diameter D mm	Diameter D Decimal	OAL L1	Flute Length L2
22453150	24812	13.50	.5315	160	108
22455120	24818	14.00	.5512	160	108
22457080	24824	14.50	.5708	169	114
22459050	24830	15.00	.5905	169	114
22461020	24839	15.50	.6102	178	120
22462990	24845	16.00	.6299	178	120
22464960	24851	16.50	.6496	184	125
22466930	24857	17.00	.6693	184	125
22468900	24866	17.50	.6890	191	130
22470870	24872	18.00	.7087	191	130
22472830	24878	18.50	.7283	198	135
22474800	24884	19.00	.7480	198	135
22478740	24896	20.00	.7874	205	140

See Series 204 on page 60 for inch size Jobbers Drills.

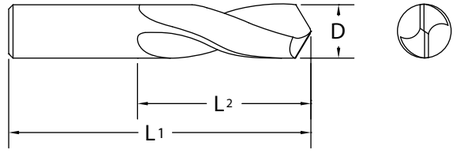
Technical information on page 113.

Twister® GP Series 226

3X | 118° | 21° | Metric/ DIN 6539

See Series 206 on page 69 for inch size Stub Drills.

Recommended for drilling cast iron, aluminum, bronze and magnesium alloys and other abrasive, but easily machined materials.



- Designed to allow high feed rates with good chip flow.
- Four facet drill point minimizes drill wander and assures accurately sized holes.
- Shorter length reduces deflection and vibration, increases drill accuracy and improves tool life.

Inch D	Inch Tolerance
.0400-.7812	+.0000/-.0005

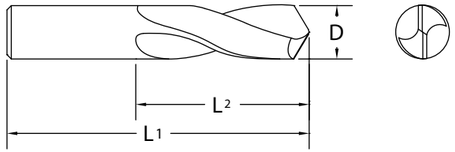
Metric (mm) D	Metric (mm) Tolerance
1.00-20.00	+.000/-.013

Tool No.	EDP	Diameter D mm	Diameter D Decimal	OAL L1	Flute Length L2
22603940	26002	1.00	.0394	26	6
22604130	26011	1.05	.0413	28	7
22604330	26020	1.10	.0433	28	7
22604520	26023	1.15	.0452	30	8
22604720	26032	1.20	.0472	30	8
22604920	26035	1.25	.0492	30	8
22605110	26038	1.30	.0511	30	8
22605310	26044	1.35	.0531	32	9
22605510	26050	1.40	.0551	32	9
22605710	26053	1.45	.0571	32	9
22605900	26056	1.50	.0590	32	9
22606300	26065	1.60	.0630	34	10
22606690	26071	1.70	.0669	34	10
22607080	26080	1.80	.0708	36	11
22607480	26086	1.90	.0748	36	11
22607870	26098	2.00	.0787	38	12
22608270	26107	2.10	.0827	38	12
22608660	26113	2.20	.0866	40	13
22609060	26119	2.30	.0906	40	13
22609450	26128	2.40	.0945	43	14
22609840	26137	2.50	.0984	43	14
22610240	26146	2.60	.1024	43	14
22610630	26152	2.70	.1063	46	16
22611020	26164	2.80	.1102	46	16
22611420	26173	2.90	.1142	46	16
22611810	26179	3.00	.1181	46	16
22612200	26185	3.10	.1220	49	18
22612600	26191	3.20	.1260	49	18
22612990	26197	3.30	.1299	49	18
22613390	26200	3.40	.1339	52	20
22613780	26206	3.50	.1378	52	20
22614170	26215	3.60	.1417	52	20
22614570	26221	3.70	.1457	52	20
22614960	26230	3.80	.1496	55	22
22615350	26236	3.90	.1535	55	22
22615750	26248	4.00	.1575	55	22

Tool No.	EDP	Diameter D mm	Diameter D Decimal	OAL L1	Flute Length L2
22616140	26257	4.10	.1614	55	22
22616540	26260	4.20	.1654	55	22
22616930	26266	4.30	.1693	58	24
22617320	26278	4.40	.1732	58	24
22617720	26284	4.50	.1772	58	24
22618110	26290	4.60	.1811	58	24
22618500	26296	4.70	.1850	58	24
22618890	26302	4.80	.1889	62	26
22619290	26311	4.90	.1929	62	26
22619680	26320	5.00	.1968	62	26
22620080	26326	5.10	.2008	62	26
22620470	26338	5.20	.2047	62	26
22620860	26344	5.30	.2086	62	26
22621260	26350	5.40	.2126	66	28
22621650	26356	5.50	.2165	66	28
22622050	26362	5.60	.2205	66	28
22622440	26368	5.70	.2244	66	28
22622830	26374	5.80	.2283	66	28
22623230	26377	5.90	.2323	66	28
22623620	26386	6.00	.2362	66	28
22624020	26392	6.10	.2402	70	31
22624410	26398	6.20	.2441	70	31
22624800	26404	6.30	.2480	70	31
22625190	26410	6.40	.2519	70	31
22625590	26413	6.50	.2559	70	31
22625980	26419	6.60	.2598	70	31
22626370	26425	6.70	.2637	70	31
22626770	26434	6.80	.2677	74	34
22627160	26437	6.90	.2716	74	34
22627560	26443	7.00	.2756	74	34
22627950	26449	7.10	.2795	74	34
22628340	26458	7.20	.2834	74	34
22628740	26461	7.30	.2874	74	34
22629130	26467	7.40	.2913	74	34
22629530	26473	7.50	.2953	74	34
22629920	26479	7.60	.2992	79	37

Technical information on page 113.

Series 226 Continued



Tool No.	EDP	Diameter D mm	Diameter D Decimal	OAL L1	Flute Length L2
22630310	26485	7.70	.3031	79	37
22630710	26488	7.80	.3071	79	37
22631100	26491	7.90	.3110	79	37
22631500	26497	8.00	.3150	79	37
22631890	26503	8.10	.3189	79	37
22632280	26506	8.20	.3228	79	37
22632670	26512	8.30	.3267	79	37
22633070	26518	8.40	.3307	79	37
22633460	26524	8.50	.3346	79	37
22633850	26527	8.60	.3385	84	40
22634250	26533	8.70	.3425	84	40
22634640	26539	8.80	.3464	84	40
22635040	26545	8.90	.3504	84	40
22635430	26548	9.00	.3543	84	40
22635820	26554	9.10	.3582	84	40
22636220	26560	9.20	.3622	84	40
22636610	26563	9.30	.3661	84	40
22637000	26569	9.40	.3700	84	40
22637400	26572	9.50	.3740	84	40
22637790	26581	9.60	.3779	89	43
22638190	26584	9.70	.3819	89	43
22638580	26587	9.80	.3858	89	43
22638970	26593	9.90	.3897	89	43
22639370	26599	10.00	.3937	89	43
22639760	26605	10.10	.3976	89	43
22640150	26608	10.20	.4015	89	43
22640550	26614	10.30	.4055	89	43
22640940	26620	10.40	.4094	89	43
22641340	26626	10.50	.4134	89	43
22641730	26629	10.60	.4173	89	43
22642120	26632	10.70	.4212	95	47
22642520	26638	10.80	.4252	95	47
22642910	26641	10.90	.4291	95	47
22643310	26644	11.00	.4331	95	47
22643700	26647	11.10	.4370	95	47
22644090	26653	11.20	.4409	95	47
22644490	26656	11.30	.4449	95	47
22644880	26659	11.40	.4488	95	47
22645270	26662	11.50	.4527	95	47
22645670	26668	11.60	.4567	95	47
22646060	26671	11.70	.4606	95	47
22646450	26674	11.80	.4645	95	47
22646850	26677	11.90	.4685	102	51
22647240	26683	12.00	.4724	102	51
22649210	26689	12.50	.4921	102	51
22651180	26695	13.00	.5118	102	51
22653150	26704	13.50	.5315	107	54
22655120	26710	14.00	.5512	107	54

Tool No.	EDP	Diameter D mm	Diameter D Decimal	OAL L1	Flute Length L2
22657080	26716	14.50	.5708	111	56
22659050	26722	15.00	.5905	111	56
22661020	26731	15.50	.6102	115	58
22662990	26737	16.00	.6299	115	58
22664960	26743	16.50	.6496	119	60
22666930	26749	17.00	.6693	119	60
22668900	26758	17.50	.6890	123	62
22670870	26764	18.00	.7087	123	62
22672830	26770	18.50	.7283	127	64
22674800	26776	19.00	.7480	127	64
22678740	26788	20.00	.7874	131	66

See Series 206 on page 69 for inch size Stub Drills.

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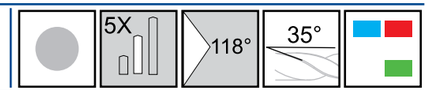
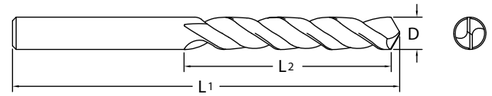
Twister® GP Series 300



Designed for drilling soft metals as well as glass reinforced circuit boards, phenolic-epoxies and other abrasive, but easily machined materials.



- Sizes from .0135 to .250.
- Made from fine grain carbide.
- Over 150 sizes available.

Tool No.	EDP	Diameter D Fraction	Diameter D Letter/Wire	Diameter D mm	Diameter D Decimal	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30001350	30001		80		.0135	1-1/2		1/4	
30001450	30005		79		.0145	1-1/2		1/4	
30001560	30009	1/64			.0156	1-1/2		1/4	
30001600	30013		78		.0160	1-1/2		1/4	
30001800	30017		77		.0180	1-1/2		1/4	
30001970	30021			0.50	.0197		38		9.5
30002000	30025		76		.0200	1-1/2		3/8	
30002100	30029		75		.0210	1-1/2		3/8	
30002170	30033			0.55	.0217		38		9.5
30002250	30037		74		.0225	1-1/2		3/8	
30002360	30041			0.60	.0236		38		9.5
30002400	30045		73		.0240	1-1/2		3/8	
30002500	30049		72		.0250	1-1/2		1/2	
30002560	30053			0.65	.0256		38		12.5
30002600	30057		71		.0260	1-1/2		1/2	
30002760	30061			0.70	.0276		38		12.5
30002800	30065		70		.0280	1-1/2		1/2	
30002920	30069		69		.0292	1-1/2		1/2	
30002950	30073			0.75	.0295		38		12.5
30003100	30077		68		.0310	1-1/2		1/2	
30003120	30081	1/32			.0312	1-1/2		1/2	
30003150	30085			0.80	.0315		38		12.5
30003200	30089		67		.0320	1-1/2		1/2	
30003300	30093		66		.0330	1-1/2		1/2	
30003350	30097			0.85	.0335		38		12.5
30003500	30101		65		.0350	1-1/2		5/8	
30003540	30105			0.90	.0354		38		16.0
30003600	30109		64		.0360	1-1/2		5/8	
30003700	30113		63		.0370	1-1/2		5/8	
30003740	30117			0.95	.0374		38		16.0
30003800	30121		62		.0380	1-1/2		5/8	
30003900	30125		61		.0390	1-1/2		5/8	
30003940	30129			1.00	.0394		38		16.0
30004000	30133		60		.0400	1-1/2		5/8	
30004100	30137		59		.0410	1-1/2		5/8	
30004130	30141			1.05	.0413		38		16.0
30004200	30145		58		.0420	1-1/2		5/8	
30004300	30149		57		.0430	1-1/2		5/8	
30004330	30153			1.10	.0433		38		16.0
30004520	30157			1.15	.0452		38		16.0
30004650	30161		56		.0465	1-1/2		5/8	
30004690	30165	3/64			.0469	1-1/2		5/8	
30004720	30169			1.20	.0472		38		16.0
30004920	30173			1.25	.0492		38		16.0
30005110	30177			1.30	.0511		38		16.0

Inch	
D	Tolerance
.0135-.2500	+.0000/-.0005

Metric (mm)	
D	Tolerance
0.50-3.15	+.000/-.013

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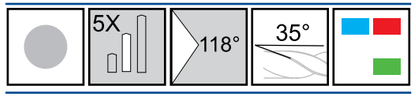

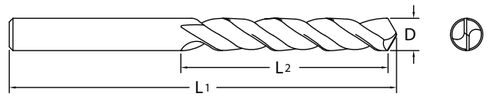

Tool No.	EDP	Diameter D Fraction	Diameter D Letter/Wire	Diameter D mm	Diameter D Decimal	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30005200	30181		55		.0520	1-1/2		5/8	
30005310	30185			1.35	.0531		38		16.0
30005500	30189		54		.0550	1-1/2		5/8	
30005510	30193			1.40	.0551		38		16.0
30005710	30197			1.45	.0571		38		16.0
30005900	30201			1.50	.0590		38		16.0
30005950	30205		53		.0595	1-1/2		5/8	
30006100	30209			1.55	.0610		38		16.0
30006250	30213	1/16			.0625	1-1/2		5/8	
30006300	30217			1.60	.0630		38		16.0
30006350	30221		52		.0635	1-1/2		5/8	
30006490	30225			1.65	.0649		38		16.0
30006690	30229			1.70	.0669		38		16.0
30006700	30233		51		.0670	1-1/2		5/8	
30006890	30237			1.75	.0689		38		16.0
30007000	30241		50		.0700	1-1/2		5/8	
30007080	30245			1.80	.0708		38		16.0
30007280	30249			1.85	.0728		38		16.0
30007300	30253		49		.0730	1-1/2		5/8	
30007480	30257			1.90	.0748		38		16.0
30007600	30261		48		.0760	1-1/2		5/8	
30007670	30265			1.95	.0767		38		16.0
30007810	30269	5/64			.0781	1-1/2		5/8	
30007850	30273		47		.0785	1-1/2		5/8	
30007870	30277			2.00	.0787		38		16.0
30008070	30281			2.05	.0807		38		16.0
30008100	30285		46		.0810	1-1/2		5/8	
30008200	30289		45		.0820	1-1/2		5/8	
30008270	30293			2.10	.0827		38		16.0
30008460	30297			2.15	.0846		38		16.0
30008600	30301		44		.0860	1-1/2		5/8	
30008660	30305			2.20	.0866		38		16.0
30008860	30309			2.25	.0886		38		16.0
30008900	30313		43		.0890	1-1/2		5/8	
30009060	30317			2.30	.0906		38		16.0
30009250	30321			2.35	.0925		38		16.0
30009350	30325		42		.0935	1-1/2		5/8	
30009380	30329	3/32			.0938	1-1/2		5/8	
30009450	30333			2.40	.0945		38		16.0
30009600	30337		41		.0960	1-1/2		5/8	
30009650	30341			2.45	.0965		38		16.0
30009800	30345		40		.0980	1-1/2		5/8	
30009840	30349			2.50	.0984		38		16.0
30009950	30353		39		.0995	1-1/2		5/8	
30010040	30357			2.55	.1004		38		16.0
30010150	30361		38		.1015	1-1/2		5/8	
30010240	30365			2.60	.1024		38		16.0
30010400	30369		37		.1040	1-1/2		5/8	
30010430	30371			2.65	.1043		38		16.0

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Tool No.	EDP	Diameter D Fraction	Diameter D Letter/Wire	Diameter D mm	Diameter D Decimal	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30010630	30373			2.70	.1063		38		16.0
30010650	30377		36		.1065	1-1/2		5/8	
30010830	30381			2.75	.1083		38		16.0
30010940	30385	7/64			.1094	1-1/2		5/8	
30011000	30389		35		.1100	1-1/2		5/8	
30011020	30393			2.80	.1102		38		16.0
30011100	30397		34		.1110	1-1/2		5/8	
30011220	30401			2.85	.1122		38		16.0
30011300	30405		33		.1130	1-1/2		5/8	
30011420	30409			2.90	.1142		38		16.0
30011600	30413		32		.1160	1-1/2		5/8	
30011610	30415			2.95	.1161		38		16.0
30011810	30417			3.00	.1181		38		16.0
30012000	30421		31		.1200	1-1/2		5/8	
30012010	30423			3.05	.1201		38		16.0
30012200	30425			3.10	.1220		38		16.0
30012400	30427			3.15	.1240		38		16.0
30012500	30429	1/8			.1250	1-1/2		5/8	
30012850	30437		30		.1285	1-1/2		3/4	
30013600	30441		29		.1360	1-1/2		3/4	
30014050	30445		28		.1405	1-1/2		3/4	
30014060	30449	9/64			.1406	1-1/2		3/4	
30014400	30453		27		.1440	1-1/2		3/4	
30014700	30457		26		.1470	1-1/2		3/4	
30014950	30461		25		.1495	1-1/2		3/4	
30015200	30465		24		.1520	1-1/2		3/4	
30015400	30469		23		.1540	1-1/2		3/4	
30015620	30473	5/32			.1562	1-1/2		3/4	
30015700	30477		22		.1570	1-1/2		3/4	
30015900	30481		21		.1590	1-1/2		3/4	
30016100	30485		20		.1610	1-1/2		3/4	
30016600	30489		19		.1660	1-1/2		3/4	
30016950	30493		18		.1695	1-1/2		3/4	
30017190	30497	11/64			.1719	1-1/2		3/4	
30017300	30501		17		.1730	1-1/2		3/4	
30017700	30505		16		.1770	1-1/2		3/4	
30018000	30509		15		.1800	1-1/2		3/4	
30018200	30513		14		.1820	1-1/2		3/4	
30018500	30517		13		.1850	1-1/2		3/4	
30018750	30521	3/16			.1875	1-1/2		3/4	
30018900	30525		12		.1890	1-1/2		3/4	
30019100	30529		11		.1910	1-1/2		3/4	
30019350	30533		10		.1935	1-1/2		3/4	
30019600	30537		9		.1960	1-1/2		3/4	
30019900	30541		8		.1990	1-1/2		3/4	
30020100	30545		7		.2010	1-1/2		3/4	
30020310	30549	13/64			.2031	1-1/2		3/4	
30020400	30553		6		.2040	1-1/2		3/4	
30020550	30557		5		.2055	1-1/2		3/4	

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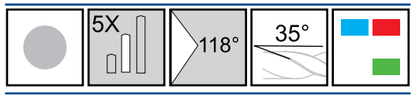

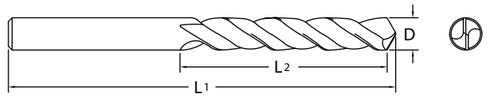

Tool No.	EDP	Diameter D Fraction	Diameter D Letter/Wire	Diameter D mm	Diameter D Decimal	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30020900	30561		4		.2090	1-1/2		3/4	
30021300	30565		3		.2130	1-1/2		3/4	
30021870	30569	7/32			.2187	1-1/2		3/4	
30022100	30573		2		.2210	1-1/2		3/4	
30022800	30577		1		.2280	1-1/2		3/4	
30023400	30581		A		.2340	1-1/2		3/4	
30023440	30585	15/64			.2344	1-1/2		3/4	
30023800	30589		B		.2380	1-1/2		3/4	
30024200	30593		C		.2420	1-1/2		3/4	
30024600	30597		D		.2460	1-1/2		3/4	
30025000	30601	1/4	E		.2500	1-1/2		3/4	

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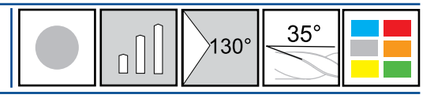
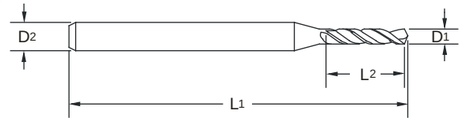
Twister® GP Series 302



Micro drills are manufactured in up to 3 different flute lengths, depending on diameter.



•Drills available with color coded depth setting rings upon request.

Tool No	EDP	Diameter D1 Fraction	Diameter D1 Letter/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30200390	32001		102	0.10	.0039	1/8	3.175	1-1/2	38	.065	1.70
30200430	32005		101		.0043	1/8		1-1/2		.065	
30200470	32009		100		.0047	1/8		1-1/2		.065	
30200510	32013		99		.0051	1/8		1-1/2		.065	
30200550	32017		98		.0055	1/8		1-1/2		.065	
30200590	32021		97	0.15	.0059	1/8	3.175	1-1/2	38	.100	2.50
30200600	32025				.0060	1/8		1-1/2		.100	
30200630	32029		96		.0063	1/8		1-1/2		.100	
30200670	32033		95		.0067	1/8		1-1/2		.100	
30200700	32037				.0070	1/8		1-1/2		.100	
30200710	32041		94		.0071	1/8		1-1/2		.100	
30200750	32045		93		.0075	1/8		1-1/2		.100	
30200780	32049			0.20	.0078		3.175		38		3.20
30200790	32053		92		.0079	1/8		1-1/2		.125	
30200800	32057				.0080	1/8		1-1/2		.125	
30200830	32061		91		.0083	1/8		1-1/2		.125	
30200870	32065		90		.0087	1/8		1-1/2		.125	
30200900	32069				.0090	1/8		1-1/2		.125	
30200910	32073		89		.0091	1/8		1-1/2		.125	
30200950	32077		88		.0095	1/8		1-1/2		.125	
30200980	32081			0.25	.0098		3.175		38		3.80
30201000	32085		87		.0100	1/8		1-1/2		.150	
30201050	32089		86		.0105	1/8		1-1/2		.150	
30201100	32093		85		.0110	1/8		1-1/2		.150	
30201150	32097		84		.0115	1/8		1-1/2		.150	
30201180	32101			0.30	.0118		3.175		38		4.80
30201200	32105		83		.0120	1/8		1-1/2		.190	
30201250	32109		82		.0125	1/8		1-1/2		.190	
30201300	32113		81		.0130	1/8		1-1/2		.190	
30201350	32117		80		.0135	1/8		1-1/2		.190	
30201351	32119		80		.0135	1/8		1-1/2		.250	
30201380	32121			0.35	.0138		3.175		38		4.80
30201381	32123			0.35	.0138		3.175		38		6.35
30201450	32125		79		.0145	1/8		1-1/2		.190	
30201451	32127		79		.0145	1/8		1-1/2		.250	
30201560	32129	1/64			.0156	1/8		1-1/2		.190	
30201561	32131	1/64			.0156	1/8		1-1/2		.250	
30201570	32133			0.40	.0157		3.175		38		4.80
30201571	32135			0.40	.0157		3.175		38		6.35
30201600	32137		78		.0160	1/8		1-1/2		.190	
30201601	32139		78		.0160	1/8		1-1/2		.250	
30201770	32141			0.45	.0177		3.175		38		4.80
30201771	32143			0.45	.0177		3.175		38		6.35
30201772	32144			0.45	.0177		3.175		38		8.13

Inch	
D1	Tolerance
≤ 0.10	+.0000/-.0003
> 0.10	+.0000/-.0005
L1	Tolerance
≤ 0.10	+/-.005
> 0.10	+/-.005
D2	Tolerance
≤ .125	+.0000/-.0002

Metric (mm)	
D1	Tolerance
≤ 0.25	+.000/-.008
> 0.25	+.000/-.013
L1	Tolerance
≤ 0.25	+/-.130
> 0.25	+/-.130
D2	Tolerance
≤ 3.18	+.000/-.005

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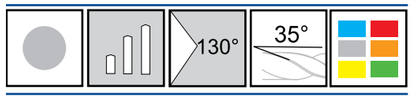

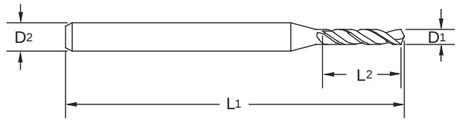

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30201800	32145		77		.0180	1/8		1-1/2		.190	
30201801	32147		77		.0180	1/8		1-1/2		.250	
30201802	32148		77		.0180	1/8		1-1/2		.320	
30201970	32149			0.50	.0197		3.175		38		4.80
30201971	32151			0.50	.0197		3.175		38		6.35
30201972	32152			0.50	.0197		3.175		38		8.13
30202000	32153		76		.0200	1/8		1-1/2		.190	
30202001	32155		76		.0200	1/8		1-1/2		.250	
30202002	32156		76		.0200	1/8		1-1/2		.320	
30202100	32157		75		.0210	1/8		1-1/2		.190	
30202101	32159		75		.0210	1/8		1-1/2		.250	
30202102	32160		75		.0210	1/8		1-1/2		.320	
30202170	32161			0.55	.0217		3.175		38		4.80
30202171	32163			0.55	.0217		3.175		38		6.35
30202172	32164			0.55	.0217		3.175		38		8.13
30202250	32165		74		.0225	1/8		1-1/2		.190	
30202251	32167		74		.0225	1/8		1-1/2		.250	
30202252	32168		74		.0225	1/8		1-1/2		.320	
30202360	32169			0.60	.0236		3.175		38		4.80
30202361	32171			0.60	.0236		3.175		38		6.35
30202362	32172			0.60	.0236		3.175		38		8.13
30202400	32173		73		.0240	1/8		1-1/2		.190	
30202401	32175		73		.0240	1/8		1-1/2		.250	
30202402	32176		73		.0240	1/8		1-1/2		.320	
30202500	32177		72		.0250	1/8		1-1/2		.190	
30202501	32179		72		.0250	1/8		1-1/2		.250	
30202502	32180		72		.0250	1/8		1-1/2		.320	
30202560	32181			0.65	.0256		3.175		38		4.80
30202561	32183			0.65	.0256		3.175		38		6.35
30202562	32184			0.65	.0256		3.175		38		8.13
30202600	32185		71		.0260	1/8		1-1/2		.190	
30202601	32187		71		.0260	1/8		1-1/2		.250	
30202602	32188		71		.0260	1/8		1-1/2		.320	
30202760	32189			0.70	.0276		3.175		38		6.35
30202761	32191			0.70	.0276		3.175		38		8.13
30202762	32192			0.70	.0276		3.175		38		10.16
30202800	32193		70		.0280	1/8		1-1/2		.250	
30202801	32195		70		.0280	1/8		1-1/2		.320	
30202802	32196		70		.0280	1/8		1-1/2		.400	
30202920	32197		69		.0292	1/8		1-1/2		.250	
30202921	32199		69		.0292	1/8		1-1/2		.320	
30202922	32200		69		.0292	1/8		1-1/2		.400	
30202950	32201			0.75	.0295		3.175		38		6.35
30202951	32203			0.75	.0295		3.175		38		8.13
30202952	32204			0.75	.0295		3.175		38		10.16
30203100	32205		68		.0310	1/8		1-1/2		.250	
30203101	32207		68		.0310	1/8		1-1/2		.400	
30203120	32209	1/32			.0312	1/8		1-1/2		.250	

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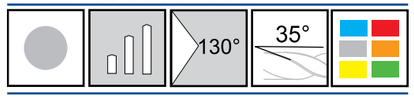
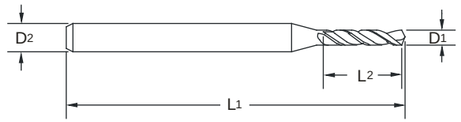
Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30203121	32211	1/32			.0312	1/8		1-1/2		.400	
30203150	32213			0.80	.0315		3.175		38		6.35
30203151	32215			0.80	.0315		3.175		38		10.16
30203200	32217		67		.0320	1/8		1-1/2		.250	
30203201	32219		67		.0320	1/8		1-1/2		.400	
30203300	32221		66		.0330	1/8		1-1/2		.250	
30203301	32223		66		.0330	1/8		1-1/2		.400	
30203350	32225			0.85	.0335		3.175		38		6.35
30203351	32227			0.85	.0335		3.175		38		10.16
30203500	32229		65		.0350	1/8		1-1/2		.400	
30203540	32233			0.90	.0354		3.175		38		10.16
30203600	32237		64		.0360	1/8		1-1/2		.400	
30203700	32241		63		.0370	1/8		1-1/2		.400	
30203740	32245			0.95	.0374		3.175		38		10.16
30203800	32249		62		.0380	1/8		1-1/2		.400	
30203900	32253		61		.0390	1/8		1-1/2		.400	
30203940	32257			1.00	.0394		3.175		38		10.16
30204000	32261		60		.0400	1/8		1-1/2		.400	
30204100	32265		59		.0410	1/8		1-1/2		.400	
30204130	32269			1.05	.0413		3.175		38		10.16
30204200	32273		58		.0420	1/8		1-1/2		.400	
30204300	32277		57		.0430	1/8		1-1/2		.400	
30204330	32281			1.10	.0433		3.175		38		10.16
30204520	32285			1.15	.0452		3.175		38		10.16
30204650	32289		56		.0465	1/8		1-1/2		.400	
30204690	32293	3/64			.0469	1/8		1-1/2		.400	
30204720	32297			1.20	.0472		3.175		38		10.16
30204920	32301			1.25	.0492		3.175		38		10.16
30205110	32305			1.30	.0511		3.175		38		10.16
30205200	32309		55		.0520	1/8		1-1/2		.400	
30205310	32313			1.35	.0531		3.175		38		10.16
30205500	32317		54		.0550	1/8		1-1/2		.400	
30205510	32321			1.40	.0551		3.175		38		10.16
30205710	32325			1.45	.0571		3.175		38		10.16
30205900	32329			1.50	.0590		3.175		38		10.16
30205950	32333		53		.0595	1/8		1-1/2		.400	
30206100	32341			1.55	.0610		3.175		38		10.16
30206250	32345	1/16			.0625	1/8		1-1/2		.480	
30206300	32349			1.60	.0630		3.175		38		12.19
30206350	32353		52		.0635	1/8		1-1/2		.480	
30206490	32357			1.65	.0649		3.175		38		12.19
30206690	32361			1.70	.0669		3.175		38		12.19
30206700	32365		51		.0670	1/8		1-1/2		.480	
30206890	32369			1.75	.0689		3.175		38		12.19
30207000	32373		50		.0700	1/8		1-1/2		.480	
30207080	32377			1.80	.0708		3.175		38		12.19
30207280	32381			1.85	.0728		3.175		38		12.19
30207300	32385		49		.0730	1/8		1-1/2		.480	
30207480	32389			1.90	.0748		3.175		38		12.19
30207600	32393		48		.0760	1/8		1-1/2		.480	

Technical information on page 116.

Series 302 Continued

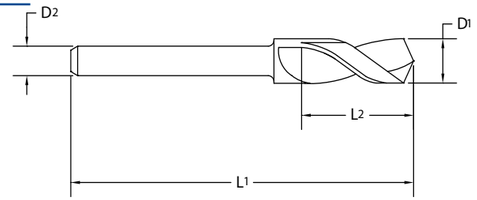


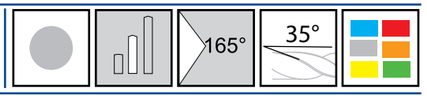


Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Letter/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30207670	32397			1.95	.0767		3.175		38		12.19
30207810	32401	5/64			.0781	1/8		1-1/2		.480	
30207850	32405		47		.0785	1/8		1-1/2		.480	
30207870	32409			2.00	.0787		3.175		38		12.19
30208070	32413			2.05	.0807		3.175		38		12.19
30208100	32417		46		.0810	1/8		1-1/2		.480	
30208200	32421		45		.0820	1/8		1-1/2		.480	
30208270	32425			2.10	.0827		3.175		38		12.19
30208460	32429			2.15	.0846		3.175		38		12.19
30208600	32433		44		.0860	1/8		1-1/2		.480	
30208660	32437			2.20	.0866		3.175		38		12.19
30208860	32441			2.25	.0886		3.175		38		12.19
30208900	32445		43		.0890	1/8		1-1/2		.480	
30209060	32449			2.30	.0906		3.175		38		12.19
30209250	32453			2.35	.0925		3.175		38		12.19
30209350	32457		42		.0935	1/8		1-1/2		.480	
30209380	32461	3/32			.0938	1/8		1-1/2		.480	
30209450	32465			2.40	.0945		3.175		38		12.19
30209600	32469		41		.0960	1/8		1-1/2		.480	
30209650	32473			2.45	.0965		3.175		38		12.19
30209800	32477		40		.0980	1/8		1-1/2		.480	
30209840	32481			2.50	.0984		3.175		38		12.19
30209950	32485		39		.0995	1/8		1-1/2		.480	
30210040	32489			2.55	.1004		3.175		38		12.19
30210150	32493		38		.1015	1/8		1-1/2		.480	
30210240	32497			2.60	.1024		3.175		38		12.19
30210400	32501		37		.1040	1/8		1-1/2		.480	
30210430	32503			2.65	.1043		3.175		38		12.19
30210630	32509			2.70	.1063		3.175		38		12.19
30210650	32513		36		.1065	1/8		1-1/2		.480	
30210830	32517			2.75	.1083		3.175		38		12.19
30210940	32521	7/64			.1094	1/8		1-1/2		.480	
30211000	32525		35		.1100	1/8		1-1/2		.480	
30211020	32529			2.80	.1102		3.175		38		12.19
30211100	32533		34		.1110	1/8		1-1/2		.480	
30211220	32537			2.85	.1122		3.175		38		12.19
30211300	32541		33		.1130	1/8		1-1/2		.480	
30211420	32545			2.90	.1142		3.175		38		12.19
30211600	32549		32		.1160	1/8		1-1/2		.480	
30211610	32551			2.95	.1161		3.175		38		12.19
30211810	32553			3.00	.1181		3.175		38		12.19
30212000	32557		31		.1200	1/8		1-1/2		.480	
30212010	32559			3.05	.1201		3.175		38		12.19
30212200	32561			3.10	.1220		3.175		38		12.19
30212400	32565			3.15	.1240		3.175		38		12.19
30212500	32569	1/8			.1250	1/8		1-1/2		.480	

Technical information on page 116.

Twister® GP Series 306





- Drills available with color coded depth setting rings upon request.

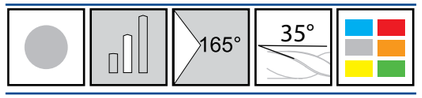
Tool No.	EDP	Diameter D1 Fraction/Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
30612600	36003		3.20	.1260		3.175		38		12.2
30612800	36005		3.25	.1280		3.175		38		12.2
30612850	36007	30		.1285	1/8		1-1/2		.480	
30612990	36009		3.30	.1299		3.175		38		12.2
30613190	36011		3.35	.1319		3.175		38		12.2
30613390	36013		3.40	.1339		3.175		38		12.2
30613580	36015		3.45	.1358		3.175		38		12.2
30613600	36017	29		.1360	1/8		1-1/2		.480	
30613780	36019		3.50	.1378		3.175		38		12.2
30613980	36021		3.55	.1398		3.175		38		12.2
30614050	36023	28		.1405	1/8		1-1/2		.480	
30614060	36025	9/64		.1406	1/8		1-1/2		.480	
30614170	36027		3.60	.1417		3.175		38		12.2
30614370	36029		3.65	.1437		3.175		38		12.2
30614400	36031	27		.1440	1/8		1-1/2		.480	
30614570	36033		3.70	.1457		3.175		38		12.2
30614700	36035	26		.1470	1/8		1-1/2		.480	
30614760	36037		3.75	.1476		3.175		38		12.2
30614950	36039	25		.1495	1/8		1-1/2		.480	
30614960	36041		3.80	.1496		3.175		38		12.2
30615160	36042		3.85	.1516		3.175		38		12.2
30615200	36043	24		.1520	1/8		1-1/2		.480	
30615350	36045		3.90	.1535		3.175		38		12.2
30615400	36047	23		.1540	1/8		1-1/2		.480	
30615550	36049		3.95	.1555		3.175		38		12.2
30615620	36051	5/32		.1562	1/8		1-1/2		.480	
30615700	36053	22		.1570	1/8		1-1/2		.480	
30615750	36055		4.00	.1575		3.175		38		12.2
30615900	36057	21		.1590	1/8		1-1/2		.480	
30615940	36059		4.05	.1594		3.175		38		12.2
30616100	36061	20		.1610	1/8		1-1/2		.480	
30616140	36063		4.10	.1614		3.175		38		12.2
30616340	36065		4.15	.1634		3.175		38		12.2
30616540	36067		4.20	.1654		3.175		38		12.2
30616600	36069	19		.1660	1/8		1-1/2		.480	
30616730	36071		4.25	.1673		3.175		38		12.2
30616930	36073		4.30	.1693		3.175		38		12.2
30616950	36075	18		.1695	1/8		1-1/2		.480	
30617130	36077		4.35	.1713		3.175		38		12.2
30617190	36079	11/64		.1719	1/8		1-1/2		.480	
30617300	36081	17		.1730	1/8		1-1/2		.480	

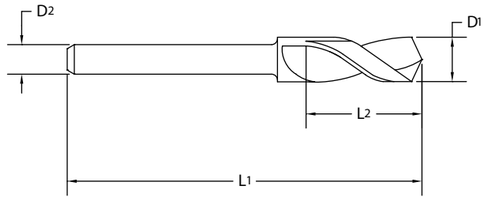
Inch	
D1	Tolerance
.1285-.2660	+0/-.0005
L1	Tolerance
.1285-.2660	+/-.005
D2	Tolerance
.1285-.2660	+0/-.0003

Metric (mm)	
D1	Tolerance
3.20-7.30	+0/-.013
L1	Tolerance
3.20-7.30	+/-.130
D2	Tolerance
3.20-7.30	+0/-.008

Technical information on page 116.

Series 306 Continued





Tool No.	EDP	Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
		Fraction/ Wire	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
30617320	36083		4.40	.1732		3.175		38		12.2
30617520	36085		4.45	.1752		3.175		38		12.2
30617700	36087	16		.1770	1/8		1-1/2		.480	
30617720	36089		4.50	.1772		3.175		38		12.2
30617910	36091		4.55	.1791		3.175		38		12.2
30618000	36093	15		.1800	1/8		1-1/2		.480	
30618110	36095		4.60	.1811		3.175		38		12.2
30618200	36097	14		.1820	1/8		1-1/2		.480	
30618310	36099		4.65	.1831		3.175		38		12.2
30618500	36101	13	4.70	.1850	1/8	3.175	1-1/2	38	.480	12.2
30618700	36103		4.75	.1870		3.175		38		12.2
30618750	36105	3/16		.1875	1/8		1-1/2		.480	
30618900	36107	12	4.80	.1890	1/8	3.175	1-1/2	38	.480	12.2
30619090	36109		4.85	.1909		3.175		38		12.2
30619100	36111	11		.1910	1/8		1-1/2		.480	
30619290	36113		4.90	.1929		3.175		38		12.2
30619350	36115	10		.1935	1/8		1-1/2		.480	
30619490	36117		4.95	.1949		3.175		38		12.2
30619600	36119	9		.1960	1/8		1-1/2		.480	
30619690	36121		5.00	.1969		3.175		38		12.2
30619880	36123		5.05	.1988		3.175		38		12.2
30619900	36125	8		.1990	1/8		1-1/2		.480	
30620080	36127		5.10	.2008		3.175		38		12.2
30620100	36129	7		.2010	1/8		1-1/2		.480	
30620280	36131		5.15	.2028		3.175		38		12.2
30620310	36133	13/64		.2031	1/8		1-1/2		.480	
30620400	36135	6		.2040	1/8		1-1/2		.480	
30620470	36137		5.20	.2047		3.175		38		12.2
30620550	36139	5		.2055	1/8		1-1/2		.480	
30620670	36141		5.25	.2067		3.175		38		12.2
30620870	36143		5.30	.2087		3.175		38		12.2
30620900	36145	4		.2090	1/8		1-1/2		.480	
30621060	36147		5.35	.2106		3.175		38		12.2
30621260	36149		5.40	.2126		3.175		38		12.2
30621300	36151	3		.2130	1/8		1-1/2		.480	
30621460	36153		5.45	.2146		3.175		38		12.2
30621650	36155		5.50	.2165		3.175		38		12.2
30621850	36157		5.55	.2185		3.175		38		12.2
30621870	36159	7/32		.2187	1/8		1-1/2		.480	
30622050	36161		5.60	.2205		3.175		38		12.2
30622100	36163	2		.2210	1/8		1-1/2		.480	
30622240	36165		5.65	.2224		3.175		38		12.2
30622440	36167		5.70	.2244		3.175		38		12.2
30622640	36169		5.75	.2264		3.175		38		12.2
30622800	36171	1		.2280	1/8		1-1/2		.480	
30622830	36173		5.80	.2283		3.175		38		12.2
30623030	36175		5.85	.2303		3.175		38		12.2
30623230	36177		5.90	.2323		3.175		38		12.2

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Series 306 Continued

Tool No.	EDP	Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
		Fraction/ Wire	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
30623400	36179	A		.2340	1/8		1-1/2		.480	
30623430	36181		5.95	.2343		3.175		38		12.2
30623440	36183	15/64		.2344	1/8		1-1/2		.480	
30623620	36185		6.00	.2362		3.175		38		12.2
30623800	36187	B		.2380	1/8		1-1/2		.480	
30623820	36188		6.05	.2382		3.175		38		12.2
30624020	36189		6.10	.2402		3.175		38		12.2
30624200	36191	C		.2420	1/8		1-1/2		.480	
30624210	36192		6.15	.2421		3.175		38		12.2
30624410	36193		6.20	.2441		3.175		38		12.2
30624600	36195	D		.2460	1/8		1-1/2		.480	
30624610	36197		6.25	.2461		3.175		38		12.2
30624800	36199		6.30	.2480		3.175		38		12.2
30625000	36201	1/4 & E	6.35	.2500	1/8	3.175	1-1/2	38	.480	12.2
30625700	36203	F		.2570	1/8		1-1/2		.480	
30626600	36205	H		.2660	1/8		1-1/2		.480	
30628740	36207		7.30	.2874		3.175		38		12.2

Technical information on page 116.

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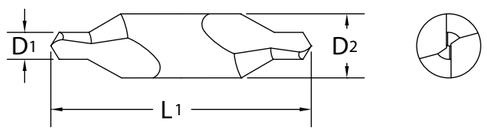
Twister® GP Series 402

Metric/ DIN 333A

Designed to maintain accurate center holes on long production runs, or when precise centering is required.



- 60° included angle.
- Solid carbide construction helps reduce tool changes when centering abrasive or difficult to machine materials.

Tool No.	EDP	Diameter D1 Size	Diameter D1 Inch	Diameter D1 mm	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm
40201970	40201			0.50		3.15		31.5*
40202500	40205	00	.025		1/8		1-1/2	
40203100	40209	0	1/32		1/8		1-1/2	
40203150	40213			0.80		3.15		31.5*
40203940	40217			1.00		3.15		31.5
40204680	40221	1	3/64		1/8		1-1/2	
40204920	40225			1.25		3.15		31.5
40206300	40229			1.60		4.0		35.5
40207810	40233	2	5/64		3/16		1-7/8	
40207870	40237			2.00		5.0		40.0
40209840	40241			2.50		6.3		45.0
40210930	40245	3	7/64		1/4		2	
40212400	40249			3.15		8.0		50.0
40212500	40253	4	1/8		5/16		2-1/8	
40215750	40257			4.00		10.0		56.0
40218750	40261	5	3/16		7/16		2-3/4	
40219680	40265			5.00		12.5		63.0
40221870	40269	6	7/32		1/2		3	
40224800	40273			6.30		16.0		71.0
40225000	40277	7	1/4		5/8		3-1/4	
40231250	40281	8	5/16		3/4		3-1/2	
40231500	40285			8.00		20.0		80.0

*Overall length not to DIN specification.

Inch	
D1	Tolerance
.0250-5/16	+.003/-.000

Metric (mm)	
D1	Tolerance
0.50-8.00	+.076/-.000

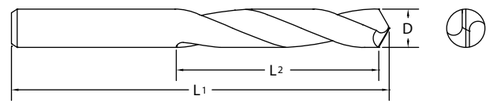
Technical information on page 118.

Twister® GP Series 403

3X+ | 120° | 21°

See page 30 for Series 200S Spotting Drills.

Designed for accurate spotting on NC machines. Solid carbide construction, short lengths and no body clearance make this a very rigid tool.



- Can be used at higher speeds and feeds, compatible with other carbide tooling.
- Easy to repoint because there is no web taper.

Tool No.	EDP	Diameter D Inch	Diameter D mm	Diameter D Decimal	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
40318750	40301	3/16		.1875	2		1	
40319680	40305		5.0	.1968		51		26.0
40323620	40309		6.0	.2362		51		26.0
40325000	40313	1/4		.2500	2		1	
40331250	40317	5/16		.3125	2-1/2		1	
40331500	40321		8.0	.3150		64		26.0
40337500	40325	3/8		.3750	2-1/2		1	
40339370	40329		10.0	.3937		70		30.0
40347240	40333		12.0	.4724		76		39.5
40350000	40337	1/2		.5000	3		1-9/16	

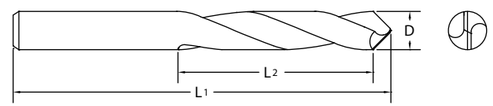
Inch	
D	Tolerance
.1875-.5000	+.0000/-.0005

Metric (mm)	
D	Tolerance
5.00-12.00	+.0000/-.0130

Twister® GP Series 404

3X+ | 90° | 21°

Designed for accurate spotting on NC machines. Solid carbide construction, short lengths and no body clearance make this a very rigid tool.



- Can be used at higher speeds and feeds, compatible with other carbide tooling.
- Easy to repoint because there is no web taper.

Tool No.	EDP	Diameter D Inch	Diameter D mm	Diameter D Decimal	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
40418750	40401	3/16		.1875	2		1	
40419680	40405		5.0	.1968		51		26.0
40423620	40409		6.0	.2362		51		26.0
40425000	40413	1/4		.2500	2		1	
40431250	40417	5/16		.3125	2-1/2		1	
40431500	40421		8.0	.3150		64		26.0
40437500	40425	3/8		.3750	2-1/2		1	
40439370	40429		10.0	.3937		70		30.0
40447240	40433		12.0	.4724		76		39.5
40450000	40437	1/2		.5000	3		1-9/16	

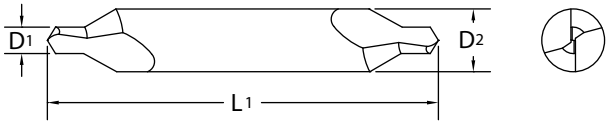
Inch	
D	Tolerance
.1875-.5000	+.0000/-.0005

Metric (mm)	
D	Tolerance
5.00-12.00	+.0000/-.0130

Technical information on page 118.

Twister® GP Series 405

Designed to maintain accurate center holes on long production runs, or when precise centering is required.



- 60° included angle.
- Solid carbide construction helps reduce tool changes when centering abrasive or difficult to machine materials.

Tool No.	EDP	Diameter Size	Diameter D1	Shank D2	OAL L1
40502500	40501	00	.0250	1/8	5
40503100	40505	0	1/32	1/8	5
40504680	40509	1	3/64	1/8	5
40507810	40513	2	5/64	3/16	5
40510930	40517	3	7/64	1/4	5
40512500	40521	4	1/8	5/16	5
40518750	40525	5	3/16	7/16	5
40521870	40529	6	7/32	1/2	5
40525000	40533	7	1/4	5/8	5
40531250	40537	8	5/16	3/4	5

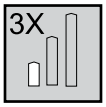
Inch	
D1	Tolerance
.0250-5/16	+.003/-.000

Technical information on page 118.

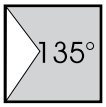
Twister® Drill Icon Glossary


Solid


Coolant Fed



Drill Length



Drill Point Angle

Helix Angle

Coatings

DIN Specs

Workpiece Material Group


Steels

Stainless Steels

Cast Iron

Special Alloys

Hardened Steels (35-65Rc)

Non-Ferrous

Formulas

Inch

RPM = SFM x 3.82/Tool Diam.
IPM = RPM x IPR

Conversion Inch to Metric

SFM to SMM = SFM x .3048
IPM to mm/min. = IPM x 25.4

Metric

RPM = SMM x 318.057/Tool Diam.
mm/min. = RPM x mm/rev.

Conversion Metric to Inch

SMM to SFM = SMM/.3048
mm/min. to IPM = (mm/min.)/25.4

Drill Troubleshooting

		Problem																														
		Tool Deterioration													Chip Formation			Tool Life	Workpiece								Process						
	Possible Solutions	Flank wear	Margin wear	Breakage	Flaking	Creater wear	Chisel edge wear	Corner chipping	Flute chipping	Cutting edge chipping	Cutting edge wear	Point center chipping	Rake face	Scoring on tool body	Long stringy	Varied chip form	Blue/brown chips	Tool Life	Undersized hole	Oversized hole	Poor alignment	Poor surface finish	Heavy burr breakout	Retract marks	Hole location	Hole straightness	Deflection	Point Deflection	Galling	Vibration	Abnormal noise	Chip packing	No drill penetration
Speed & Feed	Reduce feed or reduce at exit	x		x			x	x	x	x		x	x	x				x	x	x		x	x			x					x	
	Reduce feed at entrance			x															x			x			x		x					x	
	Consistent feed rate			x											x	x														x		x	
	Increase feed	x					x				x				x				x	x													
	Reduce speed	x	x			x		x			x							x	x										x		x	x	
	Increase speed																					x											
Coolant	Coolant mix		x	x	x					x				x				x	x			x	x								x	
	Coolant increase flow	x		x			x	x		x							x	x	x			x	x								x	
	Coolant filter	x		x	x					x								x	x			x	x								x	
Setup	Workpiece clamp rigid		x	x			x	x		x				x				x		x	x	x	x	x	x							x
	Collet accuracy			x						x										x					x	x				x			
	Tool holder fit .0008			x						x										x					x	x				x			
	Alignment			x						x										x													x
	Peck drill			x																													
	Concentricity		x	x	x			x	x					x							x	x		x	x	x		x		x			
	Do not extract tool during peck							x																									

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.

2XDSS/2XDSR Inch

Workpiece Material Group		Examples	SFM	Tool Diameter					
				1/8	1/4	3/8	1/2	5/8	3/4
				IPR					
Steels	P	Low Carbon Steels 1018/12L14	345-405	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	280-350						
		Alloy Steels (36-45 Rc) 4140/A2/D2	170-210	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000	405-500	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Ductile Cast Iron 60-40-18	315-375						
Austenitic	M	304/316	125-190	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
Precipitation Hardened Stainless Steels	M	17-4 PH 13-8 PH	95-155	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Special Alloys	S	Titanium 6AL-4V	150	.0010	.0025	.0040	.0050	.0060	.0075
		Cobalt-Based Alloys Stellite, Haynes 25/188	40						
		Nickel-Based Alloys Inconel 625/718 Iron-Based Alloys Incoloy 800-802/Multimet	80						
		High Nickel Alloys Monel	100						

2XDSS/2XDSR Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)					
				3	6	10	12	16	19
				mm/rev.					
Steels	P	Low Carbon Steels 1018/12L14	105-125	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	85-105						
		Alloy Steels (36-45 Rc) 4140/A2/D2	50-65	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000	125-150	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Ductile Cast Iron 60-40-18	95-115						
Austenitic	M	304/316	40-60	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
Precipitation Hardened Stainless Steels	M	17-4 PH 13-8 PH	30-50	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Special Alloys	S	Titanium 6AL-4V	45	.025	.064	.102	.127	.152	.191
		Cobalt-Based Alloys Stellite, Haynes 25/188	15						
		Nickel-Based Alloys Inconel 625/718 Iron-Based Alloys Incoloy 800-802/Multimet	25						
		High Nickel Alloys Monel	30						

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2XDCR Inch

Workpiece Material Group		Examples	SFM	Tool Diameter					
				1/8	1/4	3/8	1/2	5/8	3/4
				IPR					
Steels	P	Low Carbon Steels 1018/12L14	500-625	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	315-435						
		Alloy Steels (36-45 Rc) 4140/A2/D2	190-250	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000	500-625	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Ductile Cast Iron 60-40-18	565-625						
Austenitic	M	304/316	220-315	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
Precipitation Hardened Stainless Steels	M	17-4 PH 13-8 PH	155-220	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Special Alloys	S	Titanium 6AL-4V	180	.0010	.0025	.0040	.0050	.0060	.0075
		Cobalt-Based Alloys Stellite, Haynes 25/188	50						
		Nickel-Based Alloys Inconel 625/718 Iron-Based Alloys Incoloy 800-802/Multimet	95						
		High Nickel Alloys Monel	120						

2XDCR Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)					
				3	6	10	12	16	19
				mm/rev.					
Steels	P	Low Carbon Steels 1018/12L14	150-190	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	95-130						
		Alloy Steels (36-45 Rc) 4140/A2/D2	60-75	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000	150-190	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Ductile Cast Iron 60-40-18	170-190						
Austenitic	M	304/316	220-315	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
Precipitation Hardened Stainless Steels	M	17-4 PH 13-8 PH	155-220	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Special Alloys	S	Titanium 6AL-4V	55	.025	.064	.102	.127	.152	.191
		Cobalt-Based Alloys Stellite, Haynes 25/188	15						
		Nickel-Based Alloys Inconel 625/718 Iron-Based Alloys Incoloy 800-802/Multimet	30						
		High Nickel Alloys Monel	35						

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.

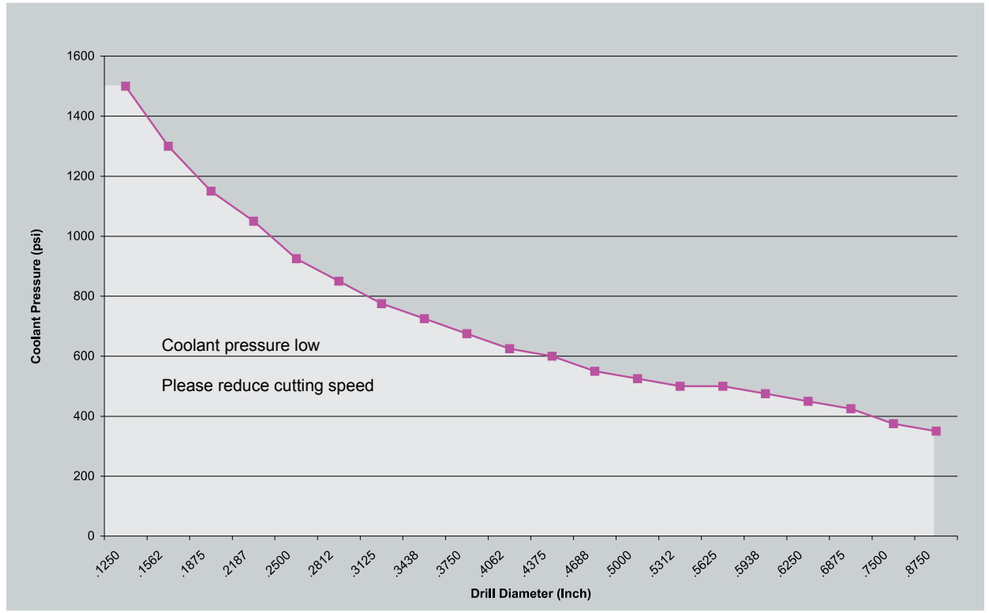
Table of Contents

2XDCL Inch

Workpiece Material Group		Examples	SFM	Tool Diameter					
				1/8	1/4	3/8	1/2	5/8	3/4
				IPR					
Steels	P	Low Carbon Steels 1018/12L14	530-595	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	280-375						
		Alloy Steels (36-45 Rc) 4140/A2/D2	170-225	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000	470-590	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Ductile Cast Iron 60-40-18	530-590						
Austenitic	M	304/316	185-280	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
Precipitation Hardened Stainless Steels	M	17-4 PH 13-8 PH	125-190	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Special Alloys	S	Titanium 6AL-4V	180	.0010	.0025	.0040	.0050	.0060	.0075
		Cobalt-Based Alloys Stellite, Haynes 25/188	50						
		Nickel-Based Alloys Inconel 625/718 Iron-Based Alloys Incoloy 800-802/Multimet	95						
		High Nickel Alloys Monel	120						

Coolant Pressure - Inch

Recommended Minimum Coolant Pressure

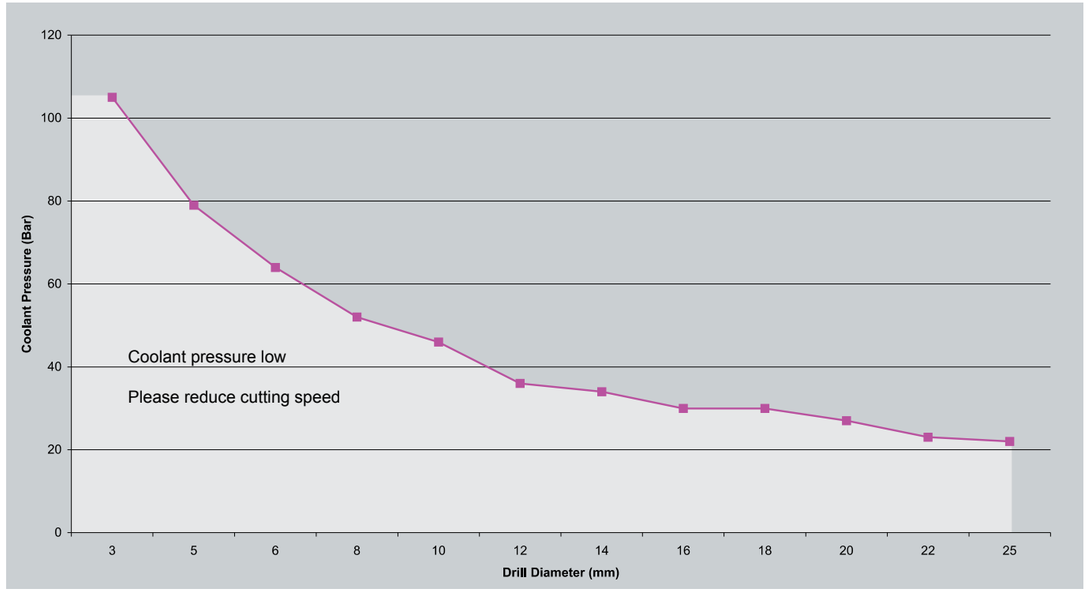


2XDCL Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)					
				3	6	10	12	16	19
				mm/rev.					
Steels	P	Low Carbon Steels 1018/12L14	160-180	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	85-115						
		Alloy Steels (36-45 Rc) 4140/A2/D2	50-70	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000	145-180	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Ductile Cast Iron 60-40-18	160-180						
Austenitic	M	304/316	55-85	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
Precipitation Hardened Stainless Steels	M	17-4 PH 13-8 PH	40-60	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Special Alloys	S	Titanium 6AL-4V	55	.025	.064	.102	.127	.152	.191
		Cobalt-Based Alloys Stellite, Haynes 25/188	15						
		Nickel-Based Alloys Inconel 625/718 Iron-Based Alloys Incoloy 800-802/Multimet	30						
		High Nickel Alloys Monel	35						

Coolant Pressure - Metric

Recommended Minimum Coolant Pressure

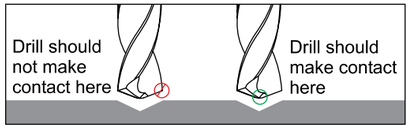


Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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

2XDCE

Process For Successful Deep Hole Drilling:



1. Start by producing a 1.5 x diameter to 3 x diameter pilot hole using a coolant or non-coolant pilot drill. Typically this tool will have a point angle the same as or greater than the deep hole drill. Run this drill at 100% of the final drill speed and 1/2 the normal IPM.
2. Retract and tool change to the final deep hole (2XDCE MA Ford® Series) drill.
3. Rapid to clearance plane and enter the pilot hole at 25% (don't exceed 400 to 500 RPM) of the final speed and 1 to 2 IPM. This will help with true position by eliminating drill whip. Once into the hole, turn on the coolant and advance to the material start. At this point, you can add a dwell to clear any chips that have been left from the previous drill and let the spindle get to full speed. Increase the speed and feed to final drilling parameters.
4. Drill one shot to the final hole depth or through.
5. Should you experience any squeaking you may need to retract the drill and increase your feed. Chip packing is occurring and will need to be addressed.
6. Once through the material, it may be necessary to reduce the RPM to eliminate breakage of the drill due to drill whip. Then retract to the clearance plane.

Machine Requirements
High Pressure Pump System (1,000 psi)
Machine runout of .0003" (.008mm) Max.

Due to the conditions of equipment, tool holders, and conditions beyond MA Ford®'s control, your results may vary.

Should your application require more in depth discussion or a special tool, please contact M.A. Ford®'s Application Engineering Department at 563-391-6220/800-553-8024.

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.

2XDCE Inch

Workpiece Material Group		Examples	SFM	Tool Diameter								
				.1181	.1575	.1968	.2362	.2756	.3150	.3543	.3937	.4724
				IPR								
Steels	P	Low Carbon Steels 1018/12L14	350	.0020	.0028	.0035	.0042	.0050	.0076	.0085	.0094	.0100
		Medium Carbon Steels 4140	260									
		Tool & Die Steels A2/D2/P20/H13										
		Alloy Steels 4140/8620										
		Structural Steels	400									
		Steel Forgings	175	.0024	.0031	.0039	.0047	.0055	.0076	.0085	.0094	.0100
Cast Irons	K	Gray Cast Iron Class 20	400									
		Ductile Cast Iron 60-40-18	260									
		Malleable Iron Ferritic	260									
Austenitic	M	304/316	180	.0020	.0028	.0035	.0042	.0050	.0076	.0085	.0094	.0100
Precipitation Hardened Stainless Steels	M	17-4 PH 13-8 PH	125									
Martensitic	M	410/440	125									
Stainless	M	Ferritic	250									
Special Alloys	S	Titanium 6AL-4V	160	.0012	.0016	.0020	.0024	.0028	.0040	.0050	.0055	.0060
		Cobalt-Based Alloys Stellite, Haynes 25/188	80	.0007	.0009	.0012	.0014	.0019	.0025	.0028	.0031	.0034
		Nickel-Based Alloys Inconel 625/718	80									
		Iron-Based Alloys Incoloy 800-802/Multimet	60									
		High Nickel Alloys Monel	80									
Hardened Materials	H	Alloy Steels (36-45 Rc) A2/D2/P20/H13	260	.0005	.0006	.0008	.0009	.0011	.0019	.0021	.0024	.0026
		Alloy Steels (46-50 Rc) A2/D2/P20/H13	120									
Non-Ferrous	N	Aluminum < 14% Si 6061-T6	500	.0033	.0044	.0055	.0066	.0077	.0110	.0120	.0130	.0140
		Aluminum > 14% Si	350									
		Brass	400	.0021	.0028	.0035	.0042	.0050	.0110	.0125	.0135	.0150
		Copper/Copper Alloys Magnesium	300									

2XDCE Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)								
				3	4	5	6	7	8	9	10	12
				mm/rev.								
Steels	P	Low Carbon Steels 1018/12L14	105	.050	.071	.088	.106	.127	.193	.215	.238	.254
		Medium Carbon Steels 4140	80									
		Tool & Die Steels A2/D2/P20/H13										
		Alloy Steels 4140/8620										
		Structural Steels	120									
		Steel Forgings	55	.060	.078	.099	.119	.139	.193	.215	.238	.254
Cast Irons	K	Gray Cast Iron Class 20	120									
		Ductile Cast Iron 60-40-18	80									
		Malleable Iron Ferritic	80									
Austenitic	M	304/316	55	.050	.071	.088	.106	.127	.193	.215	.238	.254
Precipitation Hardened Stainless Steels	M	17-4 PH 13-8 PH	40									
Martensitic	M	410/440	40									
Stainless	M	Ferritic	75									
Special Alloys	S	Titanium 6AL-4V	45	.030	.040	.050	.060	.071	.120	.127	.139	.152
		Cobalt-Based Alloys Stellite, Haynes 25/188	25	.017	.022	.030	.035	.048	.063	.071	.078	.085
		Nickel-Based Alloys Inconel 625/718	25									
		Iron-Based Alloys Incoloy 800-802/Multimet	20									
		High Nickel Alloys Monel	25									
Hardened Materials	H	Alloy Steels (36-45 Rc) A2/D2/P20/H13	35	.012	.015	.020	.022	.027	.048	.053	.060	.066
		Alloy Steels (46-50 Rc) A2/D2/P20/H13	25									
Non-Ferrous	N	Aluminum < 14% Si 6061-T6	150	.083	.110	.139	.167	.195	.279	.314	.350	.378
		Aluminum > 14% Si	105									
		Brass	120	.053	.071	.088	.106	.127	.279	.314	.350	.378
		Copper/Copper Alloys Magnesium	90									

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

Series 200S - 2XD Spot Drill Inch

Workpiece Material Group		Examples	SFM	Tool Diameter				
				1/4	5/16	3/8	1/2	5/8
				IPR				
Steels	P	Low Carbon Steels 1018	325	.003	.004	.005	.006	.008
		Alloy Steels (up to 35 Rc) 4140	225					
		Alloy Steels (36-45 Rc) 4140	150					
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	350	.003	.004	.005	.006	.006
		Ductile Cast Iron A536/60-40-18	250					
Austenitic	M	304/316	150	.003	.004	.005	.006	.006
Precipitation Hardened Stainless Steels	M	17-4 PH	100					
Special Alloys	S	Titanium 6AL-4V	175	.003	.004	.005	.006	.006
		High Temp Alloys Inconel/Hasteloy/Waspelloy	75					

Series 200S - 2XD Spot Drill Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)				
				6	8	10	12	16
				mm/rev.				
Steels	P	Low Carbon Steels 1018	100	.0760	.1010	.1270	.1524	.1524
		Alloy Steels (up to 35 Rc) 4140	70					
		Alloy Steels (36-45 Rc) 4140	45					
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	110	.0760	.1010	.1270	.1524	.1524
		Ductile Cast Iron A536/60-40-18	80					
Austenitic	M	304/316	45	.0760	.1010	.1270	.1524	.1524
Precipitation Hardened Stainless Steels	M	17-4 PH	30					
Special Alloys	S	Titanium 6AL-4V	55	.0760	.1010	.1270	.1524	.1524
		High Temp Alloys Inconel/Hasteloy/Waspelloy	20					

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

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2MDCL Micro Coolant Inch

Workpiece Material Group		Examples	Tool Diameter		
			.0787	.0984	.1161
			SFM/IPR		
Steels	P	Low Carbon Steels 1018	250/.0018	300/.0020	300/.0022
		Alloy Steels (up to 35 Rc) 4140	250/.0018	300/.0020	300/.0022
		Alloy Steels (36-45 Rc) 4140	200/.0018	250/.0018	250/.0020
Austenitic	M	304/316	200/.0013	230/.0015	230/.0017
Special Alloys	S	Nickel Alloys 718/625	65/.0010	75/.0011	75/.0014

2MDCL Micro Coolant Metric

Workpiece Material Group		Examples	Tool Diameter(mm)		
			2.00	2.50	2.95
			SMM/(mm/rev.)		
Steels	P	Low Carbon Steels 1018	80/.0460	90/.0510	90/.0560
		Alloy Steels (up to 35 Rc) 4140	80/.0460	90/.0510	90/.0560
		Alloy Steels (36-45 Rc) 4140	60/.0460	80/.0460	80/.0510
Austenitic	M	304/316	60/.0330	70/.0380	70/.0430
Special Alloys	S	Nickel Alloys 718/625	20/.0250	25/.0270	25/.0360

Machine Requirements
High Pressure Pump System (1,000 psi)
Coolant filtration of 10 microns or better
Machine runout of .0004” (.01mm) Max.

Estimated Peck Depths

For hole depths up to 6X diameter	No pecks
For hole depths up to 10X diameter	0-2 pecks
For hole depths up to 15X diameter	2-4 pecks

M.A. Ford® recommends full retraction of the body of the drill from the hole during the peck cycle.

It is recommended to leave the drill point within the hole.

For hole depths deeper than 4X the diameter, M.A. Ford® recommends using a “soft start” program that drills to .5X diameter deep at 2/3 of the speed and feed.

M.A. Ford® Phone: 800-553-8024 or 563-391-6220 • email: sales@maford.com • www.maford.com

Series 229 Inch

Workpiece Material Group		Examples	SFM	Tool Diameter							
				1/32	1/16	1/8	1/4	3/8	1/2	5/8	3/4
				IPR							
Non-Ferrous	N	Aluminum < 14% Si 6061T6	700	.0015	.0030	.0080	.0120	.0140	.0180	.0200	.0240
		Aluminum > 14% Si	500	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120
		Brass/Copper	225	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120
		Plastics	300	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120

Series 229 Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)						
				1.0	1.5	3.0	6.0	10.0	12.0	16.0
				mm/rev.						
Non-Ferrous	N	Aluminum < 14% Si 6061T6	215	.038	.076	.203	.305	.356	.457	.508
		Aluminum > 14% Si	150	.025	.051	.076	.152	.203	.254	.279
		Brass/Copper	70	.025	.051	.076	.152	.203	.254	.279
		Plastics	90	.025	.051	.076	.152	.203	.254	.279

Series 265/267/269/271/273/280/282/284 Inch

Workpiece Material Group		Examples	Series							
			265	267	269	271	273	280	282	284
			SFM							
Steels	P	Low Carbon Steels 1018	300	300	400	400	325			
		Alloy Steels (up to 35 Rc) 4140	225	225	300	300	275			
		Alloy Steels (36-45 Rc) 4140	175	175	225	225	200			
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	425	425	500	500	450	425	500	450
		Ductile Cast Iron A536/60-40-18	225	225	300	300	250	225	300	300
Austenitic	M	304/316	175	175	225	225	185			
Precipitation Hardened Stainless Steels	M	17-4 PH	135	135	175	175	150			
Special Alloys	S	Titanium 6AL-4V	135	135	175	175	150			
		High Temp Alloys Inconel/Hastelloy/ Waspelloy	85	85	135	135	120			

Workpiece Material Group		Examples	Tool Diameter							
			1/32	1/16	1/8	1/4	3/8	1/2	5/8	3/4
			IPR							
Steels	P	Low Carbon Steels 1018	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120
		Alloy Steels (up to 35 Rc) 4140	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120
		Alloy Steels (36-45 Rc) 4140	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120
		Ductile Cast Iron A536/60-40-18	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120
Austenitic	M	304/316	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120
Precipitation Hardened Stainless Steels	M	17-4 PH	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100
Special Alloys	S	Titanium 6AL-4V	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100
		High Temp Alloys Inconel/Hastelloy/ Waspelloy	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100

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

Series 265/267/269/271/273/280/282/284 Metric

Workpiece Material Group		Examples	Series							
			265	267	269	271	273	280	282	284
			SMM							
Steels	P	Low Carbon Steels 1018	90	90	120	120	100			
		Alloy Steels (up to 35 Rc) 4140	70	70	90	90	85			
		Alloy Steels (36-45 Rc) 4140	55	55	70	70	60			
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	130	130	150	150	140	135	150	135
		Ductile Cast Iron A536/60-40-18	70	70	90	90	75	70	90	90
Austenitic	M	304/316	55	55	70	70	55			
Precipitation Hardened Stainless Steels	M	17-4 PH	40	40	55	55	45			
Special Alloys	S	Titanium 6AL-4V	40	40	55	55	45			
		High Temp Alloys Inconel/Hastelloy/ Waspelloy	25	25	40	40	35			

Workpiece Material Group		Examples	Tool Diameter(mm)						
			1.0	1.5	3.0	6.0	10.0	12.0	16.0
			mm/rev.						
Steels	P	Low Carbon Steels 1018	.0254	.0500	.0762	.1524	.2030	.2540	.3048
		Alloy Steels (up to 35 Rc) 4140	.0254	.0500	.0762	.1524	.2030	.2540	.3048
		Alloy Steels (36-45 Rc) 4140	.0060	.0127	.0500	.1010	.1270	.1524	.2032
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	.0254	.0500	.0762	.1524	.2030	.2540	.3048
		Ductile Cast Iron A536/60-40-18	.0254	.0500	.0762	.1524	.2030	.2540	.3048
Austenitic	M	304/316	.0254	.0500	.0762	.1524	.2030	.2540	.3048
Precipitation Hardened Stainless Steels	M	17-4 PH	.0060	.0127	.0500	.1010	.1270	.1524	.2032
Special Alloys	S	Titanium 6AL-4V	.0060	.0127	.0500	.1010	.1270	.1524	.2032
		High Temp Alloys Inconel/Hastelloy/ Waspelloy	.0060	.0127	.0500	.1010	.1270	.1524	.2032

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

Series 200 Inch

Workpiece Material Group		Examples	SFM	Tool Diameter							
				1/32	1/16	1/8	1/4	3/8	1/2	5/8	3/4
				IPR							
Steels	P	Low Carbon Steels 1018	175	.00025	.0005	.0020	.0040	.0050	.0060	.0070	.0080
		Alloy Steels (up to 35 Rc) 4140	150	.00025	.0005	.0020	.0040	.0050	.0060	.0070	.0080
		Alloy Steels (36-45 Rc) 4140	100	.00025	.0005	.0020	.0040	.0050	.0060	.0070	.0080
Austenitic	M	304/316	125	.00025	.0005	.0020	.0040	.0050	.0060	.0070	.0080
Precipitation Hardened Stainless Steels	M	17-4 PH	60	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100
Special Alloys	S	Titanium 6AL-4V	80	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100
		High Temp Alloys Inconel/Hastelloy/ Waspelloy	75	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100
Hardened Steels	H	>45 Rc A2/52100	60	.0005	.0010	.0010	.0010	.0020	.0020	.0020	.0030
Non-Ferrous	N	Plastic	300	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100
		Kevlar/Graphite	375	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100
		Glass/Ceramic	75	.0005	.0010	.0010	.0010	.0020	.0020	.0020	.0030

Series 200 Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)							
				1.0	1.5	3.0	6.0	10.0	12.0	16.0	20.0
				mm/rev.							
Steels	P	Low Carbon Steels 1018	55	.0060	.0130	.0510	.1020	.1270	.1520	.1750	.2030
		Alloy Steels (up to 35 Rc) 4140	45	.0060	.0130	.0510	.1020	.1270	.1520	.1750	.2030
		Alloy Steels (36-45 Rc) 4140	30	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250
Austenitic	M	304/316	40	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250
Precipitation Hardened Stainless Steels	M	17-4 PH	20	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250
Special Alloys	S	Titanium 6AL-4V	25	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250
		High Temp Alloys Inconel/Hastelloy/ Waspelloy	25	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250
Hardened Steels	H	>45 Rc A2/52100	20	.0130	.0250	.0250	.0250	.0500	.0500	.0500	.0760
Non-Ferrous	N	Plastic	90	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250
		Kevlar/Graphite	115	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250
		Glass/Ceramic	25	.0130	.0250	.0250	.0250	.0500	.0500	.0500	.0760

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

Series 204/205/206/207/209/210/224/226 Inch

Workpiece Material Group		Examples	Series								
			204	205	205T	206	207	209	210	224	226
			SFM								
Steels	P	Low Carbon Steels 1018	175	175	175	175		275		175	175
		Alloy Steels (up to 35 Rc) 4140	165	150	150	165		250		165	165
		Alloy Steels (36-45 Rc) 4140	150	120	120	150		225		150	150
Austenitic	M	304/316	125	140	140	125			80	125	125
Precipitation Hardened Stainless Steels	M	17-4 PH		60	60			80			
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	275	175	175	275			275	275	275
		Ductile Cast Iron A536/60-40-18	175	175	175	175			175	175	175
Special Alloys	S	Titanium 6AL-4V		80	80			100			
		High Temp Alloys Inconel/Hastelloy/ Waspelloy		60	60			50			
Hardened Steels	H	>45 Rc A2/52100		50	50						
Non-Ferrous	N	Plastic	400	300	300	400	300			400	400
		Kevlar/Graphite	400			400	375			400	400

Workpiece Material Group		Examples	Tool Diameter								
			1/32	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1
			IPR								
Steels	P	Low Carbon Steels 1018	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120	.0140
		Alloy Steels (up to 35 Rc) 4140	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120	.0140
		Alloy Steels (36-45 Rc) 4140	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120	.0140
Austenitic	M	304/316	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120	.0140
Precipitation Hardened Stainless Steels	M	17-4 PH	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100	.0120
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120	.0140
		Ductile Cast Iron A536/60-40-18	.0010	.0020	.0030	.0060	.0080	.0100	.0110	.0120	.0140
Special Alloys	S	Titanium 6AL-4V	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100	.0120
		High Temp Alloys Inconel/Hastelloy/ Waspelloy	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100	.0120
Hardened Steels	H	>45 Rc A2/52100	.0005	.0010	.0010	.0010	.0020	.0020	.0020	.0030	.0030
Non-Ferrous	N	Plastic	.00025	.0005	.0020	.0040	.0050	.0060	.0080	.0100	.0120
		Kevlar/Graphite									

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

Series 204/205/206/207/209/210/224/226 Metric

Workpiece Material Group		Examples	Series								
			204	205	205T	206	207	209	210	224	226
			SMM								
Steels	P	Low Carbon Steels 1018	55	55	55	55		85		55	55
		Alloy Steels (up to 35 Rc) 4140	50	45	45	50		75		50	50
		Alloy Steels (36-45 Rc) 4140	45	35	35	45		70		45	45
Austenitic	M	304/316	40	45	45	40			25	40	40
Precipitation Hardened Stainless Steels	M	17-4 PH		20	20			25			
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	85	55	55	85			85	85	85
		Ductile Cast Iron A536/60-40-18	55	55	55	55			55	55	55
Special Alloys	S	Titanium 6AL-4V		25	25			30			
		High Temp Alloys Inconel/Hastelloy/ Waspelloy		20	20			15			
Hardened Steels	H	>45 Rc A2/52100		15	15						
Non-Ferrous	N	Plastic	120	90	90	120	90			120	120
		Kevlar/Graphite	120			120	115			120	120

Workpiece Material Group		Examples	Tool Diameter(mm)								
			1.0	1.5	3.0	6.0	10.0	12.0	16.0	20.0	26.0
			mm/rev.								
Steels	P	Low Carbon Steels 1018	.0250	.0500	.0760	.1520	.2030	.2540	.2750	.3050	.3560
		Alloy Steels (up to 35 Rc) 4140	.0250	.0500	.0760	.1520	.2030	.2540	.2750	.3050	.3560
		Alloy Steels (36-45 Rc) 4140	.0250	.0500	.0760	.1520	.2030	.2540	.2750	.3050	.3560
Austenitic	M	304/316	.0250	.0500	.0760	.1520	.2030	.2540	.2750	.3050	.3560
Precipitation Hardened Stainless Steels	M	17-4 PH	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250	.2540
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	.0250	.0500	.0760	.1520	.2030	.2540	.2750	.3050	.3560
		Ductile Cast Iron A536/60-40-18	.0250	.0500	.0760	.1520	.2030	.2540	.2750	.3050	.3560
Special Alloys	S	Titanium 6AL-4V	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250	.2540
		High Temp Alloys Inconel/Hastelloy/ Waspelloy	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250	.2540
Hardened Steels	H	>45 Rc A2/52100	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250	.2540
Non-Ferrous	N	Plastic	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250	.2540
		Kevlar/Graphite	.0060	.0127	.0500	.0760	.1010	.1520	.2030	.2250	.2540

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

Series 300 Inch

Workpiece Material Group		Examples	SFM	Tool Diameter					
				1/64	1/32	1/16	1/8	3/16	1/4
				IPR					
Steels	P	Low Carbon Steels 1018	175	.0007	.0010	.0020	.0030	.0040	.0060
		Alloy Steels (up to 35 Rc) 4140	150	.0007	.0010	.0020	.0030	.0040	.0060
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	275	.0007	.0010	.0020	.0030	.0040	.0060
		Ductile Cast Iron A536/60-40-18	175	.0007	.0010	.0020	.0030	.0040	.0060
Non-Ferrous	N	Aluminum (<10% Si) 6061-T6/7075-T6	400	.0007	.0010	.0020	.0030	.0040	.0060
		Aluminum (>10% Si) Copper/Brass	250	.0007	.0010	.0020	.0030	.0040	.0060
		Plastic	300	.0007	.0010	.0020	.0030	.0040	.0060

Series 300 Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)			
				0.5	1.0	2.0	3.0
				mm/rev.			
Steels	P	Low Carbon Steels 1018	55	.0170	.0250	.0500	.0760
		Alloy Steels (up to 35 Rc) 4140	45	.0170	.0250	.0500	.0760
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	85	.0170	.0250	.0500	.0760
		Ductile Cast Iron A536/60-40-18	55	.0170	.0250	.0500	.0760
Non-Ferrous	N	Aluminum (<10% Si) 6061-T6/7075-T6	120	.0170	.0250	.0500	.0760
		Aluminum (>10% Si) Copper/Brass	75	.0170	.0250	.0500	.0760
		Plastic	90	.0170	.0250	.0500	.0760

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

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Series 302/306 Inch

Workpiece Material Group		Examples	SFM	Tool Diameter				
				≤ .030	.031-.036	.037-.040	.041-.051	≥ .052
				IPR				
Steels	P	Low Carbon Steels 1018	300	.0002-.0006	.0008	.0010	.0014	.0015
		Alloy Steels (up to 35 Rc) 4140	225	.0002-.0006	.0008	.0010	.0014	.0015
		Alloy Steels (36-45 Rc) 4140	200	.0002-.0006	.0008	.0010	.0014	.0015
Austenitic	M	304/316	200	.0002-.0004	.0006	.0008	.0010	.0012
Stainless Steels	M	Free Machining	175	.0002-.0004	.0006	.0008	.0010	.0012
		Ferritic Martensitic	100	.0002-.0006	.0008	.0010	.0014	.0015
Precipitation Hardened Stainless Steels	M	17-4 PH	75	.0002-.0006	.0008	.0010	.0014	.0015
Cast Irons	K	Gray Cast Irons A48 Class 20/G4000	400	.0002-.0006	.0008	.0010	.0014	.0015
		Ductile Cast Irons A536/60-40-18	350	.0002-.0006	.0008	.0010	.0014	.0015
Special Alloys	S	Titanium 6AL-4V	60	.0002-.0004	.0006	.0008	.0010	.0012
		High Temp Alloys Inconel/Hastelloy/Waspelloy Nickel Based Alloys-Monel	50	.0002-.0004	.0006	.0008	.0010	.0012
Hardened Steels	H	45 Rc A2/52100	175	.0002-.0006	.0008	.0010	.0014	.0015
Non-Ferrous	N	Aluminum (<10% Si)	450	.0002-.0006	.0008	.0010	.0014	.0015
		Aluminum (>10% Si)	325	.0002-.0006	.0008	.0010	.0014	.0015
		Plastics	550	.0002-.0006	.0008	.0010	.0014	.0015
		Composites/Fiber Reinforced Materials/Circuit Boards	650	.0005-.0015	.0020	.0030	.0040	.0050

Chiploads above .006 are not recommended since location problems become more evident.

In typical circuit board materials, Micro Drills operate efficiently in the 600-700 SFM (180-215 SMM) ranges. Higher speed rates tend to produce excessive drill wear and early failure. In general, smaller diameter drills are limited to slower speeds, because of machine limitations.

Feed rates can be set extremely high in most applications, because of the quality and design features of the M.A. Ford® Micro Drill. However, certain precautions should be taken for proper performance and safety. When determining optimum feed rates, consider the following factors:

- Spindle motors must be rated at least one hp (1 horsepower).
- To prevent delamination, entry materials must be used.
- Pressure foot clamping must be appropriate.

When drilling harder materials, the Micro Drill life may be variable. Drilling set ups must be precise. The drill TIR must be less than .0001" (.0025mm). The feed axis motion must be smooth without any play. Machining practices are very important.

Note: Micro drills should be kept in their original packaging, or equivalent when not in use. Mechanical micrometers are not recommended for checking size.

Series 302/306 Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)				
				≤ .76	.77-.92	.93-1.02	1.03-1.30	≥ 1.31
				mm/rev.				
Steels	P	Low Carbon Steels 1018	90	.005-.015	.020	.025	.036	.038
		Alloy Steels (up to 35 Rc) 4140	70	.005-.015	.020	.025	.036	.038
		Alloy Steels (36-45 Rc) 4140	60	.005-.015	.020	.025	.036	.038
Austenitic	M	304/316	60	.005-.010	.015	.020	.025	.030
Stainless Steels	M	Free Machining	55	.005-.010	.015	.020	.025	.030
		Ferritic Martensitic	30	.005-.015	.020	.025	.036	.038
Precipitation Hardened Stainless Steels	M	17-4 PH	25	.005-.015	.020	.025	.036	.038
Cast Irons	K	Gray Cast Irons A48 Class 20/G4000	120	.005-.015	.020	.025	.036	.038
		Ductile Cast Irons A536/60-40-18	110	.005-.015	.020	.025	.036	.038
Special Alloys	S	Titanium 6AL-4V	20	.005-.010	.015	.020	.025	.030
		High Temp Alloys Inconel/Hastelloy/Waspelloy Nickel Based Alloys-Monel	15	.005-.010	.015	.020	.025	.030
Hardened Steels	H	45 Rc A2/52100	55	.005-.015	.020	.025	.036	.038
Non-Ferrous	N	Aluminum (<10% Si)	140	.005-.015	.020	.025	.036	.038
		Aluminum (>10% Si)	100	.005-.015	.020	.025	.036	.038
		Plastics	170	.005-.015	.020	.025	.036	.038
		Composites/Fiber Reinforced Materials/Circuit Boards	200	.013-.038	.051	.076	.102	.127

Chiploads above .140 are not recommended since location problems become more evident.

Series 402/403/404/405 Inch

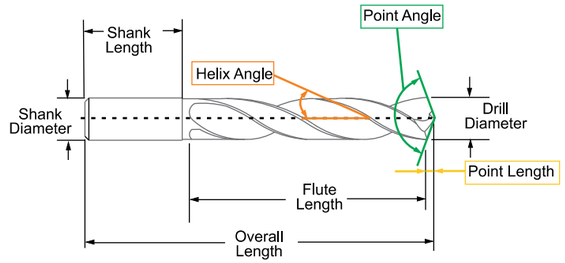
Workpiece Material Group		Examples	SFM	Tool Diameter					
				1/32	1/16	1/8	1/4	3/8	1/2
				IPR					
Steels	P	Low Carbon Steels 1018	175	.0005	.0010	.0015	.0030	.0040	.0050
		Alloy Steels (up to 35 Rc) 4140	165	.0005	.0010	.0015	.0030	.0040	.0050
		Alloy Steels (36-45 Rc) 4140	150	.0005	.0010	.0015	.0030	.0040	.0050
Stainless Steels	M	Austenitic 304/316	125	.0005	.0010	.0015	.0030	.0040	.0050
		Ph Stainless 17-4	60	.0005	.0010	.0015	.0030	.0040	.0050
Special Alloys	S	Titanium 6AL-4V	80	.0005	.0010	.0015	.0030	.0040	.0050
		High Temp Alloys Inconel/Hastelloy/Waspelloy Nickel Based Alloys-Monel	40	.0005	.0010	.0015	.0030	.0040	.0050
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	275	.0005	.0010	.0015	.0030	.0040	.0050
		Ductile Cast Iron A536/60-40-18	175	.0005	.0010	.0015	.0030	.0040	.0050
Hardened Steels	H	45 Rc A2/52100	50	.0005	.0010	.0015	.0030	.0040	.0050

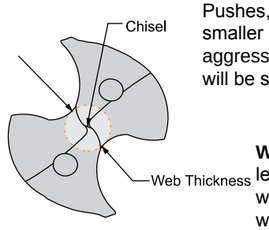
Series 402/403/404/405 Metric

Workpiece Material Group		Examples	SMM	Tool Diameter(mm)					
				1.0	1.5	3.0	6.0	10.0	12.0
				mm/rev.					
Steels	P	Low Carbon Steels 1018	55	.0125	.0250	.0380	.0760	.1020	.1270
		Alloy Steels (up to 35 Rc) 4140	50	.0125	.0250	.0380	.0760	.1020	.1270
		Alloy Steels (36-45 Rc) 4140	45	.0125	.0250	.0380	.0760	.1020	.1270
Stainless Steels	M	Austenitic 304/316	40	.0125	.0250	.0380	.0760	.1020	.1270
		Ph Stainless 17-4	20	.0125	.0250	.0380	.0760	.1020	.1270
Special Alloys	S	Titanium 6AL-4V	25	.0125	.0250	.0380	.0760	.1020	.1270
		High Temp Alloys Inconel/Hastelloy/Waspelloy Nickel Based Alloys-Monel	10	.0125	.0250	.0380	.0760	.1020	.1270
Cast Irons	K	Gray Cast Iron A48 Class 20/G4000	85	.0125	.0250	.0380	.0760	.1020	.1270
		Ductile Cast Iron A536/60-40-18	55	.0125	.0250	.0380	.0760	.1020	.1270
Hardened Steels	H	45 Rc A2/52100	15	.0125	.0250	.0380	.0760	.1020	.1270

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

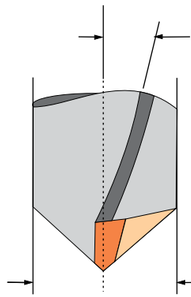
Drill Terminology





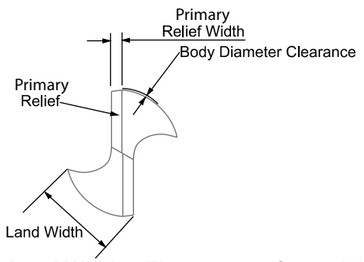
Chisel Edge – The non-cutting tip of the drill. Pushes, rather than cuts material. Having a smaller chisel means that a tool will cut more aggressively. A larger chisel means that a tool will be stronger.

Web – The core of the drill that is left from the fluting operation. A thicker web means added rigidity, while a smaller web means more chip evacuation. On two flute drills, typically varies from 16% - 30% of the tool diameter.

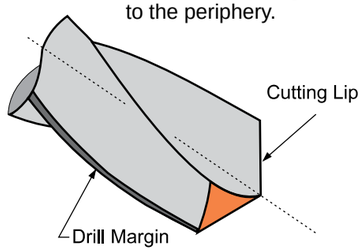


Helix Angle - Varies from 0° to 35° helix on standard tools. Lower helix angle means more rigidity and strength and a higher helix angle means more aggressive drilling and better chip evacuation.

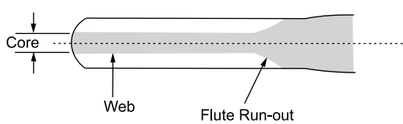
Margin Width – Provides a surface to support the drill inside the hole during the drilling operation. M.A. Ford® offers both single margin and double margin geometries. Margin widths are a balancing act between friction build-up vs. tool support in the drilling operation.



Cutting Lip - The cutting edges of a two flute drill extending from the chisel edge to the periphery.



Land Width – The amount of material left on the drill per side, from the fluting operation. Larger land widths mean more rigidity, while smaller land widths allow for better chip evacuation.



Having a problem with drill geometries? Circle the area where the problem exists.
Include a detailed explanation of the issue and fax to Attn: Technical Application Support 800-892-9522/563-386-7660

TuffCut®
High Performance End Mills

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, and aluminum and softer alloys.

New to the TuffCut® End Mill family is the TuffCut® XR7 - a 7 flute end mill that provides a 40% productivity increase over 5 flute tools. The XR family of end mills are available as 4, 5 and 7 flute square end, 4, 5 and 7 flute corner radius end and 4 flute ball nose. A variety of available lengths include stub, standard, long and extended reach as well as neck relief styles.

In addition to High Performance products, M.A. Ford® carries a complete family of standard carbide end mills designed for efficient general purpose milling of all steels, cast irons and most other materials. M.A. Ford® End Mills are ideal for tough or abrasive work. On many jobs, they can run faster than HSS or Cobalt because of their high heat resistance.

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-sharpened for maximum life.
- ALtima®, ALtima® Blaze, ALtima® 52, TiN and TiCN coatings available.
- U.S. Designed and Manufactured.




Designed and Manufactured in the USA

TuffCut® High Performance End Mills

TuffCut®
High Performance Series

- TuffCut® XR Series 177
- NEW TuffCut® XR Series 177L
- TuffCut® XR Series 177S
- TuffCut® XR Series 179
- NEW TuffCut® XR Series 179L
- TuffCut® XR Series 178
- TuffCut® XR Series 178N
- TuffCut® XR7 Series 180
- TuffCut® XR7 Series 180N
- TuffCut® AL Series 135
- TuffCut® AL Series 135N
- TuffCut® AL Series 135B
- TuffCut® AL Series 135BN
- TuffCut® AL Series 136
- TuffCut® AL Series 134
- TuffCut® X-AL Series 137
- TuffCut® X-AL Series 137N
- TuffCut® X-AL Series 138
- TuffCut® X-AL Series 138N
- TuffCut® X-AL Series 138B
- TuffCut® X-AL Series 138BN
- TuffCut® DM Series 156
- TuffCut® DM Series 198
- TuffCut® DM Series 199
- NEW TuffCut® DM Series 158
- TuffCut® DM Series 157
- TuffCut® DM Series 192
- TuffCut® SS Series 112
- TuffCut® SS Series 172
- TuffCut® SS Series 174
- TuffCut® SS Series 175
- TuffCut® SS Series 176
- TuffCut® SS Series 113

Celebrating 90 Years 1919 - 2009

ISO 9001:2000 Certified

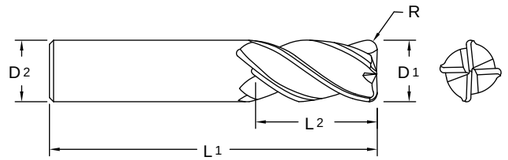
An ESOP Company

TuffCut®

TuffCut® XR Series 177

Z4 | 35°/38° | ALtima®

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



ALtima®		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
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			
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		
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

Inch	
D1	Tolerance
1/16-1/4	+.000/-.002
> 1/4-1.0	+.000/-.003

Metric (mm)	
D1	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

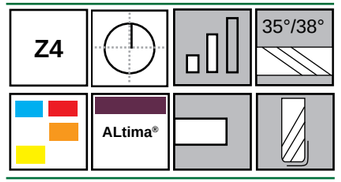
Technical information on page 240.

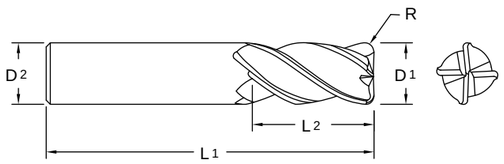
Series 177 Continued

ALtima®		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17723605A	18070		6.0	.2362		6.0		57		13.0		2.00
17723608A	17786		6.0	.2362		6.0		57		13.0		0.25
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	
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

Technical information on page 240.

Series 177 Continued





ALtima®		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
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	1/2		.5000	1/2		2-1/2		1/2			
17750002A	17765	1/2		.5000	1/2		2-1/2		1/2		0.015	
17750004A	17766	1/2		.5000	1/2		2-1/2		1/2		0.030	
17750010A	17721	1/2		.5000	1/2		3		1			
17750012A	17767	1/2		.5000	1/2		3		1		0.015	
17750014A	17768	1/2		.5000	1/2		3		1		0.030	
17750016A	17901	1/2		.5000	1/2		3		1		0.060	
17750017A	17902	1/2		.5000	1/2		3		1		0.090	
17750018A	17903	1/2		.5000	1/2		3		1		0.125	
17750020A	18094	1/2		.5000	1/2		3		1-1/4			
17750022A	18095	1/2		.5000	1/2		3		1-1/4		.015	
17750024A	18096	1/2		.5000	1/2		3		1-1/4		.030	
17750026A	18097	1/2		.5000	1/2		3		1-1/4		.060	
17750027A	18098	1/2		.5000	1/2		3		1-1/4		.090	
17750028A	18099	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	5/8		.6250	5/8		3		5/8			
17762502A	18000	5/8		.6250	5/8		3		5/8		0.015	
17762504A	17771	5/8		.6250	5/8		3		5/8		0.030	
17762505A	17772	5/8		.6250	5/8		3		5/8		0.045	
17762510A	17724	5/8		.6250	5/8		3-1/2		1-1/4			
17762512A	18001	5/8		.6250	5/8		3-1/2		1-1/4		0.015	
17762514A	17773	5/8		.6250	5/8		3-1/2		1-1/4		0.030	
17762515A	17774	5/8		.6250	5/8		3-1/2		1-1/4		0.045	
17762516A	17904	5/8		.6250	5/8		3-1/2		1-1/4		0.060	
17762517A	17905	5/8		.6250	5/8		3-1/2		1-1/4		0.090	
17762518A	17906	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

Technical information on page 240.

Series 177 Continued

ALtima®		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17775000A	17725	3/4		.7500	3/4		3		3/4			
17775002A	18002	3/4		.7500	3/4		3		3/4		0.015	
17775004A	17775	3/4		.7500	3/4		3		3/4		0.030	
17775005A	17776	3/4		.7500	3/4		3		3/4		0.045	
17775010A	17726	3/4		.7500	3/4		4		1-1/2			
17775012A	18003	3/4		.7500	3/4		4		1-1/2		0.015	
17775014A	17777	3/4		.7500	3/4		4		1-1/2		0.030	
17775015A	17778	3/4		.7500	3/4		4		1-1/2		0.045	
17775016A	17907	3/4		.7500	3/4		4		1-1/2		0.060	
17775017A	17908	3/4		.7500	3/4		4		1-1/2		0.090	
17775018A	17909	3/4		.7500	3/4		4		1-1/2		0.125	
17778700A	17955		20.0	.7874		20.0		104		38.0		
177787011A	18090		20.0	.7874		20.0		104		38.0		5.00
177787012A	18092		20.0	.7874		20.0		104		38.0		6.00
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
17798400A	17957		25.0	.9843		25.0		104		38.0		
17798403A	17958		25.0	.9843		25.0		104		38.0		1.00
17710000A	17727	1		1.0000	1		4		1			
17710002A	18004	1		1.0000	1		4		1		0.015	
17710004A	17779	1		1.0000	1		4		1		0.030	
17710005A	17780	1		1.0000	1		4		1		0.045	
17710010A	17728	1		1.0000	1		4		1-1/2			
17710012A	18005	1		1.0000	1		4		1-1/2		0.015	
17710014A	17781	1		1.0000	1		4		1-1/2		0.030	
17710015A	17782	1		1.0000	1		4		1-1/2		0.045	
17710016A	17910	1		1.0000	1		4		1-1/2		0.060	
17710017A	17911	1		1.0000	1		4		1-1/2		0.090	
17710018A	17912	1		1.0000	1		4		1-1/2		0.125	

Technical information on page 240.

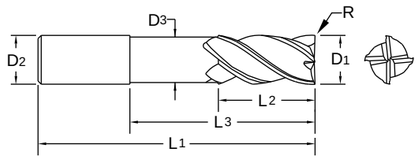
Safety Note

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.

NEW

TuffCut® XR Series 177L

Z4 | 35/38° | ALtima® | N



ALtima®		Diameter		Shank	Neck Dia.	OAL	Flute Length	Neck Length	Corner Radius
		D1 h10		D2 h6	D3	L1	L2	L3	R
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm	mm
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	152	24	62	0.5
177L4720R039N5A	18176	12	.4724	12	11.4	152	24	62	1.0
177L4720R078N5A	18177	12	.4724	12	11.4	152	24	62	2.0
177L4720R118N5A	18190	12	.4724	12	11.4	152	24	62	3.0
177L4720R157N5A	18178	12	.4724	12	11.4	152	24	62	4.0
177L6290R020N5A	18181	16	.6299	16	15.2	152	32	82	0.5
177L6290R039N5A	18191	16	.6299	16	15.2	152	32	82	1.0
177L6290R078N5A	18179	16	.6299	16	15.2	152	32	82	2.0
177L6290R118N5A	18180	16	.6299	16	15.2	152	32	82	3.0
177L7870R020N5A	18182	20	.7874	20	19.2	152	40	102	0.5
177L7870R039N5A	18192	20	.7874	20	19.2	152	40	102	1.0
177L7870R118N5A	18193	20	.7874	20	19.2	152	40	102	3.0

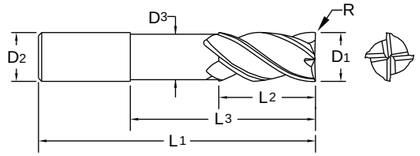
Inch Sizes Available upon request.

Technical information on page 240.

Metric (mm)	
D1	Tolerance h10
6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-20.00	+.000/-.084

TuffCut® XR Series 177S

Z4 | 35/38° | ALtima® | DIN6535 HA | N



ALtima®		Diameter		Shank	Neck Diameter	OAL	Flute Length	Neck Length	Corner Radius	Shank
		D1								
Tool No.	EDP	mm	Decimal	D2	D3	L1	L2	L3	R	
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
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
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
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
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
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
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
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
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

Metric (mm)	
D1	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

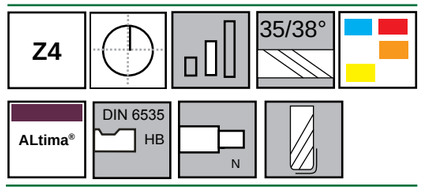
Inch Sizes Available upon request.

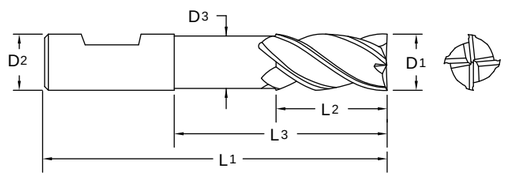
Technical information on page 240.

ISO 9001:2000 Certified

An ESOP Company

Series 177S Continued





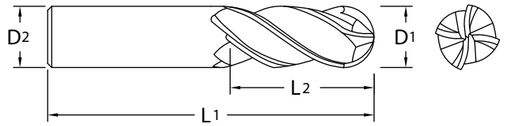
ALtima®		Diameter D1		Shank	Neck Diameter	OAL	Flute Length	Neck Length	Corner Radius	Shank
Tool No.	EDP	mm	Decimal	D2	D3	L1	L2	L3	R	
177S1181AW	18254	3	.1181	6	2.9	50	5	11		DIN 6535 HB
177S1181R008AW	18236	3	.1181	6	2.9	50	5	11	0.20	DIN 6535 HB
177S1575AW	18256	4	.1575	6	3.9	50	6	14		DIN 6535 HB
177S1575R008AW	18238	4	.1575	6	3.9	50	6	14	0.20	DIN 6535 HB
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
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
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
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
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
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
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

Inch Sizes Available upon request.

Technical information on page 240.

TuffCut® XR Series 179

Z4 | 35°/38° | ALtima®



ALtima®		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Fraction	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		2.0	.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		3.0	.1181		6		57		8.0
17911803A	18278		3.0	.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		4.0	.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		5.0	.1968		6		57		13.0
17923600A	18021		6.0	.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		8.0	.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		10.0	.3937		10		72		22.0
17947200A	18024		12.0	.4724		12		83		26.0
17950000A	18054	1/2		.5000	1/2		2-1/2		5/8	
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		16.0	.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	

Inch	
D1	Tolerance
1/16-1/4	+.000/-.002
> 1/4-1.0	+.000/-.003

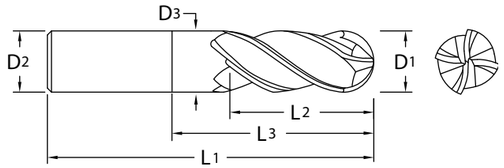
Metric (mm)	
D1	Tolerance h10
1.50-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-16.00	+.000/-.070

Technical information on page 240.

NEW

TuffCut® XR Series 179L

Z4 | 35°/38° | ALtima® | N



ALtima®		Diameter		Shank	Neck Dia.	OAL	Flute Length	Neck Length
		D1 h10		D2 h6	D3	L1	L2	L3
Tool No.	EDP	mm	Decimal	mm	mm	mm	mm	mm
179L1181N5A	18290	3	.2362	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	152	18.0	62
179L6299N5A	18306	16	.6299	16	15.2	152	24.0	82

Inch Sizes Available upon request.

Technical information on page 240.

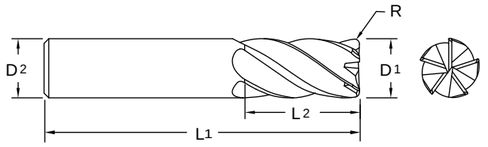
Metric (mm)	
D1	Tolerance h10
3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-16.00	+.000/-.070

Designed and Manufactured in the USA

TuffCut® XR Series 178

Z5 | 38° | ALtima®

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



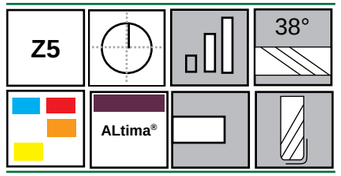
ALtima®		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17811800A	17959		3	.1181		6		57		8		
17811810A	17998		3	.1181		3		75		25		
17812500A	17800	1/8		.1250	1/8		1-1/2		1/8			
17812510A	17801	1/8		.1250	1/8		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	
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			
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	

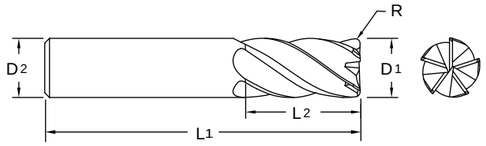
Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
> 1/4-1.0	+.000/-.003

Metric (mm)	
D1	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

Technical information on page 242.

Series 178 Continued





ALtima®		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
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	1/2		.5000	1/2		2-1/2		5/8			
17850002A	17865	1/2		.5000	1/2		2-1/2		5/8		0.015	
17850004A	17866	1/2		.5000	1/2		2-1/2		5/8		0.030	
17850010A	17821	1/2		.5000	1/2		3		1			
17850012A	17867	1/2		.5000	1/2		3		1		0.015	
17850014A	17868	1/2		.5000	1/2		3		1		0.030	
17850015A	17869	1/2		.5000	1/2		3		1		0.045	
17850016A	17913	1/2		.5000	1/2		3		1		0.060	
17850017A	17914	1/2		.5000	1/2		3		1		0.090	
17850018A	17915	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	9/16		.5625	9/16		3-1/2		1-1/8			
17856202A	17875	9/16		.5625	9/16		3-1/2		1-1/8		0.015	
17856204A	17876	9/16		.5625	9/16		3-1/2		1-1/8		0.030	
17862500A	17823	5/8		.6250	5/8		3		3/4			
17862502A	18006	5/8		.6250	5/8		3		3/4		0.015	
17862504A	17877	5/8		.6250	5/8		3		3/4		0.030	
17862505A	17878	5/8		.6250	5/8		3		3/4		0.045	
17862510A	17824	5/8		.6250	5/8		3-1/2		1-1/4			
17862512A	18007	5/8		.6250	5/8		3-1/2		1-1/4		0.015	
17862514A	17879	5/8		.6250	5/8		3-1/2		1-1/4		0.030	
17862515A	17880	5/8		.6250	5/8		3-1/2		1-1/4		0.045	
17862516A	17916	5/8		.6250	5/8		3-1/2		1-1/4		0.060	
17862517A	17917	5/8		.6250	5/8		3-1/2		1-1/4		0.090	
17862518A	17918	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

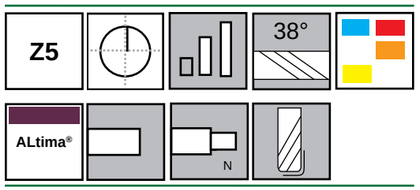
Technical information on page 242.

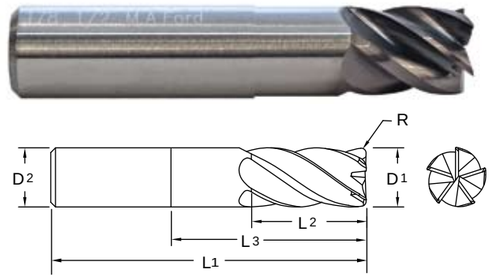
Series 178 Continued

ALtima®		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
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	3/4		.7500	3/4		3		1			
17875002A	18011	3/4		.7500	3/4		3		1		0.015	
17875004A	17887	3/4		.7500	3/4		3		1		0.030	
17875005A	17888	3/4		.7500	3/4		3		1		0.045	
17875010A	17826	3/4		.7500	3/4		4		1-1/2			
17875012A	18012	3/4		.7500	3/4		4		1-1/2		0.015	
17875014A	17889	3/4		.7500	3/4		4		1-1/2		0.030	
17875015A	17890	3/4		.7500	3/4		4		1-1/2		0.045	
17875016A	17919	3/4		.7500	3/4		4		1-1/2		0.060	
17875017A	17920	3/4		.7500	3/4		4		1-1/2		0.090	
17875018A	17921	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	1		1.0000	1		4		1			
17810010A	17828	1		1.0000	1		4		1-1/2			
17810012A	18015	1		1.0000	1		4		1-1/2		0.015	
17810014A	17895	1		1.0000	1		4		1-1/2		0.030	
17810015A	17896	1		1.0000	1		4		1-1/2		0.045	
17810016A	17922	1		1.0000	1		4		1-1/2		0.060	
17810017A	17923	1		1.0000	1		4		1-1/2		0.090	
17810018A	17924	1		1.0000	1		4		1-1/2		0.125	

Technical information on page 242.

Series 178N



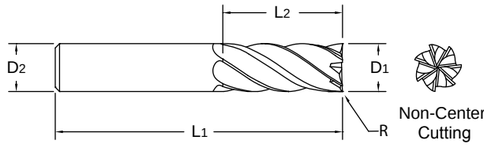


ALtima®		Diameter		Shank	OAL	Flute Length	Neck Length	Corner Radius
		D1		D2	L1	L2	L3	R
Tool No.	EDP	Fraction	Decimal	Inch	Inch	Inch	Inch	Inch
17825022NA	17833	1/4	.2500	1/4	4	3/4	2-1/8	0.015
17825024NA	17834	1/4	.2500	1/4	4	3/4	2-1/8	0.030
17831222NA	17841	5/16	.3125	5/16	4	1	2-1/8	0.015
17831224NA	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

Technical information on page 242.

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		Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2	L1	L2	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
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	
18050012B	18516	1/2	.5000	1/2	3	1-1/4	.015
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
18075000B	18570	3/4	.7500	3/4	4	1	
180750012B	18585	3/4	.7500	3/4	4	1	.250
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
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
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

Inch	
D1	Tolerance
1/2-1.0	+.000/-.0011

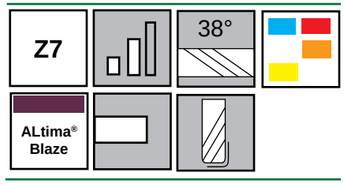
ALtima® Blaze features high temperature hardness and oxidation resistance that provides extreme wear resistance under all machining conditions.

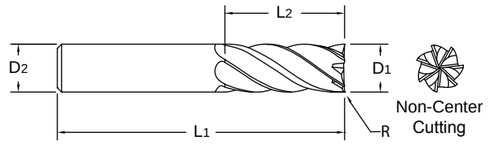
Coating Properties

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

Technical information on page 244.

Series 180 Continued



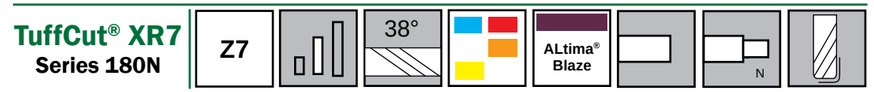


ALtima® Blaze		Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2	L1	L2	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
180750112B	18586	3/4	.7500	3/4	4	1-1/2	.250
18010000B	18597	1	1.0000	1	4	1	
180100012B	18611	1	1.0000	1	4	1	.250
18010002B	18599	1	1.0000	1	4	1	.015
18010004B	18601	1	1.0000	1	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
18010010B	18598	1	1.0000	1	4	1-1/2	
180100112B	18612	1	1.0000	1	4	1-1/2	.250
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

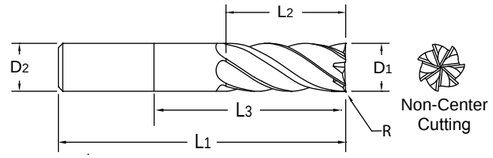
Technical information on page 244.

Celebrating 90 Years 1919 - 2009
M.A. Ford®

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		Diameter			Shank		OAL		Flute Length		Neck Length		Corner Radius	
		D1			D2		L1		L2		L3		R	
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	
D1	Tolerance
1/2-1.0	+.000/-.0011

Metric (mm)	
D1	Tolerance
12.00-20.00	+.000/-.028

Technical information on page 244.

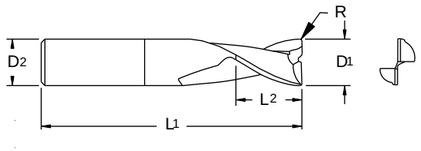
ISO 9001:2000 Certified

An ESOP Company

TuffCut® AL Series 135

Z2

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.



- 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		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
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
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	

Inch	
D1	Tolerance
3/16-1/4	+.000/-.002
> 1/4-1	+.000/-.003

Metric (mm)	
D1	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

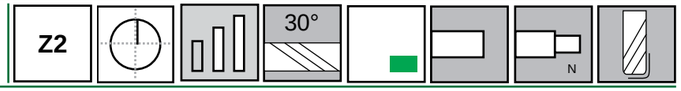
Technical information on page 224.

Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
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	

Technical information on page 224.

TuffCut® AL Series 135N

Z2



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.

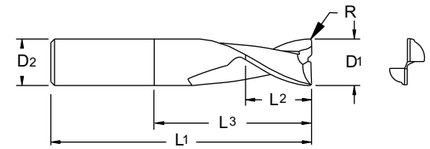
Necked		Diameter			Shank		OAL		Flute Length		Neck Length		Corner Radius	
		D1			D2		L1		L2		L3		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13511800N3	96620		3.0	.1181		3.0		38		3.5		11		
13511800N5	96623		3.0	.1181		3.0		38		3.5		16		
13511801N3	96621		3.0	.1181		3.0		38		3.5		11		0.50
13511801N5	96624		3.0	.1181		3.0		38		3.5		16		0.50
13511803N3	96622		3.0	.1181		3.0		38		3.5		11		1.00
13511803N5	96625		3.0	.1181		3.0		38		3.5		16		1.00
13511810N	13524		3.0	.1181		3.0		38		3.5		11		0.20
13515700N3	96626		4.0	.1575		4.0		51		4.8		14		
13515700N5	96629		4.0	.1575		4.0		51		4.8		22		
13515701N3	96627		4.0	.1575		4.0		51		4.8		14		0.50
13515701N5	96630		4.0	.1575		4.0		51		4.8		22		0.50
13515703N3	96628		4.0	.1575		4.0		51		4.8		14		1.00
13515703N5	96631		4.0	.1575		4.0		51		4.8		22		1.00
13515750N	13534		4.0	.1575		4.0		51		4.8		22		0.20
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	
13519600N3	96632		5.0	.1968		6.0		64		6.0		17		
13519600N5	96635		5.0	.1968		6.0		64		6.0		27		
13519601N3	96633		5.0	.1968		6.0		64		6.0		17		0.50
13519601N5	96636		5.0	.1968		6.0		64		6.0		27		0.50
13519603N3	96634		5.0	.1968		6.0		64		6.0		17		1.00
13519603N5	96637		5.0	.1968		6.0		64		6.0		27		1.00
13519680N	13503		5.0	.1968		5.0		51		6.0		22		0.25
13523600N3	96638		6.0	.2362		6.0		64		7.0		20		
13523600N5	96643		6.0	.2362		6.0		64		7.0		32		
13523601N3	96639		6.0	.2362		6.0		64		7.0		20		0.50
13523601N5	96644		6.0	.2362		6.0		64		7.0		32		0.50
13523603N3	96640		6.0	.2362		6.0		64		7.0		20		1.00
13523603N5	96645		6.0	.2362		6.0		64		7.0		32		1.00
13523604N3	96641		6.0	.2362		6.0		64		7.0		20		1.50
13523604N5	96646		6.0	.2362		6.0		64		7.0		32		1.50
13523605N3	96642		6.0	.2362		6.0		64		7.0		20		2.00
13523605N5	96647		6.0	.2362		6.0		64		7.0		32		2.00
13523620N	13505		6.0	.2362		6.0		64		7.0		26		0.30
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	
13531500N	13509		8.0	.3150		8.0		64		9.5		26		0.35
13531500N3	96648		8.0	.3150		8.0		64		9.5		26		
13531500N5	96654		8.0	.3150		8.0		75		9.5		42		
13531501N3	96649		8.0	.3150		8.0		64		9.5		26		0.50
13531501N5	96655		8.0	.3150		8.0		75		9.5		42		0.50
13531503N3	96650		8.0	.3150		8.0		64		9.5		26		1.00
13531503N5	96656		8.0	.3150		8.0		75		9.5		42		1.00
13531504N3	96651		8.0	.3150		8.0		64		9.5		26		1.50
13531504N5	96657		8.0	.3150		8.0		75		9.5		42		1.50
13531505N3	96652		8.0	.3150		8.0		64		9.5		26		2.00
13531505N5	96658		8.0	.3150		8.0		75		9.5		42		2.00
13531507N3	96653		8.0	.3150		8.0		64		9.5		26		3.00

Inch	
D1	Tolerance
3/16-1/4	+.000/-.002
> 1/4-1	+.000/-.003

Metric (mm)	
D1	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

Technical information on page 224.

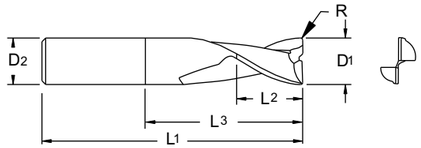
Series 135N Continued



Necked		Diameter			Shank		OAL		Flute Length		Neck Length		Corner Radius	
		D1			D2		L1		L2		L3		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
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	
13539300N3	96660		10.0	.3937		10.0		76		12.0		34		
13539301N3	96661		10.0	.3937		10.0		76		12.0		34		0.50
13539301N5	96666		10.0	.3937		10.0		89		12.0		52		0.50
13539303N3	96662		10.0	.3937		10.0		76		12.0		34		1.00
13539303N5	96667		10.0	.3937		10.0		89		12.0		52		1.00
13539304N3	96663		10.0	.3937		10.0		76		12.0		34		1.50
13539304N5	96668		10.0	.3937		10.0		89		12.0		52		1.50
13539305N3	96664		10.0	.3937		10.0		76		12.0		34		2.00
13539305N5	96669		10.0	.3937		10.0		89		12.0		52		2.00
13539307N3	96665		10.0	.3937		10.0		76		12.0		34		3.00
13539307N5	96670		10.0	.3937		10.0		89		12.0		52		3.00
13539370N	13565		10.0	.3937		10.0		70		12.0		28		0.50
13539371N	13566		10.0	.3937		10.0		76		12.0		34		0.50
13539372N	13567		10.0	.3937		10.0		89		12.0		47		0.50
13547200N3	96671		12.0	.4724		12.0		76		14.0		38		
135472011N3	96721		12.0	.4724		12.0		76		14.0		38		5.00
135472011N5	96723		12.0	.4724		12.0		110		14.0		62		5.00
13547201N3	96672		12.0	.4724		12.0		76		14.0		38		0.50
13547201N5	96678		12.0	.4724		12.0		110		14.0		62		0.50
13547203N3	96673		12.0	.4724		12.0		76		14.0		38		1.00
13547203N5	96679		12.0	.4724		12.0		110		14.0		62		1.00
13547204N3	96674		12.0	.4724		12.0		76		14.0		38		1.50
13547204N5	96680		12.0	.4724		12.0		110		14.0		62		1.50
13547205N3	96675		12.0	.4724		12.0		76		14.0		38		2.00
13547205N5	96681		12.0	.4724		12.0		110		14.0		62		2.00
13547207N3	96676		12.0	.4724		12.0		76		14.0		38		3.00
13547207N5	96682		12.0	.4724		12.0		110		14.0		62		3.00
13547209N3	96677		12.0	.4724		12.0		76		14.0		38		4.00
13547209N5	96683		12.0	.4724		12.0		110		15.0		62		4.00
13547240N	13575		12.0	.4724		12.0		76		14.0		28		0.50
13547241N	13576		12.0	.4724		12.0		102		14.0		54		0.50
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	
13562900N3	96684		16.0	.6299		16.0		117		18.0		53		
13562901N3	96685		16.0	.6299		16.0		117		18.0		53		0.50
13562901N5	96691		16.0	.6299		16.0		127		18.0		85		0.50
13562903N3	96686		16.0	.6299		16.0		117		18.0		53		1.00
13562903N5	96692		16.0	.6299		16.0		127		18.0		85		1.00
13562904N3	96687		16.0	.6299		16.0		117		18.0		53		1.50

Technical information on page 224.

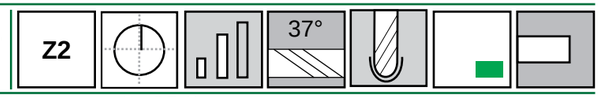
Series 135N Continued



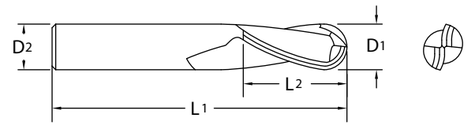
Necked		Diameter			Shank		OAL		Flute Length		Neck Length		Corner Radius	
		D1			D2		L1		L2		L3		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13562904N5	96693		16.0	.6299		16.0		127		18.0		85		1.50
13562905N3	96688		16.0	.6299		16.0		117		18.0		53		2.00
13562905N5	96694		16.0	.6299		16.0		127		18.0		85		2.00
13562907N3	96689		16.0	.6299		16.0		117		18.0		53		3.00
13562907N5	96695		16.0	.6299		16.0		127		18.0		85		3.00
13562909N3	96690		16.0	.6299		16.0		117		18.0		53		4.00
13562909N5	96696		16.0	.6299		16.0		127		18.0		85		4.00
13562990N	13585		16.0	.6299		16.0		89		18.0		39		0.75
13562991N	13586		16.0	.6299		16.0		117		18.0		83		0.75
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
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	
135787011N3	96722		20.0	.7874		20.0		127		22.0		65		5.00
135787011N5	96724		20.0	.7874		20.0		152		22.0		105		5.00
13578701N3	96697		20.0	.7874		20.0		127		22.0		65		0.50
13578701N5	96703		20.0	.7874		20.0		152		22.0		105		0.50
13578703N3	96698		20.0	.7874		20.0		127		22.0		65		1.00
13578703N5	96704		20.0	.7874		20.0		152		22.0		105		1.00
13578704N3	96699		20.0	.7874		20.0		127		22.0		65		1.50
13578704N5	96705		20.0	.7874		20.0		152		22.0		105		1.50
13578705N3	96700		20.0	.7874		20.0		127		22.0		65		2.00
13578705N5	96706		20.0	.7874		20.0		152		22.0		105		2.00
13578707N3	96701		20.0	.7874		20.0		127		22.0		65		3.00
13578707N5	96707		20.0	.7874		20.0		152		22.0		105		3.00
13578709N3	96702		20.0	.7874		20.0		127		22.0		65		4.00
13578709N5	96708		20.0	.7874		20.0		152		22.0		105		4.00
13578740N	13594		20.0	.7874		20.0		102		22.0		50		0.75
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
13598401N3	96709		25.0	.9843		25.0		127		25.0		80		0.50
13598401N5	96715		25.0	.9843		25.0		180		25.0		130		0.50
13598403N3	96710		25.0	.9843		25.0		127		25.0		80		1.00
13598403N5	96716		25.0	.9843		25.0		180		25.0		130		1.00
13598404N3	96711		25.0	.9843		25.0		127		25.0		80		1.50
13598404N5	96717		25.0	.9843		25.0		180		25.0		130		1.50
13598405N3	96712		25.0	.9843		25.0		127		25.0		80		2.00
13598405N5	96718		25.0	.9843		25.0		180		25.0		130		2.00
13598407N3	96713		25.0	.9843		25.0		127		25.0		80		3.00
13598407N5	96719		25.0	.9843		25.0		180		25.0		130		3.00
13598409N3	96714		25.0	.9843		25.0		127		25.0		80		4.00
13598409N5	96720		25.0	.9843		25.0		180		25.0		130		4.00
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
13598432N	13599		25.0	.9843		25.0		152		25.0		86		0.75
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	

Technical information on page 224.

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.
- Zirconium coating also available.

Uncoated		Diameter		Shank	OAL	Flute Length
		D1		D2	L1	L2
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

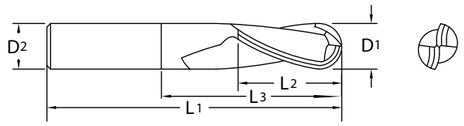
Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
> 1/4-1	+.000/-.003

Technical information on page 228.

TuffCut® AL Series 135BN

Z2 | 37° | N

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.
- Zirconium coating also available.

Uncoated		Diameter			Shank		OAL		Flute Length		Neck Length	
		D1			D2		L1		L2		L3	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
135B0787N5	13252		2.0	.0787		6.0		75.0		4.0		12.0
135B1181N3	13236		3.0	.1181		3.0		38.0		5.0		11.0
135B1181N5	13254		3.0	.1181		6.0		75.0		5.0		17.0
135B1575N3	13238		4.0	.1575		4.0		51.0		6.0		14.0
135B1575N5	13256		4.0	.1575		6.0		75.0		6.0		22.0
135B1968N3	13240		5.0	.1968		5.0		64.0		7.0		17.0
135B1968N5	13258		5.0	.1968		6.0		75.0		7.0		27.0
135B2362N3	13242		6.0	.2362		6.0		64.0		8.0		20.0
135B2362N5	13260		6.0	.2362		6.0		110.0		8.0		32.0
135B25001N	13482	1/4		.2500	1/4		4		3/4		2-1/8	
135B31251N	13484	5/16		.3125	5/16		4		13/16		2-1/8	
135B3150N3	13244		8.0	.3150		8.0		64.0		10.0		26.0
135B3150N5	13262		8.0	.3150		8.0		110.0		10.0		42.0
135B37501N	13486	3/8		.3750	3/8		4		1		2-1/8	
135B3937N3	13246		10.0	.3937		10.0		70.0		12.0		32.0
135B3937N5	13264		10.0	.3937		10.0		110.0		12.0		52.0
135B4724N3	13248		12.0	.4724		12.0		76.0		16.0		38.0
135B4724N5	13266		12.0	.4724		12.0		120.0		16.0		62.0
135B50001N	13488	1/2		.5000	1/2		4		1-1/4		2-1/8	
135B62501N	13490	5/8		.6250	5/8		6		1-5/8		3-3/8	
135B6299N3	13250		16.0	.6299		16.0		89.0		20.0		50.0
135B6299N5	13268		16.0	.6299		16.0		130.0		20.0		82.0
135B75001N	13492	3/4		.7500	3/4		6		1-5/8		3-3/8	
135B10000N	13494	1		1.0000	1		6		1-1/2		3-1/4	

Inch	
D1	Tolerance
1/4	+.000/-.002
> 1/4-1	+.000/-.003

Metric (mm)	
D1	Tolerance h10
2.00-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-16.00	+.000/-.070

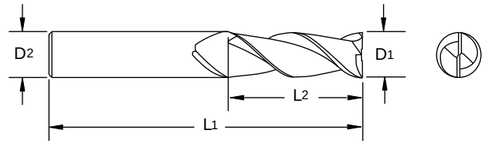
Technical information on page 228.

TuffCut® AL Series 136

Z2 | 45°

High performance aluminum finisher out performs competitors.

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



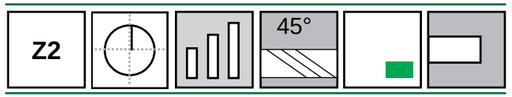
Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
13611810	13600		3.0	.1181		6.0		52		8.0
13612500	13641	1/8		.1250	1/8		1-1/2		1/4	
13612501	13642	1/8		.1250	1/8		1-1/2		1/2	
13612502	13643	1/8		.1250	1/8		2-1/2		1	
13612503	13671	1/8		.1250	1/8		1-1/2		3/8	
13612504	13672	1/8		.1250	1/8		2		3/4	
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	
13618751	13646	3/16		.1875	3/16		2-1/2		5/8	
13618752	13647	3/16		.1875	3/16		2-1/2		1	
13618753	13675	3/16		.1875	3/16		2		3/8	
13618754	13676	3/16		.1875	3/16		2-1/2		3/4	
13619680	13605		5.0	.1968		6.0		58		13.0
13623620	13610		6.0	.2362		6.0		58		13.0
13625000	13640	1/4		.2500	1/4		2-1/2		3/4	
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	
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	
13625006	13681	1/4		.2500	1/4		2-1/2		1	
13625007	13682	1/4		.2500	1/4		3		1-1/2	
13625008	13683	1/4		.2500	1/4		4		2	
13631250	13651	5/16		.3125	5/16		2		1/2	
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	
13631253	13684	5/16		.3125	5/16		2		7/16	
13631254	13685	5/16		.3125	5/16		2-1/2		13/16	
13631500	13615		8.0	.3150		8.0		64		19.0
13637500	13645	3/8		.3750	3/8		2-1/2		3/4	
13637501	13654	3/8		.3750	3/8		3-1/4		1-1/2	
13637502	13660	3/8		.3750	3/8		4-1/4		2-1/2	
13637503	13686	3/8		.3750	3/8		2		1/2	
13637504	13687	3/8		.3750	3/8		2		5/8	
13637505	13688	3/8		.3750	3/8		2-1/2		1	
13637506	13689	3/8		.3750	3/8		3		1-1/4	

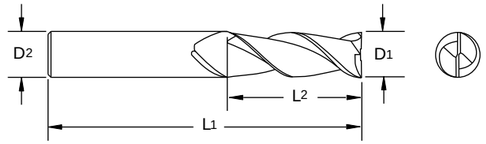
Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
>1/4-1.0	+.000/-.003

Metric (mm)	
D1	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

Technical information on page 226.

Series 136 Continued

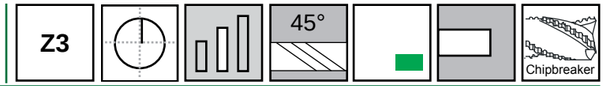




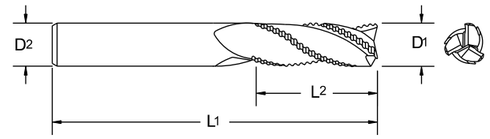
Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
13637507	13690	3/8		.3750	3/8		4		2	
13639370	13620		10.0	.3937		10.0		70		22.0
13647240	13625		12.0	.4724		12.0		84		26.0
13650000	13650	1/2		.5000	1/2		3-1/2		1-1/4	
13650001	13661	1/2		.5000	1/2		4		2	
13650002	13662	1/2		.5000	1/2		5		3	
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	
13650006	13694	1/2		.5000	1/2		4		1-1/2	
13650007	13695	1/2		.5000	1/2		5		2-1/2	
13655120	13626		14.0	.5512		14.0		84		26.0
13662500	13663	5/8		.6250	5/8		3-1/2		3/4	
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	
13662503	13696	5/8		.6250	5/8		3-1/2		1-1/4	
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
13675000	13655	3/4		.7500	3/4		4		1-5/8	
13675001	13666	3/4		.7500	3/4		5-1/4		3	
13675002	13667	3/4		.7500	3/4		6-1/4		4	
13675003	13698	3/4		.7500	3/4		4		1	
13675004	13699	3/4		.7500	3/4		5		2	
13675005	13601	3/4		.7500	3/4		5		2-1/2	
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	
13610002	13670	1		1.0000	1		6-1/2		4	
13610003	13603	1		1.0000	1		6		3	
13610004	13604	1		1.0000	1		8		5-1/2	

Technical information on page 226.

TuffCut® AL Series 134



High helix 3 flute design ideal for rapid stock removal in aluminum alloys.



- Unique geometry.
- Improved chip flow and prevents chips from packing in flute.

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
13423620	13409		6.0	.2362		6.0		64		20.0
13425000	13411	1/4		.2500	1/4		2-1/2		3/4	
13431500	13414		8.0	.3150		8.0		64		20.0
13437500	13417	3/8		.3750	3/8		2-1/2		7/8	
13439370	13419		10.0	.3937		10.0		70		25.0
13447240	13423		12.0	.4724		12.0		76		25.0
13450000	13425	1/2		.5000	1/2		3		1	
13455120	95321		14.0	.5512		14.0		89		30.0
13462990	13429		16.0	.6299		16.0		89		30.0
13470870	13430		18.0	.7087		18.0		102		35.0
13475000	13431	3/4		.7500	3/4		4		1-1/2	
13478740	13433		20.0	.7874		20.0		102		38.0
13498430	13435		25.0	.9843		25.0		102		50.0
13410000	13401	1		1.0000	1		4		2	

Inch	
D1	Tolerance
1/4-1	+.000/-.005

Metric (mm)	
D1	Tolerance
6.00-25.00	+.000/-.127

Technical information on page 224.

Designed and Manufactured in the USA

ISO 9001:2000 Certified

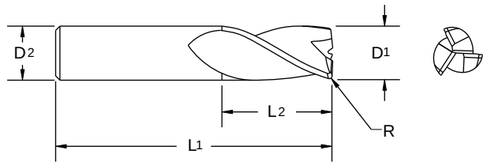
An ESOP Company

TuffCut® X-AL Series 137

Z3 | 30° | Fordlube

High performance aluminum rougher.

- Gem coating available upon request.



Uncoated		Fordlube*		Diameter			Shank		OAL		Flute Length		Corner Radius	
				D1			D2		L1		L2		R	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13718750	13700	13718750F	14346	3/16		.1875	3/16		2		1/4		0.008	
13718751	14415	13718751F	14347	3/16		.1875	3/16		3		1/4		0.008	
13719680	13701	13719680F	14348		5.0	.1968		5.0		51		6.0		0.25
13723620	13702	13723620F	14349		6.0	.2362		6.0		64		7.0		0.30
13725000	13703	13725000F	14350	1/4		.2500	1/4		2-1/2		5/16		0.011	
13725001	14416	13725001F	14351	1/4		.2500	1/4		3-1/2		5/16		0.011	
13731500	13704	13731500F	14352		8.0	.3150		8.0		64		9.5		0.35
13737500	13705	13737500F	14353	3/8		.3750	3/8		2-1/2		1/2		0.015	
13737501	13706	13737501F	14354	3/8		.3750	3/8		3		1/2		0.015	
13737502	13707	13737502F	14355	3/8		.3750	3/8		4		1/2		0.015	
13739370	13708	13739370F	14356		10.0	.3937		10.0		70		12.0		0.50
13739371	13709	13739371F	14357		10.0	.3937		10.0		76		12.0		0.50
13739372	13710	13739372F	14358		10.0	.3937		10.0		89		12.0		0.50
13747240	13711	13747240F	14414		12.0	.4724		12.0		76		14.0		0.50
13747241	13712	13747241F	14360		12.0	.4724		12.0		102		14.0		0.50
13747242	13713	13747242F	14361		12.0	.4724		12.0		127		14.0		0.50
13750000	13714	13750000F	14362	1/2		.5000	1/2		3		5/8		0.020	
13750001	13715	13750001F	14363	1/2		.5000	1/2		4		5/8		0.020	
13750002	13716	13750002F	14364	1/2		.5000	1/2		5		5/8		0.020	
13762500	14417	13762500F	14429	5/8		.6250	5/8		3-1/2		3/4		0.025	
13762501	14418	13762501F	14430	5/8		.6250	5/8		4-5/8		3/4		0.025	
13762502	14419	13762502F	14431	5/8		.6250	5/8		5-1/4		3/4		0.025	
13762990	13717	13762990F	14365		16.0	.6299		16.0		89		18.0		0.75
13762991	13718	13762991F	14366		16.0	.6299		16.0		117		18.0		0.75
13762992	13719	13762992F	14367		16.0	.6299		16.0		133		18.0		0.75
13775000	13720	13775000F	14368	3/4		.7500	3/4		4		1		0.030	
13775001	13721	13775001F	14369	3/4		.7500	3/4		5		1		0.030	
13775002	13722	13775002F	14370	3/4		.7500	3/4		6		1		0.030	
13778740	13723	13778740F	14371		20.0	.7874		20.0		102		22.0		0.75
13778741	13724	13778741F	14372		20.0	.7874		20.0		127		22.0		0.75
13778742	13725	13778742F	14373		20.0	.7874		20.0		152		22.0		0.75
13798430	13726	13798430F	14374		25.0	.9843		25.0		102		25.0		0.75
13798431	13727	13798431F	14375		25.0	.9843		25.0		127		25.0		0.75
13798432	13728	13798432F	14376		25.0	.9843		25.0		152		25.0		0.75
13710000	13729	13710000F	14377	1		1.0000	1		4		1-1/4		0.045	
13710001	13730	13710001F	14378	1		1.0000	1		5		1-1/4		0.045	
13710002	13731	13710002F	14379	1		1.0000	1		6		1-1/4		0.045	

Inch	
D1	Tolerance
3/16-1/4	+.000/-.002
> 1/4-1	+.000/-.003

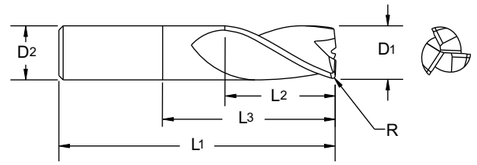
Metric (mm)	
D1	Tolerance h10
5.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-25.00	+.000/-.084

*Allow 2 weeks to ship non-stock items.

Technical information on page 224.

TuffCut® X-AL Series 137N

Z3 | 30° | Fordlube | N



Necked Uncoated		Necked Fordlube*		Diameter			Shank		OAL		Flute Length		Neck Length		Corner Radius	
				D1			D2		L1		L2		L3		R	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13718750N	13732	13718750NF	14380	3/16		.1875	3/16		2		1/4		9/16		0.008	
13718751N	13733	13718751NF	14381	3/16		.1875	3/16		3		1/4		1-9/16		0.008	
13719680N	13734	13719680NF	14382		5.0	.1968		5.0		51		6.0		22		0.25
13723620N	13735	13723620NF	14383		6.0	.2362		6.0		64		7.0		26		0.30
13725000N	13736	13725000NF	14384	1/4		.2500	1/4		2-1/2		5/16		3/4		0.011	
13725001N	13737	13725001NF	14385	1/4		.2500	1/4		3-1/2		5/16		1-3/4		0.011	
13731500N	13738	13731500NF	14386		8.0	.3150		8.0		64		9.5		26		0.35
13737500N	13739	13737500NF	14387	3/8		.3750	3/8		2-1/2		1/2		7/8		0.015	
13737501N	13740	13737501NF	14388	3/8		.3750	3/8		3		1/2		1-3/8		0.015	
13737502N	13741	13737502NF	14389	3/8		.3750	3/8		4		1/2		2-3/8		0.015	
13739370N	13742	13739370NF	14390		10.0	.3937		10.0		70		12.0		28		0.50
13739371N	13743	13739371NF	14391		10.0	.3937		10.0		76		12.0		34		0.50
13739372N	13744	13739372NF	14392		10.0	.3937		10.0		89		12.0		47		0.50
13747240N	13745	13747240NF	14393		12.0	.4724		12.0		76		14.0		28		0.50
13747241N	13746	13747241NF	14394		12.0	.4724		12.0		102		14.0		54		0.50
13747242N	13747	13747242NF	14395		12.0	.4724		12.0		127		14.0		79		0.50
13750000N	13748	13750000NF	14396	1/2		.5000	1/2		3		5/8		1-1/8		0.020	
13750001N	13749	13750001NF	14397	1/2		.5000	1/2		4		5/8		2-1/8		0.020	
13750002N	13750	13750002NF	14398	1/2		.5000	1/2		5		5/8		3-1/8		0.020	
13762500N	14420	13762500NF	14432	5/8		.6250	5/8		3-1/2		3/4		1-1/2		0.025	
13762501N	14421	13762501NF	14433	5/8		.6250	5/8		4-5/8		3/4		2-1/2		0.025	
13762502N	14422	13762502NF	14434	5/8		.6250	5/8		5-1/4		3/4		3-1/2		0.025	
13762990N	13751	13762990NF	14399		16.0	.6299		16.0		89		18.0		39		0.75
13762991N	13752	13762991NF	14400		16.0	.6299		16.0		117		18.0		83		0.75
13762992N	13753	13762992NF	14401		16.0	.6299		16.0		133		18.0		99		0.75
13775000N	13754	13775000NF	14402	3/4		.7500	3/4		4		1		1-7/8		0.030	
13775001N	13755	13775001NF	14403	3/4		.7500	3/4		5		1		2-7/8		0.030	
13775002N	13756	13775002NF	14404	3/4		.7500	3/4		6		1		3-7/8		0.030	
13778740N	13757	13778740NF	14405		20.0	.7874		20.0		102		22.0		50		0.75
13778741N	13758	13778741NF	14406		20.0	.7874		20.0		127		22.0		75		0.75
13778742N	13759	13778742NF	14407		20.0	.7874		20.0		152		22.0		100		0.75
13798430N	13760	13798430NF	14408		25.0	.9843		25.0		102		25.0		36		0.75
13798431N	13761	13798431NF	14409		25.0	.9843		25.0		127		25.0		61		0.75
13798432N	13762	13798432NF	14410		25.0	.9843		25.0		152		25.0		86		0.75
13710000N	13763	13710000NF	14411	1		1.0000	1		4		1-1/4		1-5/8		0.045	
13710001N	13764	13710001NF	14412	1		1.0000	1		5		1-1/4		2-5/8		0.045	
13710002N	13765	13710002NF	14413	1		1.0000	1		6		1-1/4		3-5/8		0.045	

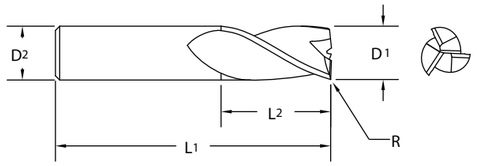
*Allow 2 weeks to ship non-stock items.

Technical information on page 224.

TuffCut® X-AL Series 138

Z3 | 36° | Fordlube

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



- Gem coating available upon request.

Inch	
D1	Tolerance
1/8-1-1/4	+.000/-.0005

Metric (mm)	
D1	Tolerance h10
3.00-20.00	+.000/-.013

Uncoated		Fordlube*		Diameter			Shank		OAL		Flute Length		Corner Radius	
				D1			D2		L1		L2		R	
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			
13825001	13815	13825001F	14218	1/4		.2500	1/4		2		1/2			
13825002	13816	13825002F	14219	1/4		.2500	1/4		4		1/2			
13825003	13817	13825003F	14220	1/4		.2500	1/4		2		5/8			
13825004	13818	13825004F	14221	1/4		.2500	1/4		2-1/2		3/4			
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			
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			

* 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.

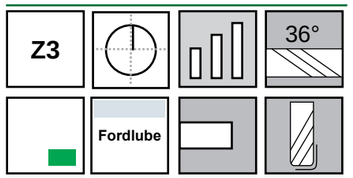
Technical information on page 226.

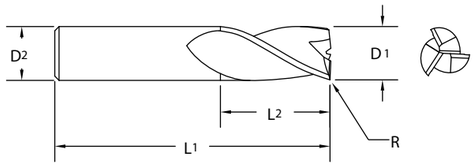
3 Flute
Series 138
TuffCut® X-AL

Uncoated		Fordlube*		Diameter			Shank		OAL		Flute Length		Corner Radius	
				D1			D2		L1		L2		R	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
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			
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			
13831256	13831	13831256F	14234	5/16		.3125	5/16		3-1/8		1-3/8			
13831257	13832	13831257F	14235	5/16		.3125	5/16		3		1-1/4			
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			
13837501	13835	13837501F	14238	3/8		.3750	3/8		2-1/2		9/16			
13837502	13836	13837502F	14239	3/8		.3750	3/8		2		5/8			
13837503	13837	13837503F	14240	3/8		.3750	3/8		4		5/8			
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			
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			
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			
13837510	13844	13837510F	14247	3/8		.3750	3/8		3		9/16			
13837511	13845	13837511F	14248	3/8		.3750	3/8		3		1			
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			
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			
13850004	13852	13850004F	14255	1/2		.5000	1/2		4		1-1/2			
13850005	13853	13850005F	14256	1/2		.5000	1/2		4		2			
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			
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			

Technical information on page 226.

Series 138 Continued



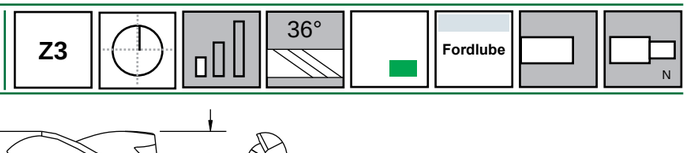


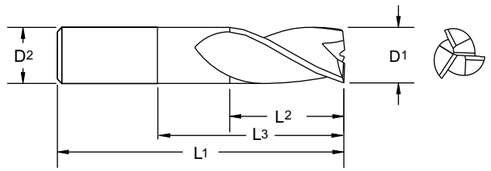
Uncoated		Fordlube*		Diameter			Shank		OAL		Flute Length		Corner Radius	
				D1			D2		L1		L2		R	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13862505	13863	13862505F	14266	5/8		.6250	5/8		5		2			
13862506	13864	13862506F	14267	5/8		.6250	5/8		5		2-1/2			
13862507	13865	13862507F	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			
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			
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			
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	1.00		6		1-1/4			
13810001	13880	13810001F	14283	1.00		1.0000	1.00		8		1-1/4			
13810002	13881	13810002F	14284	1.00		1.0000	1.00		4		1-1/2			
13810003	13882	13810003F	14285	1.00		1.0000	1.00		5		2			
13810004	13883	13810004F	14286	1.00		1.0000	1.00		5		2-1/2			
13810005	13884	13810005F	14287	1.00		1.0000	1.00		6		3			
13810006	13885	13810006F	14288	1.00		1.0000	1.00		6		3-1/2			
13810007	13886	13810007F	14289	1.00		1.0000	1.00		6		4			
13810008	13887	13810008F	14290	1.00		1.0000	1.00		7		4-1/8			
13810009	13888	13810009F	14291	1.00		1.0000	1.00		8		5-1/2			
13812510	13889	13812510F	14292	1-1/4		1.2500	1-1/4		6		2			
13812511	13890	13812511F	14293	1-1/4		1.2500	1-1/4		8		5			
13812512	13891	13812512F	14294	1-1/4		1.2500	1-1/4		12		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.

Technical information on page 226.

TuffCut® X-AL Series 138N





Inch	
D1	Tolerance
1/4-1.0	+.000/-.0005

Uncoated		Fordlube*		Diameter D1 Inch		Shank	OAL	Flute Length	Neck Length
Tool No.	EDP	Tool No.	EDP	Size	Decimal	D2 Inch	L1 Inch	L2 Inch	L3 Inch
13825002N	14450	13825002NF	14459	1/4	.2500	1/4	4	1/2	1-1/8
13831252N	14451	13831252NF	14460	5/16	.3125	5/16	4	7/16	2-1/8
13837503N	14452	13837503NF	14461	3/8	.3750	3/8	4	5/8	2-1/8
13850000N	14453	13850000NF	14462	1/2	.5000	1/2	3	5/8	1-3/8
13850010N	14454	13850010NF	14463	1/2	.5000	1/2	4	5/8	2-1/8
13850011N	14455	13850011NF	14464	1/2	.5000	1/2	6	3/4	3-3/8
13862501N	14456	13862501NF	14465	5/8	.6250	5/8	6	3/4	3-3/8
13875002N	14457	13875002NF	14466	3/4	.7500	3/4	6	1	3-3/8
13810000N	14458	13810000NF	14467	1.00	1.0000	1.00	6	1-1/4	3-3/8

* 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.

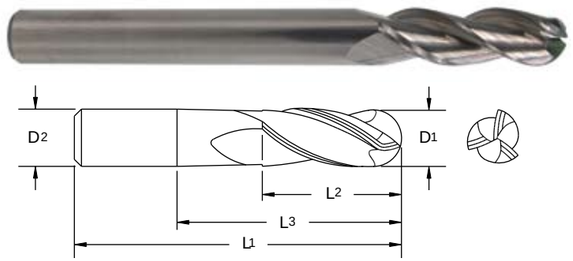
Technical information on page 226.

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.

TuffCut® X-AL Series 138B

Z3 | 36°

Designed for extreme productivity.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
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	
D1	Tolerance
1/8-1.0	+.0000/-.0005

Metric (mm)	
D1	Tolerance
2.00-16.00	+.000/-.013

Technical information on page 228.

TuffCut® X-AL Series 138BN

Z3 | 36° | N

Necked		Diameter			Shank		OAL		Flute Length		Neck Length	
		D1			D2		L1		L2		L3	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
138B0787N5	13372		2.0	.0787		6.0		75.0		4.0		12.0
138B1181N5	13374		3.0	.1181		6.0		75.0		5.0		17.0
138B1575N5	13376		4.0	.1575		6.0		75.0		6.0		22.0
138B1968N5	13378		5.0	.1968		6.0		75.0		7.0		27.0
138B2362N5	13380		6.0	.2362		6.0		110.0		8.0		32.0
138B25001N	13342	1/4		.2500	1/4		4		3/4		2-1/8	
138B31251N	13344	5/16		.3125	5/16		4		13/16		2-1/8	
138B3150N5	13382		8.0	.3150		8.0		110.0		10.0		42.0
138B37501N	13346	3/8		.3750	3/8		4		1		2-1/8	
138B3937N5	13384		10.0	.3937		10.0		110.0		12.0		52.0
138B4724N5	13386		12.0	.4724		12.0		120.0		16.0		62.0
138B50001N	13348	1/2		.5000	1/2		4		1-1/4		2-1/8	
138B62501N	13350	5/8		.6250	5/8		6		1-5/8		3-3/8	
138B6299N5	13388		16.0	.6299		16.0		130.0		20.0		82.0
138B75001N	13352	3/4		.7500	3/4		6		1-5/8		3-3/8	
138B10000N	13354	1		1.0000	1		6		1-1/2		3-1/4	

Technical information on page 228.

ISO 9001:2000 Certified

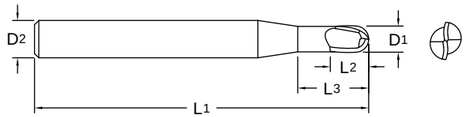
An ESOP Company

TuffCut® DM Series 156

Z2 | 12° | ALtima® 52 | N

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

NEW SIZES



ALtima® 52		Diameter			Shank		OAL		Flute Length		Neck Length	
		D1			D2		L1		L2		L3	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
15601560A	15600	1/64		.0156	1/4		2-1/2		1/64		1/64	
15601960A	15602		0.5	.0196		6.0		63		0.5		0.5
15603120A	15604	1/32		.0312	1/4		2-1/2		1/32		1/32	
15603121A	15606	1/32		.0312	1/4		2-1/2		1/32		1/4	
15603122A	15608	1/32		.0312	1/4		2-1/2		1/32		5/16	
15603123A	15610	1/32		.0312	1/4		2-1/2		1/32		3/8	
15603124A	15612	1/32		.0312	1/4		2-1/2		1/32		1/2	
15603125A	15614	1/32		.0312	1/4		2-1/2		1/32		5/8	
15603940A	15616		1.0	.0394		6.0		63		1.0		1.0
15603941A	15618		1.0	.0394		6.0		63		1.0		6.0
15603942A	15620		1.0	.0394		6.0		63		1.0		8.0
15603943A	15622		1.0	.0394		6.0		63		1.0		10.0
15603944A	15624		1.0	.0394		6.0		63		1.0		12.0
15603945A	15626		1.0	.0394		6.0		63		1.0		16.0
15605910A	15628		1.5	.0591		6.0		63		1.5		1.5
15606250A	15630	1/16		.0625	1/4		2-1/2		1/16		1/16	
15607870A	15632		2.0	.0787		6.0		63		2.0		2.0
15607871A	15634		2.0	.0787		6.0		63		2.0		8.0
15607872A	15636		2.0	.0787		6.0		63		2.0		12.0
15607873A	15638		2.0	.0787		6.0		63		2.0		20.0
15609370A	15640	3/32		.0937	1/4		2-1/2		3/32		3/32	
15609371A	15642	3/32		.0937	1/4		2-1/2		3/32		5/16	
15609372A	15644	3/32		.0937	1/4		2-1/2		3/32		1/2	
15609373A	15646	3/32		.0937	1/4		2-1/2		3/32		3/4	
15611810A	15648		3.0	.1181		6.0		75		3.0		3.0
15611811A	15650		3.0	.1181		6.0		75		3.0		20.0
15611812A	15676		3.0	.1181		6.0		75		3.0		12.0
15612500A	15652	1/8		.1250	1/4		3		1/8		1/8	
15612501A	15654	1/8		.1250	1/4		3		1/8		3/4	
15615620A	15656	5/32		.1562	1/4		3		5/32		5/32	
15615750A	15658		4.0	.1575		6.0		75		4.0		4.0
15615751A	15678		4.0	.1575		6.0		75		4.0		12.0
15615752A	15679		4.0	.1575		6.0		75		4.0		20.0
15619680A	15680		5.0	.1968		6.0		75		5.0		5.0
15619681A	15681		5.0	.1968		6.0		75		5.0		12.0
15619682A	15682		5.0	.1968		6.0		75		5.0		25.0
15623620A	15660		6.0	.2362		6.0		75		6.0		6.0
15623621A	15683		6.0	.2362		6.0		75		6.0		12.0
15623622A	15684		6.0	.2362		6.0		75		6.0		25.0
15625000A	15662	1/4		.2500	1/4		3		1/4		1/4	
15631250A	15664	5/16		.3125	5/16		3-1/8		5/16		5/16	
15631500A	15666		8.0	.3150		8.0		80		8.0		8.0
15637500A	15668	3/8		.3750	3/8		3-1/4		3/8		3/8	
15639370A	15670		10.0	.3937		10.0		82		10.0		
15647240A	15672		12.0	.4724		12.0		100		12.0		
15650000A	15674	1/2		.5000	1/2		4		1/2		1/2	

Inch	
D1	Tolerance
1/64-1/4	+.0004/-.0004
≥ 1/4-1/2	+.0004/-.0008

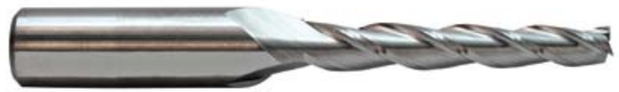
Metric (mm)	
D1	Tolerance
0.50-6.00	+.0102/-.0102
>6.00-12.00	+.0102/-.0203

Technical information on page 230.

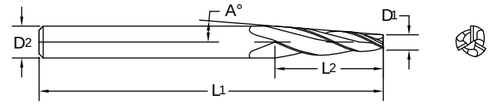
TuffCut® DM Series 198

Z3 | 30° constant lead

Designed for cutting ribs and draft forming in molds, these tapered end mills provide maximum productivity.



- Coatings available upon request.
- 7 common taper angles.



Tool No.	EDP	Diameter		Shank	OAL	Flute Length	Angle
		D1	Decimal	D2	L1	L2	A
19825001	95357	1/8	.1250	1/4	3	1-1/2	1°
19825002	95358	1/8	.1250	1/4	3	1-1/2	1-1/2°
19825003	95359	1/8	.1250	1/4	3	1 -1/4	2°
19825004	95360	1/8	.1250	1/4	3	1	3°
19825005	95361	1/8	.1250	1/4	3	3/4	5°
19825006	95362	1/8	.1250	1/4	3	1/2	7°
19825007	95363	3/32	.0937	1/4	3	1/2	10°
19837501	95364	3/16	.1875	3/8	3-1/2	1-3/4	1°
19837502	95365	3/16	.1875	3/8	3-1/2	1-3/4	1-1/2°
19837503	95366	3/16	.1875	3/8	3-1/2	1-3/4	2°
19837504	95367	5/32	.1562	3/8	3-1/2	1-3/4	3°
19837505	95368	1/8	.1250	3/8	3-1/2	1-1/2	5°
19837506	95369	1/8	.1250	3/8	3-1/2	1	7°
19837507	95370	1/8	.1250	3/8	3-1/2	3/4	10°
19850001	95371	1/4	.2500	1/2	4	2	1°
19850003	95372	1/4	.2500	1/2	4	2	2°
19850004	95373	1/4	.2500	1/2	4	2	3°
19850005	95374	1/4	.2500	1/2	4	1-1/4	5°
19850006	95375	3/16	.1875	1/2	4	1-1/4	7°
19850007	95376	1/8	.1250	1/2	4	1	10°

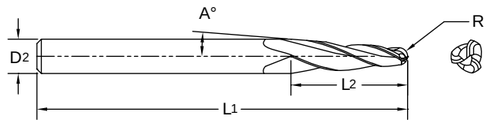
Inch	
D1	Tolerance
3/32-1/4	+.001/-.002

Technical information on page 248.

TuffCut® DM Series 199

Z3 | 30° constant lead

Designed for cutting ribs and draft forming in molds, these tapered end mills provide maximum productivity.



- Coatings available upon request.
- 7 common taper angles.

Tool No.	EDP	Radius	Shank	OAL	Flute Length	Angle
		R	D2	L1	L2	A
19925001	95337	.0625	1/4	3	1-1/2	1°
19925002	95338	.0625	1/4	3	1-1/2	1-1/2°
19925003	95339	.0625	1/4	3	1-1/4	2°
19925004	95340	.0625	1/4	3	1	3°
19925005	95341	.0625	1/4	3	3/4	5°
19925006	95342	.0625	1/4	3	1/2	7°
19925007	95343	.0470	1/4	3	1/2	10°
19937501	95344	.0930	3/8	3-1/2	1-3/4	1°
19937502	95345	.0930	3/8	3-1/2	1-3/4	1-1/2°
19937503	95346	.0930	3/8	3-1/2	1-3/4	2°
19937504	95347	.0780	3/8	3-1/2	1-3/4	3°
19937505	95348	.0625	3/8	3-1/2	1-1/2	5°
19937506	95349	.0625	3/8	3-1/2	1	7°
19937507	95350	.0625	3/8	3-1/2	3/4	10°
19950001	95351	.1250	1/2	4	2	1°
19950003	95352	.1250	1/2	4	2	2°
19950004	95353	.1250	1/2	4	2	3°
19950005	95354	.1250	1/2	4	1-1/4	5°
19950006	95355	.0930	1/2	4	1-1/4	7°
19950007	95356	.0625	1/2	4	1	10°

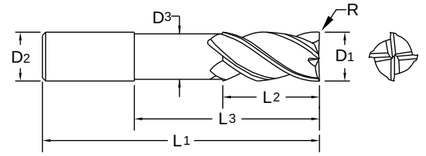
Inch	
R	Tolerance
3/64-1/8	+.0005/-.0010

Technical information on page 248.

TuffCut® DM Series 158

Z4 | 35°/38° | ALtima® 52 | N

Series 158 was designed with similar TuffCut® XR geometry, but incorporates features that make it an excellent tool for die and mold steels and hard to machine materials up to 65 Rc. Coated with ALtima® 52 for materials Rc 52 and above.



ALtima® 52		Diameter D1		Shank	Neck Diameter	OAL	Flute Length	Neck Length	Radius
Tool No.	EDP	mm	Decimal	D2 h6	D3	L1	L2	L3	R
15811800N3A	15522	3	.1181	6	2.9	50	5	9	
15811800N5A	15524	3	.1181	6	2.9	50	5	15	
15811800R012N3A	15526	3	.1181	6	2.9	50	5	9	0.3
15811800R012N5A	15528	3	.1181	6	2.9	50	5	15	0.3
15811800R031N5A	15530	3	.1181	6	2.9	50	5	15	0.8
15823600N3A	15532	6	.2362	6	5.8	100	9	18	
15823600N5A	15534	6	.2362	6	5.8	100	9	30	
15823600R012N3A	15536	6	.2362	6	5.8	100	9	18	0.3
15823600R012N5A	15538	6	.2362	6	5.8	100	9	30	0.3
15823600R059N5A	15540	6	.2362	6	5.8	100	9	30	1.5
15831500N3A	15542	8	.3150	8	7.6	100	12	24	
15831500N5A	15544	8	.3150	8	7.6	100	12	40	
15831500R012N3A	15546	8	.3150	8	7.6	100	12	24	0.3
15831500R012N5A	15548	8	.3150	8	7.6	100	12	40	0.3
15831500R079N5A	15550	8	.3150	8	7.6	100	12	40	2.0
15839300N3A	15552	10	.3937	10	9.6	100	15	30	
15839300N5A	15554	10	.3937	10	9.6	100	15	50	
15839300R012N3A	15556	10	.3937	10	9.6	100	15	30	0.3
15839300R012N5A	15558	10	.3937	10	9.6	100	15	50	0.3
15839300R079N5A	15560	10	.3937	10	9.6	100	15	50	2.0
15847200N3A	15562	12	.4724	12	11.4	100	18	36	
15847200N5A	15564	12	.4724	12	11.4	130	18	60	
15847200R012N3A	15566	12	.4724	12	11.4	100	18	36	0.3
15847200R012N5A	15568	12	.4724	12	11.4	130	18	60	0.3
15847200R079N5A	15570	12	.4724	12	11.4	130	18	60	2.0
15862900N3A	15572	16	.6299	16	15.2	130	24	48	
15862900N5A	15574	16	.6299	16	15.2	150	24	80	
15862900R012N3A	15576	16	.6299	16	15.2	130	24	48	0.3
15862900R012N5A	15578	16	.6299	16	15.2	150	24	80	0.3
15862900R118N5A	15580	16	.6299	16	15.2	150	24	80	3.0
15878700N5A	15582	20	.7874	20	19.2	150	30	100	
15878700R012N5A	15584	20	.7874	20	19.2	150	30	100	0.3
15878700R118N5A	15586	20	.7874	20	19.2	150	30	100	3.0

Technical information on page 234.

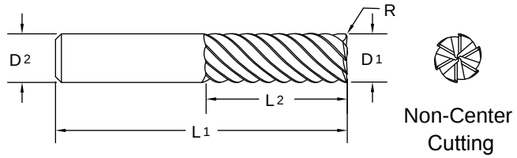
Inch	
D1	Tolerance
.0000 - .7874	+0/-.0008

Metric (mm)	
D1	Tolerance
0 - 20.0	+0/-.02

TuffCut® DM Series 157

Z Multi | 45° | ALtima® 52

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



Non-Center Cutting

ALtima® 52		Diameter			Shank		OAL		Flute Length		Corner Radius		No. of Flutes
		D1			D2		L1		L2		R		
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	
15711810A	15700		3	.1181		6		76		9			4
15711811A	15701		3	.1181		6		76		9		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		76		12			4
15715751A	15709		4	.1575		6		76		12		0.50	4
15715752A	15710		4	.1575		6		76		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
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		100		20			6
15731501A	15734		8	.3150		8		100		20		0.50	6
15731502A	15735		8	.3150		8		100		20		0.75	6
15731503A	15736		8	.3150		8		100		20		1.00	6
15731504A	15737		8	.3150		8		100		20		1.50	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

Inch	
D1	Tolerance
1/8-3/16	-.0006/-.0015
1/4-5/8	-.0008/-.0019
3/4-1	-.0008/-.0021

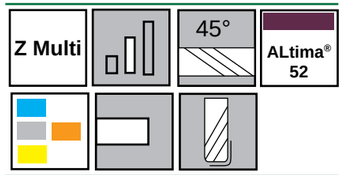
Metric (mm)	
D1	Tolerance
3.0	-.005/-.028
4.0-6.0	-.015/-.038
8.0-16.0	-.020/-.048
20.0-25.0	-.020/-.053

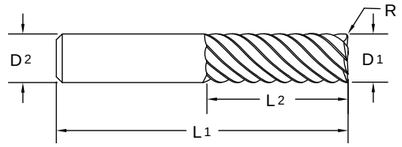
Technical information on page 232.

ALtima® 52		Diameter			Shank		OAL		Flute Length		Corner Radius		No. of Flutes
		D1			D2		L1		L2		R		
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	
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		100		25			6
15739371A	15744		10	.3937		10		100		25		0.50	6
15739372A	15745		10	.3937		10		100		25		0.75	6
15739373A	15746		10	.3937		10		100		25		1.00	6
15739374A	15747		10	.3937		10		100		25		1.50	6
15747240A	15748		12	.4724		12		100		30			6
15747241A	15749		12	.4724		12		100		30		0.50	6
15747242A	15750		12	.4724		12		100		30		0.75	6
15747243A	15751		12	.4724		12		100		30		1.00	6
15747244A	15752		12	.4724		12		100		30		1.50	6
15747245A	15753		12	.4724		12		100		30		2.00	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
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		150		40			6
15762991A	15768		16	.6299		16		150		40		0.50	6
15762992A	15769		16	.6299		16		150		40		0.75	6
15762993A	15770		16	.6299		16		150		40		1.00	6
15762994A	15771		16	.6299		16		150		40		1.50	6
15762995A	15772		16	.6299		16		150		40		2.00	6
15762996A	15773		16	.6299		16		150		40		2.50	6
15762997A	15774		16	.6299		16		150		40		3.00	6
15775000A	15775	3/4		.7500	3/4		6		1-7/8				8
15775001A	15776	3/4		.7500	3/4		6		1-7/8		0.015		8
15775002A	15777	3/4		.7500	3/4		6		1-7/8		0.020		8
15775003A	15778	3/4		.7500	3/4		6		1-7/8		0.030		8
15775004A	15779	3/4		.7500	3/4		6		1-7/8		0.045		8
15775005A	15780	3/4		.7500	3/4		6		1-7/8		0.060		8
15775006A	15781	3/4		.7500	3/4		6		1-7/8		0.090		8
15775007A	15782	3/4		.7500	3/4		6		1-7/8		0.125		8
15778740A	15783		20	.7874		20		150		45			8
15778741A	15784		20	.7874		20		150		45		0.50	8
15778742A	15785		20	.7874		20		150		45		0.75	8
15778743A	15786		20	.7874		20		150		45		1.00	8
15778744A	15787		20	.7874		20		150		45		1.50	8
15778745A	15788		20	.7874		20		150		45		2.00	8
15778746A	15789		20	.7874		20		150		45		2.50	8
15778747A	15790		20	.7874		20		150		45		3.00	8
15798430A	15791		25	.9843		25		150		50			10

Technical information on page 232.

Series 157 Continued





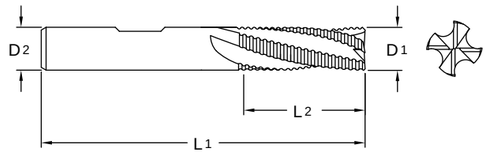
Non-Center Cutting

ALtima® 52		Diameter			Shank		OAL		Flute Length		Corner Radius		No. of Flutes
		D1			D2		L1		L2		R		
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm	
15798431A	15792		25	.9843		25		150		50		0.50	10
15798432A	15793		25	.9843		25		150		50		0.75	10
15798433A	15794		25	.9843		25		150		50		1.00	10
15798434A	15795		25	.9843		25		150		50		1.50	10
15798435A	15796		25	.9843		25		150		50		2.00	10
15798436A	15797		25	.9843		25		150		50		2.50	10
15798437A	15798		25	.9843		25		150		50		3.00	10
15710000A	15799	1		1.0000	1		6		2				10
15710001A	15800	1		1.0000	1		6		2		0.015		10
15710002A	15801	1		1.0000	1		6		2		0.020		10
15710003A	15802	1		1.0000	1		6		2		0.030		10
15710004A	15803	1		1.0000	1		6		2		0.045		10
15710005A	15804	1		1.0000	1		6		2		0.060		10
15710006A	15805	1		1.0000	1		6		2		0.090		10
15710007A	15806	1		1.0000	1		6		2		0.125		10

Technical information on page 232.

TuffCut® DM Series 192

Designed for high-speed machining of cast iron, mild steels and similar materials.



- High volumetric metal removal rates.
- Achieve 20% higher speed, 50% higher feed than a standard end mill.

ALtima®		TiN		Diameter			Shank		OAL		Flute Length		No. of Flutes
				D1			D2		L1		L2		
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	
19225000A	95730	19225000T	95447	1/4		.2500	1/4		2		1/4		3
19225001A	95737	19225001T	95454	1/4		.2500	1/4		2-1/2		3/4		3
19231500A	95744	19231500T	95461		8	.3150		8		51		8	3
19231501A	95749	19231501T	95466		8	.3150		8		64		16	3
19237500A	95731	19237500T	95448	3/8		.3750	3/8		2		3/8		4
19237501A	95738	19237501T	95455	3/8		.3750	3/8		2-1/2		7/8		4
19239370A	95745	19239370T	95462		10	.3937		10		51		10	4
19239371A	95750	19239371T	95467		10	.3937		10		70		20	4
19247240A	95746	19247240T	95463		12	.4724		12		64		12	4
19247241A	95751	19247241T	95468		12	.4724		12		76		25	4
19250000A	95732	19250000T	95449	1/2		.5000	1/2		2-1/2		1/2		4
19250001A	95739	19250001T	95456	1/2		.5000	1/2		3		1		4
19262500A	95733	19262500T	95450	5/8		.6250	5/8		3		5/8		4
19262501A	95740	19262501T	95457	5/8		.6250	5/8		3-1/2		1-1/4		4
19262990A	95747	19262990T	95464		16	.6299		16		76		16	4
19262991A	95752	19262991T	95469		16	.6299		16		89		32	4
19275000A	95734	19275000T	95451	3/4		.7500	3/4		4		3/4		4
19275001A	95741	19275001T	95458	3/4		.7500	3/4		4		1-1/2		4
19278740A	95748	19278740T	95465		20	.7874		20		76		20	4
19278741A	95753	19278741T	95470		20	.7874		20		102		38	4
19210040A	95735	19210040T	95452	1		1.0000	1		4		1		4
19210041A	95742	19210041T	95459	1		1.0000	1		4		1-1/2		4
19210050A	95736	19210050T	95453	1		1.0000	1		4		1		5*
19210051A	95743	19210051T	95460	1		1.0000	1		4		1-1/2		5*

*Non-Center Cutting.

Inch	
D1	Tolerance
1/4-1	+.000/-.003

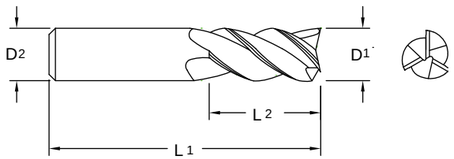
Metric (mm)	
D1	Tolerance
8.00-20.00	+.000/-.076

Technical information on page 246.

TuffCut® SS Series 112

Z3 | 53° | TiN | Weldon HB DIN6535 | 3/8" (6mm) Shanks & above

Designed for milling stainless steel, titanium, inconel and other similar metals, where high cutting forces are generated. Works well as a finishing tool.



Uncoated		TiN		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11211810	11203	11211810T	11204		3.0	.1181		3.0		38		12.0
11212500	11205	11212500T	11206	1/8		.1250	1/8		1-1/2		3/8	
11213780	11207	11213780T	11208		3.5	.1378		4.0		51		12.0
11215620	11209	11215620T	11210	5/32		.1562	3/16		2		1/2	
11215750	11211	11215750T	11212		4.0	.1575		4.0		51		14.0
11217720	11213	11217720T	11214		4.5	.1772		5.0		51		14.0
11218750	11215	11218750T	11216	3/16		.1875	3/16		2		9/16	
11219680	11217	11219680T	11218		5.0	.1968		5.0		51		20.0
11221650	11219	11221650T	11220		5.5	.2165		6.0		64		20.0
11221870	11221	11221870T	11222	7/32		.2187	1/4		2-1/2		5/8	
11223620	11223	11223620T	11224		6.0	.2362		6.0		64		20.0
11225000	11225	11225000T	11226	1/4		.2500	1/4		2-1/2		3/4	
11227560	11227	11227560T	11228		7.0	.2756		8.0		64		20.0
11228120	11229	11228120T	11230	9/32		.2812	5/16		2-1/2		3/4	
11231250	11231	11231250T	11232	5/16		.3125	5/16		2-1/2		13/16	
11231500	11233	11231500T	11234		8.0	.3150		8.0		64		20.0
11235430	11235	11235430T	11236		9.0	.3543		9.0		64		20.0
11237500	11237	11237500T	11238	3/8		.3750	3/8		2-1/2		7/8	
11239370	11239	11239370T	11240		10.0	.3937		10.0		70		25.0
11243310	11241	11243310T	11242		11.0	.4331		11.0		70		25.0
11243750	11243	11243750T	11244	7/16		.4375	7/16		2-3/4		1	
11247240	11245	11247240T	11246		12.0	.4724		12.0		76		25.0
11250000	11247	11250000T	11248	1/2		.5000	1/2		3		1	
11255120	11249	11255120T	11250		14.0	.5512		14.0		89		30.0
11256250	11251	11256250T	11252	9/16		.5625	9/16		3-1/2		1-1/8	
11262500	11253	11262500T	11254	5/8		.6250	5/8		3-1/2		1-1/4	
11262990	11255	11262990T	11256		16.0	.6299		16.0		89		30.0
11270870	11257	11270870T	11258		18.0	.7087		18.0		102		35.0
11275000	11259	11275000T	11260	3/4		.7500	3/4		4		1-1/2	
11278740	11261	11278740T	11262		20.0	.7874		20.0		102		38.0
11286620	11263	11286620T	11264		22.0	.8662		22.0		102		40.0
11287500	11265	11287500T	11266	7/8		.8750	7/8		4		1-1/2	
11298430	11267	11298430T	11268		25.0	.9843		25.0		102		40.0
11210000	11201	11210000T	11202	1		1.0000	1		4		1-1/2	

Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
> 1/4-1	+.000/-.003

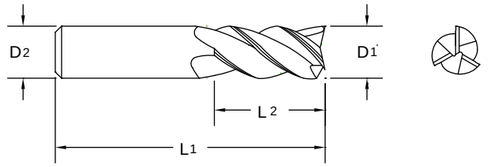
Metric (mm)	
D1	Tolerance h10
3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-25.00	+.000/-.084

- Excellent surface finishes.
- High speed and feed capabilities.
- TiN Coating adds lubricity to prevent edge build up.
- High helix angle increases length of cutting edge engaged in the cut, reducing cutting load variations and prolonging tool life.

Technical information on page 221.

TuffCut® SS Series 172

Z3 | 45° | ALtima® | TiCN



Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
>1/4-3/4	+.000/-.003

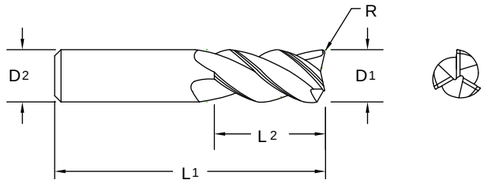
Metric (mm)	
D1	Tolerance h10
3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-20.00	+.000/-.084

ALtima®		TiCN		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
17211811A	17212	17211811C	17211		3.0	.1181		6		51		8
17212500A	17217	17212500C	17215	1/8		.1250	1/8		1-1/2		1/4	
17212501A	17218	17212501C	17216	1/8		.1250	1/8		1-1/2		3/8	
17215751A	17222	17215751C	17221		4.0	.1575		6		51		11
17218750A	17227	17218750C	17225	3/16		.1875	3/16		2		5/16	
17218751A	17228	17218751C	17226	3/16		.1875	3/16		2		9/16	
17219681A	17232	17219681C	17231		5.0	.1968		6		51		14
17223621A	17237	17223621C	17236		6.0	.2362		6		51		15
17225000A	17242	17225000C	17240	1/4		.2500	1/4		2		3/8	
17225001A	17243	17225001C	17241	1/4		.2500	1/4		2-1/2		3/4	
17231250A	17247	17231250C	17245	5/16		.3125	5/16		2		7/16	
17231251A	17248	17231251C	17246	5/16		.3125	5/16		2-1/2		13/16	
17231501A	17252	17231501C	17251		8.0	.3150		8		64		20
17237500A	17257	17237500C	17255	3/8		.3750	3/8		2		1/2	
17237501A	17258	17237501C	17256	3/8		.3750	3/8		2-1/2		1	
17239371A	17262	17239371C	17261		10.0	.3937		10		70		25
17243750A	17267	17243750C	17265	7/16		.4375	7/16		2-1/2		9/16	
17243751A	17268	17243751C	17266	7/16		.4375	7/16		2-3/4		1	
17247241A	17272	17247241C	17271		12.0	.4724		12		76		30
17250000A	17277	17250000C	17275	1/2		.5000	1/2		2-1/2		5/8	
17250001A	17278	17250001C	17276	1/2		.5000	1/2		3		1-1/4	
17262500A	17282	17262500C	17280	5/8		.6250	5/8		3		3/4	
17262501A	17283	17262501C	17281	5/8		.6250	5/8		3-1/2		1-5/8	
17262991A	17287	17262991C	17286		16.0	.6299		16		89		38
17275000A	17292	17275000C	17290	3/4		.7500	3/4		3		1	
17275001A	17293	17275001C	17291	3/4		.7500	3/4		4		1-5/8	
17278741A	17297	17278741C	17296		20.0	.7874		20		102		45

Technical information on page 238.

TuffCut® SS Series 174

Z3 | 45° | ALtima® | TiCN



Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
> 1/4-3/4	+.000/-.003

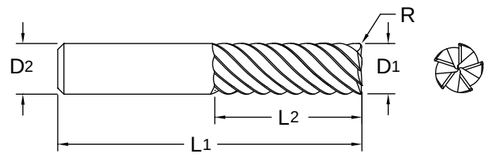
Metric (mm)	
D1	Tolerance h10
3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-20.00	+.000/-.084

ALtima®		TiCN		Diameter			Shank		OAL		Flute Length		Corner Radius	
				D1			D2		L1		L2		R	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17411811A	17410	17411811C	17411		3	.1181		6		51		8		0.2
17412500A	17413	17412500C	17415	1/8		.1250	1/8		1-1/2		1/4		0.008	
17412501A	17414	17412501C	17416	1/8		.1250	1/8		1-1/2		3/8		0.008	
17415751A	17420	17415751C	17421		4	.1575		6		51		11		0.2
17418750A	17423	17418750C	17425	3/16		.1875	3/16		2		5/16		0.008	
17418751A	17424	17418751C	17426	3/16		.1875	3/16		2		9/16		0.008	
17419681A	17430	17419681C	17431		5	.1968		6		51		14		0.4
17423621A	17435	17423621C	17436		6	.2362		6		51		15		0.4
17425000A	17438	17425000C	17440	1/4		.2500	1/4		2		3/8		0.015	
17425001A	17439	17425001C	17441	1/4		.2500	1/4		2-1/2		3/4		0.015	
17431250A	17443	17431250C	17445	5/16		.3125	5/16		2		7/16		0.015	
17431251A	17444	17431251C	17446	5/16		.3125	5/16		2-1/2		13/16		0.015	
17431501A	17450	17431501C	17451		8	.3150		8		64		20		0.5
17437500A	17453	17437500C	17455	3/8		.3750	3/8		2		1/2		0.020	
17437501A	17454	17437501C	17456	3/8		.3750	3/8		2-1/2		1		0.020	
17439371A	17460	17439371C	17461		10	.3937		10		70		25		0.5
17443750A	17463	17443750C	17465	7/16		.4375	7/16		2-1/2		9/16		0.020	
17443751A	17464	17443751C	17466	7/16		.4375	7/16		2-3/4		1		0.020	
17447241A	17470	17447241C	17471		12	.4724		12		76		30		0.5
17450000A	17473	17450000C	17475	1/2		.5000	1/2		2-1/2		5/8		0.030	
17450001A	17474	17450001C	17476	1/2		.5000	1/2		3		1-1/4		0.030	
17462500A	17478	17462500C	17480	5/8		.6250	5/8		3		3/4		0.030	
17462501A	17479	17462501C	17481	5/8		.6250	5/8		3-1/2		1-5/8		0.030	
17462991A	17485	17462991C	17486		16	.6299		16		89		38		0.7
17475000A	17488	17475000C	17490	3/4		.7500	3/4		3		1		0.035	
17475001A	17489	17475001C	17491	3/4		.7500	3/4		4		1-5/8		0.035	
17478741A	17495	17478741C	17496		20	.7874		20		102		45		0.7

Technical information on page 238.

TuffCut® SS Series 175

Z5 | 45° | ALtima® | TiCN



Inch	
D1	Tolerance
1/4	+.000/-.002
>1/4-3/4	+.000/-.003

Metric (mm)	
D1	Tolerance h10
6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-20.00	+.000/-.084

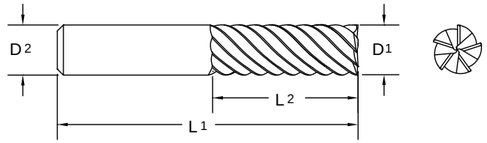
ALtima®		TiCN		Diameter			Shank		OAL		Flute Length		Corner Radius	
				D1			D2		L1		L2		R	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
17523621A	17510	17523621C	17511		6	.2362		6		51		15		0.4
17525000A	17519	17525000C	17520	1/4		.2500	1/4		2		3/8		0.015	
17525001A	95777	17525001C	95770	1/4		.2500	1/4		2-1/2		3/4		0.015	
17531250A	17524	17531250C	17525	5/16		.3125	5/16		2		7/16		0.015	
17531251A	95778	17531251C	95771	5/16		.3125	5/16		2-1/2		13/16		0.015	
17531501A	17530	17531501C	17531		8	.3150		8		64		20		0.5
17537500A	17534	17537500C	17535	3/8		.3750	3/8		2		1/2		0.020	
17537501A	95779	17537501C	95772	3/8		.3750	3/8		2-1/2		1		0.020	
17539371A	17540	17539371C	17541		10	.3937		10		70		25		0.5
17543750A	17544	17543750C	17545	7/16		.4375	7/16		2-1/2		9/16		0.020	
17543751A	95780	17543751C	95773	7/16		.4375	7/16		2-3/4		1		0.020	
17547241A	17550	17547241C	17551		12	.4724		12		76		30		0.5
17550000A	17559	17550000C	17560	1/2		.5000	1/2		2-1/2		5/8		0.030	
17550001A	95781	17550001C	95774	1/2		.5000	1/2		3		1-1/4		0.030	
17562500A	17569	17562500C	17570	5/8		.6250	5/8		3		3/4		0.030	
17562501A	95782	17562501C	95775	5/8		.6250	5/8		3-1/2		1-5/8		0.030	
17562991A	17575	17562991C	17576		16	.6299		16		89		38		0.7
17575000A	17579	17575000C	17580	3/4		.7500	3/4		3		1		0.035	
17575001A	95783	17575001C	95776	3/4		.7500	3/4		4		1-5/8		0.035	
17578741A	17590	17578741C	17591		20	.7874		20		102		45		0.7

Technical information on page 238.

Celebrating 90 Years 1919 - 2009 M.A. Ford®

TuffCut® SS Series 176

Z5 | 45° | ALtima® | TiCN



ALtima®		TiCN		Diameter D1		Shank	OAL	Flute Length
Tool No.	EDP	Tool No.	EDP	Inch	Decimal	D2	L1	L2
17625001A	17609	17625001C	17611	1/4	.2500	1/4	2-1/2	3/4
17625002A	17610	17625002C	17612	1/4	.2500	1/4	4	1-1/4
17631251A	17619	17631251C	17621	5/16	.3125	5/16	2-1/2	13/16
17631252A	17620	17631252C	17622	5/16	.3125	5/16	4	1-1/4
17637501A	17629	17637501C	17631	3/8	.3750	3/8	2-1/2	1
17637502A	17630	17637502C	17632	3/8	.3750	3/8	4	1-1/2
17643751A	17639	17643751C	17641	7/16	.4375	7/16	2-3/4	1
17643752A	17640	17643752C	17642	7/16	.4375	7/16	4	2
17650001A	17649	17650001C	17651	1/2	.5000	1/2	3	1-1/4
17650002A	17650	17650002C	17652	1/2	.5000	1/2	4	2
17662501A	17659	17662501C	17661	5/8	.6250	5/8	3-1/2	1-5/8
17662502A	17660	17662502C	17662	5/8	.6250	5/8	5	2-1/2
17675001A	17669	17675001C	17671	3/4	.7500	3/4	4	1-5/8
17675002A	17670	17675002C	17672	3/4	.7500	3/4	6	3-1/4

Inch	
D1	Tolerance
1/4	+.000/-.002
>1/4-3/4	+.000/-.003

Technical information on page 238.

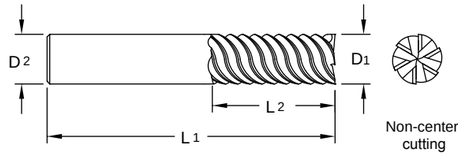
ISO 9001:2000 Certified

An ESOP Company

TuffCut® SS Series 113

Z6 | 53° | TiN | Weldon HB DIN6535 | 3/8" (6mm) Shanks & above

Ideal for machining metals where high cutting forces are generated. Also, the TuffCut® SS works well in most materials as a finishing tool.



Non-center cutting

Uncoated		TiN		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11311810	11303	11311810T	11304		3.0	.1181		3.0		38		12.0
11312500	11305	11312500T	11306	1/8		.1250	1/8		1-1/2		3/8	
11313780	11307	11313780T	11308		3.5	.1378		4.0		51		12.0
11315620	11309	11315620T	11310	5/32		.1562	3/16		2		1/2	
11315750	11311	11315750T	11312		4.0	.1575		4.0		51		14.0
11317720	11313	11317720T	11314		4.5	.1772		5.0		51		14.0
11318750	11315	11318750T	11316	3/16		.1875	3/16		2		9/16	
11319680	11317	11319680T	11318		5.0	.1968		5.0		51		20.0
11321650	11319	11321650T	11320		5.5	.2165		6.0		64		20.0
11321870	11321	11321870T	11322	7/32		.2187	1/4		2-1/2		5/8	
11323620	11323	11323620T	11324		6.0	.2362		6.0		64		20.0
11325000	11325	11325000T	11326	1/4		.2500	1/4		2-1/2		3/4	
11327560	11327	11327560T	11328		7.0	.2756		8.0		64		20.0
11328120	11329	11328120T	11330	9/32		.2812	5/16		2-1/2		3/4	
11331250	11331	11331250T	11332	5/16		.3125	5/16		2-1/2		13/16	
11331500	11333	11331500T	11334		8.0	.3150		8.0		64		20.0
11335430	11335	11335430T	11336		9.0	.3543		9.0		64		20.0
11337500	11337	11337500T	11338	3/8		.3750	3/8		2-1/2		7/8	
11339370	11339	11339370T	11340		10.0	.3937		10.0		70		25.0
11343310	11341	11343310T	11342		11.0	.4331		11.0		70		25.0
11343750	11343	11343750T	11344	7/16		.4375	7/16		2-3/4		1	
11347240	11345	11347240T	11346		12.0	.4724		12.0		76		25.0
11350000	11347	11350000T	11348	1/2		.5000	1/2		3		1	
11355120	11349	11355120T	11350		14.0	.5512		14.0		89		30.0
11356250	11351	11356250T	11352	9/16		.5625	9/16		3-1/2		1-1/8	
11362500	11353	11362500T	11354	5/8		.6250	5/8		3-1/2		1-1/4	
11362990	11355	11362990T	11356		16.0	.6299		16.0		89		30.0
11370870	11357	11370870T	11358		18.0	.7087		18.0		102		35.0
11375000	11359	11375000T	11360	3/4		.7500	3/4		4		1-1/2	
11378740	11361	11378740T	11362		20.0	.7874		20.0		102		38.0
11386620	11363	11386620T	11364		22.0	.8662		22.0		102		40.0
11387500	11365	11387500T	11366	7/8		.8750	7/8		4		1-1/2	
11398430	11367	11398430T	11368		25.0	.9843		25.0		102		40.0
11310000	11301	11310000T	11302	1		1.0000	1		4		1-1/2	

Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
> 1/4-1	+.000/-.003

Metric (mm)	
D1	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

- TiN Coating adds lubricity to prevent edge build up.
- 6 Flute geometry lowers cutting force vibration, permitting higher feeds (at comparable chip loads) and improved tool life.

Technical information on page 221.

TuffCut®

General Purpose End Mills

Designed and Manufactured in the USA

Square End/Corner Radius

4 Flute

- TuffCut® GP Series 111
- TuffCut® GP Series 114
- TuffCut® GP Series 117
- TuffCut® GP Series 151
- TuffCut® GP Series 163
- TuffCut® GP Series 161
- TuffCut® GP Series 122
- TuffCut® GP Series 132
- TuffCut® GP Series 181

3 Flute

- TuffCut® GP Series 116
- TuffCut® GP Series 169

2 Flute

- TuffCut® GP Series 121
- TuffCut® GP Series 164
- TuffCut® GP Series 162
- TuffCut® GP Series 123
- TuffCut® GP Series 183

Ball Nose

4 Flute

- TuffCut® GP Series 140
- TuffCut® GP Series 165
- TuffCut® GP Series 167
- TuffCut® GP Series 184

3 Flute

- TuffCut® GP Series 145

2 Flute

- TuffCut® GP Series 150
- TuffCut® GP Series 166
- TuffCut® GP Series 168
- TuffCut® GP Series 186




ISO 9001:2000 Certified

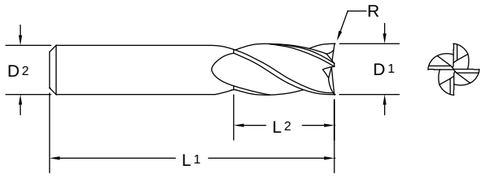
An ESOP Company

For product information, call your local distributor.

TuffCut® GP Series 111

Z4 | 30°

Designed for aggressive milling of most materials.



- Micro sizes available.
  .005 - .100" and 0.2 - 2.0mm

Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
11100500	51001			.0050*	1/8		1-1/2		.015			
11100780	51003		0.2	.0078*		3.0		38		0.6		
11101000	51005			.0100*	1/8		1-1/2		.030			
11101180	51007		0.3	.0118*		3.0		38		0.9		
11101500	51009			.0150*	1/8		1-1/2		.045			
11101560	11011	1/64		.0156	1/8		1-1/2		1/32			
11101570	51013		0.4	.0157		3.0		38		1.2		
11101960	51015		0.5	.0196		3.0		38		1.5		
11102000	51017			.0200	1/8		1-1/2		.060			
11102360	51019		0.6	.0236		3.0		38		1.8		
11102500	51021			.0250	1/8		1-1/2		.075			
11102750	51023		0.7	.0275		3.0		38		2.1		
11103000	51025			.0300	1/8		1-1/2		.090			
11103120	11027	1/32		.0312	1/8		1-1/2		5/64			
11103150	51029		0.8	.0315		3.0		38		2.4		
11103500	51031			.0350	1/8		1-1/2		.105			
11103540	51033		0.9	.0354		3.0		38		2.7		
11103940	11035		1.0	.0394		3.0		38		3.0		
11104000	51039			.0400	1/8		1-1/2		.120			
11104330	51041		1.1	.0433		3.0		38		3.3		
11104500	51043			.0450	1/8		1-1/2		.135			
11104680	11045	3/64		.0468	1/8		1-1/2		7/64			
11104720	51047		1.2	.0472		3.0		38		3.6		
11105000	51049			.0500	1/8		1-1/2		.150			
11105120	51051		1.3	.0512		3.0		38		3.9		
11105500	51053			.0550	1/8		1-1/2		.165			
11105510	51055		1.4	.0551		3.0		38		4.2		
11105910	11057		1.5	.0591		3.0		38		6.0		
11105911	51057		1.5	.0591		3.0		38		4.5		
11106000	51061			.0600	1/8		1-1/2		.180			
11106250	11063	1/16		.0625	1/8		1-1/2		3/16			
11106300	51065		1.6	.0630		3.0		38		4.8		
11106500	51067			.0650	1/8		1-1/2		.195			
11106690	51069		1.7	.0669		3.0		38		5.1		
11107000	51071			.0700	1/8		1-1/2		.210			
11107090	51073		1.8	.0709		3.0		38		5.4		
11107480	51075		1.9	.0748		3.0		38		5.7		
11107500	51077			.0750	1/8		1-1/2		.225			

*End mills 0.015" (0.3mm) and smaller are non-center cutting.

Inch	
D1	Tolerance
1/64	+.000/-.001
1/32-1/4	+.000/-.002
>1/4-1 1/4	+.000/-.003
D1 Micro Sizes*	Tolerance
.005-.100	+.0005/-.0005

*Inch decimal size range .005 - .100 only.

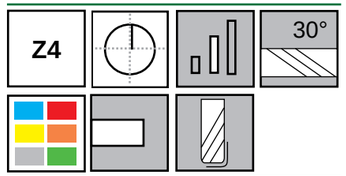
Metric (mm)	
D1	Tolerance h10
0.20-0.50	+.000/-.025
0.60-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-30.00	+.000/-.084
32.00	+.000/-.100

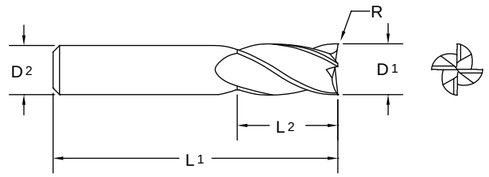
Coated tools on page 175.

Technical information on page 250.

For product information, call your local distributor.

Series 111 Continued





Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
11107810	11079	5/64		.0781	1/8		1-1/2		3/16			
11107870	11081		2.0	.0787		3.0		38		9.0		
11107871	51081		2.0	.0787		3.0		38		6.0		
11108000	51085			.0800	1/8		1-1/2		.240			
11108500	51087			.0850	1/8		1-1/2		.255			
11109000	51089			.0900	1/8		1-1/2		.270			
11109370	11091	3/32		.0937	1/8		1-1/2		9/32			
11109500	51093			.0950	1/8		1-1/2		.285			
11109840	11095		2.5	.0984		3.0		38		12.0		
11110010	51099			.1000	1/8		1-1/2		.300			
11110930	11101	7/64		.1093	1/8		1-1/2		3/8			
11111810	11103		3.0	.1181		3.0		38		12.0		
11111811	51402		3.0	.1181		3.0		38		12.0		0.50
11112500	11105	1/8		.1250	1/8		1-1/2		3/8			
11112501	11108	1/8		.1250	1/8		1-1/2		1/2			
11112511	51401	1/8		.1250	1/8		1-1/2		3/8		0.015	
11112512	51403	1/8		.1250	1/8		1-1/2		3/8		0.020	
11113780	11111		3.5	.1378		4.0		51		12.0		
11114060	11112	9/64		.1406	3/16		2		1/2			
11115620	11113	5/32		.1562	3/16		2		1/2			
11115750	11115		4.0	.1575		4.0		51		14.0		
11115751	51404		4.0	.1575		4.0		51		14.0		0.50
11115752	51422		4.0	.1575		4.0		51		14.0		0.75
11117190	11116	11/64		.1719	3/16		2		5/8			
11117720	11117		4.5	.1772		5.0		51		14.0		
11118750	11119	3/16		.1875	3/16		2		5/8			
11118751	51405	3/16		.1875	3/16		2		5/8		0.015	
11118752	51407	3/16		.1875	3/16		2		5/8		0.020	
11118753	51409	3/16		.1875	3/16		2		5/8		0.030	
11119680	11121		5.0	.1968		5.0		51		20.0		
11119681	51406		5.0	.1968		5.0		51		20.0		0.50
11119682	51424		5.0	.1968		5.0		51		20.0		0.75
11119683	51440		5.0	.1968		5.0		51		20.0		1.00
11120310	11122	13/64		.2031	1/4		2-1/2		5/8			
11121650	11123		5.5	.2165		6.0		64		20.0		
11121870	11125	7/32		.2187	1/4		2-1/2		5/8			
11123440	11126	15/64		.2344	1/4		2-1/2		3/4			
11123620	11127		6.0	.2362		6.0		64		20.0		
11123621	51408		6.0	.2362		6.0		64		20.0		0.50
11123622	51426		6.0	.2362		6.0		64		20.0		0.75
11123623	51442		6.0	.2362		6.0		64		20.0		1.00
11125000	11129	1/4		.2500	1/4		2-1/2		3/4			
11125001	51411	1/4		.2500	1/4		2-1/2		3/4		0.015	

Coated tools on page 175.

Technical information on page 250.

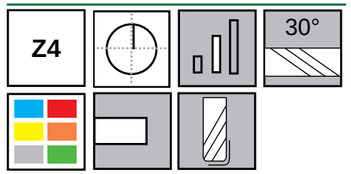
Series 111 Continued

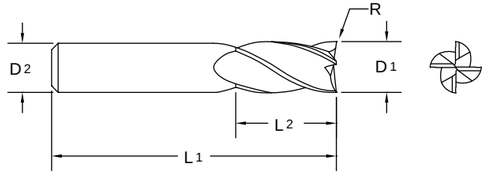
Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
11125002	51413	1/4		.2500	1/4		2-1/2		3/4		0.020	
11125003	51415	1/4		.2500	1/4		2-1/2		3/4		0.030	
11125004	51417	1/4		.2500	1/4		2-1/2		3/4		0.045	
11127560	11131		7.0	.2756		8.0		64		20.0		
11128120	11133	9/32		.2812	5/16		2-1/2		3/4			
11131250	11135	5/16		.3125	5/16		2-1/2		13/16			
11131251	51419	5/16		.3125	5/16		2-1/2		13/16		0.015	
11131252	51421	5/16		.3125	5/16		2-1/2		13/16		0.020	
11131253	51423	5/16		.3125	5/16		2-1/2		13/16		0.030	
11131254	51425	5/16		.3125	5/16		2-1/2		13/16		0.045	
11131500	11137		8.0	.3150		8.0		64		20.0		
11131501	51410		8.0	.3150		8.0		64		20.0		0.50
11131502	51428		8.0	.3150		8.0		64		20.0		0.75
11131503	51444		8.0	.3150		8.0		64		20.0		1.00
11131504	51456		8.0	.3150		8.0		64		20.0		1.50
11135430	11139		9.0	.3543		9.0		64		20.0		
11137500	11141	3/8		.3750	3/8		2-1/2		1			
11137501	51427	3/8		.3750	3/8		2-1/2		1		0.015	
11137502	51429	3/8		.3750	3/8		2-1/2		1		0.020	
11137503	51431	3/8		.3750	3/8		2-1/2		1		0.030	
11137504	51433	3/8		.3750	3/8		2-1/2		1		0.045	
11139370	11143		10.0	.3937		10.0		70		25.0		
11139371	51412		10.0	.3937		10.0		70		25.0		0.50
11139372	51430		10.0	.3937		10.0		70		25.0		0.75
11139373	51446		10.0	.3937		10.0		70		25.0		1.00
11139374	51458		10.0	.3937		10.0		70		25.0		1.50
11143310	11145		11.0	.4331		11.0		70		25.0		
11143750	11147	7/16		.4375	7/16		2-3/4		1			
11147240	11149		12.0	.4724		12.0		76		25.0		
11147241	51414		12.0	.4724		12.0		76		25.0		0.50
11147242	51432		12.0	.4724		12.0		76		25.0		0.75
11147243	51448		12.0	.4724		12.0		76		25.0		1.00
11147244	51460		12.0	.4724		12.0		76		25.0		1.50
11147245	51468		12.0	.4724		12.0		76		25.0		2.00
11150000	11151	1/2		.5000	1/2		3		1			
11150001	51435	1/2		.5000	1/2		3		1		0.015	
11150002	51437	1/2		.5000	1/2		3		1		0.020	
11150003	51439	1/2		.5000	1/2		3		1		0.030	
11150004	51441	1/2		.5000	1/2		3		1		0.045	
11150005	51443	1/2		.5000	1/2		3		1		0.060	
11155120	11153		14.0	.5512		14.0		89		30.0		
11156250	11155	9/16		.5625	9/16		3-1/2		1-1/8			
11162500	11157	5/8		.6250	5/8		3-1/2		1-1/4			
11162501	51445	5/8		.6250	5/8		3-1/2		1-1/4		0.015	
11162502	51447	5/8		.6250	5/8		3-1/2		1-1/4		0.020	
11162503	51449	5/8		.6250	5/8		3-1/2		1-1/4		0.030	
11162504	51451	5/8		.6250	5/8		3-1/2		1-1/4		0.045	
11162505	51453	5/8		.6250	5/8		3-1/2		1-1/4		0.060	
11162506	51455	5/8		.6250	5/8		3-1/2		1-1/4		0.090	
11162990	11159		16.0	.6299		16.0		89		30.0		

Coated tools on page 175.

Technical information on page 250.

Series 111 Continued



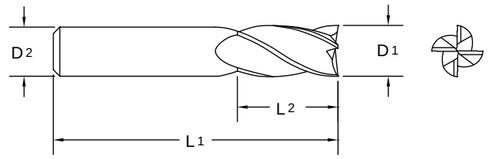


Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
11162991	51416		16.0	.6299		16.0		89		30.0		0.50
11162992	51434		16.0	.6299		16.0		89		30.0		0.75
11162993	51450		16.0	.6299		16.0		89		30.0		1.00
11162994	51462		16.0	.6299		16.0		89		30.0		1.50
11162995	51470		16.0	.6299		16.0		89		30.0		2.00
11162996	51476		16.0	.6299		16.0		89		30.0		2.50
11162997	51482		16.0	.6299		16.0		89		30.0		3.00
11170870	11161		18.0	.7087		18.0		102		35.0		
11175000	11163	3/4		.7500	3/4		4		1-1/2			
11175001	51457	3/4		.7500	3/4		4		1-1/2		0.015	
11175002	51459	3/4		.7500	3/4		4		1-1/2		0.020	
11175003	51461	3/4		.7500	3/4		4		1-1/2		0.030	
11175004	51463	3/4		.7500	3/4		4		1-1/2		0.045	
11175005	51465	3/4		.7500	3/4		4		1-1/2		0.060	
11175006	51467	3/4		.7500	3/4		4		1-1/2		0.090	
11175007	51469	3/4		.7500	3/4		4		1-1/2		0.125	
11178740	11165		20.0	.7874		20.0		102		38.0		
11178741	51418		20.0	.7874		20.0		102		38.0		0.50
11178742	51436		20.0	.7874		20.0		102		38.0		0.75
11178743	51452		20.0	.7874		20.0		102		38.0		1.00
11178744	51464		20.0	.7874		20.0		102		38.0		1.50
11178745	51472		20.0	.7874		20.0		102		38.0		2.00
11178746	51478		20.0	.7874		20.0		102		38.0		2.50
11178747	51484		20.0	.7874		20.0		102		38.0		3.00
11186620	11167		22.0	.8662		22.0		102		40.0		
11187500	11169	7/8		.8750	7/8		4		1-1/2			
11198430	11171		25.0	.9843		25.0		102		40.0		
11198431	51420		25.0	.9843		25.0		102		40.0		0.50
11198432	51438		25.0	.9843		25.0		102		40.0		0.75
11198433	51454		25.0	.9843		25.0		102		40.0		1.00
11198434	51466		25.0	.9843		25.0		102		40.0		1.50
11198435	51474		25.0	.9843		25.0		102		40.0		2.00
11198436	51480		25.0	.9843		25.0		102		40.0		2.50
11198437	51486		25.0	.9843		25.0		102		40.0		3.00
11110000	11097	1.0		1.0000	1		4		1-1/2			
11110001	51471	1.0		1.0000	1		4		1-1/2		0.015	
11110002	51473	1.0		1.0000	1		4		1-1/2		0.020	
11110003	51475	1.0		1.0000	1		4		1-1/2		0.030	
11110004	51477	1.0		1.0000	1		4		1-1/2		0.045	
11110005	51479	1.0		1.0000	1		4		1-1/2		0.060	
11110006	51481	1.0		1.0000	1		4		1-1/2		0.090	
11110007	51483	1.0		1.0000	1		4		1-1/2		0.125	
11112510	11107	1-1/4		1.2500	1-1/4		4-3/8		1-9/16			
11112600	11109		32.0	1.2600		32.0		111		40.0		

Coated tools on page 175.

Technical information on page 250.

TuffCut® GP Series 111 Coated



TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11111810T	11104	11111810A	11003	11111810C	11004		3.0	.1181		3.0		38		12.0
11112500T	11106	11112500A	11005	11112500C	11006	1/8		.1250	1/8		1-1/2		3/8	
11115750T	11118	11115750A	11007	11115750C	11008		4.0	.1575		4.0		51		14.0
11118750T	11120	11118750A	11009	11118750C	11010	3/16		.1875	3/16		2		5/8	
11119680T	11124	11119680A	11013	11119680C	11014		5.0	.1968		5.0		51		20.0
11123620T	11128	11123620A	11015	11123620C	11016		6.0	.2362		6.0		64		20.0
11125000T	11130	11125000A	11017	11125000C	11018	1/4		.2500	1/4		2-1/2		3/4	
11131250T	11136	11131250A	11019	11131250C	11020	5/16		.3125	5/16		2-1/2		13/16	
11131500T	11138	11131500A	11021	11131500C	11022		8.0	.3150		8.0		64		20.0
11137500T	11142	11137500A	11023	11137500C	11024	3/8		.3750	3/8		2-1/2		1	
11139370T	11144	11139370A	11025	11139370C	11026		10.0	.3937		10.0		70		25.0
11143750T	11148	11143750A	11029	11143750C	11030	7/16		.4375	7/16		2-3/4		1	
11147240T	11150	11147240A	11031	11147240C	11032		12.0	.4724		12.0		76		25.0
11150000T	11152	11150000A	11033	11150000C	11034	1/2		.5000	1/2		3		1	
11162500T	11158	11162500A	11037	11162500C	11038	5/8		.6250	5/8		3-1/2		1-1/4	
11162990T	11160	11162990A	11039	11162990C	11040		16.0	.6299		16.0		89		30.0
11175000T	11164	11175000A	11041	11175000C	11042	3/4		.7500	3/4		4		1-1/2	
11178740T	11166	11178740A	11043	11178740C	11044		20.0	.7874		20.0		102		38.0
11198430T	11172	11198430A	11047	11198430C	11048		25.0	.9843		25.0		102		40.0
11110000T	11098	11110000A	11001	11110000C	11002	1.0		1.0000	1		4		1-1/2	

Uncoated tools on page 171.

Technical information on page 250.

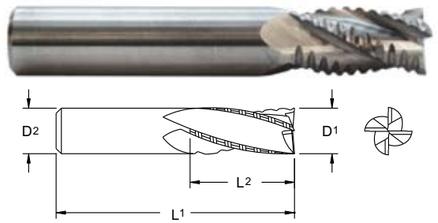
Safety Note
Always wear the appropriate personal protective equipment such as safety glasses and protective clothing when using solid carbide or HSS cutting tools. Machines should be fully guarded. Technical data provided should be considered advisory only as variations may be necessary depending on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

TuffCut® GP Series 114

Z4 | 30° | TiN | Chipbreaker

Chipbreaker end mill designed for aggressive milling of most materials.

- Allows high feed rates when roughing.
- Designed to minimize cutting forces, reduce or eliminate chatter and prolong tool life.
- Designed with tooth overlap to produce smooth part finish.



Uncoated		TiN		Diameter			Shank		OAL		Flute Length	
				D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11411810	11403	11411810T	11404		3.0	.1181		3.0		38		12.0
11412500	11405	11412500T	11406	1/8		.1250	1/8		1-1/2		3/8	
11413780	11407				3.5	.1378		4.0		51		12.0
11415620	11409			5/32		.1562	3/16		2		1/2	
11415750	11411				4.0	.1575		4.0		51		14.0
11417720	11413				4.5	.1772		5.0		51		14.0
11418750	11415	11418750T	11416	3/16		.1875	3/16		2		5/8	
11419680	11417	11419680T	11418		5.0	.1968		5.0		51		20.0
11421650	11419				5.5	.2165		6.0		64		20.0
11421870	11421			7/32		.2187	1/4		2-1/2		5/8	
11423620	11423	11423620T	11424		6.0	.2362		6.0		64		20.0
11425000	11425	11425000T	11426	1/4		.2500	1/4		2-1/2		3/4	
11427560	11427				7.0	.2756		8.0		64		20.0
11428120	11429			9/32		.2812	5/16		2-1/2		3/4	
11431250	11431	11431250T	11432	5/16		.3125	5/16		2-1/2		13/16	
11431500	11433	11431500T	11434		8.0	.3150		8.0		64		20.0
11435430	11435				9.0	.3543		9.0		64		20.0
11437500	11437	11437500T	11438	3/8		.3750	3/8		2-1/2		1	
11439370	11439	11439370T	11440		10.0	.3937		10.0		70		25.0
11443310	11441				11.0	.4331		11.0		70		25.0
11443750	11443	11443750T	11444	7/16		.4375	7/16		2-3/4		1	
11447240	11445	11447240T	11446		12.0	.4724		12.0		76		25.0
11450000	11447	11450000T	11448	1/2		.5000	1/2		3		1	
11455120	11449				14.0	.5512		14.0		89		30.0
11456250	11451			9/16		.5625	9/16		3-1/2		1-1/8	
11462500	11453	11462500T	11454	5/8		.6250	5/8		3-1/2		1-1/4	
11462990	11455	11462990T	11456		16.0	.6299		16.0		89		30.0
11470870	11457	11470870T	11458		18.0	.7087		18.0		102		35.0
11475000	11459	11475000T	11460	3/4		.7500	3/4		4		1-1/2	
11478740	11461	11478740T	11462		20.0	.7874		20.0		102		38.0
11486620	11463				22.0	.8662		22.0		102		40.0
11487500	11465			7/8		.8750	7/8		4		1-1/2	
11498430	11467				25.0	.9843		25.0		102		40.0
11410000	11401			1		1.0000	1		4		1-1/2	

Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
> 1/4-1	+.000/-.003

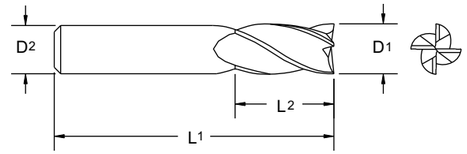
Metric (mm)	
D1	Tolerance h10
3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-25.00	+.000/-.084

Technical information on page 222.

TuffCut® GP Series 117

Z4 | 30°

Recommended for use on close tolerance milling.



- NC tolerances on cutting diameter:
  Imperial +.001"/-.000"
  Metric +.025mm/-.000mm
- TiN and ALtima® coatings available.

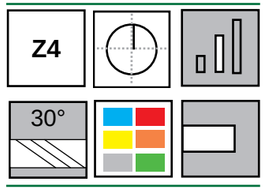
Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11701560	11701	1/64		.0156	1/8		1-1/2		.040	
11703120	11703	1/32		.0312	1/8		1-1/2		5/64	
11703940	11705		1.0	.0394		3.0		38		3.0
11704680	11707	3/64		.0468	1/8		1-1/2		7/64	
11705910	11709		1.5	.0591		3.0		38		6.0
11706250	11711	1/16		.0625	1/8		1-1/2		3/16	
11707810	11713	5/64		.0781	1/8		1-1/2		15/64	
11707870	11715		2.0	.0787		3.0		38		9.0
11709370	11717	3/32		.0937	1/8		1-1/2		9/32	
11709840	11719		2.5	.0984		3.0		38		12.0
11710930	11723	7/64		.1093	1/8		1-1/2		21/64	
11711810	11725		3.0	.1181		3.0		38		12.0
11712500	11727	1/8		.1250	1/8		1-1/2		3/8	
11713780	11729		3.5	.1378		4.0		51		12.0
11715620	11731	5/32		.1562	3/16		2		1/2	
11715750	11733		4.0	.1575		4.0		51		14.0
11717720	11735		4.5	.1772		5.0		51		14.0
11718750	11737	3/16		.1875	3/16		2		9/16	
11719680	11739		5.0	.1968		5.0		51		20.0
11721650	11741		5.5	.2165		6.0		64		20.0
11721870	11743	7/32		.2187	1/4		2-1/2		5/8	
11723620	11745		6.0	.2362		6.0		64		20.0
11725000	11747	1/4		.2500	1/4		2-1/2		3/4	
11727560	11749		7.0	.2756		8.0		64		20.0
11728120	11751	9/32		.2812	5/16		2-1/2		3/4	
11731250	11753	5/16		.3125	5/16		2-1/2		13/16	
11731500	11755		8.0	.3150		8.0		64		20.0
11735430	11757		9.0	.3543		9.0		64		20.0
11737500	11759	3/8		.3750	3/8		2-1/2		7/8	
11739370	11761		10.0	.3937		10.0		70		25.0

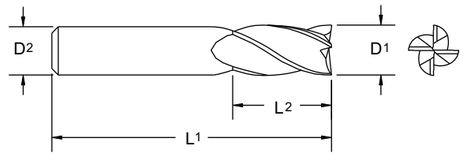
Inch	
D1	Tolerance
1/64 - 1	+.001/-.000

Metric (mm)	
D1	Tolerance
1.00-25.00	+.025/-.000

Technical information on page 250.

Series 117 Continued





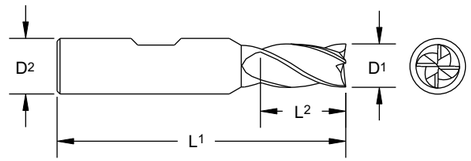
Uncoated		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11743310	11763		11.0	.4331		11.0		70		25.0
11743750	11765	7/16		.4375	7/16		2-3/4		1	
11747240	11767		12.0	.4724		12.0		76		25.0
11750000	11769	1/2		.5000	1/2		3		1	
11755120	11771		14.0	.5512		14.0		89		30.0
11756250	11773	9/16		.5625	9/16		3-1/2		1-1/8	
11762500	11775	5/8		.6250	5/8		3-1/2		1-1/4	
11762990	11777		16.0	.6299		16.0		89		30.0
11770870	11779		18.0	.7087		18.0		102		35.0
11775000	11781	3/4		.7500	3/4		4		1-1/2	
11778740	11783		20.0	.7874		20.0		102		38.0
11786620	11785		22.0	.8662		22.0		102		40.0
11787500	11787	7/8		.8750	7/8		4		1-1/2	
11798430	11789		25.0	.9843		25.0		102		40.0
11710000	11721	1		1.0000	1		4		1-1/2	

Technical information on page 250.

Celebrating 90 Years 1919 - 2009 M.A. Ford®

TuffCut® GP Series 151

Designed for aggressive milling of most materials.
Imperial NC tolerance on body diameter +.001”/-.000”.



Uncoated		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
15111810	15121		3.0	.1181		6.0		57		8.0
15112500	15101	1/8		.1250	3/8		2-1/2		1/2	
15115620	15103	5/32		.1562	3/8		2-1/2		9/16	
15115750	15123		4.0	.1575		6.0		57		11.0
15118750	15105	3/16		.1875	3/8		2-1/2		5/8	
15119680	15125		5.0	.1968		6.0		57		13.0
15121870	15107	7/32		.2187	3/8		2-1/2		5/8	
15123620	15127		6.0	.2362		6.0		57		13.0
15125000	15109	1/4		.2500	3/8		2-1/2		3/4	
15128120	15111	9/32		.2812	3/8		2-1/2		3/4	
15131250	15113	5/16		.3125	3/8		2-1/2		13/16	
15131500	15129		8.0	.3150		8.0		63		19.0
15137500	15115	3/8		.3750	3/8		2-1/2		7/8	
15139370	15131		10.0	.3937		10.0		72		22.0
15143750	15117	7/16		.4375	1/2		3		1	
15147240	15133		12.0	.4724		12.0		83		26.0
15150000	15119	1/2		.5000	1/2		3		1	
15155120	15135		14.0	.5512		14.0		83		26.0
15162990	15137		16.0	.6299		16.0		92		32.0
15170870	15139		18.0	.7087		18.0		92		32.0
15178740	15141		20.0	.7874		20.0		104		38.0

Inch	
D1	Tolerance
1/8-1/2	+.001/-.000

Metric (mm)	
D1	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

Technical information on page 250.

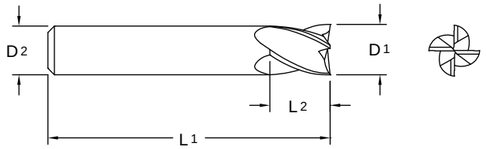
ISO 9001:2000 Certified

An ESOP Company

TuffCut® GP Series 163

Z4 | 30°

Designed for aggressive milling of most materials with reduced deflection, improved tool life and overall economy.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16301560	16300	1/64		.0156	1/8		1-1/2		.023	
16303120	16301	1/32		.0312	1/8		1-1/2		1/16	
16303940	16303		1.0	.0394		3.0		38		2.0
16304680	16305	3/64		.0468	1/8		1-1/2		3/32	
16305910	16307		1.5	.0591		3.0		38		3.0
16306250	16309	1/16		.0625	1/8		1-1/2		1/8	
16307810	16310	5/64		.0781	1/8		1-1/2		5/32	
16307870	16311		2.0	.0787		3.0		38		4.0
16309370	16313	3/32		.0937	1/8		1-1/2		3/16	
16309840	16315		2.5	.0984		3.0		38		5.0
16310930	16316	7/64		.1093	1/8		1-1/2		7/32	
16311810	16317		3.0	.1181		3.0		38		6.0
16312500	16319	1/8		.1250	1/8		1-1/2		1/4	
16313780	16321		3.5	.1378		4.0		51		7.0
16314060	16322	9/64		.1406	3/16		2		5/16	
16315620	16323	5/32		.1562	3/16		2		5/16	
16315750	16325		4.0	.1575		4.0		51		8.0
16317180	16326	11/64		.1718	3/16		2		3/8	
16317720	16327		4.5	.1772		5.0		51		9.0
16318750	16329	3/16		.1875	3/16		2		3/8	
16319680	16331		5.0	.1968		5.0		51		11.0
16320310	16332	13/64		.2031	1/4		2		1/2	
16321650	16333		5.5	.2165		6.0		51		12.0
16321870	16335	7/32		.2187	1/4		2		1/2	
16323430	16336	15/64		.2343	1/4		2		1/2	
16323620	16337		6.0	.2362		6.0		51		13.0
16325000	16339	1/4		.2500	1/4		2		1/2	
16327560	16341		7.0	.2756		8.0		51		13.0
16328120	16342	9/32		.2812	5/16		2		1/2	
16331250	16343	5/16		.3125	5/16		2		1/2	
16331500	16345		8.0	.3150		8.0		51		13.0
16335430	16347		9.0	.3543		9.0		51		14.0
16337500	16349	3/8		.3750	3/8		2		5/8	
16339370	16351		10.0	.3937		10.0		51		14.0
16343310	16353		11.0	.4331		11.0		64		16.0

Inch	
D1	Tolerance
1/64	+.000/-.001
1/32-1/4	+.000/-.002
>1/4-3/4	+.000/-.003

Metric (mm)	
D1	Tolerance h10
1.00-3.00	+.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

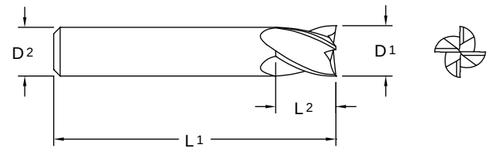
Coated tools on page 181.

Technical information on page 250.

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16343750	16355	7/16		.4375	7/16		2-1/2		5/8	
16347240	16357		12.0	.4724		12.0		64		16.0
16350000	16359	1/2		.5000	1/2		2-1/2		5/8	
16355120	16361		14.0	.5512		14.0		70		18.0
16362500	16363	5/8		.6250	5/8		3		3/4	
16362990	16365		16.0	.6299		16.0		76		20.0
16370870	16367		18.0	.7087		18.0		76		25.0
16375000	16369	3/4		.7500	3/4		3		1	
16378740	16371		20.0	.7874		20.0		76		25.0

TuffCut® GP Series 163 Coated

Z4 | 30° | TiN | ALtima® | TiCN



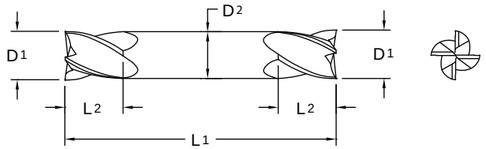
TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16311810T	56300	16311810A	56333	16311810C	56366		3.0	.1181		3.0		38		6.0
16312500T	56301	16312500A	56334	16312500C	56367	1/8		.1250	1/8		1-1/2		1/4	
16315750T	56305	16315750A	56338	16315750C	56371		4.0	.1575		4.0		51		8.0
16318750T	56308	16318750A	56341	16318750C	56374	3/16		.1875	3/16		2		3/8	
16319680T	56309	16319680A	56342	16319680C	56375		5.0	.1968		5.0		51		11.0
16323620T	56314	16323620A	56347	16323620C	56380		6.0	.2362		6.0		51		13.0
16325000T	56315	16325000A	56348	16325000C	56381	1/4		.2500	1/4		2		1/2	
16331250T	56318	16331250A	56351	16331250C	56384	5/16		.3125	5/16		2		1/2	
16331500T	56319	16331500A	56352	16331500C	56385		8.0	.3150		8.0		51		13.0
16337500T	56321	16337500A	56354	16337500C	56387	3/8		.3750	3/8		2		5/8	
16339370T	56322	16339370A	56355	16339370C	56388		10.0	.3937		10.0		51		14.0
16343750T	56324	16343750A	56357	16343750C	56390	7/16		.4375	7/16		2-1/2		5/8	
16347240T	56325	16347240A	56358	16347240C	56391		12.0	.4724		12.0		64		16.0
16350000T	56326	16350000A	56359	16350000C	56392	1/2		.5000	1/2		2-1/2		5/8	
16362500T	56328	16362500A	56361	16362500C	56394	5/8		.6250	5/8		3		3/4	
16362990T	56329	16362990A	56362	16362990C	56395		16.0	.6299		16.0		76		20.0
16375000T	56331	16375000A	56364	16375000C	56397	3/4		.7500	3/4		3		1	
16378740T	56332	16378740A	56365	16378740C	56398		20.0	.7874		20.0		76		25.0

Uncoated tools on page 180. Technical information on page 250.

TuffCut® GP Series 161

Z4 | 30°

Designed with the same geometry as our standard 4-flute end mills.



- Twice the cutting edge saves you money.
- Good choice for shallow hole milling.

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16101560	16100	1/64		.0156	1/8		1-1/2		.023	
16103120	16101	1/32		.0312	1/8		1-1/2		1/16	
16103940	16103		1.0	.0394		3.0		38		2.0
16104680	16105	3/64		.0468	1/8		1-1/2		3/32	
16105910	16107		1.5	.0591		3.0		38		3.0
16106250	16109	1/16		.0625	1/8		1-1/2		1/8	
16107810	16111	5/64		.0781	1/8		1-1/2		5/32	
16107870	16113		2.0	.0787		3.0		38		4.0
16109370	16115	3/32		.0937	1/8		1-1/2		3/16	
16109840	16117		2.5	.0984		3.0		38		5.0
16110930	16119	7/64		.1093	1/8		1-1/2		7/32	
16111810	16121		3.0	.1181		3.0		38		6.0
16112500	16123	1/8		.1250	1/8		1-1/2		1/4	
16113780	16125		3.5	.1378		4.0		51		7.0
16114060	16126	9/64		.1406	3/16		2		5/16	
16115620	16127	5/32		.1562	3/16		2		5/16	
16115750	16129		4.0	.1575		4.0		51		8.0
16117720	16131		4.5	.1772		5.0		51		9.0
16118750	16133	3/16		.1875	3/16		2		3/8	
16119680	16135		5.0	.1968		5.0		51		11.0
16121650	16137		5.5	.2165		6.0		64		12.0
16123620	16141		6.0	.2362		6.0		64		13.0
16125000	16143	1/4		.2500	1/4		2-1/2		1/2	
16127560	16145		7.0	.2756		8.0		64		13.0
16131500	16151		8.0	.3150		8.0		64		13.0
16135430	16153		9.0	.3543		9.0		64		14.0
16137500	16155	3/8		.3750	3/8		2-1/2		9/16	
16139370	16157		10.0	.3937		10.0		70		14.0
16147240	16163		12.0	.4724		12.0		76		16.0
16150000	16165	1/2		.5000	1/2		3		5/8	
16162500	16169	5/8		.6250	5/8		3-1/2		3/4	
16175000	16175	3/4		.7500	3/4		4		1	

Inch	
D1	Tolerance
1/64-1/4	+.000/-.002
> 1/4-3/4	+.000/-.003

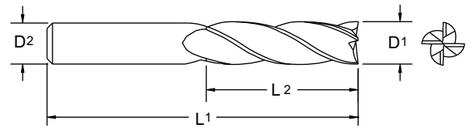
Metric (mm)	
D1	Tolerance h10
1.00- 3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-12.00	+.000/-.070

Technical information on page 250.

TuffCut® GP Series 122

Z4 | 30°

Designed for deep pocket milling and other applications where standard flute lengths are too short.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
12211810	12203		3.0	.1181		3.0		64		25.0
12212500	12205	1/8		.1250	1/8		2-1/2		1	
12215750	12206		4.0	.1575		4.0		64		25.0
12218750	12207	3/16		.1875	3/16		3		1-1/8	
12219680	12208		5.0	.1968		5.0		64		25.0
12223620	12209		6.0	.2362		6.0		76		30.0
12225000	12211	1/4		.2500	1/4		3		1-1/4	
12227560	12212		7.0	.2756		8.0		83		30.0
12231250	12213	5/16		.3125	5/16		3-1/4		1-3/8	
12231500	12215		8.0	.3150		8.0		83		35.0
12235430	12216		9.0	.3543		10.0		89		35.0
12237500	12217	3/8		.3750	3/8		3-1/2		1-1/2	
12239370	12219		10.0	.3937		10.0		89		40.0
12243310	12220		11.0	.4331		12.0		102		40.0
12243750	12221	7/16		.4375	7/16		4		1-3/4	
12247240	12223		12.0	.4724		12.0		102		50.0
12250000	12225	1/2		.5000	1/2		4		2	
12262500	12227	5/8		.6250	5/8		4-5/8		2-1/2	
12262990	12229		16.0	.6299		16.0		117		65.0
12275000	12231	3/4		.7500	3/4		5-1/4		3	
12278740	12233		20.0	.7874		20.0		133		80.0
12298430	12235		25.0	.9843		25.0		152		80.0
12210000	12201	1		1.0000	1		6		3	

Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
>1/4-1	+.000/-.003

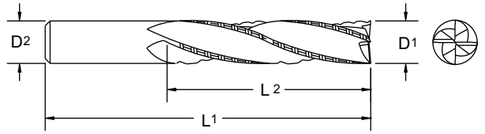
Metric (mm)	
D1	Tolerance
3.00-6.00	+.000/-.051
7.00-25.00	+.000/-.076

Technical information on page 250.

TuffCut® GP Series 132

Z4 | 30° | Chipbreaker

Chipbreakers are designed to minimize cutting forces, reduce or eliminate chatter and prolong tool life.



- Chipbreaker geometry permits extremely high feed rates in roughing operations. Tools designed with tooth overlap to produce fairly smooth part finish.
- Designed for deep pocket milling and other applications where standard flute lengths are too short.
- TiN coating available.

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
13211810	13203		3.0	.1181		3.0		64		25.0
13212500	13205	1/8		.1250	1/8		2-1/2		1	
13218750	13207	3/16		.1875	3/16		3		1-1/8	
13223620	13209		6.0	.2362		6.0		76		30.0
13225000	13211	1/4		.2500	1/4		3		1-1/4	
13231250	13213	5/16		.3125	5/16		3-1/4		1-3/8	
13231500	13215		8.0	.3150		8.0		83		35.0
13237500	13217	3/8		.3750	3/8		3-1/2		1-1/2	
13239370	13219		10.0	.3937		10.0		89		40.0
13243750	13221	7/16		.4375	7/16		4		1-3/4	
13247240	13223		12.0	.4724		12.0		102		50.0
13250000	13225	1/2		.5000	1/2		4		2	
13262500	13227	5/8		.6250	5/8		4-5/8		2-1/2	
13262990	13229		16.0	.6299		16.0		117		65.0
13275000	13231	3/4		.7500	3/4		5-1/4		3	
13278740	13233		20.0	.7874		20.0		133		80.0
13298430	13235		25.0	.9843		25.0		152		80.0
13210000	13201	1		1.0000	1		6		3	

Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
> 1/4-1	+.000/-.003

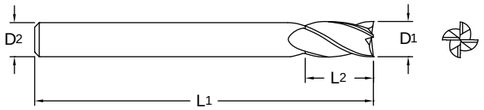
Metric (mm)	
D1	Tolerance
3.00-6.00	+.000/-.051
8.00-25.00	+.000/-.076

Technical information on page 222.

TuffCut® GP Series 181

Z4 | 30°

Designed for extended reach in die and mold work and other deep pocket applications.



- General purpose milling of most materials.
- 4 flutes for reduced chip loads in tougher materials.
- Available with neck relief upon request.
- Standard flute lengths reduce cutter deflection.

Uncoated		Diameter			Shank		OAL		Flue Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
18125000	18100	1/4		.2500	1/4		4		3/4	
18131250	18110	5/16		.3125	5/16		4		13/16	
18131500	18135		8.0	.3150		8.0		101		20.0
18137500	18120	3/8		.3750	3/8		4		7/8	
18143750	18130	7/16		.4375	7/16		4		1	
18150000	18140	1/2		.5000	1/2		6		1	
18175000	18160	3/4		.7500	3/4		6		1-1/2	

Inch	
D1	Tolerance
1/4	+.000/-.002
> 1/4-3/4	+.000/-.003

Metric (mm)	
D1	Tolerance
>6.00-8.00	-.020/-.048

Technical information on page 250.

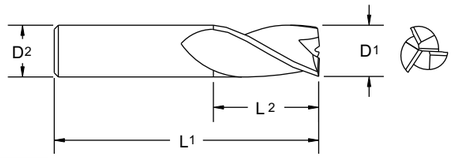
ISO 9001:2000 Certified

An ESOP Company

TuffCut® GP Series 116

Z3 | 30°

Designed for aggressive milling of most materials.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11601560	11601	1/64		.0156	1/8		1-1/2		1/32	
11603120	11603	1/32		.0312	1/8		1-1/2		5/64	
11603940	11605		1.0	.0394		3.0		38		3.0
11604680	11607	3/64		.0468	1/8		1-1/2		7/64	
11605910	11609		1.5	.0591		3.0		38		6.0
11606250	11611	1/16		.0625	1/8		1-1/2		3/16	
11607810	11613	5/64		.0781	1/8		1-1/2		3/16	
11607870	11615		2.0	.0787		3.0		38		9.0
11609370	11617	3/32		.0937	1/8		1-1/2		9/32	
11609840	11619		2.5	.0984		3.0		38		12.0
11610930	11623	7/64		.1093	1/8		1-1/2		3/8	
11611810	11625		3.0	.1181		3.0		38		12.0
11612500	11627	1/8		.1250	1/8		1-1/2		3/8	
11612501	11630	1/8		.1250	1/8		1-1/2		1/2	
11613780	11633		3.5	.1378		4.0		51		12.0
11614060	11634	9/64		.1406	3/16		2		1/2	
11615620	11635	5/32		.1562	3/16		2		1/2	
11615750	11637		4.0	.1575		4.0		51		14.0
11617190	11638	11/64		.1719	3/16		2		5/8	
11617720	11639		4.5	.1772		5.0		51		14.0
11618750	11641	3/16		.1875	3/16		2		5/8	
11619680	11643		5.0	.1968		5.0		51		20.0
11620310	11644	13/64		.2031	1/4		2-1/2		5/8	
11621650	11645		5.5	.2165		6.0		64		20.0
11621870	11647	7/32		.2187	1/4		2-1/2		5/8	
11623440	11648	15/64		.2344	1/4		2-1/2		3/4	
11623620	11649		6.0	.2362		6.0		64		20.0
11625000	11651	1/4		.2500	1/4		2-1/2		3/4	
11627560	11653		7.0	.2756		8.0		64		20.0
11628120	11655	9/32		.2812	5/16		2-1/2		3/4	
11631250	11657	5/16		.3125	5/16		2-1/2		13/16	
11631500	11659		8.0	.3150		8.0		64		20.0
11635430	11661		9.0	.3543		9.0		64		20.0
11637500	11663	3/8		.3750	3/8		2-1/2		1	
11639370	11665		10.0	.3937		10.0		70		25.0
11643310	11667		11.0	.4331		11.0		70		25.0
11643750	11669	7/16		.4375	7/16		2-3/4		1	

Inch	
D1	Tolerance
1/64	+.000/-.001
1/32-1/4	+.000/-.002
>1/4-1 1/4	+.000/-.003

Metric (mm)	
D1	Tolerance h10
1.00-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-30.00	+.000/-.084
32.00	+.000/-.100

Coated tools on page 188.

Technical information on page 250.

Series 116 Continued

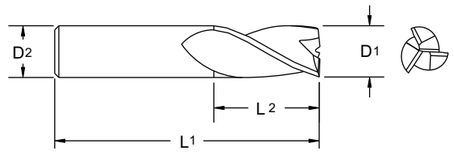
Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11647240	11671		12.0	.4724		12.0		76		25.0
11650000	11673	1/2		.5000	1/2		3		1	
11655120	11675		14.0	.5512		14.0		89		30.0
11656250	11677	9/16		.5625	9/16		3-1/2		1-1/8	
11662500	11679	5/8		.6250	5/8		3-1/2		1-1/4	
11662990	11681		16.0	.6299		16.0		89		30.0
11670870	11683		18.0	.7087		18.0		102		35.0
11675000	11685	3/4		.7500	3/4		4		1-1/2	
11678740	11687		20.0	.7874		20.0		102		38.0
11686620	11689		22.0	.8662		22.0		102		40.0
11687500	11691	7/8		.8750	7/8		4		1-1/2	
11698430	11693		25.0	.9843		25.0		102		40.0
11610000	11621	1		1.0000	1		4		1-1/2	
11612510	11629	1-1/4		1.2500	1-1/4		4-3/8		1-9/16	
11612600	11631		32.0	1.2600		32.0		111		40.0

Coated tools on page 188.

Technical information on page 250.

TuffCut® GP Series 116 Coated

Z3 | 30° | TiN | ALtima® | TiCN



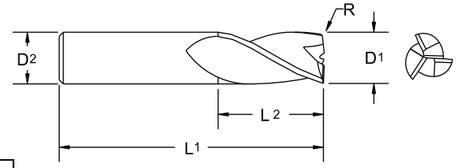
TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
11611810T	11626	11611810A	51603	11611810C	51604		3.0	.1181		3.0		38		12.0
11612500T	11628	11612500A	51605	11612500C	51606	1/8		.1250	1/8		1-1/2		3/8	
11615750T	11636	11615750A	51607	11615750C	51608		4.0	.1575		4.0		51		14.0
11618750T	11642	11618750A	51609	11618750C	51610	3/16		.1875	3/16		2		5/8	
11619680T	11646	11619680A	51611	11619680C	51612		5.0	.1968		5.0		51		20.0
11623620T	11650	11623620A	51613	11623620C	51614		6.0	.2362		6.0		64		20.0
11625000T	11652	11625000A	51615	11625000C	51616	1/4		.2500	1/4		2-1/2		3/4	
11631250T	11658	11631250A	51617	11631250C	51618	5/16		.3125	5/16		2-1/2		13/16	
11631500T	11660	11631500A	51619	11631500C	51620		8.0	.3150		8.0		64		20.0
11637500T	11664	11637500A	51621	11637500C	51622	3/8		.3750	3/8		2-1/2		1	
11639370T	11666	11639370A	51623	11639370C	51624		10.0	.3937		10.0		70		25.0
11643750T	11670	11643750A	51625	11643750C	51626	7/16		.4375	7/16		2-3/4		1	
11647240T	11672	11647240A	51627	11647240C	51628		12.0	.4724		12.0		76		25.0
11650000T	11674	11650000A	51629	11650000C	51630	1/2		.5000	1/2		3		1	
11662500T	11680	11662500A	51631	11662500C	51632	5/8		.6250	5/8		3-1/2		1-1/4	
11662990T	11682	11662990A	51633	11662990C	51634		16.0	.6299		16.0		89		30.0
11675000T	11686	11675000A	51635	11675000C	51636	3/4		.7500	3/4		4		1-1/2	
11678740T	11688	11678740A	51637	11678740C	51638		20.0	.7874		20.0		102		38.0
11698430T	11694	11698430A	51639	11698430C	51640		25.0	.9843		25.0		102		40.0
11610000T	11622	11610000A	51601	11610000C	51602	1		1.0000	1		4		1-1/2	

Uncoated tools on page 186.

Technical information on page 250.

TuffCut® GP Series 116C Workhorse

Z3 | 30° | TiCN



- Performs well in all materials including Stainless Steel, Inconel and Stellite.
- Produces long cuts at reasonable speeds on everyday equipment.
- Exceptional tool life at moderate speeds and feeds.
- Ideal for long cuts requiring accuracy and minimal tool wear deflection.
- Perfect Job Shop Tool.

TiCN		Diameter		Shank	OAL	Flute Length	Corner Radius
Tool No.	EDP	D1	Decimal	D2	L1	L2	R
11612508C	11695	1/8	.1250	1/8	1-1/2	1/2	0.01
11615628C	11696	5/32	.1562	3/16	2	9/16	0.01
11618758C	11697	3/16	.1875	3/16	2	5/8	0.01
11621872C	11698	7/32	.2187	1/4	2-1/2	3/4	0.02
11625002C	11699	1/4	.2500	1/4	2-1/2	3/4	0.02
11628122C	11468	9/32	.2812	5/16	2-1/2	3/4	0.02
11631252C	11469	5/16	.3125	5/16	2-1/2	13/16	0.02
11634382C	11500	11/32	.3438	3/8	2-1/2	7/8	0.02
11637502C	11369	3/8	.3750	3/8	2-1/2	1	0.02
11640622C	11370	13/32	.4062	7/16	2-3/4	1	0.02
11643752C	11382	7/16	.4375	7/16	2-3/4	1	0.02
11646882C	11383	15/32	.4688	1/2	3	1-1/4	0.02
11650002C	11371	1/2	.5000	1/2	3	1-1/4	0.02
11650003C	11372	1/2	.5000	1/2	3	1-1/4	0.03
11662502C	11373	5/8	.6250	5/8	3-1/2	1-5/8	0.02
11662503C	11374	5/8	.6250	5/8	3-1/2	1-5/8	0.03
11675002C	11375	3/4	.7500	3/4	4	1-1/2	0.02
11675003C	11376	3/4	.7500	3/4	4	1-1/2	0.03
11610002C	11379	1	1.0000	1	4	1-1/2	0.02
11610003C	11380	1	1.0000	1	4	1-1/2	0.03
11610012C	11377	1	1.0000	1	4	2	0.02
11610013C	11378	1	1.0000	1	4	2	0.03

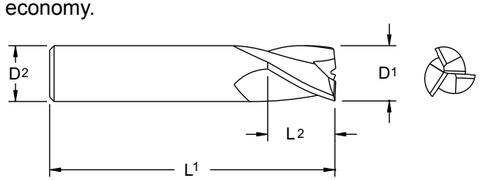
Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
>1/4-1	+.000/-.003

Technical information on page 250.

TuffCut® GP Series 169

Z3 | 30°

Designed for aggressive milling of most materials. Provides reduced deflection, improved tool life and overall economy.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16901560	16900	1/64		.0156	1/8		1-1/2		.023	
16903120	16901	1/32		.0312	1/8		1-1/2		1/16	
16903940	16903		1.0	.0394		3.0		38		2.0
16904680	16905	3/64		.0468	1/8		1-1/2		3/32	
16905910	16907		1.5	.0591		3.0		38		3.0
16906250	16909	1/16		.0625	1/8		1-1/2		1/8	
16907810	16911	5/64		.0781	1/8		1-1/2		5/32	
16907870	16913		2.0	.0787		3.0		38		4.0
16909370	16915	3/32		.0937	1/8		1-1/2		3/16	
16909840	16917		2.5	.0984		3.0		38		5.0
16910930	16919	7/64		.1093	1/8		1-1/2		7/32	
16911810	16921		3.0	.1181		3.0		38		6.0
16912500	16923	1/8		.1250	1/8		1-1/2		1/4	
16913780	16925		3.5	.1378		4.0		51		7.0
16914060	16926	9/64		.1406	3/16		2		5/16	
16915620	16927	5/32		.1562	3/16		2		5/16	
16915750	16929		4.0	.1575		4.0		51		8.0
16917180	16930	11/64		.1718	3/16		2		3/8	
16917720	16931		4.5	.1772		5.0		51		9.0
16918750	16933	3/16		.1875	3/16		2		3/8	
16919680	16935		5.0	.1968		5.0		51		11.0
16920310	16936	13/64		.2031	1/4		2		1/2	
16921650	16937		5.5	.2165		6.0		51		12.0
16921870	16939	7/32		.2187	1/4		2		1/2	
16923430	16940	15/64		.2343	1/4		2		1/2	
16923620	16941		6.0	.2362		6.0		51		13.0
16925000	16943	1/4		.2500	1/4		2		1/2	
16927560	16945		7.0	.2756		8.0		51		13.0
16928120	16947	9/32		.2812	5/16		2		1/2	
16931250	16949	5/16		.3125	5/16		2		1/2	
16931500	16951		8.0	.3150		8.0		51		13.0
16935430	16953		9.0	.3543		9.0		51		14.0
16937500	16955	3/8		.3750	3/8		2		5/8	
16939370	16957		10.0	.3937		10.0		51		14.0
16943310	16959		11.0	.4331		11.0		64		16.0
16943750	16961	7/16		.4375	7/16		2-1/2		5/8	

Inch	
D1	Tolerance
1/64	+.000/-.001
1/32-1/4	+.000/-.002
>1/4-3/4	+.000/-.003

Metric (mm)	
D1	Tolerance h10
1.00-3.00	+.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

Coated tools on page 191.

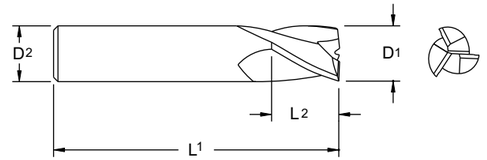
Technical information on page 250.

Series169 Continued

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16947240	16963		12.0	.4724		12.0		64		16.0
16950000	16965	1/2		.5000	1/2		2-1/2		5/8	
16955120	16967		14.0	.5512		14.0		70		18.0
16962500	16969	5/8		.6250	5/8		3		3/4	
16962990	16971		16.0	.6299		16.0		76		20.0
16970870	16973		18.0	.7087		18.0		76		25.0
16975000	16975	3/4		.7500	3/4		3		1	
16978740	16977		20.0	.7874		20.0		76		25.0

TuffCut® GP Series 169 Coated

Z3 | 30° | TiN | ALtima® | TiCN



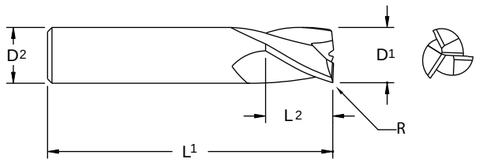
TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16911810T	56900	16911810A	56933	16911810C	56966		3.0	.1181		3.0		38		6.0
16912500T	56901	16912500A	56934	16912500C	56967	1/8		.1250	1/8		1-1/2		1/4	
16915750T	56905	16915750A	56938	16915750C	56971		4.0	.1575		4.0		51		8.0
16918750T	56908	16918750A	56941	16918750C	56974	3/16		.1875	3/16		2		3/8	
16919680T	56909	16919680A	56942	16919680C	56975		5.0	.1968		5.0		51		11.0
16923620T	56914	16923620A	56947	16923620C	56980		6.0	.2362		6.0		51		13.0
16925000T	56915	16925000A	56948	16925000C	56981	1/4		.2500	1/4		2		1/2	
16931250T	56918	16931250A	56951	16931250C	56984	5/16		.3125	5/16		2		1/2	
16931500T	56919	16931500A	56952	16931500C	56985		8.0	.3150		8.0		51		13.0
16937500T	56921	16937500A	56954	16937500C	56987	3/8		.3750	3/8		2		5/8	
16939370T	56922	16939370A	56955	16939370C	56988		10.0	.3937		10.0		51		14.0
16943750T	56924	16943750A	56957	16943750C	56990	7/16		.4375	7/16		2-1/2		5/8	
16947240T	56925	16947240A	56958	16947240C	56991		12.0	.4724		12.0		64		16.0
16950000T	56926	16950000A	56959	16950000C	56992	1/2		.5000	1/2		2-1/2		5/8	
16962500T	56928	16962500A	56961	16962500C	56994	5/8		.6250	5/8		3		3/4	
16962990T	56929	16962990A	56962	16962990C	56995		16.0	.6299		16.0		76		20.0
16975000T	56931	16975000A	56964	16975000C	56997	3/4		.7500	3/4		3		1	
16978740T	56932	16978740A	56965	16978740C	56998		20.0	.7874		20.0		76		25.0

Uncoated tools on page 190.

Technical information on page 250.

TuffCut® GP Series 169C Workhorse

Z3 | 30° | TiCN



TiCN		Diameter		Shank	OAL	Flute Length	Corner Radius
Tool No.	EDP	D1	Decimal	D2	L1	L2	R
16912508C	16978	1/8	.1250	1/8	1-1/2	1/4	0.01
16915628C	16979	5/32	.1562	3/16	2	5/16	0.01
16918758C	16980	3/16	.1875	3/16	2	3/8	0.01
16921872C	16981	7/32	.2187	1/4	2	1/2	0.02
16925002C	16982	1/4	.2500	1/4	2	1/2	0.02
16928122C	11381	9/32	.2812	5/16	2	1/2	0.02
16931252C	16983	5/16	.3125	5/16	2	1/2	0.02
16934382C	16984	11/32	.3438	3/8	2	1/2	0.02
16937502C	16985	3/8	.3750	3/8	2	5/8	0.02
16940622C	16986	13/32	.4062	7/16	2-1/2	9/16	0.02
16943752C	16987	7/16	.4375	7/16	2-1/2	5/8	0.02
16946882C	16988	15/32	.4688	1/2	2-1/2	1/2	0.02
16950002C	16989	1/2	.5000	1/2	2-1/2	5/8	0.02
16950003C	16990	1/2	.5000	1/2	2-1/2	5/8	0.03
16962502C	16991	5/8	.6250	5/8	3	3/4	0.02
16962503C	16992	5/8	.6250	5/8	3	3/4	0.03
16975002C	16993	3/4	.7500	3/4	3	1	0.02
16975003C	16994	3/4	.7500	3/4	3	1	0.03

Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
>1/4-3/4	+.000/-.003

- Performs well in all materials including Stainless Steel, Inconel and Stellite.
- Produces long cuts at reasonable speeds on everyday equipment.
- Exceptional tool life at moderate speeds and feeds.
- Ideal for long cuts requiring accuracy and minimal tool wear deflection.
- Perfect Job Shop Tool.

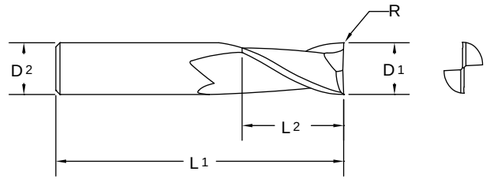
Technical information on page 250.

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.

TuffCut® GP Series 121

Z2 | 30°

Designed for aggressive milling of most materials.



- Micro sizes available. .005-.100" and 0.2-2.0mm.

Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
12100500	52101			.0050	1/8		1-1/2		.015			
12100600	52191			.0060	1/8		1-1/2		.018			
12100700	52192			.0070	1/8		1-1/2		.021			
12100780	52102		0.2	.0078		3.0		38		0.6		
12100800	52193			.0080	1/8		1-1/2		.024			
12100900	52194			.0090	1/8		1-1/2		.027			
12101000	52103			.0100	1/8		1-1/2		.030			
12101100	52195			.0110	1/8		1-1/2		.033			
12101180	52104		0.3	.0118		3.0		38		0.9		
12101200	52196			.0120	1/8		1-1/2		.036			
12101300	52197			.0130	1/8		1-1/2		.039			
12101400	52198			.0140	1/8		1-1/2		.042			
12101500	52105			.0150	1/8		1-1/2		.045			
12101560	12106	1/64		.0156	1/8		1-1/2		1/32			
12101570	52107		0.4	.0157		3.0		38		1.2		
12101600	52199			.0160	1/8		1-1/2		.048			
12101700	52250			.0170	1/8		1-1/2		.051			
12101800	52251			.0180	1/8		1-1/2		.054			
12101900	52252			.0190	1/8		1-1/2		.057			
12101960	52108		0.5	.0196		3.0		38		1.5		
12102000	52109			.0200	1/8		1-1/2		.060			
12102100	52253			.0210	1/8		1-1/2		.063			
12102200	52254			.0220	1/8		1-1/2		.066			
12102300	52255			.0230	1/8		1-1/2		.069			
12102360	52110		0.6	.0236		3.0		38		1.8		
12102400	52256			.0240	1/8		1-1/2		.072			
12102500	52111			.0250	1/8		1-1/2		.075			
12102600	52257			.0260	1/8		1-1/2		.078			
12102700	52258			.0270	1/8		1-1/2		.081			
12102750	52112		0.7	.0275		3.0		38		2.1		
12102800	52259			.0280	1/8		1-1/2		.084			
12102900	52260			.0290	1/8		1-1/2		.087			
12103000	52113			.0300	1/8		1-1/2		.090			
12103120	12114	1/32		.0312	1/8		1-1/2		5/64			
12103150	52115		0.8	.0315		3.0		38		2.4		
12103500	52116			.0350	1/8		1-1/2		.105			
12103540	52117		0.9	.0354		3.0		38		2.7		
12103940	12118		1.0	.0394		3.0		38		3.0		
12104000	52120			.0400	1/8		1-1/2		.120			
12104330	52121		1.1	.0433		3.0		38		3.3		
12104500	52122			.0450	1/8		1-1/2		.135			
12104680	12123	3/64		.0468	1/8		1-1/2		7/64			

Inch	
D1	Tolerance
1/64	+.000/-.001
1/32-1/4	+.000/-.002
>1/4-1 1/4	+.000/-.003
D1 Micro Sizes*	Tolerance
.005-.100	+.0005/-.0005

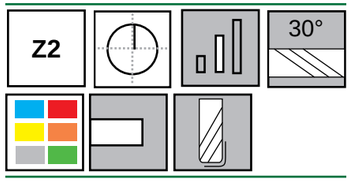
Metric (mm)	
D1	Tolerance h10
0.20-0.50	+.000/-.025
0.60-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-30.00	+.000/-.084
32.00	+.000/-.100

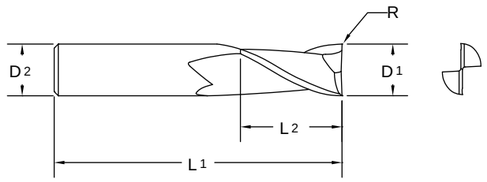
*Inch decimal size range .005-.100" only.

Coated tools on page 198.

Technical information on page 250.

Series 121 Continued





Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
12104720	52124		1.2	.0472		3.0		38		3.6		
12105000	52125			.0500	1/8		1-1/2		.150			
12105120	52126		1.3	.0512		3.0		38		3.9		
12105500	52127			.0550	1/8		1-1/2		.165			
12105510	52128		1.4	.0551		3.0		38		4.2		
12105910	12129		1.5	.0591		3.0		38		6.0		
12105911	52129		1.5	.0591		3.0		38		4.5		
12106000	52131			.0600	1/8		1-1/2		.180			
12106250	12132	1/16		.0625	1/8		1-1/2		3/16			
12106300	52133		1.6	.0630		3.0		38		4.8		
12106500	52134			.0650	1/8		1-1/2		.195			
12106690	52135		1.7	.0669		3.0		38		5.1		
12107000	52136			.0700	1/8		1-1/2		.210			
12107090	52137		1.8	.0709		3.0		38		5.4		
12107480	52138		1.9	.0748		3.0		38		5.7		
12107500	52139			.0750	1/8		1-1/2		.225			
12107810	12140	5/64		.0781	1/8		1-1/2		3/16			
12107870	12141		2.0	.0787		3.0		38		9.0		
12107871	52141		2.0	.0787		3.0		38		6.0		
12108000	52143			.0800	1/8		1-1/2		.240			
12108500	52144			.0850	1/8		1-1/2		.255			
12109000	52145			.0900	1/8		1-1/2		.270			
12109370	12146	3/32		.0937	1/8		1-1/2		9/32			
12109500	52147			.0950	1/8		1-1/2		.285			
12109840	12148		2.5	.0984		3.0		38		12.0		
12110010	52150			.1000	1/8		1-1/2		.300			
12110930	12151	7/64		.1093	1/8		1-1/2		3/8			
12111810	12152		3.0	.1181		3.0		38		12.0		
12111811	52402		3.0	.1181		3.0		38		12.0		0.500
12112500	12153	1/8		.1250	1/8		1-1/2		3/8			
12112511	52401	1/8		.1250	1/8		1-1/2		3/8			0.015
12112512	52403	1/8		.1250	1/8		1-1/2		3/8			0.020
12112501	12150	1/8		.1250	1/8		1-1/2		1/2			
12113780	12156		3.5	.1378		4.0		51		12.0		
12114060	12187	9/64		.1406	3/16		2		1/2			
12115620	12157	5/32		.1562	3/16		2		1/2			
12115750	12158		4.0	.1575		4.0		51		14.0		
12115751	52404		4.0	.1575		4.0		51		14.0		0.500
12115752	52422		4.0	.1575		4.0		51		14.0		0.750
12117190	12188	11/64		.1719	3/16		2		5/8			
12117720	12159		4.5	.1772		5.0		51		14.0		
12118750	12160	3/16		.1875	3/16		2		5/8			
12118751	52405	3/16		.1875	3/16		2		5/8			0.015
12118752	52407	3/16		.1875	3/16		2		5/8			0.020
12118753	52409	3/16		.1875	3/16		2		5/8			0.030
12119680	12161		5.0	.1968		5.0		51		20.0		

Coated tools on page 198.

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Series 121 Continued

Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
12119681	52406		5.0	.1968		5.0		51		20.0		0.500
12119682	52424		5.0	.1968		5.0		51		20.0		0.750
12119683	52440		5.0	.1968		5.0		51		20.0		1.000
12120310	12189	13/64		.2031	1/4		2-1/2		5/8			
12121650	12162		5.5	.2165		6.0		64		20.0		
12121870	12163	7/32		.2187	1/4		2-1/2		5/8			
12123440	12190	15/64		.2344	1/4		2-1/2		3/4			
12123620	12164		6.0	.2362		6.0		64		20.0		
12123621	52408		6.0	.2362		6.0		64		20.0		0.500
12123622	52426		6.0	.2362		6.0		64		20.0		0.750
12123623	52442		6.0	.2362		6.0		64		20.0		1.000
12125000	12165	1/4		.2500	1/4		2-1/2		3/4			
12125001	52411	1/4		.2500	1/4		2-1/2		3/4		0.015	
12125002	52413	1/4		.2500	1/4		2-1/2		3/4		0.020	
12125003	52415	1/4		.2500	1/4		2-1/2		3/4		0.030	
12125004	52417	1/4		.2500	1/4		2-1/2		3/4		0.045	
12127560	12166		7.0	.2756		8.0		64		20.0		
12128120	12167	9/32		.2812	5/16		2-1/2		3/4			
12131250	12168	5/16		.3125	5/16		2-1/2		13/16			
12131251	52419	5/16		.3125	5/16		2-1/2		13/16		0.015	
12131252	52421	5/16		.3125	5/16		2-1/2		13/16		0.020	
12131253	52423	5/16		.3125	5/16		2-1/2		13/16		0.030	
12131254	52425	5/16		.3125	5/16		2-1/2		13/16		0.045	
12131500	12169		8.0	.3150		8.0		64		20.0		
12131501	52410		8.0	.3150		8.0		64		20.0		0.500
12131502	52428		8.0	.3150		8.0		64		20.0		0.750
12131503	52444		8.0	.3150		8.0		64		20.0		1.000
12131504	52456		8.0	.3150		8.0		64		20.0		1.500
12135430	12170		9.0	.3543		9.0		64		20.0		
12137500	12171	3/8		.3750	3/8		2-1/2		1			
12137501	52427	3/8		.3750	3/8		2-1/2		1		0.015	
12137502	52429	3/8		.3750	3/8		2-1/2		1		0.020	
12137503	52431	3/8		.3750	3/8		2-1/2		1		0.030	
12137504	52433	3/8		.3750	3/8		2-1/2		1		0.045	
12139370	12172		10.0	.3937		10.0		70		25.0		
12139371	52412		10.0	.3937		10.0		70		25.0		0.500
12139372	52430		10.0	.3937		10.0		70		25.0		0.750
12139373	52446		10.0	.3937		10.0		70		25.0		1.000
12139374	52458		10.0	.3937		10.0		70		25.0		1.500
12143310	12173		11.0	.4331		11.0		70		25.0		
12143750	12174	7/16		.4375	7/16		2-3/4		1			
12147240	12175		12.0	.4724		12.0		76		25.0		
12147241	52414		12.0	.4724		12.0		76		25.0		0.500
12147242	52432		12.0	.4724		12.0		76		25.0		0.750
12147243	52448		12.0	.4724		12.0		76		25.0		1.000
12147244	52460		12.0	.4724		12.0		76		25.0		1.500
12147245	52468		12.0	.4724		12.0		76		25.0		2.000
12150000	12176	1/2		.5000	1/2		3		1			
12150001	52435	1/2		.5000	1/2		3		1		0.015	
12150002	52437	1/2		.5000	1/2		3		1		0.020	
12150003	52439	1/2		.5000	1/2		3		1		0.030	
12150004	52441	1/2		.5000	1/2		3		1		0.045	

Coated tools on page 198.

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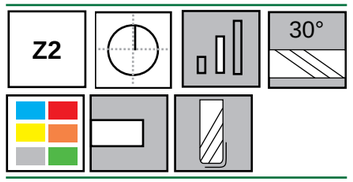
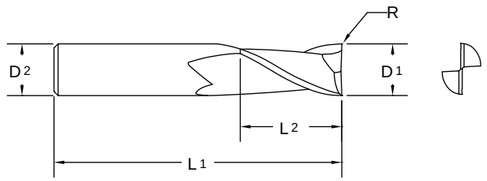
Series 121 Continued





Uncoated		Diameter			Shank		OAL		Flute Length		Corner Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
12150005	52443	1/2		.5000	1/2		3		1		0.060	
12155120	12177		14.0	.5512		14.0		89		30.0		
12156250	12178	9/16		.5625	9/16		3-1/2		1-1/8			
12162500	12179	5/8		.6250	5/8		3-1/2		1-1/4			
12162501	52445	5/8		.6250	5/8		3-1/2		1-1/4		0.015	
12162502	52447	5/8		.6250	5/8		3-1/2		1-1/4		0.020	
12162503	52449	5/8		.6250	5/8		3-1/2		1-1/4		0.030	
12162504	52451	5/8		.6250	5/8		3-1/2		1-1/4		0.045	
12162505	52453	5/8		.6250	5/8		3-1/2		1-1/4		0.060	
12162506	52455	5/8		.6250	5/8		3-1/2		1-1/4		0.090	
12162990	12180		16.0	.6299		16.0		89		30.0		
12162991	52416		16.0	.6299		16.0		89		30.0		0.500
12162992	52434		16.0	.6299		16.0		89		30.0		0.750
12162993	52450		16.0	.6299		16.0		89		30.0		1.000
12162994	52462		16.0	.6299		16.0		89		30.0		1.500
12162995	52470		16.0	.6299		16.0		89		30.0		2.000
12162996	52476		16.0	.6299		16.0		89		30.0		2.500
12162997	52482		16.0	.6299		16.0		89		30.0		3.000
12170870	12181		18.0	.7087		18.0		102		35.0		
12175000	12182	3/4		.7500	3/4		4		1-1/2			
12175001	52457	3/4		.7500	3/4		4		1-1/2		0.015	
12175002	52459	3/4		.7500	3/4		4		1-1/2		0.020	
12175003	52461	3/4		.7500	3/4		4		1-1/2		0.030	
12175004	52463	3/4		.7500	3/4		4		1-1/2		0.045	
12175005	52465	3/4		.7500	3/4		4		1-1/2		0.060	
12175006	52467	3/4		.7500	3/4		4		1-1/2		0.090	
12175007	52469	3/4		.7500	3/4		4		1-1/2		0.125	
12178740	12183		20.0	.7874		20.0		102		38.0		
12178741	52418		20.0	.7874		20.0		102		38.0		0.500
12178742	52436		20.0	.7874		20.0		102		38.0		0.750
12178743	52452		20.0	.7874		20.0		102		38.0		1.000
12178744	52464		20.0	.7874		20.0		102		38.0		1.500
12178745	52472		20.0	.7874		20.0		102		38.0		2.000
12178746	52478		20.0	.7874		20.0		102		38.0		2.500
12178747	52484		20.0	.7874		20.0		102		38.0		3.000
12186620	12184		22.0	.8662		22.0		102		40.0		
12187500	12185	7/8		.8750	7/8		4		1-1/2			
12198430	12186		25.0	.9843		25.0		102		40.0		
12198431	52420		25.0	.9843		25.0		102		40.0		0.500
12198432	52438		25.0	.9843		25.0		102		40.0		0.750
12198433	52454		25.0	.9843		25.0		102		40.0		1.000
12198434	52466		25.0	.9843		25.0		102		40.0		1.500
12198435	52474		25.0	.9843		25.0		102		40.0		2.000
12198436	52480		25.0	.9843		25.0		102		40.0		2.500

Coated tools on page 198.

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Series 121 Continued

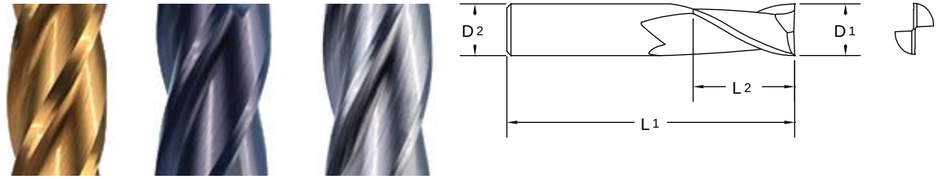
Uncoated		Diameter			Shank		OAL		Flute Length		Radius	
		D1			D2		L1		L2		R	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Inch	mm
12198437	52486		25.0	.9843		25.0		102		40.0		3.00
12110000	12149	1		1.0000	1		4		1-1/2			
12110001	52471	1		1.0000	1		4		1-1/2		0.015	
12110002	52473	1		1.0000	1		4		1-1/2		0.020	
12110003	52475	1		1.0000	1		4		1-1/2		0.030	
12110004	52477	1		1.0000	1		4		1-1/2		0.045	
12110005	52479	1		1.0000	1		4		1-1/2		0.060	
12110006	52481	1		1.0000	1		4		1-1/2		0.090	
12110007	52483	1		1.0000	1		4		1-1/2		0.125	
12112510	12154	1-1/4		1.2500	1-1/4		4-3/8		1-9/16			
12112600	12155		32.0	1.2600		32.0		111		40.0		

Coated tools on page 198.

Technical information on page 250.

TuffCut® GP Series 121 Coated

Z2 | 30° | TiN | ALtima® | TiCN



TiN		ALtima®		TiCN		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
12111810T	12270	12111810A	52153	12111810C	52154		3.0	.1181		3.0		38		12.0
12112500T	12261	12112500A	52155	12112500C	52156	1/8		.1250	1/8		1-1/2		3/8	
12115750T	12278	12115750A	52157	12115750C	52158		4.0	.1575		4.0		51		14.0
12118750T	12262	12118750A	52159	12118750C	52160	3/16		.1875	3/16		2		5/8	
12119680T	12271	12119680A	52161	12119680C	52162		5.0	.1968		5.0		51		20.0
12123620T	12272	12123620A	52163	12123620C	52164		6.0	.2362		6.0		64		20.0
12125000T	12263	12125000A	52165	12125000C	52166	1/4		.2500	1/4		2-1/2		3/4	
12131250T	12264	12131250A	52167	12131250C	52168	5/16		.3125	5/16		2-1/2		13/16	
12131500T	12273	12131500A	52169	12131500C	52170		8.0	.3150		8.0		64		20.0
12137500T	12265	12137500A	52171	12137500C	52172	3/8		.3750	3/8		2-1/2		1	
12139370T	12274	12139370A	52173	12139370C	52174		10.0	.3937		10.0		70		25.0
12143750T	12266	12143750A	52175	12143750C	52176	7/16		.4375	7/16		2-3/4		1	
12147240T	12275	12147240A	52177	12147240C	52178		12.0	.4724		12.0		76		25.0
12150000T	12267	12150000A	52179	12150000C	52180	1/2		.5000	1/2		3		1	
12162500T	12268	12162500A	52181	12162500C	52182	5/8		.6250	5/8		3-1/2		1-1/4	
12162990T	12276	12162990A	52183	12162990C	52184		16.0	.6299		16.0		89		30.0
12175000T	12269	12175000A	52185	12175000C	52186	3/4		.7500	3/4		4		1-1/2	
12178740T	12277	12178740A	52187	12178740C	52188		20.0	.7874		20.0		102		38.0
12198430T	12280	12198430A	52189	12198430C	52190		25.0	.9843		25.0		102		40.0
12110000T	12279	12110000A	52151	12110000C	52152	1		1.0000	1		4		1-1/2	

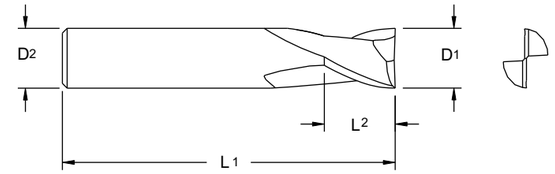
Uncoated tools on page 193.

Technical information on page 250.

TuffCut® GP Series 164

Z2 | 30°

Designed for aggressive milling of most materials with reduced deflection, improved tool life and overall economy.



- Micro sizes available .005-.060” and 0.2-2.0 mm.

Uncoated		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16400500	16468			.0050	1/8		1-1/2		.010	
16400600	16469			.0060	1/8		1-1/2		.012	
16400700	16470			.0070	1/8		1-1/2		.014	
16400780	16402		0.2	.0078		3.0		38		0.4
16400800	16471			.0080	1/8		1-1/2		.016	
16400900	16472			.0090	1/8		1-1/2		.018	
16401000	16473			.0100	1/8		1-1/2		.020	
16401100	16474			.0110	1/8		1-1/2		.022	
16401180	16404		0.3	.0118		3.0		38		0.6
16401200	16475			.0120	1/8		1-1/2		.024	
16401300	16476			.0130	1/8		1-1/2		.026	
16401400	16477			.0140	1/8		1-1/2		.028	
16401500	16478			.0150	1/8		1-1/2		.030	
16401560	16400	1/64		.0156	1/8		1-1/2		.023	
16401570	16406		0.4	.0157		3.0		38		0.8
16401600	16479			.0160	1/8		1-1/2		.032	
16401700	16480			.0170	1/8		1-1/2		.034	
16401800	16481			.0180	1/8		1-1/2		.036	
16401900	16482			.0190	1/8		1-1/2		.038	
16401960	16408		0.5	.0196		3.0		38		1.0
16402000	16483			.0200	1/8		1-1/2		.040	
16402100	16484			.0210	1/8		1-1/2		.042	
16402200	16485			.0220	1/8		1-1/2		.044	
16402300	16486			.0230	1/8		1-1/2		.046	
16402360	16412		0.6	.0236		3.0		38		1.2
16402400	16487			.0240	1/8		1-1/2		.048	
16402500	16488			.0250	1/8		1-1/2		.050	
16402600	16489			.0260	1/8		1-1/2		.052	
16402700	16490			.0270	1/8		1-1/2		.054	
16402750	16414		0.7	.0275		3.0		38		1.4
16402800	16491			.0280	1/8		1-1/2		.056	
16402900	16492			.0290	1/8		1-1/2		.058	
16403000	16493			.0300	1/8		1-1/2		.060	
16403120	16401	1/32		.0312	1/8		1-1/2		1/16	
16403150	16418		0.8	.0315		3.0		38		1.6
16403500	16494			.0350	1/8		1-1/2		.070	
16403540	16420		0.9	.0354		3.0		38		1.8

Inch	
D1	Tolerance
1/64	+.000/-.001
1/32-1/4	+.000/-.002
>1/4-3/4	+.000/-.003
D1 Micro Sizes*	Tolerance
.005-.060	+.0005/-.0005

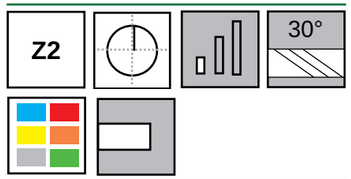
*Inch decimal size range .005-.060” only.

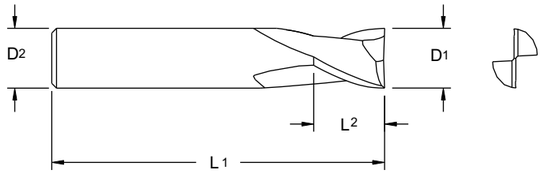
Metric (mm)	
D1	Tolerance h10
0.20-0.50	+.000/-.025
0.60-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-20.00	+.000/-.084

Coated tools on page 201.

Technical information on page 250.

Series 164 Continued





Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16403940	16403		1.0	.0394		3.0		38		2.0
16404000	16495			.0400	1/8		1-1/2		.080	
16404330	16428		1.1	.0433		3.0		38		2.2
16404500	16496			.0450	1/8		1-1/2		.090	
16404680	16405	3/64		.0468	1/8		1-1/2		3/32	
16404720	16430		1.2	.0472		3.0		38		2.4
16405000	16497			.0500	1/8		1-1/2		.100	
16405120	16434		1.3	.0512		3.0		38		2.6
16405500	16498			.0550	1/8		1-1/2		.110	
16405510	16438		1.4	.0551		3.0		38		2.8
16405910	16407		1.5	.0591		3.0		38		3.0
16406000	16499			.0600	1/8		1-1/2		.120	
16406250	16409	1/16		.0625	1/8		1-1/2		1/8	
16406300	16444		1.6	.0630		3.0		38		3.2
16406690	16446		1.7	.0669		3.0		38		3.4
16407090	16448		1.8	.0709		3.0		38		3.6
16407480	16450		1.9	.0748		3.0		38		3.8
16407810	16410	5/64		.0781	1/8		1-1/2		5/32	
16407870	16411		2.0	.0787		3.0		38		4.0
16409370	16413	3/32		.0937	1/8		1-1/2		3/16	
16409840	16415		2.5	.0984		3.0		38		5.0
16410930	16416	7/64		.1093	1/8		1-1/2		7/32	
16411810	16417		3.0	.1181		3.0		38		6.0
16412500	16419	1/8		.1250	1/8		1-1/2		1/4	
16413780	16421		3.5	.1378		4.0		51		7.0
16414060	16422	9/64		.1406	3/16		2		5/16	
16415620	16423	5/32		.1562	3/16		2		5/16	
16415750	16425		4.0	.1575		4.0		51		8.0
16417180	16426	11/64		.1718	3/16		2		3/8	
16417720	16427		4.5	.1772		5.0		51		9.0
16418750	16429	3/16		.1875	3/16		2		3/8	
16419680	16431		5.0	.1968		5.0		51		11.0
16420310	16432	13/64		.2031	1/4		2		1/2	
16421650	16433		5.5	.2165		6.0		51		12.0
16421870	16435	7/32		.2187	1/4		2		1/2	
16423430	16436	15/64		.2343	1/4		2		1/2	
16423620	16437		6.0	.2362		6.0		51		13.0
16425000	16439	1/4		.2500	1/4		2		1/2	
16427560	16441		7.0	.2756		8.0		51		13.0
16428120	16442	9/32		.2812	5/16		2		1/2	
16431250	16443	5/16		.3125	5/16		2		1/2	
16431500	16445		8.0	.3150		8.0		51		13.0

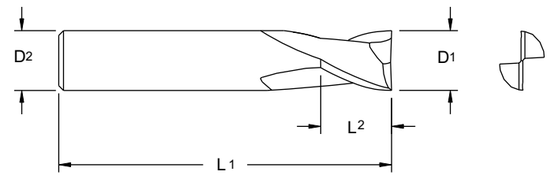
Coated tools on page 201.

Technical information on page 250.

Series164 Continued

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16435430	16447		9.0	.3543		9.0		51		14.0
16437500	16449	3/8		.3750	3/8		2		5/8	
16439370	16451		10.0	.3937		10.0		51		14.0
16443310	16453		11.0	.4331		11.0		64		16.0
16443750	16455	7/16		.4375	7/16		2-1/2		5/8	
16447240	16457		12.0	.4724		12.0		64		16.0
16450000	16459	1/2		.5000	1/2		2-1/2		5/8	
16455120	16461		14.0	.5512		14.0		70		18.0
16462500	16463	5/8		.6250	5/8		3		3/4	
16462990	16465		16.0	.6299		16.0		76		20.0
16470870	16466		18.0	.7087		18.0		76		25.0
16475000	16467	3/4		.7500	3/4		3		1	
16478740	16462		20.0	.7874		20.0		76		25.0

TuffCut® GP Series 164 Coated



TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16411810T	56400	16411810A	56433	16411810C	56466		3.0	.1181		3.0		38		6.0
16412500T	56401	16412500A	56434	16412500C	56467	1/8		.1250	1/8		1-1/2		1/4	
16415750T	56405	16415750A	56438	16415750C	56471		4.0	.1575		4.0		51		8.0
16418750T	56408	16418750A	56441	16418750C	56474	3/16		.1875	3/16		2		3/8	
16419680T	56409	16419680A	56442	16419680C	56475		5.0	.1968		5.0		51		11.0
16423620T	56414	16423620A	56447	16423620C	56480		6.0	.2362		6.0		51		13.0
16425000T	56415	16425000A	56448	16425000C	56481	1/4		.2500	1/4		2		1/2	
16431250T	56418	16431250A	56451	16431250C	56484	5/16		.3125	5/16		2		1/2	
16431500T	56419	16431500A	56452	16431500C	56485		8.0	.3150		8.0		51		13.0
16437500T	56421	16437500A	56454	16437500C	56487	3/8		.3750	3/8		2		5/8	
16439370T	56422	16439370A	56455	16439370C	56488		10.0	.3937		10.0		51		14.0
16443750T	56424	16443750A	56457	16443750C	56490	7/16		.4375	7/16		2-1/2		5/8	
16447240T	56425	16447240A	56458	16447240C	56491		12.0	.4724		12.0		64		16.0
16450000T	56426	16450000A	56459	16450000C	56492	1/2		.5000	1/2		2-1/2		5/8	
16462500T	56428	16462500A	56461	16462500C	56494	5/8		.6250	5/8		3		3/4	
16462990T	56429	16462990A	56462	16462990C	56495		16.0	.6299		16.0		76		20.0
16475000T	56431	16475000A	56464	16475000C	56497	3/4		.7500	3/4		3		1	
16478740T	56432	16478740A	56465	16478740C	56498		20.0	.7874		20.0		76		25.0

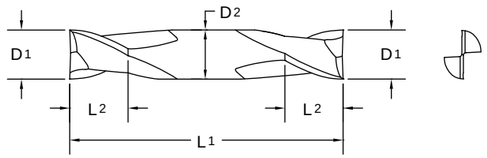
Uncoated tools on page 199.
Technical information on page 250.

TuffCut® GP Series 162

Z2 | 30°

Designed with the same geometry as our standard 2 flute end mills.

- Twice the cutting edges saves you money.
- Good choice for shallow hole milling.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16201560	16200	1/64		.0156	1/8		1-1/2		.023	
16203120	16201	1/32		.0312	1/8		1-1/2		1/16	
16203940	16203		1.0	.0394		3.0		38		2.0
16204680	16205	3/64		.0468	1/8		1-1/2		3/32	
16205910	16207		1.5	.0591		3.0		38		3.0
16206250	16209	1/16		.0625	1/8		1-1/2		1/8	
16207810	16211	5/64		.0781	1/8		1-1/2		5/32	
16207870	16213		2.0	.0787		3.0		38		4.0
16209370	16215	3/32		.0937	1/8		1-1/2		3/16	
16209840	16217		2.5	.0984		3.0		38		5.0
16210930	16219	7/64		.1093	1/8		1-1/2		7/32	
16211810	16221		3.0	.1181		3.0		38		6.0
16212500	16223	1/8		.1250	1/8		1-1/2		1/4	
16213780	16225		3.5	.1378		4.0		51		7.0
16214060	16226	9/64		.1406	3/16		2		5/16	
16215620	16227	5/32		.1562	3/16		2		5/16	
16215750	16229		4.0	.1575		4.0		51		8.0
16217720	16231		4.5	.1772		5.0		51		9.0
16218750	16233	3/16		.1875	3/16		2		3/8	
16219680	16235		5.0	.1968		5.0		51		11.0
16223620	16241		6.0	.2362		6.0		64		13.0
16225000	16243	1/4		.2500	1/4		2-1/2		1/2	
16231500	16251		8.0	.3150		8.0		64		13.0
16235430	16253		9.0	.3543		9.0		64		14.0
16237500	16255	3/8		.3750	3/8		2-1/2		9/16	
16239370	16257		10.0	.3937		10.0		70		14.0
16247240	16263		12.0	.4724		12.0		76		16.0
16250000	16265	1/2		.5000	1/2		3		5/8	
16262500	16269	5/8		.6250	5/8		3-1/2		3/4	
16275000	16275	3/4		.7500	3/4		4		1	

Inch	
D1	Tolerance
1/64-1/4	+.000/-.002
>1/4-3/4	+.000/-.003

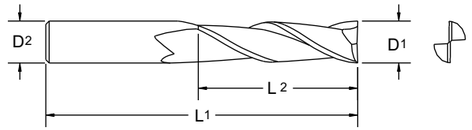
Metric (mm)	
D1	Tolerance h10
1.00- 3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-12.00	+.000/-.070

Technical information on page 250.

TuffCut® GP Series 123

Z2 | 30°

Designed for deep pocket milling and other applications where standard flute lengths are too short.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
12311810	12303		3.0	.1181		3.0		64		25.0
12312500	12305	1/8		.1250	1/8		2-1/2		1	
12315750	12306		4.0	.1575		4.0		64		25.0
12318750	12307	3/16		.1875	3/16		3		1-1/8	
12319680	12308		5.0	.1968		5.0		64		25.0
12323620	12309		6.0	.2362		6.0		76		30.0
12325000	12311	1/4		.2500	1/4		3		1-1/4	
12327560	12312		7.0	.2756		8.0		83		30.0
12331250	12313	5/16		.3125	5/16		3-1/4		1-3/8	
12331500	12315		8.0	.3150		8.0		83		35.0
12335430	12316		9.0	.3543		10.0		89		35.0
12337500	12317	3/8		.3750	3/8		3-1/2		1-1/2	
12339370	12319		10.0	.3937		10.0		89		40.0
12343310	12320		11.0	.4331		12.0		102		40.0
12343750	12321	7/16		.4375	7/16		4		1-3/4	
12347240	12323		12.0	.4724		12.0		102		50.0
12350000	12325	1/2		.5000	1/2		4		2	
12362500	12327	5/8		.6250	5/8		4-5/8		2-1/2	
12362990	12329		16.0	.6299		16.0		117		65.0
12375000	12331	3/4		.7500	3/4		5-1/4		3	
12378740	12333		20.0	.7874		20.0		133		80.0
12398430	12335		25.0	.9843		25.0		152		80.0
12310000	12301	1		1.0000	1		6		3	

Inch	
D1	Tolerance
1/8-1/4	+.000/-.002
>1/4-1	+.000/-.003

Metric (mm)	
D1	Tolerance
3.00-6.00	+.000/-.051
7.00-25.00	+.000/-.076

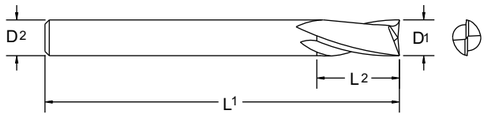
Technical information on page 250.

TuffCut® GP Series 183

Z2 | 30°

Designed for extended reach in die and mold work and other deep pocket applications.

- General purpose milling of most materials.
- Standard flute lengths reduce cutter deflection.
- Available with neck relief upon request.



Uncoated		Diameter		Shank	OAL	Flute Length
		D1		D2	L1	L2
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch
18325000	18300	1/4	.2500	1/4	4	3/4
18331250	18310	5/16	.3125	5/16	4	13/16
18337500	18320	3/8	.3750	3/8	4	7/8
18343750	18330	7/16	.4375	7/16	4	1
18350000	18340	1/2	.5000	1/2	6	1
18375000	18360	3/4	.7500	3/4	6	1-1/2

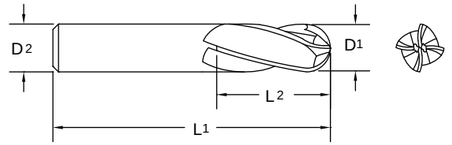
Inch	
D1	Tolerance
1/4	+.000/-.002
> 1/4-3/4	+.000/-.003

Technical information on page 250.

TuffCut® GP Series 140

Z4 | 30°

Manufactured with a full ball radius end. Designed for milling fillets or similar rounded corners in the bottom of a cut.



- Ideal for most ferrous metal applications.

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
14003120	14001	1/32		.0312	1/8		1-1/2		5/64	
14003940	14003		1.0	.0394		3.0		38		3.0
14004680	14005	3/64		.0468	1/8		1-1/2		7/64	
14005910	14007		1.5	.0591		3.0		38		6.0
14006250	14009	1/16		.0625	1/8		1-1/2		3/16	
14007810	14011	5/64		.0781	1/8		1-1/2		3/16	
14007870	14013		2.0	.0787		3.0		38		9.0
14009370	14015	3/32		.0937	1/8		1-1/2		9/32	
14009840	14017		2.5	.0984		3.0		38		12.0
14010930	14021	7/64		.1093	1/8		1-1/2		3/8	
14011810	14023		3.0	.1181		3.0		38		12.0
14012500	14025	1/8		.1250	1/8		1-1/2		3/8	
14013780	14027		3.5	.1378		4.0		51		12.0
14015620	14029	5/32		.1562	3/16		2		1/2	
14015750	14031		4.0	.1575		4.0		51		14.0
14017720	14033		4.5	.1772		5.0		51		14.0
14018750	14035	3/16		.1875	3/16		2		5/8	
14019680	14037		5.0	.1968		5.0		51		20.0
14021650	14039		5.5	.2165		6.0		64		20.0
14021870	14041	7/32		.2187	1/4		2-1/2		5/8	
14023620	14043		6.0	.2362		6.0		64		20.0
14025000	14045	1/4		.2500	1/4		2-1/2		3/4	
14027560	14047		7.0	.2756		8.0		64		20.0
14028120	14049	9/32		.2812	5/16		2-1/2		3/4	
14031250	14051	5/16		.3125	5/16		2-1/2		13/16	
14031500	14053		8.0	.3150		8.0		64		20.0
14035430	14055		9.0	.3543		9.0		64		20.0
14037500	14057	3/8		.3750	3/8		2-1/2		1	
14039370	14059		10.0	.3937		10.0		70		25.0
14043310	14061		11.0	.4331		11.0		70		25.0
14043750	14063	7/16		.4375	7/16		2-3/4		1	
14047240	14065		12.0	.4724		12.0		76		25.0
14050000	14067	1/2		.5000	1/2		3		1	
14055120	14069		14.0	.5512		14.0		89		30.0
14056250	14071	9/16		.5625	9/16		3-1/2		1-1/8	
14062500	14073	5/8		.6250	5/8		3-1/2		1-1/4	

Inch	
D1	Tolerance
1/32-1/4	+.000/-.002
>1/4-1	+.000/-.003

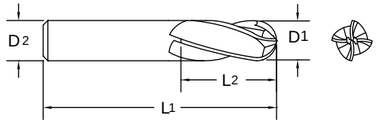
Metric (mm)	
D1	Tolerance h10
1.00-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-25.00	+.000/-.084

Coated tools on page 206.

Technical information on page 250.

Series 140 Continued

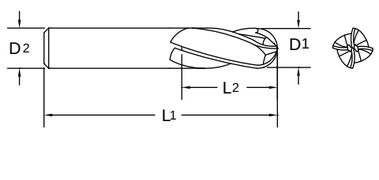
Z4 | 30°



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
14062990	14075		16.0	.6299		16.0		89		30.0
14068750	14077	11/16		.6875	3/4		4		1-3/8	
14070870	14079		18.0	.7087		18.0		102		35.0
14075000	14081	3/4		.7500	3/4		4		1-1/2	
14078740	14083		20.0	.7874		20.0		102		38.0
14086620	14085		22.0	.8662		22.0		102		40.0
14087500	14087	7/8		.8750	7/8		4		1-1/2	
14098430	14089		25.0	.9843		25.0		102		40.0
14010000	14019	1		1.0000	1		4		1-1/2	

TuffCut® GP Series 140 Coated

Z4 | 30° | TiN | ALtima® | TiCN



TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
14011810T	14072	14011810A	14000	14011810C	14036		3.0	.1181		3.0		38		12.0
14012500T	14074	14012500A	14002	14012500C	14038	1/8		.1250	1/8		1-1/2		3/8	
14015750T	14076	14015750A	14004	14015750C	14040		4.0	.1575		4.0		51		14.0
14018750T	14078	14018750A	14006	14018750C	14042	3/16		.1875	3/16		2		5/8	
14019680T	14080	14019680A	14008	14019680C	14044		5.0	.1968		5.0		51		20.0
14023620T	14082	14023620A	14010	14023620C	14046		6.0	.2362		6.0		64		20.0
14025000T	14084	14025000A	14012	14025000C	14048	1/4		.2500	1/4		2-1/2		3/4	
14031250T	14086	14031250A	14014	14031250C	14050	5/16		.3125	5/16		2-1/2		13/16	
14031500T	14088	14031500A	14016	14031500C	14052		8.0	.3150		8.0		64		20.0
14037500T	14090	14037500A	14018	14037500C	14054	3/8		.3750	3/8		2-1/2		1	
14039370T	14091	14039370A	14020	14039370C	14056		10.0	.3937		10.0		70		25.0
14043750T	14092	14043750A	14022	14043750C	14058	7/16		.4375	7/16		2-3/4		1	
14047240T	14093	14047240A	14024	14047240C	14060		12.0	.4724		12.0		76		25.0
14050000T	14094	14050000A	14026	14050000C	14062	1/2		.5000	1/2		3		1	
14062500T	14095	14062500A	14028	14062500C	14064	5/8		.6250	5/8		3-1/2		1-1/4	
14062990T	14096	14062990A	14030	14062990C	14066		16.0	.6299		16.0		89		30.0
14075000T	14097	14075000A	14032	14075000C	14068	3/4		.7500	3/4		4		1-1/2	
14078740T	14098	14078740A	14034	14078740C	14070		20.0	.7874		20.0		102		38.0
14098430T	54003	14098430A	54004	14098430C	54005		25.0	.9843		25.0		102		40.0
14010000T	54000	14010000A	54001	14010000C	54002	1		1.0000	1		4		1-1/2	

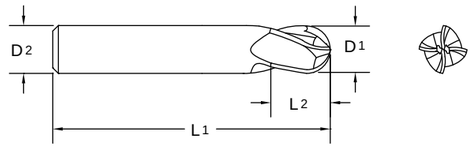
Uncoated tools on page 205.

Technical information on page 250

TuffCut® GP Series 165

Z4 | 30°

Manufactured with full ball radius end.



- Ideal for most ferrous metal applications

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16501560	16500	1/64		.0156	1/8		1-1/2		.023	
16503120	16501	1/32		.0312	1/8		1-1/2		1/16	
16503940	16503		1.0	.0394		3.0		38		2.0
16504680	16505	3/64		.0468	1/8		1-1/2		3/32	
16505910	16507		1.5	.0591		3.0		38		3.0
16506250	16509	1/16		.0625	1/8		1-1/2		1/8	
16507810	16510	5/64		.0781	1/8		1-1/2		5/32	
16507870	16511		2.0	.0787		3.0		38		4.0
16509370	16513	3/32		.0937	1/8		1-1/2		3/16	
16509840	16515		2.5	.0984		3.0		38		5.0
16510930	16516	7/64		.1093	1/8		1-1/2		7/32	
16511810	16517		3.0	.1181		3.0		38		6.0
16512500	16519	1/8		.1250	1/8		1-1/2		1/4	
16513780	16521		3.5	.1378		4.0		51		7.0
16514060	16522	9/64		.1406	3/16		2		5/16	
16515620	16523	5/32		.1562	3/16		2		5/16	
16515750	16525		4.0	.1575		4.0		51		8.0
16517180	16526	11/64		.1718	3/16		2		3/8	
16517720	16527		4.5	.1772		5.0		51		9.0
16518750	16529	3/16		.1875	3/16		2		3/8	
16519680	16531		5.0	.1968		5.0		51		11.0
16520310	16532	13/64		.2031	1/4		2		1/2	
16521650	16533		5.5	.2165		6.0		51		12.0
16521870	16535	7/32		.2187	1/4		2		1/2	
16523430	16536	15/64		.2343	1/4		2		1/2	
16523620	16537		6.0	.2362		6.0		51		13.0
16525000	16539	1/4		.2500	1/4		2		1/2	
16527560	16541		7.0	.2756		8.0		51		13.0
16528120	16542	9/32		.2812	5/16		2		1/2	
16531250	16543	5/16		.3125	5/16		2		1/2	
16531500	16545		8.0	.3150		8.0		51		13.0
16535430	16547		9.0	.3543		9.0		51		14.0
16537500	16549	3/8		.3750	3/8		2		5/8	
16539370	16551		10.0	.3937		10.0		51		14.0
16543310	16553		11.0	.4331		11.0		64		16.0
16543750	16555	7/16		.4375	7/16		2-1/2		5/8	
16547240	16557		12.0	.4724		12.0		64		16.0

Inch	
D1	Tolerance
1/64	+.000/-.001
1/32-1/4	+.000/-.002
>1/4-3/4	+.000/-.003

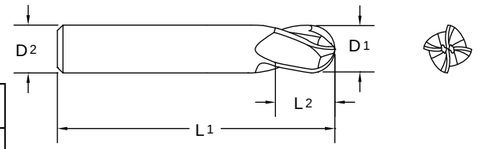
Metric (mm)	
D1	Tolerance h10
1.00-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058
>10.00-18.00	+.000/-.070
>18.00-20.00	+.000/-.084

Coated tools on page 208.

Technical information on page 250.

Series 165 Continued

Z4 | 30°

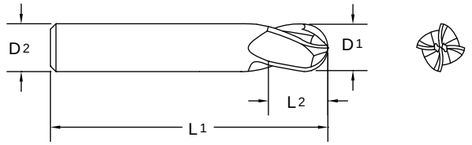


Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16550000	16559	1/2		.5000	1/2		2-1/2		5/8	
16555120	16561		14.0	.5512		14.0		70		18.0
16562500	16563	5/8		.6250	5/8		3		3/4	
16562990	16565		16.0	.6299		16.0		76		20.0
16570870	16567		18.0	.7087		18.0		76		25.0
16575000	16569	3/4		.7500	3/4		3		1	
16578740	16571		20.0	.7874		20.0		76		25.0

Technical information on page 250.

TuffCut® GP Series 165 Coated

Z4 | 30° | TiN | ALtima® | TiCN



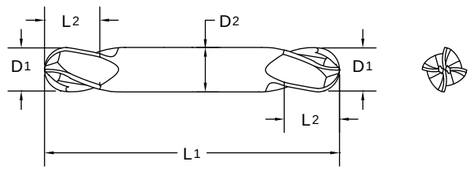
Uncoated tools on page 207.

TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16511810T	56500	16511810A	56533	16511810C	56566		3.0	.1181		3.0		38		6.0
16512500T	56501	16512500A	56534	16512500C	56567	1/8		.1250	1/8		1-1/2		1/4	
16515750T	56505	16515750A	56538	16515750C	56571		4.0	.1575		4.0		51		8.0
16518750T	56508	16518750A	56541	16518750C	56574	3/16		.1875	3/16		2		3/8	
16519680T	56509	16519680A	56542	16519680C	56575		5.0	.1968		5.0		51		11.0
16523620T	56514	16523620A	56547	16523620C	56580		6.0	.2362		6.0		51		13.0
16525000T	56515	16525000A	56548	16525000C	56581	1/4		.2500	1/4		2		1/2	
16531250T	56518	16531250A	56551	16531250C	56584	5/16		.3125	5/16		2		1/2	
16531500T	56519	16531500A	56552	16531500C	56585		8.0	.3150		8.0		51		13.0
16537500T	56521	16537500A	56554	16537500C	56587	3/8		.3750	3/8		2		5/8	
16539370T	56522	16539370A	56555	16539370C	56588		10.0	.3937		10.0		51		14.0
16543750T	56524	16543750A	56557	16543750C	56590	7/16		.4375	7/16		2-1/2		5/8	
16547240T	56525	16547240A	56558	16547240C	56591		12.0	.4724		12.0		64		16.0
16550000T	56526	16550000A	56559	16550000C	56592	1/2		.5000	1/2		2-1/2		5/8	
16562500T	56528	16562500A	56561	16562500C	56594	5/8		.6250	5/8		3		3/4	
16562990T	56529	16562990A	56562	16562990C	56595		16.0	.6299		16.0		76		20.0
16575000T	56531	16575000A	56564	16575000C	56597	3/4		.7500	3/4		3		1	
16578740T	56532	16578740A	56565	16578740C	56598		20.0	.7874		20.0		76		25.0

TuffCut® GP Series 167

Z4 | 30°

Designed with the same geometry as our standard 4-flute ball end mills.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16701560	16700	1/64		.0156	1/8		1-1/2		.023	
16703120	16701	1/32		.0312	1/8		1-1/2		1/16	
16703940	16703		1.0	.0394		3.0		38		2.0
16705910	16707		1.5	.0591		3.0		38		3.0
16706250	16709	1/16		.0625	1/8		1-1/2		1/8	
16707870	16711		2.0	.0787		3.0		38		4.0
16709370	16713	3/32		.0937	1/8		1-1/2		3/16	
16709840	16715		2.5	.0984		3.0		38		5.0
16711810	16717		3.0	.1181		3.0		38		6.0
16712500	16719	1/8		.1250	1/8		1-1/2		1/4	
16713780	16721		3.5	.1378		4.0		51		7.0
16715750	16725		4.0	.1575		4.0		51		8.0
16718750	16729	3/16		.1875	3/16		2		3/8	
16719680	16731		5.0	.1968		5.0		51		11.0
16723620	16737		6.0	.2362		6.0		64		13.0
16725000	16739	1/4		.2500	1/4		2-1/2		1/2	
16731500	16745		8.0	.3150		8.0		64		13.0
16737500	16749	3/8		.3750	3/8		2-1/2		9/16	

Inch	
D1	Tolerance
1/64-1/4	+.000/-.002
> 1/4-3/8	+.000/-.003

Metric (mm)	
D1	Tolerance h10
1.00- 3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-8.00	+.000/-.058

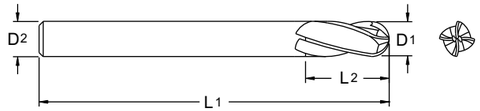
Technical information on page 250.

TuffCut® GP Series 184

Z4 | 30°

Designed for extended reach in die and mold work and other deep pocket applications. Ball nose geometry for inside corner radius and CNC contouring.

- General purpose milling of most materials.
- 4 flutes for reduced chip loads in tougher materials.
- Available with neck relief upon request.
- Standard flute lengths reduce cutter deflection.



Uncoated		Diameter		Shank	OAL	Flute Length
		D1		D2	L1	L2
Tool No.	EDP	Fraction	Decimal			
18425000	18400	1/4	.2500	1/4	4	3/4
18431250	18410	5/16	.3125	5/16	4	13/16
18437500	18420	3/8	.3750	3/8	4	7/8
18443750	18430	7/16	.4375	7/16	4	1
18450000	18440	1/2	.5000	1/2	6	1
18475000	18460	3/4	.7500	3/4	6	1-1/2

Inch	
D1	Tolerance
1/4	+.000/-.002
> 1/4-3/4	+.000/-.003

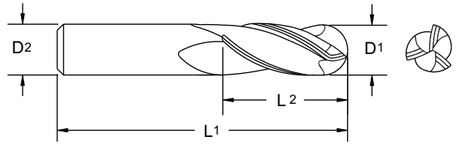
Technical information on page 250.

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.

TuffCut® GP Series 145

Z3 | 30° | TiN | ALtima® | TiCN

Manufactured with a full ball radius end. Designed for milling fillets or similar rounded corners in the bottom of a cut. Ideal for most ferrous metal applications. Inch sizes available as a special. Call customer service for pricing.



Uncoated		TiN		ALtima®		TiCN		Diameter		Shank	OAL	Flute Length
								D1		D2	L1	L2
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	mm	Decimal	mm	mm	mm
14503940	14501							1.0	.0394	3.0	38	3.0
14505910	14504							1.5	.0591	3.0	38	6.0
14507870	14507							2.0	.0787	3.0	38	9.0
14511810	14513	14511810T	14514	14511810A	14515	14511810C	14570	3.0	.1181	3.0	38	12.0
14515750	14519	14515750T	14520	14515750A	14521	14515750C	14571	4.0	.1575	4.0	51	14.0
14519680	14525	14519680T	14526	14519680A	14527	14519680C	14572	5.0	.1968	5.0	51	20.0
14523620	14531	14523620T	14532	14523620A	14533	14523620C	14573	6.0	.2362	6.0	64	20.0
14531500	14537	14531500T	14538	14531500A	14359	14531500C	14574	8.0	.3150	8.0	64	20.0
14539370	14543	14539370T	14544	14539370A	14545	14539370C	14575	10.0	.3937	10.0	70	25.0

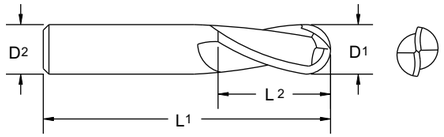
Metric (mm)	
D1	Tolerance h10
1.00-3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-10.00	+.000/-.058

Technical information on page 250.

TuffCut® GP Series 150

Z2 | 30°

Manufactured with a full ball radius end. Designed for milling fillets or similar rounded corners in the bottom of a cut. Ideal for most ferrous metal applications.



- Micro sizes from .015 - .100” and 0.4-2.0mm

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
15001500	15002			.0150	1/8		1-1/2		.045	
15001570	15038		0.4	.0157		3		38		1.2
15001960	15040		0.5	.0196		3		38		1.5
15002000	15004			.0200	1/8		1-1/2		.060	
15002360	15042		0.6	.0236		3		38		1.8
15002500	15006			.0250	1/8		1-1/2		.075	
15002750	15044		0.7	.0275		3		38		2.1
15003000	15008			.0300	1/8		1-1/2		.090	
15003120	15001	1/32		.0312	1/8		1-1/2		5/64	
15003150	15046		0.8	.0315		3		38		2.4
15003500	15010			.0350	1/8		1-1/2		.105	
15003540	15048		0.9	.0354		3		38		2.7
15003940	15003		1.0	.0394		3		38		3.0
15004000	15012			.0400	1/8		1-1/2		.120	
15004330	15052		1.1	.0433		3		38		3.3
15004500	15014			.0450	1/8		1-1/2		.135	
15004680	15005	3/64		.0468	1/8		1-1/2		7/64	
15004720	15054		1.2	.0472		3		38		3.6
15005000	15016			.0500	1/8		1-1/2		.150	
15005120	15056		1.3	.0512		3		38		3.9
15005500	15018			.0550	1/8		1-1/2		.165	
15005510	15058		1.4	.0551		3		38		4.2
15005910	15007		1.5	.0591		3		38		6.0
15005911	15060		1.5	.0591		3		38		4.5
15006000	15020			.0600	1/8		1-1/2		.180	
15006250	15009	1/16		.0625	1/8		1-1/2		3/16	
15006300	15062		1.6	.0630		3		38		4.8
15006500	15022			.0650	1/8		1-1/2		.195	
15006690	15064		1.7	.0669		3		38		5.1
15007000	15024			.0700	1/8		1-1/2		.210	
15007090	15066		1.8	.0709		3		38		5.4
15007480	15068		1.9	.0748		3		38		5.7
15007500	15026			.0750	1/8		1-1/2		.225	
15007810	15011	5/64		.0781	1/8		1-1/2		3/16	

Inch	
D1	Tolerance
1/32-1/4	+.000/-.002
>1/4-1	+.000/-.003
D1 Micro Sizes*	Tolerance
.015-.100	+.0005/-.0005

Metric (mm)	
D1	Tolerance h10
0.40-0.50	+.000/-.025
0.60-3.00	+.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

*Inch decimal size range .015-.100" only.

Coated tools on page 214

Technical information on page 250.

Series 150 Continued

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
15007870	15013		2.0	.0787		3		38		9.0
15007871	15070		2.0	.0787		3		38		6.0
15008000	15028			.0800	1/8		1-1/2		.240	
15008500	15030			.0850	1/8		1-1/2		.255	
15009000	15032			.0900	1/8		1-1/2		.270	
15009370	15015	3/32		.0937	1/8		1-1/2		9/32	
15009500	15034			.0950	1/8		1-1/2		.285	
15009840	15017		2.5	.0984		3		38		12
15010010	15036			.1000	1/8		1-1/2		.300	
15010930	15021	7/64		.1093	1/8		1-1/2		3/8	
15011810	15023		3.0	.1181		3		38		12
15012500	15025	1/8		.1250	1/8		1-1/2		3/8	
15013780	15027		3.5	.1378		4		51		12
15015620	15029	5/32		.1562	3/16		2		1/2	
15015750	15031		4.0	.1575		4		51		14
15017720	15033		4.5	.1772		5		51		14
15018750	15035	3/16		.1875	3/16		2		5/8	
15019680	15037		5.0	.1968		5		51		20
15021650	15039		5.5	.2165		6		64		20
15021870	15041	7/32		.2187	1/4		2-1/2		5/8	
15023620	15043		6.0	.2362		6		64		20
15025000	15045	1/4		.2500	1/4		2-1/2		3/4	
15027560	15047		7.0	.2756		8		64		20
15028120	15049	9/32		.2812	5/16		2-1/2		3/4	
15031250	15051	5/16		.3125	5/16		2-1/2		13/16	
15031500	15053		8.0	.3150		8		64		20
15035430	15055		9.0	.3543		9		64		20
15037500	15057	3/8		.3750	3/8		2-1/2		1	
15039370	15059		10.0	.3937		10		70		25
15043310	15061		11.0	.4331		11		70		25
15043750	15063	7/16		.4375	7/16		2-3/4		1	
15047240	15065		12.0	.4724		12		76		25
15050000	15067	1/2		.5000	1/2		3		1	
15055120	15069		14.0	.5512		14		89		30
15056250	15071	9/16		.5625	9/16		3-1/2		1-1/8	
15062500	15073	5/8		.6250	5/8		3-1/2		1-1/4	
15062990	15075		16.0	.6299		16		89		30
15068750	15077	11/16		.6875	3/4		4		1-3/8	
15070870	15079		18.0	.7087		18		102		35
15075000	15081	3/4		.7500	3/4		4		1-1/2	
15078740	15083		20.0	.7874		20		102		38
15086620	15085		22.0	.8662		22		102		40
15087500	15087	7/8		.8750	7/8		4		1-1/2	
15098430	15089		25.0	.9843		25		102		40
15010000	15019	1		1.0000	1		4		1-1/2	

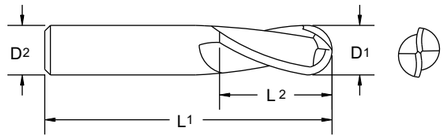
Coated tools on page 214.

Technical information on page 250.

For product information, call your local distributor.

TuffCut® GP Series 150 Coated

Z2 | 30° | TiN | ALtima® | TiCN



TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
15011810T	55076	15011810A	55040	15011810C	55058		3	.1181		3.0		38		12.0
15012500T	55077	15012500A	55041	15012500C	55059	1/8		.1250	1/8		1-1/2		3/8	
15015750T	55078	15015750A	55042	15015750C	55060		4	.1575		4.0		51		14.0
15018750T	55079	15018750A	55043	15018750C	55061	3/16		.1875	3/16		2		5/8	
15019680T	55080	15019680A	55044	15019680C	55062		5	.1968		5.0		51		20.0
15023620T	55081	15023620A	55045	15023620C	55063		6	.2362		6.0		64		20.0
15025000T	55082	15025000A	55046	15025000C	55064	1/4		.2500	1/4		2-1/2		3/4	
15031250T	55083	15031250A	55047	15031250C	55065	5/16		.3125	5/16		2-1/2		13/16	
15031500T	55084	15031500A	55048	15031500C	55066		8	.3150		8.0		64		20.0
15037500T	55085	15037500A	55049	15037500C	55067	3/8		.3750	3/8		2-1/2		1	
15039370T	55086	15039370A	55050	15039370C	55068		10	.3937		10.0		70		25.0
15043750T	55087	15043750A	55051	15043750C	55069	7/16		.4375	7/16		2-3/4		1	
15047240T	55088	15047240A	55052	15047240C	55070		12	.4724		12.0		76		25.0
15050000T	55089	15050000A	55053	15050000C	55071	1/2		.5000	1/2		3		1	
15062500T	55090	15062500A	55054	15062500C	55072	5/8		.6250	5/8		3-1/2		1-1/4	
15062990T	55091	15062990A	55055	15062990C	55073		16	.6299		16.0		89		30.0
15075000T	55092	15075000A	55056	15075000C	55074	3/4		.7500	3/4		4		1-1/2	
15078740T	55093	15078740A	55057	15078740C	55075		20	.7874		20.0		102		38.0
15098430T	55097	15098430A	55098	15098430C	55099		25	.9843		25.0		102		40.0
15010000T	55094	15010000A	55095	15010000C	55096	1		1.0000	1		4		1-1/2	

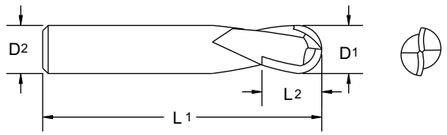
Uncoated tools on page 212.

Technical information on page 250.

TuffCut® GP Series 166

Z2 | 30°

Manufactured with a full ball radius end. Designed for milling fillets or similar rounded corners in the bottom of a cut. Ideal for most ferrous metal applications.



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16601560	16600	1/64		.0156	1/8		1-1/2		.023	
16603120	16601	1/32		.0312	1/8		1-1/2		1/16	
16603940	16603		1.0	.0394		3.0		38		2.0
16604680	16605	3/64		.0468	1/8		1-1/2		3/32	
16605910	16607		1.5	.0591		3.0		38		3.0
16606250	16609	1/16		.0625	1/8		1-1/2		1/8	
16607810	16610	5/64		.0781	1/8		1-1/2		5/32	
16607870	16611		2.0	.0787		3.0		38		4.0
16609370	16613	3/32		.0937	1/8		1-1/2		3/16	
16609840	16615		2.5	.0984		3.0		38		5.0
16610930	16616	7/64		.1093	1/8		1-1/2		7/32	
16611810	16617		3.0	.1181		3.0		38		6.0
16612500	16619	1/8		.1250	1/8		1-1/2		1/4	
16613780	16621		3.5	.1378		4.0		51		7.0
16614060	16622	9/64		.1406	3/16		2		5/16	
16615620	16623	5/32		.1562	3/16		2		5/16	
16615750	16625		4.0	.1575		4.0		51		8.0
16617180	16626	11/64		.1718	3/16		2		3/8	
16617720	16627		4.5	.1772		5.0		51		9.0
16618750	16629	3/16		.1875	3/16		2		3/8	
16619680	16631		5.0	.1968		5.0		51		11.0
16620310	16632	13/64		.2031	1/4		2		1/2	
16621650	16633		5.5	.2165		6.0		51		12.0
16621870	16635	7/32		.2187	1/4		2		1/2	
16623430	16636	15/64		.2343	1/4		2		1/2	
16623620	16637		6.0	.2362		6.0		51		13.0
16625000	16639	1/4		.2500	1/4		2		1/2	
16627560	16641		7.0	.2756		8.0		51		13.0
16628120	16642	9/32		.2812	5/16		2		1/2	
16631250	16643	5/16		.3125	5/16		2		1/2	
16631500	16645		8.0	.3150		8.0		51		13.0
16635430	16647		9.0	.3543		9.0		51		14.0
16637500	16649	3/8		.3750	3/8		2		5/8	
16639370	16651		10.0	.3937		10.0		51		14.0
16643310	16653		11.0	.4331		11.0		64		16.0
16643750	16655	7/16		.4375	7/16		2-1/2		5/8	
16647240	16657		12.0	.4724		12.0		64		16.0
16650000	16659	1/2		.5000	1/2		2-1/2		5/8	

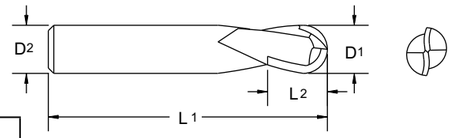
Inch	
D1	Tolerance
1/64	+.000/-.001
1/32-1/4	+.000/-.002
> 1/4-3/4	+.000/-.003

Metric (mm)	
D1	Tolerance h10
1.00- 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

Coated tools on page 216

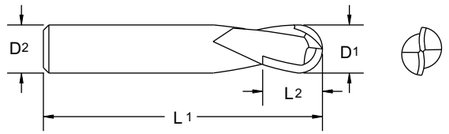
Technical information on page 250.

Series 166 Continued



Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16655120	16661		14.0	.5512		14.0		70		18.0
16662500	16663	5/8		.6250	5/8		3		3/4	
16662990	16665		16.0	.6299		16.0		76		20.0
16670870	16667		18.0	.7087		18.0		76		25.0
16675000	16669	3/4		.7500	3/4		3		1	
16678740	16671		20.0	.7874		20.0		76		25.0

TuffCut® GP Series 166 Coated

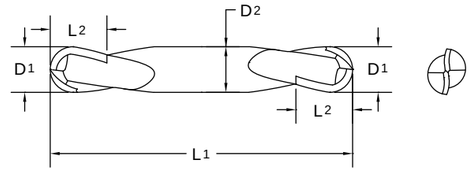


TiN		ALtima®		TiCN		Diameter			Shank		OAL		Flute Length	
						D1			D2		L1		L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16611810T	56600	16611810A	56633	16611810C	56666		3.0	.1181		3.0		38		6.0
16612500T	56601	16612500A	56634	16612500C	56667	1/8		.1250	1/8		1-1/2		1/4	
16615750T	56605	16615750A	56638	16615750C	56671		4.0	.1575		4.0		51		8.0
16618750T	56608	16618750A	56641	16618750C	56674	3/16		.1875	3/16		2		3/8	
16619680T	56609	16619680A	56642	16619680C	56675		5.0	.1968		5.0		51		11.0
16623620T	56614	16623620A	56647	16623620C	56680		6.0	.2362		6.0		51		13.0
16625000T	56615	16625000A	56648	16625000C	56681	1/4		.2500	1/4		2		1/2	
16631250T	56618	16631250A	56651	16631250C	56684	5/16		.3125	5/16		2		1/2	
16631500T	56619	16631500A	56652	16631500C	56685		8.0	.3150		8.0		51		13.0
16637500T	56621	16637500A	56654	16637500C	56687	3/8		.3750	3/8		2		5/8	
16639370T	56622	16639370A	56655	16639370C	56688		10.0	.3937		10.0		51		14.0
16643750T	56624	16643750A	56657	16643750C	56690	7/16		.4375	7/16		2-1/2		5/8	
16647240T	56625	16647240A	56658	16647240C	56691		12.0	.4724		12.0		64		16.0
16650000T	56626	16650000A	56659	16650000C	56692	1/2		.5000	1/2		2-1/2		5/8	
16662500T	56628	16662500A	56661	16662500C	56694	5/8		.6250	5/8		3		3/4	
16662990T	56629	16662990A	56662	16662990C	56695		16.0	.6299		16.0		76		20.0
16675000T	56631	16675000A	56664	16675000C	56697	3/4		.7500	3/4		3		1	
16678740T	56632	16678740A	56665	16678740C	56698		20.0	.7874		20.0		76		25.0

Uncoated tools on page 215.

Technical information on page 250.

TuffCut® GP Series 168



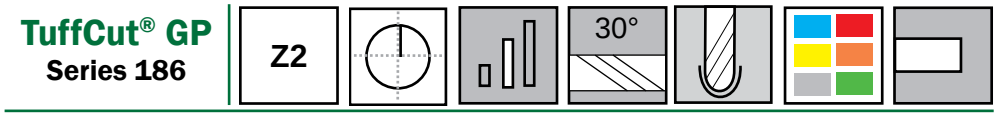
Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Inch	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
16801560	16800	1/64		.0156	1/8		1-1/2		.023	
16803120	16801	1/32		.0312	1/8		1-1/2		1/16	
16803940	16803		1.0	.0394		3.0		38		2.0
16805910	16807		1.5	.0591		3.0		38		3.0
16806250	16809	1/16		.0625	1/8		1-1/2		1/8	
16807870	16811		2.0	.0787		3.0		38		4.0
16809370	16813	3/32		.0937	1/8		1-1/2		3/16	
16809840	16815		2.5	.0984		3.0		38		5.0
16811810	16817		3.0	.1181		3.0		38		6.0
16812500	16819	1/8		.1250	1/8		1-1/2		1/4	
16813780	16821		3.5	.1378		4.0		51		7.0
16815750	16825		4.0	.1575		4.0		51		8.0
16818750	16829	3/16		.1875	3/16		2		3/8	
16819680	16831		5.0	.1968		5.0		51		11.0
16823620	16837		6.0	.2362		6.0		64		13.0
16825000	16839	1/4		.2500	1/4		2-1/2		1/2	
16831500	16845		8.0	.3150		8.0		64		13.0
16837500	16849	3/8		.3750	3/8		2-1/2		9/16	

Inch	
D1	Tolerance
1/64-1/4	+.000/-.002
> 1/4-3/8	+.000/-.003

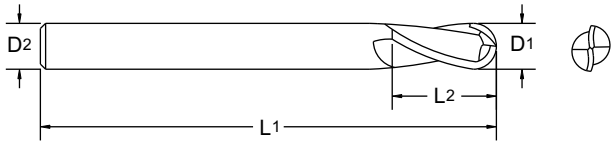
Metric (mm)	
D1	Tolerance h10
1.00- 3.00	+.000/-.040
>3.00-6.00	+.000/-.048
>6.00-8.00	+.000/-.058

Technical information on page 250.

TuffCut® GP Series 186



Designed for extended reach in die and mold work and other deep pocket applications. Ball nose geometry for inside corner radius and CNC contouring.



- General purpose milling of most materials.
- Standard flute lengths reduce cutter deflection.
- Available with neck relief upon request.

Uncoated		Diameter			Shank		OAL		Flute Length	
		D1			D2		L1		L2	
Tool No.	EDP	Fraction	mm	Decimal	Inch	mm	Inch	mm	Inch	mm
18611810	18605		3.0	.1181		6.0		60		6.0
18623620	18625		6.0	.2362		6.0		76		15.0
18625000	18600	1/4		.2500	1/4		4		3/4	
18631500	18635		8.0	.3150		8.0		101		20.0
18637500	18620	3/8		.3750	3/8		4		7/8	
18639370	18645		10.0	.3937		10.0		101		25.0
18647240	18655		12.0	.4724		12.0		152		25.0
18650000	18640	1/2		.5000	1/2		6		1	

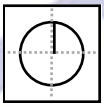
Inch	
D1	Tolerance
1/4	+.000/-.002
> 1/4-1/2	+.000/-.003

Metric (mm)	
D1	Tolerance
3.00	-.005/-.028
> 3.00-6.00	-.016/-.038
> 6.00-12.00	-.020/-.048

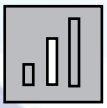
Technical information on page 250.

Icon Glossary

Number of Flutes

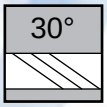


Center Cutting



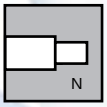
Lengths

Coatings

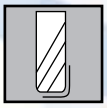


Helix Angle

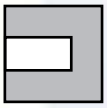
Ball Nose



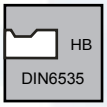
Neck Relief



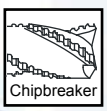
Corner Radius



Shank

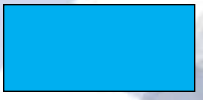


Shank/DIN



Chipbreaker

Workpiece Material Group



Steels

Stainless Steels

Cast Iron

Special Alloys

Hardened Steels (35-65Rc)

Non-Ferrous

Celebrating 90 Years 1919 - 2009 M.A. Ford®

End Mill Troubleshooting

Problem	Rigidity	Increase Inches/tooth	Reduce Inches/tooth	Material	Recutting Chips	Increase Rake Angle	Handling	Runout	Reduce Speed	Increase Speed	Depth of Cut	Fixturing	Coolant	Finish	Dull Tool	Chip Evacuation	Inadequate Number of Flutes	Insufficient Coolant	Plunge Cutting	Reduce Feed	Increase Feed	Tool Holder	Balance Holder & Tool
	Possible Solutions																						
Chipping	x		x	x	x		x	x														x	
Chatter	x	x							x		x	x										x	
Built Up Edge		x				x				x			x	x									
Breakage	x		x								x				x	x						x	
Chip Packing																	x	x	x				
Poor Slotting	x	x	x						x		x	x								x			
Premature Wear				x					x	x			x							x	x	x	
Chip Welding			x			x			x				x	x									
Cratering																							x

Formulas

Inch

RPM=SFM x 3.82/Tool Diameter
IPM=RPM x number of teeth x (inches/tooth)

Metric

RPM=SMM x 318.057/Tool Diameter
mm/min.=RPM x number of teeth x (mm/tooth)

Conversion Inch to Metric

SMM=SFM x .3048
mm/min.= IPM x 25.4

Conversion Metric to Inch

SFM=SMM/.3048
IPM= (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 necessary depending on the particular application.

Series 112/113 Inch

Workpiece Material Group		Examples	SFM
Stainless Steels	M	Stainless Steel Free Machining	200-400
		Austenitic 304/316	150-175
		Ferritic	175-225
		Martensitic PH Stainless 17-4 PH	80-125

Workpiece Material Group		Examples	SFM
Special Alloys	S	Titanium 6AL-4V	175-225
		Stellite Inconel 625/718 Incoloy 800-802	80-125

Workpiece Material Group		Examples	Tool Diameter								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inches/Tooth								
Stainless Steels	M	Stainless Steel Free Machining	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Austenitic 304/316	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
		Ferritic	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Martensitic PH Stainless 17-4 PH	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Special Alloys	S	Titanium 6AL-4V	.0003-.0004	.0004-.0006	.0006-.0008	.0008-.0012	.0008-.0012	.0012-.0016	.0016-.0018	.0018-.0020	.0020-.0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010-.0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Series 112/113 Metric

Workpiece Material Group		Examples	SMM
Stainless Steels	M	Stainless Steel Free Machining	60-120
		Austenitic 304/316	45-55
		Ferritic	55-70
		Martensitic	25-40
		PH Stainless 17-4 PH	25-40

Workpiece Material Group		Examples	SMM
Special Alloys	S	Titanium 6AL-4V	55-70
		Stellite Inconel 625/718 Incoloy 800-802	25-40

Workpiece Material Group		Examples	Tool Diameter (mm)								
			3	5	6	8	10	12	16	20	25
			mm/Tooth								
Stainless Steels	M	Stainless Steel Free Machining	.013-.030	.025-.030	.038-.051	.038-.064	.053-.076	.051-.089	.058-.102	.056-.109	.081-.127
		Austenitic 304/316	.008-.013	020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
		Ferritic	.013-.030	.025-.030	.038-.051	.038-.064	.053-.076	.051-.089	.058-.102	.056-.109	.081-.127
		Martensitic PH Stainless 17-4 PH	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
Special Alloys	S	Titanium 6AL-4V	.008-.010	.010-.017	.017-.02	.020-.030	.020-.030	.030-.041	.041-.046	.046-.051	.051-.076
		Stellite Inconel 625/718 Incoloy 800-802	.008-.013	.013-.038	.013-.038	.025-.051	.025-.051	.025-.076	.051-.076	.064-.089	.064-.089

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

Series 114/132 Inch

Workpiece Material Group		Examples	SFM
Steels	P	Steel - Mild (.2-.3 Carbon) 1018	450-500
		Steel - Mild (.4-.5 Carbon) 4140	250-300
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	125-250
Cast Irons	K	Iron - Cast (Soft)	450-600
		Iron - Cast (Medium Hard)	300-400
		Iron - Cast (Hard Chilled)	250-300
		Iron (Malleable)	225-300

Workpiece Material Group		Examples	SFM
Stainless Steels	M	Stainless Steel Free Machining	200-300
		Austenitic 304/316	180-225
		Ferritic	200-275
		Martensitic	150-200
		PH Stainless 17-4 PH	125-200
Special Alloys	S	Titanium 6AL-4V	175-375
		Cobalt-Based Alloys Stellite	80-125
		Nickel-Based Alloys Inconel 625/718	80-125
		Iron-Based Alloys Incoloy 800-802	80-125
Hardened Steels	H	Hardened Steels 35-45 Rc	200-250
		Hardened Steels 45-55 Rc	150-200

Workpiece Material Group		Examples	Tool Diameter								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inches/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Cast Irons	K	Iron - Cast (Soft) Iron - Cast (Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
Stainless Steels	M	Stainless Steel Free Machining Ferritic	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Austenitic 304/316 Martensitic PH Stainless 17-4 PH	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Special Alloys	S	Titanium 6AL-4V	.0003-.0004	.0004-.0006	.0006-.0008	.0008-.0012	.0008-.0012	.0012-.0016	.0016-.0018	.0018-.0020	.0020-.0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010.-0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010-.0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035

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

Series 114/132 Metric

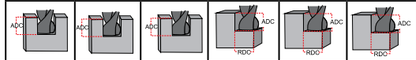
Workpiece Material Group		Examples	SMM
Steels	P	Steel - Mild (.2-.3 Carbon) 1018	135-150
		Steel - Mild (.4-.5 Carbon) 4140	75-90
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	40-75
Cast Irons	K	Iron - Cast (Soft)	135-185
		Iron - Cast (Medium Hard)	90-120
		Iron (Hard Chilled)	75-90
		Iron (Malleable)	70-90
Stainless Steels	M	Stainless Steel Free Machining	60-90
		Austenitic 304/316	55-70

Workpiece Material Group		Examples	SMM
Stainless Steels	M	Ferritic	60-85
		Martensitic	45-60
		PH Stainless 17-4 PH	40-60
Special Alloys	S	Titanium 6AL-4V	55-115
		Cobalt-Based Alloys Stellite	25-40
		Nickel-Based Alloys Inconel 625/718	25-40
		Iron-Based Alloys Incoloy 800-802	25-40
Hardened Steels	H	Hardened Steels 35-45 Rc	60-75
		Hardened Steels 45-55 Rc	45-60

Workpiece Material Group		Examples	Tool Diameter (mm)								
			3	5	6	8	10	14	16	18	25
			mm/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.056-.076	.058-.102	.056-.109	.081-.127
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
Cast Irons	K	Iron - Cast (Soft) Iron - Cast (Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.056-.076	.058-.102	.056-.109	.081-.127
Stainless Steels	M	Stainless Steel Free Machining Ferritic	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.056-.076	.058-.102	.056-.109	.081-.127
		Austenitic 304/316	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
		Martensitic PH Stainless 17-4 PH	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
Special Alloys	S	Titanium 6AL-4V	.008-.010	.010-.015	.015-.020	.020-.030	.020-.030	.030-.041	.041-.046	.046-.051	.051-.076
		Stellite Inconel 625/718 Incoloy 800-802	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc	.008-.013	.013-.038	.013-.038	.025-.051	.025-.051	.025-.076	.051-.076	.064-.089	.064-.089

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

Series 134/135/137 Inch

Workpiece Material Group		Examples	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth		
							1 x Diameter Axial Depth		
							Profile Milling		
				25% Axial	50% Axial	100% Axial	10% of Dia.	25% of Dia.	50% of Dia.
			Max.						
			Type	SFM					
Non-Ferrous	N	Aluminum < 10% Si	•	1000-2000			2000	1625	1000
		Aluminum > 10% Si	•	800-1500			1500	1230	800
		Brass	•	500-900			900	750	500
		Plastics	•	800-1200			1200	1050	800

Workpiece Material Group		Examples	Milling Type	Tool Diameter								
				1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
				Inches/Tooth								
Non-Ferrous	N	Aluminum / Aluminum Alloys < 10% Si Aluminum / Aluminum Alloys > 10% Si Brass Plastics	Slotting	.003-.004	.004-.006	.004-.008	.006-.009	.007-.012	.010-.045	.015-.040	.015-.040	.015-.040
			Profile Milling	.0012	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) New Feed per Tooth x Number of Teeth x RPM = IPM (Inches per Minute)

Above 20,000 RPM, Tool Balancing Is Required.

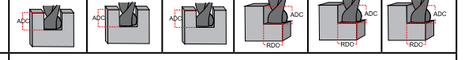
Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

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

Series 134/135/137 Metric

Workpiece Material Group		Examples	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth		
							1 x Diameter Axial Depth		
							Profile Milling		
				25% Axial	50% Axial	100% Axial	10% of Dia.	25% of Dia.	50% of Dia.
			Max.						
			Type	SMM					
Non-Ferrous	N	Aluminum < 10% Si	•	305-610			610	495	305
		Aluminum > 10% Si	•	245-460			460	375	245
		Brass	•	150-275			900	230	155
		Plastics	•	245-365			365	320	245

Workpiece Material Group		Examples	Milling Type	Tool Diameter(mm)								
				3	5	6	8	10	14	16	18	25
				mm/Tooth								
Non-Ferrous	N	Aluminum / Aluminum Alloys < 10% Si Aluminum / Aluminum Alloys > 10% Si Brass Plastics	Slotting	.076-.102	.102-.152	.102-.203	.152-.229	.178-.305	.254-1.143	.381-1.016	.381-1.016	.381-1.016
			Profile Milling	.030	.046	.064	.081	.094	.127	.165	.191	.254

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) New Feed per Tooth x Number of Teeth x RPM = mm/min. (mm per Minute)

Above 20,000 RPM, Tool Balancing Is Required.

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

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

Series 136/138 Inch

Workpiece Material Group		Examples	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth		
							1 x Diameter Axial Depth		
							Profile Milling		
			Max.	25% Axial	50% Axial	100% Axial	10% of Dia.	25% of Dia.	50% of Dia.
			Type	SFM					
Non-Ferrous	N	Aluminum < 10% Si	•	1400-2000			2000	1775	1400
		Aluminum > 10% Si	•	1000-1500			1500	1310	1000
		Brass	•	500-900			900	750	500
		Plastics	•	800-1200			1200	1050	800

Workpiece Material Group		Examples	Milling Type	Tool Diameter								
				1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
				Inches/Tooth								
Non-Ferrous	N	Aluminum / Aluminum Alloys < 10% Si Aluminum / Aluminum Alloys > 10% Si Brass Plastics	Slotting	.0024	.0036	.0050	.0064	.0074	.0100	.0120	.0140	.0200
			Profile Milling	.0012	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) New Feed per Tooth x Number of Teeth x RPM = IPM (Inches per Minute)

Above 20,000 RPM, Tool Balancing Is Required.

Spindle Max.
Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

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

Series 136/138 Metric

Workpiece Material Group		Examples	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth		
							1 x Diameter Axial Depth		
							Profile Milling		
			Max.	25% Axial	50% Axial	100% Axial	10% of Dia.	25% of Dia.	50% of Dia.
			Type	SMM					
Non-Ferrous	N	Aluminum < 10% Si	•	425-610			610	540	425
		Aluminum > 10% Si	•	305-460			460	400	305
		Brass	•	150-275			275	230	150
		Plastics	•	245-365			365	320	245

Workpiece Material Group		Examples	Milling Type	Tool Diameter(mm)								
				3	5	6	8	10	14	16	18	25
				mm/Tooth								
Non-Ferrous	N	Aluminum / Aluminum Alloys < 10% Si Aluminum / Aluminum Alloys > 10% Si Brass Plastics	Slotting	.061	.091	.127	.163	.188	.254	.305	.356	.508
			Profile Milling	.030	.046	.064	.081	.094	.127	.165	.191	.254

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) New Feed per Tooth x Number of Teeth x RPM = mm/min. (mm per Minute)

Above 20,000 RPM, Tool Balancing Is Required.

Spindle Max.
Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

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

Series 135B/138B
Inch

Workpiece Material Group		Examples	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth			Contouring
							1 x Diameter Axial Depth			
							Profile Milling			
				25% Axial	50% Axial	100% Axial	10% of Dia.	25% of Dia.	50% of Dia.	
			Max.							
			Type	SFM						
Non-Ferrous	N	Aluminum < 10% Si	•	1400-2000			2000	1775	1400	2000
		Aluminum > 10% Si	•	1000-1500			1500	1310	1000	1500
		Brass	•	500-900			900	750	500	900
		Plastics	•	800-1200			1200	1050	800	1200

Workpiece Material Group		Examples	Milling Type	Tool Diameter								
				1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
				Inches/Tooth								
Non-Ferrous	N	Aluminum / Aluminum Alloys < 10% Si Aluminum / Aluminum Alloys > 10% Si Brass Plastics	Slotting	.0024	.0036	.0050	.0064	.0074	.0100	.0120	.0140	.0200
			Profile Milling	.0012	.0018	.0025	.0032	.0037	.0050	.0065	.0075	.0100
			Contouring	.0024	.0036	.0050	.0064	.0074	.0100	.0120	.0140	.0200

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) New Feed per Tooth x Number of Teeth x RPM = IPM (Inches per Minute)

Above 20,000 RPM, Tool Balancing Is Required.
If axial depth is less than the ball diameter, the speed is figured using the effective cutting diameter.

Spindle Max.
Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

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

Series 135B/138B
Metric

Workpiece Material Group		Examples	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth			Contouring
							1 x Diameter Axial Depth			
							Profile Milling			
				25% Axial	50% Axial	100% Axial	10% of Dia.	25% of Dia.	50% of Dia.	
			Max.							
			Type	SMM						
Non-Ferrous	N	Aluminum < 10% Si	•	425-610			610	540	425	610
		Aluminum > 10% Si	•	305-460			460	400	305	460
		Brass	•	150-275			275	230	150	275
		Plastics	•	245-365			365	320	245	365

Workpiece Material Group		Examples	Milling Type	Tool Diameter(mm)								
				3	5	6	8	10	14	16	18	25
				mm/Tooth								
Non-Ferrous	N	Aluminum / Aluminum Alloys < 10% Si Aluminum / Aluminum Alloys > 10% Si Brass Plastics	Slotting	.061	.091	.127	.163	.188	.254	.305	.356	.508
			Profile Milling	.030	.046	.064	.081	.094	.127	.165	.191	.254
			Contouring	.061	.091	.127	.163	.188	.254	.305	.356	.508

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) New Feed per Tooth x Number of Teeth x RPM = mm/min. (mm per Minute)

Above 20,000 RPM, Tool Balancing Is Required.
If axial depth is less than the ball diameter, the speed is figured using the effective cutting diameter.

Spindle Max.
Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

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.

Series 156 Inch

Workpiece Material Group		Examples	Tool Diameter	Maximum Cut		Tool Diameter									
						Decimal									
				% of Diameter		1/64	1/32	1/16	3/32	1/8	5/32	1/4	5/16	3/8	1/2
				Axial Depth	Radial Depth	.0150	.0312	.0625	.0937	.1250	.1562	.2500	.3125	.3750	.5000
						RPM									
Steels	P	Plain Carbon/ Alloy & Tool Steels 30 - 40 Rc 4140/8620/P20	< 1/16	5%	20%	30,000	30,000	30,000							
			> 1/16	10%	20%				25,000	17,500	14,000	8,750	7,000	5,800	4,300
Stainless Steels	M	Ferritic/ Martensitic & PH Stainless < 40 Rc 416/420F/PH Stainless 15-5/ 17-4/17-4 H	< 1/16	5%	20%	30,000	30,000	30,000							
			> 1/16	10%	20%				25,000	17,500	14,000	8,750	7,000	5,800	4,300
Hardened Steels	H	Hardened Steels 40 - 45 Rc H13/D2/P20/ 4140/8620	< 1/16	5%	20%	30,000	30,000	23,500							
			> 1/16	10%	20%				22,000	14,500	11,500	7,250	5,800	4,800	3,625
Hardened Steels	H	Hardened Steels 45 - 55 Rc H13/D2/P20/ 4140/8620	< 1/16	5%	10%	30,000	30,000	23,500							
			> 1/16	5%	10%				20,000	12,000	9,600	6,000	4,800	4,000	3,000
Hardened Steels	H	Hardened Steels 55 - 60 Rc H13/D2/P20/ 4140/8620	< 1/16	5%	10%	30,000	30,000	15,000							
			> 1/16	5%	10%				10,000	7,000	5,600	3,500	2,800	2,300	1,750

Workpiece Material Group		Examples	Tool Diameter	Tool Diameter									
				Decimal									
				1/64	1/32	1/16	3/32	1/8	5/32	1/4	5/16	3/8	1/2
				.0150	.0312	.0625	.0937	.1250	.1562	.2500	.3125	.3750	.5000
				Inches/Minute (IPM)									
Steels	P	Plain Carbon/ Alloy & Tool Steels 30 - 40 Rc 4140/8620/P20	< 1/16	20	27	62							
			> 1/16				84	94	120	140	168	125	140
Stainless Steels	M	Ferritic/ Martensitic & PH Stainless < 40 Rc 416/420F/PH Stainless 15-5/ 17-4/17-4 H	< 1/16	20	27	62							
			> 1/16				84	94	120	140	168	125	140
Hardened Steels	H	Hardened Steels 40 - 45 Rc H13/D2/P20/ 4140/8620	< 1/16	20	24	57							
			> 1/16				96	90	88	70	68	51	46
Hardened Steels	H	Hardened Steels 45 - 55 Rc H13/D2/P20/ 4140/8620	< 1/16	12	18	33							
			> 1/16				35	35	37	38	35	30	25
Hardened Steels	H	Hardened Steels 55 - 60 Rc H13/D2/P20/ 4140/8620	< 1/16	10	15	15							
			> 1/16				15	15	20	18	15	15	10

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

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

Series 156 Metric

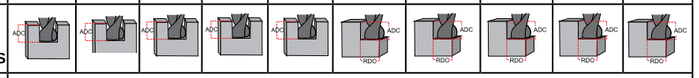
Workpiece Material Group		Examples	Tool Diameter	Maximum Cut		Tool Diameter (mm)									
						Decimal									
				% of Diameter		.5	1	1.5	2	3	4	6	8	10	12
				Axial Depth	Radial Depth	.0196	.0394	.0591	.0787	.1181	.1575	.2362	.3150	.3937	.4724
						RPM									
Steels	P	Plain Carbon/Alloy & Tool Steels 30 - 40 Rc 4140/8620/P20	< 1mm	5%	20%	30,000									
			> 1mm	10%	20%		30,000	30,000	25,000	17,500	14,000	8,750	7,000	5,800	4,300
Stainless Steels	M	Ferritic/Martensitic & PH Stainless < 40 Rc 416/420F/PH Stainless 15-5 17-4/17-4 H	< 1mm	5%	20%	30,000									
			> 1mm	10%	20%		30,000	30,000	25,000	17,500	14,000	8,750	7,000	5,800	4,300
Hardened Steels	H	Hardened Steels 40 - 45 Rc H13/D2 P20/4140/8620	< 1mm	5%	20%	30,000									
			> 1mm	10%	20%		30,000	23,500	22,000	14,500	11,500	7,250	5,800	4,800	3,625
Hardened Steels	H	Hardened Steels 45 - 55 Rc H13/D2 P20/4140/8620	< 1mm	5%	10%	30,000									
			> 1mm	5%	10%		30,000	23,500	20,000	12,000	9,600	6,000	4,800	4,000	3,000
Hardened Steels	H	Hardened Steels 55 - 60 Rc H13/D2 P20/4140/8620	< 1mm	5%	10%	30,000									
			> 1mm	5%	10%		30,000	15,000	10,000	7,000	5,600	3,500	2,800	2,300	1,750

Workpiece Material Group		Examples	Tool Diameter	Tool Diameter (mm)									
				Decimal									
				.5	1	1.5	2	3	4	6	8	10	12
				.0196	.0394	.0591	.0787	.1181	.1575	.2362	.3150	.3937	.4724
				mm/Minute									
Steels	P	Plain Carbon/Alloy & Tool Steels 30 - 40 Rc 4140/8620/P20	< 1mm	508									
			> 1mm		683	1575	2133	2392	3050	3558	4267	3175	3558
Stainless Steels	M	Ferritic/Martensitic & PH Stainless < 40 Rc 416/420F/PH Stainless 15-5 17-4/17-4 H	< 1mm	508									
			> 1mm		683	1575	2133	2392	3050	3558	4267	3175	3558
Hardened Steels	H	Hardened Steels 40 - 45 Rc H13/D2 P20/4140/8620	< 1mm	508									
			> 1mm		608	1450	2442	2283	2233	1775	1725	1292	1167
Hardened Steels	H	Hardened Steels 45 - 55 Rc H13/D2 P20/4140/8620	< 1mm	308									
			> 1mm		458	942	892	892	942	967	892	758	633
Hardened Steels	H	Hardened Steels 55 - 60 Rc H13/D2 P20/4140/8620	< 1mm	250									
			> 1mm		383	383	383	383	508	458	383	383	250

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

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

Series 157 Inch

Workpiece Material Group		Examples	Coolant			Slotting					1 x Diameter Axial Depth: Profile Milling Small Radial Depth =======> Large Radial Depth				
						30% Axial	40% Axial	50% Axial	75% Axial	100% Axial	10% of Dia.	20% of Dia.	25% of Dia.	30% of Dia.	40% of Dia.
			Max	Air	MMS										
			Type			SFM									
Steels	P	Low Carbon Steels < 30 Rc 1018/1141/12L14	•	•	•	480	480	480	480	480					600
		Tool Steels < 30 Rc 4140/8620/P20	•	•	•	480	480	480	480	480					600
		Medium Carbon 31 - 40 Rc	•	•	•	420	420	420	420						525
		Alloy Steels Alloy Steels 31 - 40 Rc	•	•	•	420	420	420	420						525
Stainless Steels	M	Ferritic	•	x	x	420	420	420	420						525
		Martensitic 400-500 Series	•	x	x	420	420	420	420						525
		PH Stainless Steels < 35 Rc 13-4 PH/15-5 PH	•	x	x	420	420	420	420						525
Special Alloys	S	Titanium Alloys	•	x	x						400				
Hardened Steels	H	Hardened Steels 40 - 50 Rc D2/H13/4140/P20	•	•	•	260-360	260-360	260-360			600-700			325-450	
		Hardened Steels 50 - 55 Rc D2/H13/4140/P20	•	•	•	180	180				300-400		225		
		Hardened Steels > 55 Rc D2/H13/4140/P20	•	•	•	140					200-300	175			

Workpiece Material Group		Examples	Milling Type	Tool Diameter						
				1/4	5/16	3/8	1/2	5/8	3/4	1
				Inches/Tooth						
Steels	P	Low Carbon Steels < 30 Rc 1018/1141/12L14 Tool Steels < 30 Rc 4140/8620/P20	Profile Milling	.0022	.0028	.0035	.0043	.0059	.0070	.0080
			Slotting	.0011	.0014	.0017	.0021	.0029	.0030	.0040
			Profile Milling	.0022	.0028	.0035	.0043	.0059	.0070	.0080
			Slotting	.0011	.0014	.0017	.0021	.0029	.0030	.0040
		Medium Carbon 31 - 40 Rc Alloy Steels 31 - 40 Rc	Profile Milling	.0020	.0024	.0033	.0040	.0055	.0067	.0075
			Slotting	.0010	.0012	.0016	.0020	.0027	.0033	.0037
			Profile Milling	.0020	.0024	.0033	.0040	.0055	.0067	.0075
			Slotting	.0010	.0012	.0016	.0020	.0027	.0033	.0037
Stainless Steels	M	Ferritic Stainless	Profile Milling	.0020	.0024	.0033	.0040	.0055	.0067	.0075
			Slotting	.0010	.0012	.0016	.0020	.0027	.0033	.0037
		Martensitic 400-500 Series	Profile Milling	.0020	.0024	.0033	.0040	.0055	.0067	.0075
			Slotting	.0010	.0012	.0016	.0020	.0027	.0033	.0037
		PH Stainless Steels < 35 Rc 13-4 PH/15-5 PH	Profile Milling	.0020	.0024	.0033	.0040	.0055	.0067	.0075
			Slotting	.0010	.0012	.0016	.0020	.0027	.0033	.0037
Special Alloys	S	Titanium Alloys 6AL-4V	Profile Milling	.0008	.0012	.0016	.0018	.0024	.0030	.0035
			Slotting	.0004	.0006	.0008	.0009	.0012	.0015	.0017
Hardened Steels	H	Hardened Steels 40 - 50 Rc D2/H13/4140/P20	Profile Milling	.0014	.0020	.0024	.0030	.0040	.0046	.0060
			Slotting	.0006	.0010	.0012	.0015	.0020	.0023	.0030
		Hardened Steels 50 - 55 Rc D2/H13/4140/P20	Profile Milling	.0008	.0012	.0016	.0018	.0024	.0030	.0035
			Slotting	.0004	.0006	.0008	.0009	.0012	.0015	.0017
		Hardened Steels > 55 Rc D2/H13/4140/P20	Profile Milling	.0006	.0008	.0010	.0015	.0018	.0022	.0025
			Slotting	.0003	.0004	.0005	.0007	.0009	.0011	.0012

•	Preferred
○	Possible
x	Not Possible

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

Calculated Feed x Spindle Max.

Calculated Speed

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

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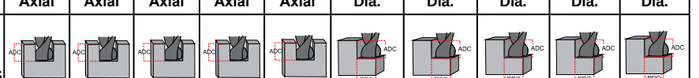
Series 157 Metric

Workpiece Material Group		Examples	Coolant			Slotting					1 x Diameter Axial Depth: Profile Milling Small Radial Depth =======> Large Radial Depth				
						30% Axial	40% Axial	50% Axial	75% Axial	100% Axial	10% of Dia.	20% of Dia.	25% of Dia.	30% of Dia.	40% of Dia.
			Max	Air	MMS										
			Type			SMM									
Steels	P	Low Carbon Steels < 30 Rc 1018/1141/12L14	•	•	•	145	145	145	145	145					180
		Tool Steels < 30 Rc 4140/8620/P20	•	•	•	145	145	145	145	145					180
		Medium Carbon 31 - 40 Rc	•	•	•	125	125	125	125						160
		Alloy Steels 31 - 40 Rc	•	•	•	125	125	125	125						160
Stainless Steels	M	Ferritic Stainless	•	x	x	35	35	35	35						160
		Martensitic 400-500 Series	•	x	x	125	125	125	125						160
		PH Stainless Steels < 35 Rc 13-4 PH/15-5 PH	•	x	x	125	125	125	125						160
Special Alloys	S	Titanium Alloys	•	x	x						120				
Hardened Steels	H	Hardened Steels 40 - 50 Rc D2/H13/4140/P20	•	•	•	80-110	80-110	80-110			180-210			100-135	
		Hardened Steels 50 - 55 Rc D2/H13/4140/P20	•	•	•	55	55				90-120		65		
		Hardened Steels > 55 Rc D2/H13/4140/P20	•	•	•	40					60-90	55			

Workpiece Material Group		Examples	Milling Type	Tool Diameter (mm)						
				6	8	10	12	16	20	25
				mm/Tooth						
Steels	P	Low Carbon Steels < 30 Rc 1018/1141/12L14	Profile Milling	.055	.071	.088	.106	.149	.177	.203
			Slotting	.027	.035	.043	.053	.075	.077	.100
		Tool Steels < 30 Rc 4140/8620/P20	Profile Milling	.055	.071	.088	.106	.149	.177	.203
			Slotting	.027	.035	.043	.053	.075	.077	.100
		Medium Carbon 31 - 40 Rc	Profile Milling	.050	.060	.083	.101	.140	.170	.190
			Slotting	.025	.030	.041	.051	.069	.084	.094
		Alloy Steels Alloy Steels 31 - 40 Rc	Profile Milling	.050	.060	.083	.101	.140	.170	.190
			Slotting	.025	.030	.041	.051	.069	.084	.094
Stainless Steels	M	Ferritic Stainless	Profile Milling	.051	.061	.084	.102	.140	.170	.191
			Slotting	.025	.030	.041	.051	.069	.084	.094
		Martensitic 400-500 Series	Profile Milling	.051	.061	.084	.102	.140	.170	.191
			Slotting	.025	.030	.041	.051	.069	.084	.094
		PH Stainless Steels < 35 Rc 13-4 PH/15-5 PH	Profile Milling	.051	.061	.084	.102	.140	.170	.191
			Slotting	.025	.030	.041	.051	.069	.084	.094
Special Alloys	S	Titanium Alloys 6AL-4V	Profile Milling	.020	.030	.041	.046	.061	.076	.089
			Slotting	.010	.015	.020	.020	.030	.038	.043
Hardened Steels	H	Hardened Steels 40 - 50 Rc D2/H13/4140/P20	Profile Milling	.036	.051	.061	.076	.102	.117	.152
			Slotting	.015	.025	.030	.038	.051	.058	.076
		Hardened Steels 50 - 55 Rc D2/H13/4140/P20	Profile Milling	.020	.030	.041	.046	.061	.076	.089
			Slotting	.010	.015	.020	.023	.030	.038	.043
		Hardened Steels > 55 Rc D2/H13/4140/P20	Profile Milling	.015	.020	.025	.038	.046	.056	.054
			Slotting	.008	.010	.013	.018	.023	.028	.030

•	Preferred
○	Possible
x	Not Possible

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

Calculated Feed x Spindle Max.

Calculated Speed

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

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Series 158 Inch

Cutting Conditions - Lower RPM/High Feed

Workpiece Material Group		Examples	Tool Over-hang	Tool Diameter															
				.1181 X R .0315 (3.0 x R 0.8mm)				.2362 X R .059 (6.0 x R 1.5mm)				.315 X R .0787 (8.0 x R 2.0mm)				.3937 X R .0787 (10.0 x R 2.0mm)			
				Axial Depth	Radial Depth	RPM	IPM	Axial Depth	Radial Depth	RPM	IPM	Axial Depth	Radial Depth	RPM	IPM	Axial Depth	Radial Depth	RPM	IPM
Steels	P	Cast Iron/ Carbon Steels/ Alloy Steels 150-250 HB	5 x D	.0094	.0275	8,000	239	.0170	.0590	4,000	264	.0236	.0787	3,000	264	.0236	.1180	2,400	264
			6 X D	.0085	.0275			.0159	.0590			.0210	.0787			.0212	.1180		
			7 X D	.0078	.0275			.0147	.0590			.0196	.0787			.0196	.1180		
			8 X D	.0072	.0275			.0135	.0590			.0181	.0787			.0181	.1180		
			9 X D	.0059	.0275			.0112	.0590			.0149	.0787			.0149	.1180		
			10 X D	.0047	.0275			.0088	.0590			.0118	.0787			.0118	.1180		
Steels	P	Tool Steels 25-35 Rc	5 x D	.0094	.0275	7,400	200	.0170	.0590	3,700	224	.0236	.0787	2,800	225	.0236	.1180	2,200	222
			6 X D	.0085	.0275			.0159	.0590			.0210	.0787			.0212	.1180		
			7 X D	.0078	.0275			.0147	.0590			.0196	.0787			.0196	.1180		
			8 X D	.0072	.0275			.0135	.0590			.0181	.0787			.0181	.1180		
			9 X D	.0059	.0275			.0112	.0590			.0149	.0787			.0149	.1180		
			10 X D	.0047	.0275			.0088	.0590			.0118	.0787			.0118	.1180		
Hardened Steels	H	Hardened Steels 35-45 Rc H13/D2/P20 4140/8620	5 x D	.0094	.0275	6,900	146	.0170	.0590	3,400	160	.0236	.0787	2,600	164	.0236	.1180	2,100	165
			6 X D	.0085	.0275			.0159	.0590			.0210	.0787			.0212	.1180		
			7 X D	.0078	.0275			.0147	.0590			.0196	.0787			.0196	.1180		
			8 X D	.0072	.0275			.0135	.0590			.0181	.0787			.0181	.1180		
			9 X D	.0059	.0275			.0112	.0590			.0149	.0787			.0149	.1180		
			10 X D	.0047	.0275			.0088	.0590			.0118	.0787			.0118	.1180		
Hardened Steels	H	Hardened Steels 45 - 55 Rc H13/D2/P20 4140/8620	5 x D	.0066	.0275	5,300	112	.0124	.0590	2,700	127	.0165	.0787	2,000	125	.0165	.1180	1,600	125
			6 X D	.0059	.0275			.0111	.0590			.0148	.0787			.0148	.1180		
			7 X D	.0055	.0275			.0103	.0590			.0137	.0787			.0137	.1180		
			8 X D	.0050	.0275			.0095	.0590			.0126	.0787			.0126	.1180		
			9 X D	.0041	.0275			.0078	.0590			.0104	.0787			.0104	.1180		
			10 X D	.0033	.0275			.0062	.0590			.0082	.0787			.0082	.1180		
Hardened Steels	H	Hardened Steels 55-60 Rc H13/D2/P20 4140/8620	5 x D	.0047	.0275	5,300	45	.0088	.0590	2,700	50	.0118	.0787	2,000	50	.0118	.1180	1,600	50
			6 X D	.0042	.0275			.0079	.0590			.0106	.0787			.0106	.1180		
			7 X D	.0039	.0275			.0073	.0590			.0098	.0787			.0098	.1180		
			8 X D	.0036	.0275			.0067	.0590			.0090	.0787			.0090	.1180		
			9 X D	.0029	.0275			.0056	.0590			.0074	.0787			.0074	.1180		
			10 X D	.0023	.0275			.0044	.0590			.0059	.0787			.0059	.1180		

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

Series 158 Inch Continued

Cutting Conditions - Lower RPM/High Feed

Workpiece Material Group		Examples	Tool Over-hang	Tool Diameter											
				.4724 x R .0787 (12.0 x R 2.0mm)				.6299 X R .1181 (16.0 x R 3.0mm)				.7874 X R .1181 (20.0 x R 3.0mm)			
				Axial Depth	Radial Depth	RPM	IPM	Axial Depth	Radial Depth	RPM	IPM	Axial Depth	Radial Depth	RPM	IPM
Steels	P	Cast Iron/ Carbon Steels/ Alloy Steels 150-250 HB	5 x D	.0236	.1574	2,000	250	.0354	.1968	1,500	210	.0354	.2755	1,200	172
			6 X D	.0212	.1574			.0318	.1968			.0318	.2755		
			7 X D	.0196	.1574			.0295	.1968			.0295	.2755		
			8 X D	.0181	.1574			.0271	.1968			.0271	.2755		
			9 X D	.0149	.1574			.0224	.1968			.0226	.2755		
			10 X D	.0118	.1574			.0177	.1968			.0177	.2755		
Steels	P	Tool Steels 25-35 Rc	5 x D	.0236	.1574	1,900	218	.0354	.1968	1,400	180	.0354	.2755	1,100	144
			6 X D	.0212	.1574			.0318	.1968			.0318	.2755		
			7 X D	.0196	.1574			.0295	.1968			.0295	.2755		
			8 X D	.0181	.1574			.0271	.1968			.0271	.2755		
			9 X D	.0149	.1574			.0224	.1968			.0226	.2755		
			10 X D	.0118	.1574			.0177	.1968			.0177	.2755		
Hardened Steels	H	Hardened Steels 35-45 Rc H13/D2/P20 4140/8620	5 x D	.0236	.1574	1,700	153	.0354	.1968	1,300	131	.0354	.2755	1,000	102
			6 X D	.0212	.1574			.0318	.1968			.0318	.2755		
			7 X D	.0196	.1574			.0295	.1968			.0295	.2755		
			8 X D	.0181	.1574			.0271	.1968			.0271	.2755		
			9 X D	.0149	.1574			.0224	.1968			.0226	.2755		
			10 X D	.0118	.1574			.0177	.1968			.0177	.2755		
Hardened Steels	H	Hardened Steels 45 - 55 Rc H13/D2/P20 4140/8620	5 x D	.0165	.1574	1,300	116	.0248	.1968	1,000	100	.0248	.2755	800	82
			6 X D	.0148	.1574			.0223	.1968			.0223	.2755		
			7 X D	.0137	.1574			.0206	.1968			.0206	.2755		
			8 X D	.0126	.1574			.0190	.1968			.0190	.2755		
			9 X D	.0104	.1574			.0157	.1968			.0157	.2755		
			10 X D	.0082	.1574			.0124	.1968			.0124	.2755		
Hardened Steels	H	Hardened Steels 55-60 Rc H13/D2/P20 4140/8620	5 x D	.0118	.1574	1,300	47	.0177	.1968	1,000	40	.0177	.2755	800	32
			6 X D	.0106	.1574			.0159	.1968			.0159	.2755		
			7 X D	.0098	.1574			.0147	.1968			.0147	.2755		
			8 X D	.0090	.1574			.0135	.1968			.0135	.2755		
			9 X D	.0074	.1574			.0112	.1968			.0112	.2755		
			10 X D	.0059	.1574			.0088	.1968			.0088	.2755		

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

Series 158 Metric

Cutting Conditions - Lower RPM/High Feed

Workpiece Material Group		Examples	Tool Over-hang	Tool Diameter(mm)													
				3.0 x R 0.8				6.0 x R 1.5				8.0 x R 2.0				10.0 x R 2.0			
				Axial Depth	Radial Depth	RPM	mm/ min.	Axial Depth	Radial Depth	RPM	mm/ min.	Axial Depth	Radial Depth	RPM	mm/ min.	Axial Depth	Radial Depth	RPM	mm/ min.
Steels	P	Cast Iron/ Carbon Steels/ Alloy Steels 150-250 HB	5 x D	0.24	0.7	8,000	6,080	0.45	1.5	4,000	6700	0.60	2.0	3,000	6,700	0.60	3.0	2,400	6,700
			6 X D	0.22	0.7			0.41	1.5			0.54	2.0			0.54	3.0		
			7 X D	0.20	0.7			0.38	1.5			0.50	2.0			0.50	3.0		
			8 X D	0.18	0.7			0.35	1.5			0.46	2.0			0.46	3.0		
			9 X D	0.15	0.7			0.29	1.5			0.38	2.0			0.38	3.0		
			10 X D	0.12	0.7			0.23	1.5			0.30	2.0			0.30	3.0		
Steels	P	Tool Steels 25-35 Rc	5 x D	0.24	0.7	7,400	5,100	0.45	1.5	3,700	5670	0.60	2.0	2,800	5,725	0.60	3.0	2,200	5,620
			6 X D	0.22	0.7			0.41	1.5			0.54	2.0			0.54	3.0		
			7 X D	0.20	0.7			0.38	1.5			0.50	2.0			0.50	3.0		
			8 X D	0.18	0.7			0.35	1.5			0.46	2.0			0.46	3.0		
			9 X D	0.15	0.7			0.29	1.5			0.38	2.0			0.38	3.0		
			10 X D	0.12	0.7			0.23	1.5			0.30	2.0			0.30	3.0		
Hardened Steels	H	Hardened Steels 35-45 Rc H13/D2/P20 4140/8620	5 x D	0.24	0.7	6,900	3,720	0.45	1.5	3,400	4050	0.60	2.0	2,600	4,150	0.60	3.0	2,100	4,200
			6 X D	0.22	0.7			0.41	1.5			0.54	2.0			0.54	3.0		
			7 X D	0.20	0.7			0.38	1.5			0.50	2.0			0.50	3.0		
			8 X D	0.18	0.7			0.35	1.5			0.46	2.0			0.46	3.0		
			9 X D	0.15	0.7			0.29	1.5			0.38	2.0			0.38	3.0		
			10 X D	0.12	0.7			0.23	1.5			0.30	2.0			0.30	3.0		
Hardened Steels	H	Hardened Steels 45 - 55 Rc H13/D2/P20 4140/8620	5 x D	0.17	0.7	5,300	2,850	0.32	1.5	2,700	3230	0.42	2.0	2,000	3,190	0.42	3.0	1,600	3,190
			6 X D	0.15	0.7			0.28	1.5			0.38	2.0			0.38	3.0		
			7 X D	0.14	0.7			0.26	1.5			0.35	2.0			0.35	3.0		
			8 X D	0.13	0.7			0.24	1.5			0.32	2.0			0.32	3.0		
			9 X D	0.11	0.7			0.20	1.5			0.27	2.0			0.27	3.0		
			10 X D	0.08	0.7			0.16	1.5			0.21	2.0			0.21	3.0		
Hardened Steels	H	Hardened Steels 55-60 Rc H13/D2/P20 4140/8620	5 x D	0.12	0.7	5,300	1,130	0.23	1.5	2,700	1295	0.30	2.0	2,000	1,275	0.30	3.0	1,600	1,275
			6 X D	0.11	0.7			0.20	1.5			0.27	2.0			0.27	3.0		
			7 X D	0.10	0.7			0.19	1.5			0.25	2.0			0.25	3.0		
			8 X D	0.09	0.7			0.17	1.5			0.23	2.0			0.23	3.0		
			9 X D	0.08	0.7			0.14	1.5			0.19	2.0			0.19	3.0		
			10 X D	0.06	0.7			0.11	1.5			0.15	2.0			0.15	3.0		

Series 158 Metric Continued

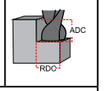
Cutting Conditions - Lower RPM/High Feed

Workpiece Material Group		Examples	Tool Over-hang	Tool Diameter(mm)							
				12.0 x R 2.0				16.0 x R 3.0			
				Axial Depth	Radial Depth	RPM	mm/ min.	Axial Depth	Radial Depth	RPM	mm/ min.
Steels	P	Cast Iron/ Carbon Steels/ Alloy Steels 150-250 HB	5 x D	0.60	4.0	2,000	6,350	0.90	5.0	1,500	5,350
			6 X D	0.54	4.0			0.81	5.0		
			7 X D	0.50	4.0			0.75	5.0		
			8 X D	0.46	4.0			0.69	5.0		
			9 X D	0.38	4.0			0.57	5.0		
			10 X D	0.30	4.0			0.45	5.0		
Steels	P	Tool Steels 25-35 Rc	5 x D	0.60	4.0	1,900	5,530	0.90	5.0	1,400	4,580
			6 X D	0.54	4.0			0.81	5.0		
			7 X D	0.50	4.0			0.75	5.0		
			8 X D	0.46	4.0			0.69	5.0		
			9 X D	0.38	4.0			0.57	5.0		
			10 X D	0.30	4.0			0.45	5.0		
Hardened Steels	H	Hardened Steels 35-45 Rc H13/D2/P20 4140/8620	5 x D	0.60	4.0	1,700	3,875	0.90	5.0	1,300	3,325
			6 X D	0.54	4.0			0.81	5.0		
			7 X D	0.50	4.0			0.75	5.0		
			8 X D	0.46	4.0			0.69	5.0		
			9 X D	0.38	4.0			0.57	5.0		
			10 X D	0.30	4.0			0.45	5.0		
Hardened Steels	H	Hardened Steels 45 - 55 Rc H13/D2/P20 4140/8620	5 x D	0.42	4.0	1,300	2,950	0.63	5.0	1,000	2,550
			6 X D	0.38	4.0			0.57	5.0		
			7 X D	0.35	4.0			0.53	5.0		
			8 X D	0.32	4.0			0.48	5.0		
			9 X D	0.27	4.0			0.40	5.0		
			10 X D	0.21	4.0			0.32	5.0		
Hardened Steels	H	Hardened Steels 55-60 Rc H13/D2/P20 4140/8620	5 x D	0.30	4.0	1,300	1,185	0.45	5.0	1,000	1,000
			6 X D	0.27	4.0			0.41	5.0		
			7 X D	0.25	4.0			0.38	5.0		
			8 X D	0.23	4.0			0.35	5.0		
			9 X D	0.19	4.0			0.29	5.0		
			10 X D	0.15	4.0			0.23	5.0		

Tool Diameter(mm)							
20.0 x R 3.0							
Axial Depth	Radial Depth	RPM	mm/ min.				
0.90	7.0	1,200	4,360				
0.81	7.0						
0.75	7.0						
0.69	7.0						
0.57	7.0						
0.45	7.0						
0.90	7.0	1,100	3,650				
0.81	7.0						
0.75	7.0						
0.69	7.0						
0.57	7.0						
0.45	7.0						
0.90	7.0	1,000	2,595				
0.81	7.0						
0.75	7.0						
0.69	7.0						
0.57	7.0						
0.45	7.0						
0.63	7.0	800	2,070				
0.57	7.0						
0.53	7.0						
0.48	7.0						
0.40	7.0						
0.32	7.0						
0.45	7.0	800	825				
0.41	7.0						
0.38	7.0						
0.35	7.0						
0.29	7.0						
0.23	7.0						

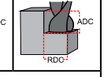
Series 172/174/175/176 Inch

Series 172, 174 Recommended for Slotting
Series 175, 176 Recommended for Profile Milling

Workpiece Material Group		Examples	Coolant		Slotting					Profile Milling		
					30% Axial	40% Axial	50% Axial	75% Axial	100% Axial	10% Radial	25% Radial	50% Radial
			Max	Air								
			Type		SFM							
Steels	P	Alloy & Tool Steels 4140/P20/H13	•	•	350	335	320	285	250	350	320	250
Stainless Steels	M	Free Machining	•		400	385	370	335	300	400	370	300
		Austenitic 303/304/316	•		300	285	270	235	200	300	270	200
		Ferritic 416F/420F	•		250	235	220	185	150	250	220	150
		Martensitic 403/410/416	•		250	190	185	160	150	250	185	150
		Precipitation Hardened 13-8,15-5	•		200	185	170	135	100	200	170	100
Special Alloys	S	Titanium 6AL-4V	•		260	245	230	195	160	260	230	160
		Inconel 625/718 Stellite/Haynes 25/188 Incoloy 800/Multimet	•		200	185	170	135	100	200	170	100

Series 172/174/175/176 Metric

Series 172, 174 Recommended for Slotting
Series 175, 176 Recommended for Profile Milling

Workpiece Material Group		Examples	Coolant		Slotting					Profile Milling		
					30% Axial	40% Axial	50% Axial	75% Axial	100% Axial	10% Radial	25% Radial	50% Radial
			Max	Air								
			Type		SMM							
Steels	P	Alloy & Tool Steels 4140/P20/H13	•	•	105	100	95	85	75	105	95	75
Stainless Steels	M	Free Machining	•		120	115	110	100	90	120	110	90
		Austenitic 303/304/316	•		90	85	80	70	60	90	80	60
		Ferritic 416F/420F	•		75	70	65	55	45	75	65	45
		Martensitic 403/410/416	•		75	55	55	50	45	75	55	45
		Precipitation Hardened 13-8/15-5	•		60	55	50	40	30	60	50	30
Special Alloys	S	Titanium 6AL-4V	•		80	75	70	60	50	80	70	50
		Inconel 625/718 Stellite/ Haynes 25/188 Incoloy 800/ Multimet	•		60	55	50	40	30	60	50	30

Workpiece Material Group		Examples	Tool Diameter				
			Decimal				
			1/8	1/4	1/2	3/4	1
			.1250	.2500	.5000	.7500	1.0000
			Inches/Tooth				
Steels	P	Alloy & Tool Steels 4140/P20/H13	.0005	.0015	.0025	.0035	.0050
Stainless Steels	M	Free Machining	.0005-.0007	.0010	.0030	.0050	.0060
		Austenitic 303/304/316	.0003-.0008	.001-.002	.0010-.0030	.0025-.0050	.0040-.0080
		Ferritic 416F/420F	.0002-.0005	.0005-.0010	.0007-.0015	.0015-.0030	.0030-.0050
		Martensitic 403/410/416	.0003-.0008	.0010-.0020	.0010-.0030	.0025-.0050	.0040-.0080
		Precipitation Hardened 13-8/15-5	.0002-.0005	.0005-.0010	.0007-.0015	.0015-.0030	.0030-.0050
Special Alloys	S	Titanium 6AL-4V	.00015-.0003	.0003-.0005	.0005-.0010	.0010-.0020	.0020-.0040
		Inconel 625/718 Stellite Haynes 25/188 Incoloy 800 Multimet	.0005-.0007	.0005-.0010	.0010-.0020	.0020-.0030	.0030-.0040

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Workpiece Material Group		Examples	Tool Diameter (mm)				
			Decimal				
			3	6	12	19	25
			.1181	.2362	.4724	.7480	.9842
			mm/Tooth				
Steels	P	Alloy & Tool Steels 4140/P20/H13	0.013	0.038	0.064	0.089	0.127
Stainless Steels	M	Free Machining	.013-.018	0.025	0.076	0.127	0.152
		Austenitic 303/ 04/316	.008-.020	.025-.051	.025-.076	.064-.127	.102-.203
		Ferritic 416F/420F	.005-.013	.013-.025	.018-.038	.038-.076	.076-.127
		Martensitic 403/410/416	.008-.020	.025-.051	.025-.076	.064-.127	.102-.203
		Precipitation Hardened 13-8/15-5	.005-.013	.013-.025	.018-.038	.038-.076	.076-.127
Special Alloys	S	Titanium 6AL-4V	.003-.008	.008-.013	.013-.025	.025-.051	.051-.102
		Inconel 625/718 Stellite Haynes 25/188 Incoloy 800 Multimet	.013-.018	.013-.025	.025-.051	.051-.076	.076-.102

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Series 177/179 Inch

Workpiece Material Group		Examples	Coolant Type: Max	Air	MMS	Slotting 25% Axial	Slotting 50% Axial	1 x Diameter Axial Depth – Profiling – Small Radial Depth ==========> Large Radial Depth: 1% of Dia.	5% of Dia.	10% of Dia.	15% of Dia.	20% of Dia.	30% of Dia.	50% of Dia.
						SFM								
Steels	P	Free Machining	●	●	●	500	500	2400	2250	2050	1850	1660	1260	500
		Low Carbon	●	●	●	500	500	2400	2250	2050	1850	1660	1260	500
		Medium Carbon	●	●	●	300	300	1100	1030	950	875	790	620	300
		Alloy Steels	●	●	●	250	250	500	480	450	430	400	350	250
		High Strength Alloys	●	●	●	250	250	500	480	450	430	400	350	250
		Structural Steels	●	●	●	500	500	2400	2250	2050	1850	1660	1260	500
		Die/Tool Steels	●	●	●	200	200	400	390	380	370	360	300	200
Stainless Steels	M	Free Machining	●	x	○	300	300	500	485	460	450	430	380	300
		Moderate Stainless	●	x	○	250	250	500	390	380	370	360	320	250
		Difficult Stainless	●	x	○	200	200	350	330	320	300	295	260	200
		PH Stainless	●	x	○	125	125	250	245	240	235	230	195	125
		Cobalt Chrome Alloys	●	x	○	150	150	250	245	230	225	215	190	150
		Duplex (22%)	●	x	○	125	125	250	245	230	225	215	185	125
		Super Duplex (25%)	●	x	○	100	100	200	195	180	180	170	140	100
Special Alloys	S	High Temp Alloys	●	x	x	150	150	250	240	220	215	200	180	150
		Titanium Alloys	●	x	x	175	175	425	400	380	350	325	275	175
Cast Irons	K	Gray Cast Iron	●	○	○	400	400	1500	1420	1315	1210	1100	860	400
		SG Iron	●	○	○	350	350	1200	1130	1050	980	900	710	350
		Ductile Cast Iron	●	○	○	300	300	500	485	460	450	430	380	300
		Malleable Iron	●	○	○	300	300	400	385	375	360	345	330	300

● Preferred
○ Possible
x Not Possible

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

Workpiece Material Group		Examples	Tool Diameter: 1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1.0
			Inches/Tooth									
Steels	P	Free Machining Low Carbon Medium Carbon Alloy Steels High Strength Alloys Structural Steels Die/Tool Steels	.0002	.0004	.0007	.0010-.0016	.0013-.0021	.0016-.0026	.0020-.0031	.0026-.0033	.0031-.0035	.0035-.0051
Stainless Steels	M	Free Machining Moderate Stainless Difficult Stainless PH Stainless Cobalt Chrome Alloys Duplex (22%) Super Duplex (25%)	.0002	.0004	.0007	.0010-.0016	.0012-.0021	.0012-.0026	.0020-.0031	.0020-.0033	.0022-.0035	.0024-.0039
Special Alloys	S	Titanium Alloys										
		High Temp Alloys	.0001	.0002	.0008	.0005-.0008	.0007-.0011	.0007-.0013	.0010-.0016	.0010-.0017	.0011-.0018	.0012-.0020
Cast Irons	K	Gray Cast Iron SG Iron Ductile Cast Iron Malleable Iron	.0002	.0004	.0007	.0007-.0016	.0010-.0022	.0015-.0028	.0018-.0033	.0024-.0035	.0028-.0039	.0024-.0050

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) New Feed per Tooth x Number of Teeth x RPM = IPM (Inches per Minute)

Slotting

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Divide by 2 for Slotting.
5) Multiply Feed per Tooth x Number of Teeth x RPM
6) Answer: IPM (Inches per Minute)

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

Calculated Feed x Spindle Max.

Calculated Speed

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Series 177/179 Metric

Workpiece Material Group		Examples	Coolant Type: Max	Air	MMS	Slotting 25% Axial	Slotting 50% Axial	1 x Diameter Axial Depth – Profiling – Small Radial Depth ==========> Large Radial Depth: 1% of Dia.	5% of Dia.	10% of Dia.	15% of Dia.	20% of Dia.	30% of Dia.	50% of Dia.
						SMM								
Steels	P	Free Machining	●	●	●	150	150	730	685	620	565	500	380	150
		Low Carbon	●	●	●	150	150	730	685	620	565	500	380	150
		Medium Carbon	●	●	●	90	90	335	310	290	260	240	180	90
		Alloy Steels	●	●	●	75	75	150	140	130	130	120	105	75
		High Strength Alloys	●	●	●	75	75	150	140	130	130	120	105	75
		Structural Steels	●	●	●	150	150	730	685	620	565	500	380	150
		Die/Tool Steels	●	●	●	60	60	120	115	115	110	110	90	60
Stainless Steels	M	Free Machining	●	x	○	90	90	150	145	140	135	130	115	90
		Moderate Stainless	●	x	○	75	75	150	115	115	110	105	95	75
		Difficult Stainless	●	x	○	60	60	105	100	95	90	90	75	60
		PH Stainless	●	x	○	40	40	75	75	75	70	70	60	40
		Cobalt Chrome Alloys	●	x	○	45	45	75	75	75	70	70	60	45
		Duplex (22%)	●	x	○	40	40	75	75	75	70	70	60	40
		Super Duplex (25%)	●	x	○	30	30	60	60	55	55	50	45	30
Special Alloys	S	High Temp Alloys	●	x	x	45	45	75	75	75	70	60	55	45
		Titanium Alloys	●	x	x	55	55	125	120	115	105	100	80	55
Cast Irons	K	Gray Cast Iron	●	○	○	120	120	450	430	400	360	335	250	120
		SG Iron	●	○	○	105	105	365	345	320	295	275	215	105
		Ductile Cast Iron	●	○	○	90	90	150	145	140	130	130	115	90
		Malleable Iron	●	○	○	90	90	120	115	110	105	105	100	90

● Preferred
○ Possible
x Not Possible

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

Workpiece Material Group		Examples	Tool Diameter (mm): 1	3	4	6	8	10	12	16	18	25
			mm/Tooth									
Steels	P	Free Machining Low Carbon Medium Carbon Alloy Steels High Strength Alloys Structural Steels Die/Tool Steels	.005	.010	.017	.025-.040	.033-.053	.040	.066	.066-.083	.078-.088	.088-.129
Stainless Steels	M	Free Machining Moderate Stainless Difficult Stainless PH Stainless Cobalt Chrome Alloys Duplex (22%) Super Duplex (25%)	.005	.010	.017	.025-.040	.033-.053	.040	.066	.066-.083	.078-.088	.088-.129
Special Alloys	S	Titanium Alloys										
		High Temp Alloys	.002	.005	.020	.012-.020	.017-.027	.017-.033	.025-.040	.025-.043	.027-.045	.030-.050
Cast Irons	K	Gray Cast Iron SG Iron Ductile Cast Iron Malleable Iron	.005	.010	.017	.017-.040	.025-.055	.038-.071	.045-.083	.060-.088	.071-.099	.060-.127

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) RPM x New Feed per Tooth x number of Teeth = mm/min. (mm per Minute)

Slotting

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Divide by 2 for Slotting.
5) Multiply (Feed per Tooth x Number of Teeth x RPM.
6) Answer: mm/min. (Millimeters per Minute)

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

Calculated Feed x Spindle Max.

Calculated Speed

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Series 178 Inch

Workpiece Material Group		Examples	Coolant Max	Coolant Air	Coolant MMS	1 x Diameter Axial Depth – Profiling – Small Radial Depth ==========> Large Radial Depth: 1% of Dia.	5% of Dia.	10% of Dia.	15% of Dia.	20% of Dia.	30% of Dia.	50% of Dia.
			Type			SFM						
Steels	P	Free Machining	●	●	●	2400	2250	2050	1850	1660	1260	500
		Low Carbon	●	●	●	2400	2250	2050	1850	1660	1260	500
		Medium Carbon	●	●	●	1100	1030	950	875	790	620	300
		Alloy Steels	●	●	●	500	480	450	430	400	350	250
		High Strength Alloys	●	●	●	500	480	450	430	400	350	250
		Structural Steels	●	●	●	2400	2250	2050	1850	1660	1260	500
		Die/Tool Steels	●	●	●	400	390	380	370	360	300	200
Stainless Steels	M	Free Machining	●	x	○	500	485	460	450	430	380	300
		Moderate Stainless	●	x	○	500	390	380	370	360	320	250
		Difficult Stainless	●	x	○	350	330	320	300	295	260	200
		PH Stainless	●	x	○	250	245	240	235	230	195	125
		Cobalt Chrome Alloys	●	x	○	250	245	230	225	215	190	150
		Duplex (22%)	●	x	○	250	245	230	225	215	185	125
		Super Duplex (25%)	●	x	○	200	195	180	180	170	140	100
Special Alloys	S	High Temp Alloys	●	x	x	250	240	220	215	200	180	150
		Titanium Alloys	●	x	x	425	400	380	350	325	275	175
Cast Irons	K	Gray Cast Iron	●	○	○	1500	1420	1315	1210	1100	860	400
		SG Iron	●	○	○	1200	1130	1050	980	900	710	350
		Ductile Cast Iron	●	○	○	500	485	460	450	430	380	300
		Malleable Iron	●	○	○	400	385	375	360	345	330	300

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

Calculated Feed x Spindle Max.

Calculated Speed

● Preferred
○ Possible
x Not Possible

Workpiece Material Group		Examples	Tool Diameter 1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1.0
			Inches/Tooth									
Steels	P	Free Machining Low Carbon Medium Carbon Alloy Steels High Strength Alloys Structural Steels Die/Tool Steels	.0002	.0004	.0007	.0010-.0016	.0013-.0021	.0016-.0026	.0020-.0031	.0026-.0033	.0031-.0035	.0035-.0051
Stainless Steels	M	Free Machining Moderate Stainless Difficult Stainless PH Stainless Cobalt Chrome Alloys Duplex (22%) Super Duplex (25%)	.0002	.0004	.0007	.0010-.0016	.0012-.0021	.0012-.0026	.0020-.0031	.0020-.0033	.0022-.0035	.0024-.0039
Special Alloys	S	Titanium Alloys										
		High Temp Alloys	.0001	.0002	.0008	.0005-.0008	.0007-.0011	.0007-.0013	.0010-.0016	.0010-.0017	.0011-.0018	.0012-.0020
Cast Irons	K	Gray Cast Iron SG Iron Ductile Cast Iron Malleable Iron	.0002	.0004	.0007	.0007-.0016	.0010-.0022	.0015-.0028	.0018-.0033	.0024-.0035	.0028-.0039	.0024-.0050

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8)New Feed per Tooth x Number of Teeth x RPM = IPM (Inches per Minute)

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

Series 178 Metric

Workpiece Material Group		Examples	Coolant Max	Coolant Air	Coolant MMS	1 x Diameter Axial Depth – Profiling – Small Radial Depth ==========> Large Radial Depth: 1% of Dia.	5% of Dia.	10% of Dia.	15% of Dia.	20% of Dia.	30% of Dia.	50% of Dia.
			Type			SMM						
Steels	P	Free Machining	●	●	●	730	685	620	565	500	380	150
		Low Carbon	●	●	●	730	685	620	565	500	380	150
		Medium Carbon	●	●	●	335	310	290	260	240	180	90
		Alloy Steels	●	●	●	150	140	130	130	120	105	75
		High Strength Alloys	●	●	●	150	140	130	130	120	105	75
		Structural Steels	●	●	●	730	685	620	565	500	380	150
		Die/Tool Steels	●	●	●	120	115	115	110	110	90	60
Stainless Steels	M	Free Machining	●	x	○	150	145	140	135	130	115	90
		Moderate Stainless	●	x	○	150	115	115	110	105	95	75
		Difficult Stainless	●	x	○	105	100	95	90	90	75	60
		PH Stainless	●	x	○	75	75	75	70	70	60	40
		Cobalt Chrome Alloys	●	x	○	75	75	75	70	70	60	45
		Duplex (22%)	●	x	○	75	75	75	70	70	60	40
		Super Duplex (25%)	●	x	○	60	60	55	55	50	45	30
Special Alloys	S	High Temp Alloys	●	x	x	75	75	75	70	60	55	45
		Titanium Alloys	●	x	x	125	120	115	105	100	80	55
Cast Irons	K	Gray Cast Iron	●	○	○	450	430	400	360	335	250	120
		SG Iron	●	○	○	365	345	320	295	275	215	105
		Ductile Cast Iron	●	○	○	150	145	140	130	130	115	90
		Malleable Iron	●	○	○	120	115	110	105	105	100	90

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

Calculated Feed x Spindle Max.

Calculated Speed

● Preferred
○ Possible
x Not Possible

Workpiece Material Group		Examples	Tool Diameter (mm) 1	3	4	6	8	10	12	16	18	25
			mm/Tooth									
Steels	P	Free Machining Low Carbon Medium Carbon Alloy Steels High Strength Alloys Structural Steels Die/Tool Steels	.005	.010	.017	.025-.040	.033-.053	.040	.066	.066-.083	.078-.088	.088-.129
Stainless Steels	M	Free Machining Moderate Stainless Difficult Stainless PH Stainless Cobalt Chrome Alloys Duplex (22%) Super Duplex (25%)	.005	.010	.017	.025-.040	.033-.053	.040	.066	.066-.083	.078-.088	.088-.129
Special Alloys	S	Titanium Alloys										
		High Temp Alloys	.002	.005	.020	.012-.020	.017-.027	.017-.033	.025-.040	.025-.043	.027-.045	.030-.050
Cast Irons	K	Gray Cast Iron SG Iron Ductile Cast Iron Malleable Iron	.005	.010	.017	.017-.040	.025-.055	.038-.071	.045-.083	.060-.088	.071-.099	.060-.127

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

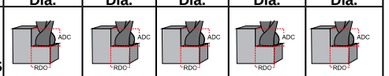
During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1.00
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) RPM x New Feed per Tooth x number of Teeth = mm/min. (mm per Minute)

Series 180 Inch

Workpiece Material Group		Examples	Coolant			1 x Diameter Axial Depth				
						Profiling				
						Small Radial Depth ==========> Large Radial Depth				
						1% of Dia.	5% of Dia.	10% of Dia.	15% of Dia.	20% of Dia.
			Max	Air	MMS					
			Type			SFM				
Steels	P	Free Machining	●	●	●	2400	2250	2050	1850	1660
		Low Carbon	●	●	●	2400	2250	2050	1850	1660
		Medium Carbon	●	●	●	1100	1030	950	875	790
		Alloy Steels	●	●	●	500	480	450	430	400
		High Strength Alloys	●	●	●	500	480	450	430	400
		Structural Steels	●	●	●	2400	2250	2050	1850	1660
		Die/Tool Steels	●	●	●	400	390	380	370	360
Stainless Steels	M	Free Machining	●	x	○	500	485	460	450	430
		Moderate Stainless	●	x	○	500	390	380	370	360
		Difficult Stainless	●	x	○	350	330	320	300	295
		PH Stainless	●	x	○	250	245	240	235	230
		Cobalt Chrome Alloys	●	x	○	250	245	230	225	215
		Duplex (22%)	●	x	○	250	245	230	225	215
		Super Duplex (25%)	●	x	○	200	195	180	180	170
Special Alloys	S	High Temp Alloys	●	x	x	250	240	220	215	200
		Titanium Alloys	●	x	x	425	400	380	350	325
Cast Irons	K	Gray Cast Iron	●	○	○	1500	1420	1315	1210	1100
		SG Iron	●	○	○	1200	1130	1050	980	900
		Ductile Cast Iron	●	○	○	500	485	460	450	430
		Malleable Iron	●	○	○	400	385	375	360	345

●	Preferred
○	Possible
x	Not Possible

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

Calculated Feed x Spindle Max.

Calculated Speed

Workpiece Material Group		Examples	Tool Diameter			
			1/2	5/8	3/4	1.0
			Inches/Tooth			
Steels	P	Free Machining Low Carbon Medium Carbon Alloy Steels High Strength Alloys Structural Steels Die/Tool Steels	.0020-.0031	.0026-.0033	.0031-.0035	.0035-.0051
Stainless Steels	M	Free Machining Moderate Stainless Difficult Stainless PH Stainless Cobalt Chrome Alloys Duplex (22%) Super Duplex (25%)	.0020-.0031	.0020-.0033	.0022-.0035	.0024-.0039
Special Alloys	S	Titanium Alloys				
		High Temp Alloys	.0010-.0016	.0010-.0017	.0011-.0018	.0012-.0020
Cast Irons	K	Gray Cast Iron SG Iron Ductile Cast Iron Malleable Iron	.0018-.0033	.0024-.0035	.0028-.0039	.0024-.0050

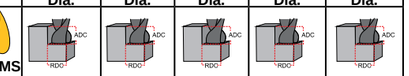
During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) New Feed per Tooth x Number of Teeth x RPM = IPM (Inches per Minute)

Series 180 Metric

Workpiece Material Group		Examples	Coolant			1 x Diameter Axial Depth				
						Profiling				
						Small Radial Depth =========> Large Radial Depth				
						1% of Dia.	5% of Dia.	10% of Dia.	15% of Dia.	20% of Dia.
			Max	Air	MMS					
			Type			SMM				
Steels	P	Free Machining	●	●	●	730	685	625	565	505
		Low Carbon	●	●	●	730	685	625	565	505
		Medium Carbon	●	●	●	335	310	290	265	240
		Alloy Steels	●	●	●	150	145	135	130	120
		High Strength Alloys	●	●	●	150	145	135	130	120
		Structural Steels	●	●	●	730	685	625	565	505
		Die/Tool Steels	●	●	●	120	115	115	110	110
Stainless Steels	M	Free Machining	●	x	○	150	145	140	135	130
		Moderate Stainless	●	x	○	150	115	115	110	105
		Difficult Stainless	●	x	○	105	100	95	90	90
		PH Stainless	●	x	○	75	75	75	70	70
		Cobalt Chrome Alloys	●	x	○	75	75	70	65	65
		Duplex (22%)	●	x	○	75	75	70	65	65
		Super Duplex (25%)	●	x	○	60	60	55	55	50
Special Alloys	S	High Temp Alloys	●	x	x	75	75	70	65	60
		Titanium Alloys	●	x	x	130	120	115	105	100
Cast Irons	K	Gray Cast Iron	●	○	○	455	430	400	365	335
		SG Iron	●	○	○	365	345	320	295	275
		Ductile Cast Iron	●	○	○	150	145	140	135	130
		Malleable Iron	●	○	○	120	115	115	110	105

●	Preferred
○	Possible
x	Not Possible

Spindle Max.

Should the Calculated Spindle Speed be more than your actual Spindle Max., Use Formula Below:

Calculated Feed x Spindle Max.

Calculated Speed

Workpiece Material Group		Examples	Tool Diameter (mm)			
			12	16	18	25
			mm/Tooth			
Steels	P	Free Machining Low Carbon Medium Carbon Alloy Steels High Strength Alloys Structural Steels Die/Tool Steels	.050-.078	.066-.083	.078-.088	.088-.129
Stainless Steels	M	Free Machining Moderate Stainless Difficult Stainless PH Stainless Cobalt Chrome Alloys Duplex (22%) Super Duplex (25%)	.050-.078	.050-.083	.055-.088	.060-.099
Special Alloys	S	Titanium Alloys				
		High Temp Alloys	.025-.040	.025-.043	.027-.045	.030-.050
Cast Irons	K	Gray Cast Iron SG Iron Ductile Cast Iron Malleable Iron	.045-.083	.060-.088	.071-.099	.060-.127

During Profile Milling less than 50% of the cutter diameter radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Example: Profile Milling

1) Select Material from chart.
2) Select Tool Size.
3) Select feed per tooth.
4) Figure percentage of cutter Diameter Radial Cut Depth.
5) Select Chip Load Factor for Radial Depth.
6) Multiply Chip Load Factor x Feed per Tooth.
7) Answer: New Feed per Tooth.
8) RPM x New Feed per Tooth x number of Teeth = mm/min. (mm per Minute)

Series 192 Inch

Workpiece Material Group		Examples	SFM
Steels	P	Steel - Mild (.2-.3 Carbon) 1018	450-500
		Steel - Mild (.4-.5 Carbon) 4140	250-300
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	125-250
Cast Irons	K	Iron - Cast (Soft)	450-600
		Iron - Cast (Medium Hard)	300-400
		Iron - Cast (Hard Chilled)	250-300
		Iron (Malleable)	225-300

Workpiece Material Group		Examples	SFM
Stainless Steels	M	Stainless Steel Free Machining	200-300
		Austenitic Stainless 304/316	180-225
		Ferritic	200-275
		Martensitic	150-200
		PH Stainless 17-4 PH	125-200
Special Alloys	S	Titanium 6AL-4V	175-375
		Cobalt-Based Alloys Stellite	80-125
		Nickel-Based Alloys Inconel 625/718	80-125
		Iron-Based Alloys Incoloy 800-802	80-125
Hardened Steels	H	Hardened Steels 35-45 Rc	200-250
		Hardened Steels 45-55 Rc	150-200

Workpiece Material Group		Examples	Tool Diameter								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inches/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Cast Irons	K	Iron - Cast (Soft) Iron - Cast (Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
Stainless Steels	M	Stainless Steel Free Machining Ferritic	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Special Alloys	S	Titanium 6AL-4V	.0003-.0004	.0004-.0006	.0006-.0008	.0008-.0012	.0008-.0012	.0012-.0016	.0016-.0018	.0018-.0020	.0020-.0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010.-0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010-.0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035

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

Series 192 Metric

Workpiece Material Group		Examples	SMM
Steels	P	Steel - Mild (.2-.3 Carbon) 1018	135-150
		Steel - Mild (.4-.5 Carbon) 4140	75-90
		Tool Steels (1.2 carbon) A2/D2 /H13/P20 Forgings	40-75
Cast Irons	K	Iron - Cast (Soft)	135-185
		Iron - Cast (Medium Hard)	90-120
		Iron (Hard Chilled)	75-90
		Iron (Malleable)	70-90
Stainless Steels	M	Stainless Steel Free Machining	60-90
		Austenitic Stainless 304/316	55-70

Workpiece Material Group		Examples	SMM
Stainless Steels	M	Ferritic	60-85
		Martensitic	45-60
		PH Stainless 17-4 PH	40-60
Special Alloys	S	Titanium 6AL-4V	55-115
		Cobalt-Based Alloys Stellite	25-40
		Nickel-Based Alloys Inconel 625/718	25-40
		Iron-Based Alloys Incoloy 800-802	25-40
Hardened Steels	H	Hardened Steels 35-45 Rc	60-75
		Hardened Steels 45-55 Rc	45-60

Workpiece Material Group		Examples	Tool Diameter (mm)							
			3	5	6	8	10	12	16	20	25
			mm/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.056-.076	.058-.102	.056-.109	.081-.127
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
Cast Irons	K	Iron - Cast (Soft) Iron - Cast (Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.056-.076	.058-.102	.056-.109	.081-.127
Stainless Steels	M	Stainless Steel Free Machining Ferritic	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.056-.076	.058-.102	.056-.109	.081-.127
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
Special Alloys	S	Titanium 6AL-4V	.008-.010	.010-.015	.015-.020	.020-.030	.020-.030	.030-.041	.041-.046	.046-.051	.051-.076
		Stellite Inconel 625/718 Incoloy 800-802	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.060-.081	.060-.081
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc	.008-.013	.013-.038	.013-.038	.025-.051	.025-.051	.025-.076	.051-.076	.064-.089	.064-.089

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

Series 198/199 Inch

Workpiece Material Group		Examples	SFM
Steels	P	Steel - Mild (.2-.3 Carbon) 1018	100-350
		Steel - Mild (.4-.5 Carbon) 4140 Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	100-160
Cast Irons	K	Iron - Cast (Soft)	100-350
		Iron - Cast (Medium Hard)	100-200
		Iron (Hard Chilled)	100-150
		Iron (Malleable)	150-200
Stainless	M	Stainless Steel Free Machining	100-350
		Austenitic Stainless 304/316	100-150
		Ferritic	150-200
		Martensitic	80-175
		PH Stainless 17-4 PH	80-125

Workpiece Material Group		Examples	SFM
Special Alloys	S	Titanium 6AL-4V	100-175
		Cobalt-Based Alloys Stellite	80-125
		Nickel-Based Alloys Inconel 625/718 Iron-Based Alloys Incoloy 800-802	80-100
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc	100-150
		Hardened Steels 55-65 Rc	50-100
Non-Ferrous	N	Aluminum/ Aluminum Alloys	500-700
		Brass/Bronze	400-600
		Magnesium/ Magnesium Alloys	700-1000
		Plastics/Bakelite	200-500

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

Workpiece Material Group		Examples	Tool Diameter								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inches/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.004	.0022-.0043	.0032-.0050
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Cast Irons	K	Iron - Cast (Soft) Iron - Cast (Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
Stainless Steels	M	Stainless Steel Free Machining Ferritic	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Special Alloys	S	Titanium 6AL-4V	.0003-.0004	.0004-.0006	.0006-.0008	.0008-.0012	.0008-.0012	.0012-.0016	.0016-.0018	.0018-.0020	.0020-.0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010.-0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010-.0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035
Non-Ferrous	N	Aluminum/Aluminum Alloys Brass/Bronze Magnesium/Magnesium Alloys Plastics/Bakelite	.0008-.0015	.0015-.0020	.0020-.0025	.0025-.0030	.0030-.0035	.0035-.0050	.0050-.0080	.0075-.0095	.0085-.0100

Series 198/199 Metric

Workpiece Material Group		Examples	SMM
Steels	P	Steel - Mild (.2-.3 Carbon) 1018	30-105
		Steel - Mild (.4-.5 Carbon) 4140 Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	30-50
Cast Irons	K	Iron - Cast (Soft)	30-105
		Iron - Cast (Medium Hard)	30-60
		Iron (Hard Chilled)	30-45
		Iron (Malleable)	45-60
Stainless Steels	M	Stainless Steel Free Machining	30-105
		Austenitic Stainless 304/316	30-45

Workpiece Material Group		Examples	SMM
Stainless Steels	M	Ferritic	45-60
		Martensitic	25-55
		PH Stainless 17-4 PH	25-40
Special Alloys	S	Titanium 6AL-4V	30-55
		Cobalt-Based Alloys Stellite	25-40
		Nickel-Based Alloys Inconel 625/718	25-30
		Iron-Based Alloys Incoloy 800-802	25-30
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc	30-45
		Hardened Steels 55-65 Rc	15-30
Non-Ferrous	N	Aluminum/ Aluminum Alloys	150-215
		Brass/Bronze	120-185
		Magnesium/ Magnesium Alloys	215-305
		Plastics/Bakelite	60-150

Workpiece Material Group		Examples	Tool Diameter (mm)								
			3	5	6	8	10	12	16	20	25
			mm/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild(.4-.5 Carbon) 4140	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.051-.089	.058-.102	.056-.109	.081-.127
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.061-.081	.061-.081
Cast Irons	K	Iron - Cast (Soft) Iron - Cast (Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.051-.089	.058-.102	.056-.109	.081-.127
Stainless Steels	M	Stainless Steel Free Machining Ferritic	.013-.020	.025-.030	.038-.051	.038-.064	.053-.076	.051-.089	.058-.102	.056-.109	.081-.127
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.061-.081	.061-.081
Special Alloys	S	Titanium 6AL-4V	.008-.010	.010-.015	.015-.020	.020-.030	.020-.030	.030-.041	.041-.046	.046-.051	.051-.076
		Stellite Inconel 625/718 Incoloy 800-802	.008-.013	.013-.038	.013-.038	.025-.051	.025-.051	.025-.076	.051-.076	.064-.089	.064-.089
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.008-.013	.013-.038	.013-.038	.025-.051	.025-.051	.025-.076	.051-.076	.064-.089	.064-.089
Non-Ferrous	N	Aluminum/Aluminum Alloys Brass/Bronze Magnesium/Magnesium Alloys Plastics/Bakelite	.020-.038	.038-.051	.051-.064	.064-.076	.076-.089	.089-.127	.127-.203	.191-.241	.216-.254

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

General Purpose Technical Inch

	2 Flute Series			3 Flute Series		4 Flute Series				
Stub	164	166	162/168	169		163	165	117	167	161
Standard	121	150		116	145	111	140	151		
Long Length/Reach	123		183/186			122			181/184	

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

Workpiece Material Group		Examples	SFM
Steels	**P**	Steel - Mild (.2-.3 Carbon) 1018	350-500
		Steel - Mild (.4-.5 Carbon) 4140	250-350
		Tool Steels (1.2 carbon) A2/D2/H13/P20	200-250
		Forgings	125-250
Cast Irons	**K**	Iron - Cast (Soft)	450-600
		Iron - Cast (Medium Hard)	300-400
		Iron (Hard Chilled)	250-300
		Iron (Malleable)	225-300

Workpiece Material Group		Examples	SFM
Stainless Steels	**M**	Stainless Steel Free Machining	300-400
		Austenitic Stainless 304/316	180-225
		Ferritic	200-275
		Martensitic	150-200
		PH Stainless 17-4 PH	125-200
Special Alloys	**S**	Titanium 6AL-4V	175-375
		Cobalt-Based Alloys Stellite	100-200
		Nickel-Based Alloys Inconel 625/718	100-200
		Iron-Based Alloys Incoloy 800-802	125-200

Workpiece Material Group		Examples	SFM
Hardened Steels	**H**	Hardened Steels 35-45 Rc	200-250
		Hardened Steels 45-55 Rc	150-200
		Hardened Steels 55-65 Rc	50-100
Non-Ferrous	**N**	Aluminum/ Aluminum Alloys	500-700
		Brass/Bronze	400-600
		Magnesium/ Magnesium Alloys	700-1000
		Plastics/Bakelite	800-1200

Bright Tool use low SFM.

ALtima® Coated use high SFM.

Workpiece Material Group		Examples	Tool Diameter								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inches/Tooth								
Steels	**P**	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Cast Irons	**K**	Iron - Cast (Soft) Iron - Cast (Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
Stainless Steels	**M**	Stainless Steel Free Machining Ferritic	.0005-.0008	.0010-.0012	.0015-.0020	.0015-.0025	.0021-.0030	.0020-.0035	.0023-.0040	.0022-.0043	.0032-.0050
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.0003-.0005	.0008-.0010	.0012-.0015	.0014-.0018	.0018-.0020	.0020-.0023	.0023-.0030	.0024-.0032	.0024-.0032
Special Alloys	**S**	Titanium 6AL-4V	.0003-.0004	.0004-.0006	.0006-.0008	.0008-.0012	.0008-.0012	.0012-.0016	.0016-.0018	.0018-.0020	.0020-.0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010.-0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035
Hardened Steels	**H**	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.0003-.0005	.0005-.0015	.0005-.0015	.0010-.0020	.0010-.0020	.0010-.0030	.0020-.0030	.0025-.0035	.0025-.0035
Non-Ferrous	N	Aluminum/Aluminum Alloys Brass/Bronze Magnesium/Magnesium Alloys Plastics/Bakelite	.0008-.0015	.0015-.0020	.0020-.0025	.0025-.0030	.0030-.0035	.0035-.0050	.0050-.0080	.0075-.0095	.0085-.0100

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General Purpose Technical Metric

	2 Flute Series			3 Flute Series		4 Flute Series				
Stub	164	166	162/168	169		163	165	117	167	161
Standard	121	150		116	145	111	140	151		
Long Length/Reach	123		183/186			122			181/184	

Workpiece Material Group		Examples	SMM
Steels	**P**	Steel - Mild (.2-.3 Carbon) 1018	105-150
		Steel - Mild (.4-.5 Carbon) 4140	75-105
		Tool Steels (1.2 carbon) A2/D2/H13/P20	60-75
		Forgings	40-75
Cast Irons	**K**	Iron - Cast (Soft)	140-185
		Iron - Cast (Medium Hard)	90-120
		Iron (Hard Chilled)	75-90
		Iron (Malleable)	70-90

Workpiece Material Group		Examples	SMM
Stainless Steels	**M**	Stainless Steel Free Machining	90-120
		Austenitic Stainless 304/316	55-70
		Ferritic	60-85
		Martensitic	45-60
		PH Stainless 17-4 PH	40-60
Special Alloys	**S**	Titanium 6AL-4V	55-115
		Cobalt-Based Alloys Stellite	30-60
		Nickel-Based Alloys Inconel 625/718	30-60
		Iron-Based Alloys Incoloy 800-802	40-60

Workpiece Material Group		Examples	SMM
Hardened Steels	**H**	Hardened Steels 35-45 Rc	60-75
		Hardened Steels 45-55 Rc	45-60
		Hardened Steels 55-65 Rc	15-30
Non-Ferrous	**N**	Aluminum/ Aluminum Alloys	150-215
		Brass/Bronze	120-185
		Magnesium/ Magnesium Alloys	215-305
		Plastics/Bakelite	245-365

Bright Tool use low SMM.

ALtima® Coated use high SMM.

Workpiece Material Group		Examples	Tool Diameter (mm)								
			3	5	6	8	10	12	16	20	25
			mm/Tooth								
Steels	**P**	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.013-.020	.025-.030	.038-.051	.038-.051	.053-.076	.051-.089	.058-.102	.056-.109	.081-.127
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.061-.081	.061-.081
Cast Irons	**K**	Iron - Cast (Soft) Iron - Cast (Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.013-.020	.025-.030	.038-.051	.038-.051	.053-.076	.051-.089	.058-.102	.056-.109	.081-.127
Stainless Steels	**M**	Stainless Steel Free Machining Ferritic	.013-.020	.025-.030	.038-.051	.038-.051	.053-.076	.051-.089	.058-.102	.056-.109	.081-.127
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.008-.013	.020-.025	.030-.038	.036-.046	.046-.051	.051-.058	.058-.076	.061-.081	.061-.081
Special Alloys	**S**	Titanium 6AL-4V	.008-.010	.010-.015	.015-.020	.020-.030	.020-.030	.030-.041	.041-.046	.046-.051	.051-.076
		Stellite Inconel 625/718 Incoloy 800-802	.008-.013	.013-.038	.013-.038	.025-.051	.025-.051	.025-.076	.051-.076	.064-.089	.064-.089
Hardened Steels	**H**	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.008-.013	.013-.038	.013-.038	.025-.051	.025-.051	.025-.076	.051-.076	.064-.089	.064-.089
Non-Ferrous	N	Aluminum/Aluminum Alloys Brass/Bronze Magnesium/Magnesium Alloys Plastics/Bakelite	.020-.038	.038-.051	.051-.064	.064-.076	.076-.089	.089-.127	.127-.216	.191-.241	.216-.254

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

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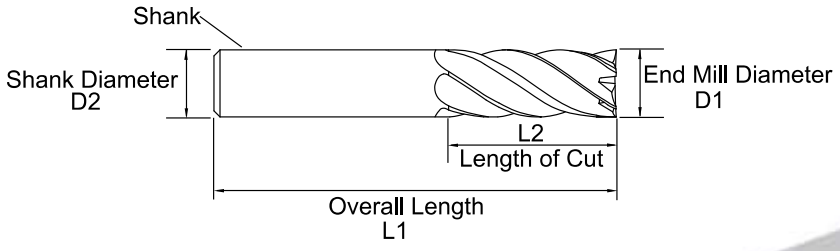
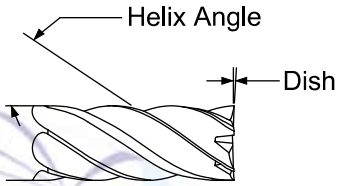
End Mill Terminology

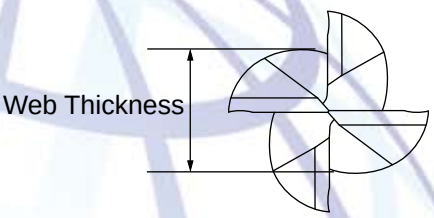


Length of Cut (Flute Length) – Always select the shortest Flute Length possible for your application. By selecting the shortest Flute Length, you can increase rigidity and allow for higher feed rates.

End Mill Diameter – Always select the largest diameter possible for your milling operation. Increasing your diameter by just 10%, can increase your rigidity by 25%.

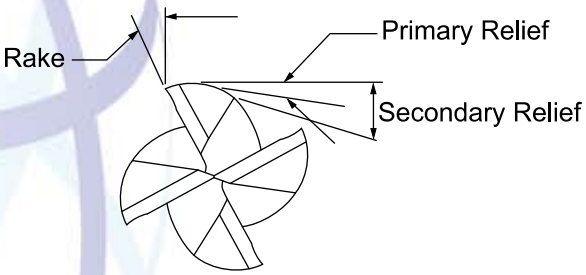


Helix Angle – Varies from 0 to 60 degrees. Higher helix angles can increase the number of teeth in a cut, and help in redirecting cutting forces. This is beneficial in harder to machine materials in particular. Changes in helix angle can also greatly affect the flute form of an end mill, and affect chip evacuation.



Web Thickness – The cross section of the fluting of the end mill. Larger webs allow for more rigidity, while smaller webs allow for better chip evacuation. This feature is highly dependent on the material being machined.

Rake Angle – The measurement of the curvature of the cutting edge in the face of the flute. A high rake angle will cut more aggressively, while a lower rake angle will increase the strength of the cutting edge.



Primary Relief – The clearance directly behind the cutting edge. High primary relief angles will allow for more aggressive milling, while lower relief angles will increase the strength of the cutting edge. The primary relief will also affect the wear on a cutting edge. Lower primary relief angles can tend to develop larger wear lands.

Solid Carbide TrueSize® Reamers Deliver High-Precision Hole Finishes

In applications that require high-precision hole finishes, or tighter diameter control, M.A. Ford® True Size® Reamers can be used with confidence. Solid Carbide Reamers are available in a wide range of sizes for virtually all materials, including cast iron, aluminum, stainless steel, exotic alloys, plastics and other non-ferrous materials.

Complete Family of Standard and Metric Sizes

M.A. Ford® stocks over 900 inch and metric size reamers in its product line, ranging from .013 inch to 16mm diameter. These products are available for immediate shipment. M.A. Ford® also maintains an inventory of pre-finished blanks, wich can be finished to your precise specifications and shipped within 72 hours upon request.

Material Removal Parameters

For proper finishing with a reamer, the correct amount of material must be left in the hole. If the hole is too close to the finish size, the reamer will tend to burnish the hole, and excessive tool wear will occur. If too much material is left, chips can clog the flutes of the reamer, resulting in a poor finish, poor size control, and possible tool breakage.

Refer to chart Total Stock Allowance on page 280 as a starting point for reaming operations.

For Technical Data, see page 279.

Designed and Manufactured in the USA

TrueSize® Reamer Series

TrueSize® Series 270
TrueSize® Series 270L
TrueSize® Series 272

All M.A. Ford® Reamers are ground between centers to assure maximum concentricity.

TrueSize Carbide Range Reamer
Straight Flute
Series 270

TrueSize Carbide Range Reamer
Left Hand Spiral
Series 270L

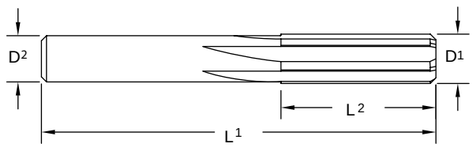
Metric
DIN
1420 H7

RHC

Before you order a 270 Series - check our listing of standard diameters in the 272 Series. Competitors special sizes are our standards!

Recommended for general purpose reaming in most non-ferrous and non-metallic materials. Kept in stock as a semi-finished tool. When orders are received tools can be promptly finish ground to the desired diameter. Specify size when ordering.

- Right hand cutting
- 45° lead cutting angle



Need a Reamer Fast?

Request Rapid Turn Around Service. Sizes above .0433" (1.10mm) can be shipped within 72 hours upon request.

Inch	
D1	**Tolerance**
≤ 3/8	+.0001/+.0003
> 3/8	+.0001/+.0004
D2	**Tolerance**
≤ 3/8	+.000/-.001
> 3/8	+.000/-.001
L1	**Tolerance**
≤ 3/8	+/- 1/16
> 3/8	+/- 1/16
L2	**Tolerance**
≤ 3/8	+/- 1/16
> 3/8	+/- 1/16

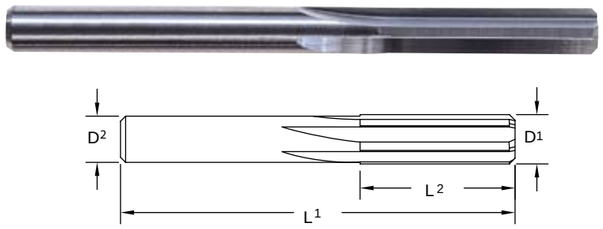
Metric (mm)	
D1	**Tolerance**
0.35-16.0	DIN1420 H7
D2	**Tolerance**
0.35-16.0	+0.00/-0.03
L1	**Tolerance**
0.35-16.0	+/- 1.5
L2	**Tolerance**
0.35-16.0	+/- 1.5

DIN1420 H7	
D1	**Tolerance (mm)**
≤ 3mm	+.004/+.008
>3mm-6mm	+.005/+.010
>6mm-10mm	+.006/+.012
>10mm-16mm	+.008/+.015

Series 270 Diameter Range D1		Series 270L Diameter Range D1		Shank D2		OAL L1		Flute Length L2		Flutes
Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	
.0135-.0200	00.34-0.50	.0135-.0200	00.34-0.50	.0135-.0433 (0.34-0.50mm) diameter 270/270L are available as a special. Please contact Customer Service at 800-553-8024 or 563-391-6220 for pricing.						
.0201-.0400	00.51-1.01	.0201-.0400	00.51-1.01							
.0401-.0433	01.02-1.09	.0401-.0433	01.02-1.09							
.0434-.0519	01.10-1.31	.0434-.0519	01.10-1.31	.043	1.09	1-1/2	38	3/8	9.5	4
.0520-.0590	01.32-1.49	.0520-.0590	01.32-1.49	.046	1.17	1-1/2	38	3/8	9.5	4
.0591-.0660	01.50-1.67	.0591-.0660	01.50-1.67	.058	1.47	1-1/2	38	3/8	9.5	4
.0661-.0740	01.68-1.87	.0661-.0740	01.68-1.87	.065	1.65	1-3/4	44	1/2	12.5	4
.0741-.0810	01.88-2.05	.0741-.0810	01.88-2.05	.073	1.85	1-3/4	44	1/2	12.5	4
.0811-.0890	02.06-2.26	.0811-.0890	02.06-2.26	.080	2.03	2	44	1/2	12.5	4
.0891-.0970	02.27-2.46	.0891-.0970	02.27-2.46	.088	2.24	2	44	1/2	12.5	4
.0971-.1050	02.47-2.66	.0971-.1050	02.47-2.66	.096	2.44	2-1/4	57	5/8	16	4
.1051-.1130	02.67-2.87	.1051-.1130	02.67-2.87	.104	2.64	2-1/4	57	5/8	16	4
.1131-.1210	02.88-3.07	.1131-.1210	02.88-3.07	.112	2.84	2-1/4	57	5/8	16	4
.1211-.1280	03.08-3.25	.1211-.1280	03.08-3.25	.120	3.05	2-1/4	57	5/8	16	4
.1281-.1360	03.26-3.45	.1281-.1360	03.26-3.45	.127	3.23	2-1/2	64	3/4	19	4
.1361-.1440	03.46-3.65	.1361-.1440	03.46-3.65	.135	3.43	2-1/2	64	3/4	19	4
.1441-.1520	03.66-3.86	.1441-.1520	03.66-3.86	.143	3.63	2-1/2	64	3/4	19	4
.1521-.1590	03.87-4.03	.1521-.1590	03.87-4.03	.151	3.84	2-1/2	64	3/4	19	4
.1591-.1670	04.04-4.24	.1591-.1670	04.04-4.24	.158	4.01	2-3/4	70	7/8	22	4
.1671-.1750	04.25-4.44	.1671-.1750	04.25-4.44	.166	4.22	2-3/4	70	7/8	22	4
.1751-.1830	04.45-4.64	.1751-.1830	04.45-4.64	.174	4.42	2-3/4	70	7/8	22	4
.1831-.1910	04.65-4.85	.1831-.1910	04.65-4.85	.182	4.62	2-3/4	70	7/8	22	4
.1911-.1990	04.86-5.05	.1911-.1990	04.86-5.05	.190	4.83	3	76	1	25.5	4
.1991-.2060	05.06-5.23	.1991-.2060	05.06-5.23	.198	5.03	3	76	1	25.5	4
.2061-.2140	05.24-5.43	.2061-.2140	05.24-5.43	.205	5.21	3	76	1	25.5	4
.2141-.2220	05.44-5.63	.2141-.2220	05.44-5.63	.213	5.41	3	76	1	25.5	4
.2221-.2300	05.64-5.84	.2221-.2300	05.64-5.84	.221	5.61	3	76	1	25.5	4
.2301-.2370	05.85-6.01	.2301-.2370	05.85-6.01	.229	5.82	3	76	1	25.5	4
.2371-.2450	06.02-6.22	.2371-.2450	06.02-6.22	.236	5.99	3	76	1	25.5	4
.2451-.2530	06.23-6.42	.2451-.2530	06.23-6.42	.244	6.20	3	76	1	25.5	4
.2531-.2710	06.43-6.88	.2531-.2710	06.43-6.88	.252	6.40	3-1/4	83	1-1/8	28.5	6
.2711-.2860	06.89-7.26	.2711-.2860	06.89-7.26	.270	6.86	3-1/4	83	1-1/8	28.5	6
.2861-.3020	07.27-7.67	.2861-.3020	07.27-7.67	.285	7.24	3-1/4	83	1-1/8	28.5	6
.3021-.3180	07.68-8.07	.3021-.3180	07.68-8.07	.301	7.65	3-1/4	83	1-1/8	28.5	6
.3181-.3330	08.08-8.45	.3181-.3330	08.08-8.45	.317	8.05	3-1/2	89	1-1/4	32	6
.3331-.3490	08.46-8.86	.3331-.3490	08.46-8.86	.332	8.43	3-1/2	89	1-1/4	32	6
.3491-.3640	08.87-9.24	.3491-.3640	08.87-9.24	.348	8.84	3-1/2	89	1-1/4	32	6
.3641-.3860	09.25-9.80	.3641-.3860	09.25-9.80	.363	9.22	3-1/2	89	1-1/4	32	6
.3861-.4150	09.81-10.54			.380	9.65	3-1/2	89	1-1/4	32	6
.4151-.4450	10.55-11.30			.410	10.41	3-3/4	95	1-3/8	35	6
.4451-.4750	11.31-12.06			.440	11.18	3-3/4	95	1-3/8	35	6
.4751-.5100	12.07-12.95			.470	11.93	4	102	1-1/2	38	6
.5101-.5400	12.96-13.71			.505	12.83	4	102	1-1/2	38	6
.5401-.5700	13.72-14.47			.535	13.59	4	102	1-1/2	38	6
.5701-.6000	14.48-15.24			.565	14.35	4	102	1-3/4	44.5	6
.6001-.6350	15.25-16.13			.595	15.11	4	102	1-3/4	44.5	6

Technical information on page 279.

TrueSize Carbide Reamer
Series 272



- Recommended for general purpose reaming.
- Straight flutes.
- Well suited for ferrous metals and many non-ferrous and non-metallic materials.
- Special sizes, shank diameters, flute lengths, step reamers, coating, etc. available as specials. Call Customer Service at 800-553-8024 for a quote.

If you don't see the size you need - Just Ask
Most special sizes shipped within 72 hours upon request.

Inch	
D1	**Tolerance**
≤ 3/8	+.0001/+.0003
> 3/8	+.0001/+.0004
D2	**Tolerance**
≤ 3/8	+.000/-.001
> 3/8	+.000/-.001
L1	**Tolerance**
≤ 3/8	+/- 1/16
> 3/8	+/- 1/16
L2	**Tolerance**
≤ 3/8	+/- 1/16
> 3/8	+/- 1/16

Metric (mm)	
D1	**Tolerance**
0.35-16.0	DIN1420 H7
D2	**Tolerance**
0.35-16.0	+0.00/-0.03
L1	**Tolerance**
0.35-16.0	+/- 1.5
L2	**Tolerance**
0.35-16.0	+/- 1.5

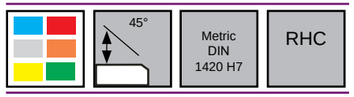
DIN1420 H7	
D1	**Tolerance (mm)**
≤ 3mm	+.004/+.008
>3mm-6mm	+.005/+.010
>6mm-10mm	+.006/+.012
>10mm-16mm	+.008/+.015

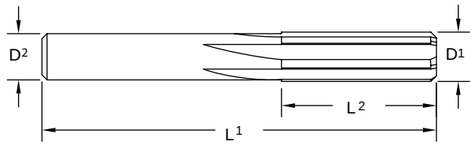
Series 272

Technical information on page 279.

		Diameter				Shank		OAL		Flute Length		
		D1				D2		L1		L2		
Tool No.	EDP	Fraction	Wire	mm	Decimal	Inch	mm	Inch	mm	Inch	mm	Flutes
27201300	03000				0.0130	0.0130		1-1/2		3/16		4
27201350	01001		80		0.0135	0.0135		1-1/2		3/16		4
27201380	01005			0.35	0.0138	0.0138	0.35		38		5.0	4
27201400	03001				0.0140	0.0140		1-1/2		3/16		4
27201450	01009		79		0.0145	0.0145		1-1/2		3/16		4
27201500	03002				0.0150	0.0150		1-1/2		3/16		4
27201550	03003				0.0155	0.0155		1-1/2		3/16		4
27201560	01013	1/64			0.0156	0.0156		1-1/2		3/16		4
27201570	01017			0.40	0.0157	0.0157	0.40		38		5.0	4
27201600	01021		78		0.0160	0.0160		1-1/2		3/16		4
27201650	03004				0.0165	0.0165		1-1/2		3/16		4
27201700	03005				0.0170	0.0170		1-1/2		3/16		4
27201750	03006				0.0175	0.0175		1-1/2		3/16		4
27201770	01025			0.45	0.0177	0.0177	0.45		38		5.0	4
27201800	01029		77		0.0180	0.0180		1-1/2		3/16		4
27201850	03007				0.0185	0.0185		1-1/2		3/16		4
27201900	03008				0.0190	0.0190		1-1/2		3/16		4
27201950	03009				0.0195	0.0195		1-1/2		3/16		4
27201970	01033			0.50	0.0197	0.0197	0.50		38		5.0	4
27202000	01037		76		0.0200	0.0200		1-1/2		3/16		4
27202050	03010				0.0205	0.0205		1-1/2		1/4		4
27202100	01041		75		0.0210	0.0210		1-1/2		1/4		4
27202150	03011				0.0215	0.0215		1-1/2		1/4		4
27202170	01045			0.55	0.0217	0.0217	0.55		38		6.5	4
27202200	03012				0.0220	0.0220		1-1/2		1/4		4
27202250	01049		74		0.0225	0.0225		1-1/2		1/4		4
27202300	03013				0.0230	0.0230		1-1/2		1/4		4
27202350	03014				0.0235	0.0235		1-1/2		1/4		4
27202360	01053			0.60	0.0236	0.0236	0.60		38		6.5	4
27202400	01057		73		0.0240	0.0240		1-1/2		1/4		4
27202450	03015				0.0245	0.0245		1-1/2		1/4		4
27202500	01061		72		0.0250	0.0250		1-1/2		1/4		4
27202550	03016				0.0255	0.0255		1-1/2		1/4		4
27202560	01065			0.65	0.0256	0.0256	0.65		38		6.5	4
27202600	01069		71		0.0260	0.0260		1-1/2		1/4		4
27202650	03017				0.0265	0.0265		1-1/2		1/4		4
27202700	03018				0.0270	0.0270		1-1/2		1/4		4
27202750	03019				0.0275	0.0275		1-1/2		1/4		4
27202760	01073			0.70	0.0276	0.0276	0.70		38		6.5	4
27202800	01077		70		0.0280	0.0280		1-1/2		1/4		4
27202850	03020				0.0285	0.0285		1-1/2		1/4		4
27202900	03021				0.0290	0.0290		1-1/2		1/4		4

Series 272 Continued





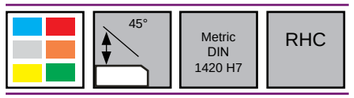
Technical information on page 279.

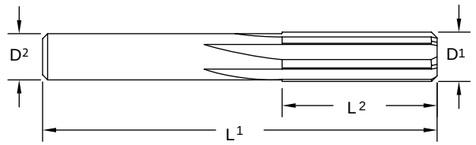
Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Flutes
27202920	01081		69		0.0292	0.0292		1-1/2		1/4		4
27202950	01085			0.75	0.0295	0.0295	0.75		38		6.5	4
27202951	03620				0.0295	0.0295		1-1/2		1/4		4
27203000	03022				0.0300	0.0300		1-1/2		1/4		4
27203050	03023				0.0305	0.0305		1-1/2		1/4		4
27203100	01089		68		0.0310	0.0310		1-1/2		1/4		4
27203120	01093	1/32			0.0312	0.0312		1-1/2		1/4		4
27203150	01097			0.80	0.0315	0.0315	0.80		38		6.5	4
27203151	03621				0.0315	0.0315		1-1/2		1/4		4
27203200	01101		67		0.0320	0.0320		1-1/2		1/4		4
27203250	03024				0.0325	0.0325		1-1/2		1/4		4
27203300	01105		66		0.0330	0.0330		1-1/2		1/4		4
27203350	01109			0.85	0.0335	0.0335	0.85		38		6.5	4
27203351	03622				0.0335	0.0335		1-1/2		1/4		4
27203400	03025				0.0340	0.0340		1-1/2		1/4		4
27203450	03026				0.0345	0.0345		1-1/2		1/4		4
27203500	01113		65		0.0350	0.0350		1-1/2		1/4		4
27203540	01117			0.90	0.0354	0.0354	0.90		38		6.5	4
27203550	03027				0.0355	0.0355		1-1/2		1/4		4
27203600	01121		64		0.0360	0.0360		1-1/2		1/4		4
27203650	03028				0.0365	0.0365		1-1/2		1/4		4
27203700	01125		63		0.0370	0.0370		1-1/2		1/4		4
27203740	01129			0.95	0.0374	0.0374	0.95		38		6.5	4
27203750	03029				0.0375	0.0375		1-1/2		1/4		4
27203800	01133		62		0.0380	0.0380		1-1/2		1/4		4
27203850	03030				0.0385	0.0385		1-1/2		1/4		4
27203900	01137		61		0.0390	0.0390		1-1/2		1/4		4
27203940	01141			1.00	0.0394	0.0394	1.00		38		6.5	4
27203950	03031				0.0395	0.0395		1-1/2		1/4		4
27204000	01145		60		0.0400	0.0400		1-1/2		1/4		4
27204050	03032				0.0405	0.0405		1-1/2		3/8		4
27204100	01149		59		0.0410	0.0410		1-1/2		3/8		4
27204130	01153			1.05	0.0413	0.0413	1.05		38		9.5	4
27204150	03033				0.0415	0.0415		1-1/2		3/8		4
27204200	01157		58		0.0420	0.0420		1-1/2		3/8		4
27204250	03034				0.0425	0.0425		1-1/2		3/8		4
27204300	01161		57		0.0430	0.0430		1-1/2		3/8		4
27204330	01165			1.10	0.0433	0.0433	1.09		38		9.5	4
27204350	03035				0.0435	0.0430		1-1/2		3/8		4
27204400	03036				0.0440	0.0430		1-1/2		3/8		4

Technical information on page 279.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Flutes
27204450	03037				0.0445	0.0430		1-1/2		3/8		4
27204500	03038				0.0450	0.0430		1-1/2		3/8		4
27204520	01169			1.15	0.0452	0.0430	1.09		38		9.5	4
27204550	03039				0.0455	0.0430		1-1/2		3/8		4
27204600	03040				0.0460	0.0430		1-1/2		3/8		4
27204650	01173		56		0.0465	0.0430		1-1/2		3/8		4
27204680	01177	3/64			0.0468	0.0430		1-1/2		3/8		4
27204700	03041				0.0470	0.0430		1-1/2		3/8		4
27204720	01181			1.20	0.0472	0.0430	1.09		38		9.5	4
27204750	03042				0.0475	0.0430		1-1/2		3/8		4
27204800	03043				0.0480	0.0430		1-1/2		3/8		4
27204850	03044				0.0485	0.0430		1-1/2		3/8		4
27204900	03045				0.0490	0.0430		1-1/2		3/8		4
27204920	01185			1.25	0.0492	0.0430	1.09		38		9.5	4
27204950	03046				0.0495	0.0430		1-1/2		3/8		4
27205000	03047				0.0500	0.0430		1-1/2		3/8		4
27205050	03048				0.0505	0.0430		1-1/2		3/8		4
27205100	03049				0.0510	0.0430		1-1/2		3/8		4
27205110	01189			1.30	0.0511	0.0430	1.09		38		9.5	4
27205150	03050				0.0515	0.0430		1-1/2		3/8		4
27205200	01193		55		0.0520	0.0460		1-1/2		3/8		4
27205250	03051				0.0525	0.0460		1-1/2		3/8		4
27205300	03052				0.0530	0.0460		1-1/2		3/8		4
27205310	01197			1.35	0.0531	0.0460	1.17		38		9.5	4
27205350	03053				0.0535	0.0460		1-1/2		3/8		4
27205400	03054				0.0540	0.0460		1-1/2		3/8		4
27205450	03055				0.0545	0.0460		1-1/2		3/8		4
27205500	01201		54		0.0550	0.0460		1-1/2		3/8		4
27205510	01205			1.40	0.0551	0.0460	1.17		38		9.5	4
27205550	03056				0.0555	0.0460		1-1/2		3/8		4
27205600	03057				0.0560	0.0460		1-1/2		3/8		4
27205650	03058				0.0565	0.0460		1-1/2		3/8		4
27205700	03059				0.0570	0.0460		1-1/2		3/8		4
27205710	01209			1.45	0.0571	0.0460	1.17		38		9.5	4
27205750	03060				0.0575	0.0460		1-1/2		3/8		4
27205800	03061				0.0580	0.0460		1-1/2		3/8		4
27205850	03062				0.0585	0.0460		1-1/2		3/8		4
27205900	01213			1.50	0.0590	0.0460	1.17		38		9.5	4
27205901	03623				0.0590	0.0460		1-1/2		3/8		4
27205950	01217		53		0.0595	0.0580		1-1/2		3/8		4
27206000	03063				0.0600	0.0580		1-1/2		3/8		4
27206050	03064				0.0605	0.0580		1-1/2		3/8		4
27206100	01221			1.55	0.0610	0.0580	1.47		38		9.5	4
27206101	03624				0.0610	0.0580		1-1/2		3/8		4
27206150	03065				0.0615	0.0580		1-1/2		3/8		4
27206200	03066				0.0620	0.0580		1-1/2		3/8		4

Series 272 Continued





Technical information on page 279.

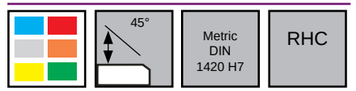
Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Flutes
27206250	01225	1/16			0.0625	0.0580		1-1/2		3/8		4
27206300	01229			1.60	0.0630	0.0580	1.47		38		9.5	4
27206301	03625				0.0630	0.0580		1-1/2		3/8		4
27206350	01233		52		0.0635	0.0580		1-1/2		3/8		4
27206400	03067				0.0640	0.0580		1-1/2		3/8		4
27206450	03068				0.0645	0.0580		1-1/2		3/8		4
27206490	01237			1.65	0.0649	0.0580	1.47		38		9.5	4
27206500	03069				0.0650	0.0580		1-1/2		3/8		4
27206550	03070				0.0655	0.0580		1-1/2		3/8		4
27206600	03071				0.0660	0.0580		1-1/2		3/8		4
27206650	03072				0.0665	0.0650		1-3/4		1/2		4
27206690	01241			1.70	0.0669	0.0650	1.65		44		12.5	4
27206700	01245		51		0.0670	0.0650		1-3/4		1/2		4
27206750	03073				0.0675	0.0650		1-3/4		1/2		4
27206800	03074				0.0680	0.0650		1-3/4		1/2		4
27206850	03075				0.0685	0.0650		1-3/4		1/2		4
27206890	01249			1.75	0.0689	0.0650	1.65		44		12.5	4
27206900	03076				0.0690	0.0650		1-3/4		1/2		4
27206950	03077				0.0695	0.0650		1-3/4		1/2		4
27207000	01253		50		0.0700	0.0650		1-3/4		1/2		4
27207050	03078				0.0705	0.0650		1-3/4		1/2		4
27207080	01257			1.80	0.0708	0.0650	1.65		44		12.5	4
27207100	03079				0.0710	0.0650		1-3/4		1/2		4
27207150	03080				0.0715	0.0650		1-3/4		1/2		4
27207200	03081				0.0720	0.0650		1-3/4		1/2		4
27207250	03082				0.0725	0.0650		1-3/4		1/2		4
27207280	01261			1.85	0.0728	0.0650	1.65		44		12.5	4
27207300	01265		49		0.0730	0.0650		1-3/4		1/2		4
27207350	03083				0.0735	0.0650		1-3/4		1/2		4
27207400	03084				0.0740	0.0650		1-3/4		1/2		4
27207450	03085				0.0745	0.0730		1-3/4		1/2		4
27207480	01269			1.90	0.0748	0.0730	1.85		44		12.5	4
27207500	03086				0.0750	0.0730		1-3/4		1/2		4
27207550	03087				0.0755	0.0730		1-3/4		1/2		4
27207600	01273		48		0.0760	0.0730		1-3/4		1/2		4
27207650	03088				0.0765	0.0730		1-3/4		1/2		4
27207670	01277			1.95	0.0767	0.0730	1.85		44		12.5	4
27207700	03089				0.0770	0.0730		1-3/4		1/2		4
27207750	03090				0.0775	0.0730		1-3/4		1/2		4
27207800	03091				0.0780	0.0730		1-3/4		1/2		4

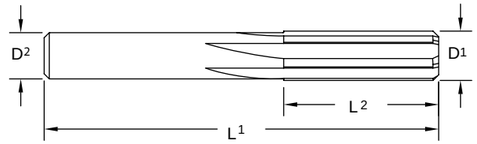
Series 272 Continued

Technical information on page 279.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Flutes
27207810	01281	5/64			0.0781	0.0730		1-3/4		1/2		4
27207850	01285		47		0.0785	0.0730		1-3/4		1/2		4
27207870	01289			2.00	0.0787	0.0730	1.85		44		12.5	4
27207900	03092				0.0790	0.0730		1-3/4		1/2		4
27207950	03093				0.0795	0.0730		1-3/4		1/2		4
27208000	03094				0.0800	0.0730		1-3/4		1/2		4
27208050	03095				0.0805	0.0730		1-3/4		1/2		4
27208070	01293			2.05	0.0807	0.0730	1.85		44		12.5	4
27208100	01297		46		0.0810	0.0730		1-3/4		1/2		4
27208150	03096				0.0815	0.0800		2		1/2		4
27208200	01301		45		0.0820	0.0800		2		1/2		4
27208250	03097				0.0825	0.0800		2		1/2		4
27208270	01305			2.10	0.0827	0.0800	2.03		51		12.5	4
27208300	03098				0.0830	0.0800		2		1/2		4
27208350	03099				0.0835	0.0800		2		1/2		4
27208400	03100				0.0840	0.0800		2		1/2		4
27208450	03101				0.0845	0.0800		2		1/2		4
27208460	01309			2.15	0.0846	0.0800	2.03		51		12.5	4
27208500	03102				0.0850	0.0800		2		1/2		4
27208550	03103				0.0855	0.0800		2		1/2		4
27208600	01313		44		0.0860	0.0800		2		1/2		4
27208650	03104				0.0865	0.0800		2		1/2		4
27208660	01317			2.20	0.0866	0.0800	2.03		51		12.5	4
27208700	03105				0.0870	0.0800		2		1/2		4
27208750	03106				0.0875	0.0800		2		1/2		4
27208800	03107				0.0880	0.0800		2		1/2		4
27208850	03108				0.0885	0.0800		2		1/2		4
27208860	01321			2.25	0.0886	0.0800	2.03		51		12.5	4
27208900	01325		43		0.0890	0.0800		2		1/2		4
27208950	03109				0.0895	0.0880		2		1/2		4
27209000	03110				0.0900	0.0880		2		1/2		4
27209050	03111				0.0905	0.0880		2		1/2		4
27209060	01329			2.30	0.0906	0.0880	2.24		51		12.5	4
27209100	03112				0.0910	0.0880		2		1/2		4
27209150	03113				0.0915	0.0880		2		1/2		4
27209200	03114				0.0920	0.0880		2		1/2		4
27209250	01333			2.35	0.0925	0.0880	2.24		51		12.5	4
27209251	03626				0.0925	0.0880		2		1/2		4
27209300	03115				0.0930	0.0880		2		1/2		4
27209350	01337		42		0.0935	0.0880		2		1/2		4
27209370	01341	3/32			0.0937	0.0880		2		1/2		4
27209400	03116				0.0940	0.0880		2		1/2		4
27209450	01345			2.40	0.0945	0.0880	2.24		51		12.5	4
27209451	03627				0.0945	0.0880		2		1/2		4
27209500	03117				0.0950	0.0880		2		1/2		4

Series 272 Continued





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Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27209550	03118				0.0955	0.0880		2		1/2		4
27209600	01349		41		0.0960	0.0880		2		1/2		4
27209650	01353			2.45	0.0965	0.0880	2.24		51		12.5	4
27209651	03628				0.0965	0.0880		2		1/2		4
27209700	03119				0.0970	0.0880		2		1/2		4
27209750	03120				0.0975	0.0960		2-1/4		5/8		4
27209800	01357		40		0.0980	0.0960		2-1/4		5/8		4
27209840	01361			2.50	0.0984	0.0960	2.44		57		16.0	4
27209850	03121				0.0985	0.0960		2-1/4		5/8		4
27209900	03122				0.0990	0.0960		2-1/4		5/8		4
27209950	01365		39		0.0995	0.0960		2-1/4		5/8		4
27210000	03123				0.1000	0.0960		2-1/4		5/8		4
27210040	01366			2.55	0.1004	0.0960	2.44		57		16.0	4
27210050	03124				0.1005	0.0960		2-1/4		5/8		4
27210100	03125				0.1010	0.0960		2-1/4		5/8		4
27210150	01369		38		0.1015	0.0960		2-1/4		5/8		4
27210200	03126				0.1020	0.0960		2-1/4		5/8		4
27210240	01373			2.60	0.1024	0.0960	2.44		57		16.0	4
27210250	03127				0.1025	0.0960		2-1/4		5/8		4
27210300	03128				0.1030	0.0960		2-1/4		5/8		4
27210350	03129				0.1035	0.0960		2-1/4		5/8		4
27210400	01377		37		0.1040	0.0960		2-1/4		5/8		4
27210430	01378			2.65	0.1043	0.0960	2.44		57		16.0	4
27210450	03130				0.1045	0.0960		2-1/4		5/8		4
27210500	03131				0.1050	0.0960		2-1/4		5/8		4
27210550	03132				0.1055	0.1040		2-1/4		5/8		4
27210600	03133				0.1060	0.1040		2-1/4		5/8		4
27210630	01381			2.70	0.1063	0.1040	2.64		57		16.0	4
27210650	01385		36		0.1065	0.1040		2-1/4		5/8		4
27210700	03134				0.1070	0.1040		2-1/4		5/8		4
27210750	03135				0.1075	0.1040		2-1/4		5/8		4
27210800	03136				0.1080	0.1040		2-1/4		5/8		4
27210830	01389			2.75	0.1083	0.1040	2.64		57		16.0	4
27210850	03137				0.1085	0.1040		2-1/4		5/8		4
27210900	03138				0.1090	0.1040		2-1/4		5/8		4
27210940	01393	7/64			0.1094	0.1040		2-1/4		5/8		4
27210950	03139				0.1095	0.1040		2-1/4		5/8		4
27211000	01397		35		0.1100	0.1040		2-1/4		5/8		4
27211020	01401			2.80	0.1102	0.1040	2.64		57		16.0	4
27211050	03140				0.1105	0.1040		2-1/4		5/8		4

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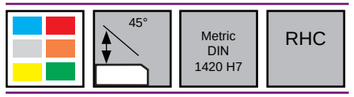
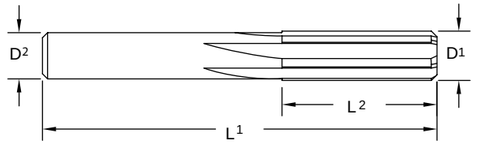
Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27211100	01405		34		0.1110	0.1040		2-1/4		5/8		4
27211150	03141				0.1115	0.1040		2-1/4		5/8		4
27211200	03142				0.1120	0.1040		2-1/4		5/8		4
27211220	01406			2.85	0.1122	0.1040	2.64		57		16.0	4
27211250	03143				0.1125	0.1040		2-1/4		5/8		4
27211300	01409		33		0.1130	0.1040		2-1/4		5/8		4
27211350	03144				0.1135	0.1120		2-1/4		5/8		4
27211400	03145				0.1140	0.1120		2-1/4		5/8		4
27211420	01413			2.90	0.1142	0.1120	2.84		57		16.0	4
27211450	03146				0.1145	0.1120		2-1/4		5/8		4
27211500	03147				0.1150	0.1120		2-1/4		5/8		4
27211550	03148				0.1155	0.1120		2-1/4		5/8		4
27211600	01417		32		0.1160	0.1120		2-1/4		5/8		4
27211610	01418			2.95	0.1161	0.1120	2.84		57		16.0	4
27211650	03149				0.1165	0.1120		2-1/4		5/8		4
27211700	03150				0.1170	0.1120		2-1/4		5/8		4
27211750	03151				0.1175	0.1120		2-1/4		5/8		4
27211800	03152				0.1180	0.1120		2-1/4		5/8		4
27211810	01421			3.00	0.1181	0.1120	2.84		57		16.0	4
27211850	03153				0.1185	0.1120		2-1/4		5/8		4
27211900	03154				0.1190	0.1120		2-1/4		5/8		4
27211950	03155				0.1195	0.1120		2-1/4		5/8		4
27212000	01425		31		0.1200	0.1120		2-1/4		5/8		4
27212010	01426			3.05	0.1201	0.1120	2.84		57		16.0	4
27212050	03156				0.1205	0.1120		2-1/4		5/8		4
27212100	03157				0.1210	0.1120		2-1/4		5/8		4
27212150	03158				0.1215	0.1200		2-1/4		5/8		4
27212200	01429			3.10	0.1220	0.1200	3.05		57		16.0	4
27212201	03629				0.1220	0.1200		2-1/4		5/8		4
27212250	03159				0.1225	0.1200		2-1/4		5/8		4
27212300	03160				0.1230	0.1200		2-1/4		5/8		4
27212350	03161				0.1235	0.1200		2-1/4		5/8		4
27212400	03162				0.1240	0.1200		2-1/4		5/8		4
27212401	01436			3.15	0.1240	0.1200	3.05		57		16.0	4
27212450	03163	1/8 DP2			0.1245	0.1200		2-1/4		5/8		4
27212470	01434				0.1247	0.1200		2-1/4		5/8		4
27212480	03164	1/8 DP1			0.1248	0.1200		2-1/4		5/8		4
27212490	03165	1/8 US			0.1249	0.1200		2-1/4		5/8		4
27212500	01433	1/8			0.1250	0.1200		2-1/4		5/8		4
27212550	03166				0.1255	0.1200		2-1/4		5/8		4
27212600	01437			3.20	0.1260	0.1200	3.05		57		16.0	4
27212601	03167	1/8 OS			0.1260	0.1200		2-1/4		5/8		4
27212650	03168				0.1265	0.1200		2-1/4		5/8		4
27212700	03169				0.1270	0.1200		2-1/4		5/8		4
27212750	03170				0.1275	0.1200		2-1/4		5/8		4

Series 272 Continued





Technical information on page 279.

Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27212800	01441			3.25	0.1280	0.1200	3.05		57		16.0	4
27212801	03630				0.1280	0.1200		2-1/4		5/8		4
27212850	01445		30		0.1285	0.1270		2-1/2		3/4		4
27212900	03171				0.1290	0.1270		2-1/2		3/4		4
27212950	03172				0.1295	0.1270		2-1/2		3/4		4
27212990	01449			3.30	0.1299	0.1270	3.23		63		19.0	4
27213000	03173				0.1300	0.1270		2-1/2		3/4		4
27213050	03174				0.1305	0.1270		2-1/2		3/4		4
27213100	03175				0.1310	0.1270		2-1/2		3/4		4
27213150	03176				0.1315	0.1270		2-1/2		3/4		4
27213190	01453			3.35	0.1319	0.1270	3.23		63		19.0	4
27213200	03177				0.1320	0.1270		2-1/2		3/4		4
27213250	03178				0.1325	0.1270		2-1/2		3/4		4
27213300	03179				0.1330	0.1270		2-1/2		3/4		4
27213350	03180				0.1335	0.1270		2-1/2		3/4		4
27213390	01457			3.40	0.1339	0.1270	3.23		63		19.0	4
27213400	03181				0.1340	0.1270		2-1/2		3/4		4
27213450	03182				0.1345	0.1270		2-1/2		3/4		4
27213500	03183				0.1350	0.1270		2-1/2		3/4		4
27213550	03184				0.1355	0.1270		2-1/2		3/4		4
27213580	01461			3.45	0.1358	0.1270	3.23		63		19.0	4
27213600	01465		29		0.1360	0.1270		2-1/2		3/4		4
27213650	03185				0.1365	0.1350		2-1/2		3/4		4
27213700	03186				0.1370	0.1350		2-1/2		3/4		4
27213750	03187				0.1375	0.1350		2-1/2		3/4		4
27213780	01469			3.50	0.1378	0.1350	3.43		63		19.0	4
27213800	03188				0.1380	0.1350		2-1/2		3/4		4
27213850	03189				0.1385	0.1350		2-1/2		3/4		4
27213900	03190				0.1390	0.1350		2-1/2		3/4		4
27213950	03191				0.1395	0.1350		2-1/2		3/4		4
27213980	01473			3.55	0.1398	0.1350	3.43		63		19.0	4
27214000	03192				0.1400	0.1350		2-1/2		3/4		4
27214050	01477		28		0.1405	0.1350		2-1/2		3/4		4
27214060	01481	9/64			0.1406	0.1350		2-1/2		3/4		4
27214100	03193				0.1410	0.1350		2-1/2		3/4		4
27214150	03194				0.1415	0.1350		2-1/2		3/4		4
27214170	01485			3.60	0.1417	0.1350	3.43		63		19.0	4
27214200	03195				0.1420	0.1350		2-1/2		3/4		4
27214250	03196				0.1425	0.1350		2-1/2		3/4		4

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Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27214300	03197				0.1430	0.1350		2-1/2		3/4		4
27214350	03198				0.1435	0.1350		2-1/2		3/4		4
27214370	01489			3.65	0.1437	0.1350	3.43		63		19.0	4
27214400	01493		27		0.1440	0.1350		2-1/2		3/4		4
27214450	03199				0.1445	0.1430		2-1/2		3/4		4
27214500	03200				0.1450	0.1430		2-1/2		3/4		4
27214550	03201				0.1455	0.1430		2-1/2		3/4		4
27214570	01497			3.70	0.1457	0.1430	3.63		63		19.0	4
27214600	03202				0.1460	0.1430		2-1/2		3/4		4
27214650	03203				0.1465	0.1430		2-1/2		3/4		4
27214700	01501		26		0.1470	0.1430		2-1/2		3/4		4
27214750	03204				0.1475	0.1430		2-1/2		3/4		4
27214760	01505			3.75	0.1476	0.1430	3.63		63		19.0	4
27214800	03205				0.1480	0.1430		2-1/2		3/4		4
27214850	03206				0.1485	0.1430		2-1/2		3/4		4
27214900	03207				0.1490	0.1430		2-1/2		3/4		4
27214950	01509		25		0.1495	0.1430		2-1/2		3/4		4
27214960	01513			3.80	0.1496	0.1430	3.63		63		19.0	4
27215000	03208				0.1500	0.1430		2-1/2		3/4		4
27215050	03209				0.1505	0.1430		2-1/2		3/4		4
27215100	03210				0.1510	0.1430		2-1/2		3/4		4
27215150	03211				0.1515	0.1430		2-1/2		3/4		4
27215160	01518			3.85	0.1516	0.1430	3.63		63		19.0	4
27215200	01517		24		0.1520	0.1430		2-1/2		3/4		4
27215250	03213				0.1525	0.1510		2-1/2		3/4		4
27215300	03214				0.1530	0.1510		2-1/2		3/4		4
27215350	01521			3.90	0.1535	0.1510	3.84		63		19.0	4
27215351	03631				0.1535	0.1510		2-1/2		3/4		4
27215400	01525		23		0.1540	0.1510		2-1/2		3/4		4
27215450	03215				0.1545	0.1510		2-1/2		3/4		4
27215500	03216				0.1550	0.1510		2-1/2		3/4		4
27215550	01529			3.95	0.1555	0.1510	3.84		63		19.0	4
27215551	03632				0.1555	0.1510		2-1/2		3/4		4
27215600	03217				0.1560	0.1510		2-1/2		3/4		4
27215620	01533	5/32			0.1562	0.1510		2-1/2		3/4		4
27215650	03218				0.1565	0.1510		2-1/2		3/4		4
27215700	01537		22		0.1570	0.1510		2-1/2		3/4		4
27215750	01541			4.00	0.1575	0.1510	3.84		63		19.0	4
27215751	03633				0.1575	0.1510		2-1/2		3/4		4
27215800	03219				0.1580	0.1510		2-1/2		3/4		4
27215850	03220				0.1585	0.1510		2-1/2		3/4		4
27215900	01545		21		0.1590	0.1510		2-1/2		3/4		4
27215940	01549			4.05	0.1594	0.1580	4.01		70		22.0	4
27215950	03221				0.1595	0.1580		2-3/4		7/8		4
27216000	03222				0.1600	0.1580		2-3/4		7/8		4

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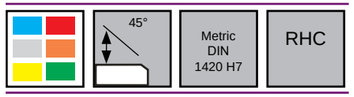

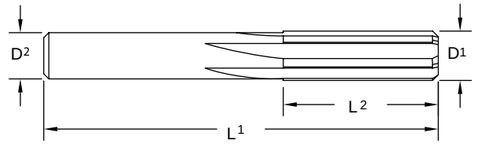

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Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Flutes
27216050	03223				0.1605	0.1580		2-3/4		7/8		4
27216100	01553		20		0.1610	0.1580		2-3/4		7/8		4
27216140	01557			4.10	0.1614	0.1580	4.01		70		22.0	4
27216150	03224				0.1615	0.1580		2-3/4		7/8		4
27216200	03225				0.1620	0.1580		2-3/4		7/8		4
27216250	03226				0.1625	0.1580		2-3/4		7/8		4
27216300	03227				0.1630	0.1580		2-3/4		7/8		4
27216340	01561			4.15	0.1634	0.1580	4.01		70		22.0	4
27216350	03228				0.1635	0.1580		2-3/4		7/8		4
27216400	03229				0.1640	0.1580		2-3/4		7/8		4
27216450	03230				0.1645	0.1580		2-3/4		7/8		4
27216500	03231				0.1650	0.1580		2-3/4		7/8		4
27216540	01565			4.20	0.1654	0.1580	4.01		70		22.0	4
27216550	03232				0.1655	0.1580		2-3/4		7/8		4
27216600	01569		19		0.1660	0.1580		2-3/4		7/8		4
27216650	03233				0.1665	0.1580		2-3/4		7/8		4
27216700	03234				0.1670	0.1580		2-3/4		7/8		4
27216730	01573			4.25	0.1673	0.1660	4.22		70		22.0	4
27216750	03235				0.1675	0.1660		2-3/4		7/8		4
27216800	03236				0.1680	0.1660		2-3/4		7/8		4
27216850	03237				0.1685	0.1660		2-3/4		7/8		4
27216900	03238				0.1690	0.1660		2-3/4		7/8		4
27216930	01577			4.30	0.1693	0.1660	4.22		70		22.0	4
27216950	01581		18		0.1695	0.1660		2-3/4		7/8		4
27217000	03239				0.1700	0.1660		2-3/4		7/8		4
27217050	03240				0.1705	0.1660		2-3/4		7/8		4
27217100	03241				0.1710	0.1660		2-3/4		7/8		4
27217130	01585			4.35	0.1713	0.1660	4.22		70		22.0	4
27217150	03242				0.1715	0.1660		2-3/4		7/8		4
27217190	01589	11/64			0.1719	0.1660		2-3/4		7/8		4
27217200	03243				0.1720	0.1660		2-3/4		7/8		4
27217250	03244				0.1725	0.1660		2-3/4		7/8		4
27217300	01593		17		0.1730	0.1660		2-3/4		7/8		4
27217320	01597			4.40	0.1732	0.1660	4.22		70		22.0	4
27217350	03245				0.1735	0.1660		2-3/4		7/8		4
27217400	03246				0.1740	0.1660		2-3/4		7/8		4
27217450	03247				0.1745	0.1660		2-3/4		7/8		4
27217500	03248				0.1750	0.1660		2-3/4		7/8		4
27217520	01601			4.45	0.1752	0.1740	4.42		70		22.0	4

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Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Flutes
27217550	03249				0.1755	0.1740		2-3/4		7/8		4
27217600	03250				0.1760	0.1740		2-3/4		7/8		4
27217650	03251				0.1765	0.1740		2-3/4		7/8		4
27217700	01605		16		0.1770	0.1740		2-3/4		7/8		4
27217720	01609			4.50	0.1772	0.1740	4.42		70		22.0	4
27217750	03252				0.1775	0.1740		2-3/4		7/8		4
27217800	03253				0.1780	0.1740		2-3/4		7/8		4
27217850	03254				0.1785	0.1740		2-3/4		7/8		4
27217900	03255				0.1790	0.1740		2-3/4		7/8		4
27217910	01613			4.55	0.1791	0.1740	4.42		70		22.0	4
27217950	03256				0.1795	0.1740		2-3/4		7/8		4
27218000	01617		15		0.1800	0.1740		2-3/4		7/8		4
27218050	03257				0.1805	0.1740		2-3/4		7/8		4
27218100	03258				0.1810	0.1740		2-3/4		7/8		4
27218110	01621			4.60	0.1811	0.1740	4.42		70		22.0	4
27218150	03259				0.1815	0.1740		2-3/4		7/8		4
27218200	01625		14		0.1820	0.1740		2-3/4		7/8		4
27218250	03260				0.1825	0.1740		2-3/4		7/8		4
27218300	03261				0.1830	0.1740		2-3/4		7/8		4
27218310	01629			4.65	0.1831	0.1820	4.62		70		22.0	4
27218350	03262				0.1835	0.1820		2-3/4		7/8		4
27218400	03263				0.1840	0.1820		2-3/4		7/8		4
27218450	03264				0.1845	0.1820		2-3/4		7/8		4
27218500	01633			4.70	0.1850	0.1820	4.62		70		22.0	4
27218501	03265		13		0.1850	0.1820		2-3/4		7/8		4
27218550	03266				0.1855	0.1820		2-3/4		7/8		4
27218600	03267				0.1860	0.1820		2-3/4		7/8		4
27218650	03268				0.1865	0.1820		2-3/4		7/8		4
27218700	01637			4.75	0.1870	0.1820	4.62		70		22.0	4
27218701	03269	3/16 DP2			0.1870	0.1820		2-3/4		7/8		4
27218730	03270	3/16 DP1			0.1873	0.1820		2-3/4		7/8		4
27218740	03271	3/16 US			0.1874	0.1820		2-3/4		7/8		4
27218750	01641	3/16			0.1875	0.1820		2-3/4		7/8		4
27218800	03272				0.1880	0.1820		2-3/4		7/8		4
27218850	03273	3/16 OS			0.1885	0.1820		2-3/4		7/8		4
27218890	01645			4.80	0.1889	0.1820	4.62		70		22.0	4
27218900	01649		12		0.1890	0.1820		2-3/4		7/8		4
27218950	03274				0.1895	0.1820		2-3/4		7/8		4
27219000	03275				0.1900	0.1820		2-3/4		7/8		4
27219050	03276				0.1905	0.1820		2-3/4		7/8		4
27219090	01653			4.85	0.1909	0.1820	4.62		70		22.0	4
27219100	01657		11		0.1910	0.1820		2-3/4		7/8		4
27219150	03277				0.1915	0.1900		3		1		4
27219200	03278				0.1920	0.1900		3		1		4
27219250	03279				0.1925	0.1900		3		1		4

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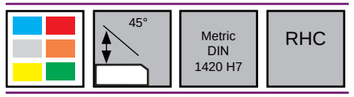

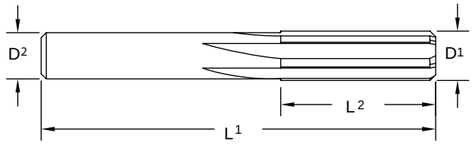

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Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27219290	01661			4.90	0.1929	0.1900	4.83		76		25.5	4
27219300	03280				0.1930	0.1900		3		1		4
27219350	01665		10		0.1935	0.1900		3		1		4
27219400	03281				0.1940	0.1900		3		1		4
27219450	03282				0.1945	0.1900		3		1		4
27219490	01669			4.95	0.1949	0.1900	4.83		76		25.5	4
27219500	03283				0.1950	0.1900		3		1		4
27219550	03284				0.1955	0.1900		3		1		4
27219600	01673		9		0.1960	0.1900		3		1		4
27219650	03285				0.1965	0.1900		3		1		4
27219690	01677			5.00	0.1969	0.1900	4.83		76		25.5	4
27219700	03286				0.1970	0.1900		3		1		4
27219750	03287				0.1975	0.1900		3		1		4
27219800	03288				0.1980	0.1900		3		1		4
27219850	03289				0.1985	0.1900		3		1		4
27219880	01681			5.05	0.1988	0.1900	4.83		76		25.5	4
27219900	01685		8		0.1990	0.1900		3		1		4
27219950	03290				0.1995	0.1980		3		1		4
27220000	03291				0.2000	0.1980		3		1		4
27220050	03292				0.2005	0.1980		3		1		4
27220080	01689			5.10	0.2008	0.1980	5.03		76		25.5	4
27220100	01693		7		0.2010	0.1980		3		1		4
27220150	03293				0.2015	0.1980		3		1		4
27220200	03294				0.2020	0.1980		3		1		4
27220250	03295				0.2025	0.1980		3		1		4
27220280	01697			5.15	0.2028	0.1980	5.03		76		25.5	4
27220300	03296				0.2030	0.1980		3		1		4
27220310	01701	13/64			0.2031	0.1980		3		1		4
27220350	03297				0.2035	0.1980		3		1		4
27220400	01705		6		0.2040	0.1980		3		1		4
27220450	03298				0.2045	0.1980		3		1		4
27220470	01709			5.20	0.2047	0.1980	5.03		76		25.5	4
27220500	03299				0.2050	0.1980		3		1		4
27220550	01713		5		0.2055	0.1980		3		1		4
27220600	03300				0.2060	0.1980		3		1		4
27220650	03301				0.2065	0.2050		3		1		4
27220670	01717			5.25	0.2067	0.2050	5.21		76		25.5	4
27220700	03302				0.2070	0.2050		3		1		4
27220750	03303				0.2075	0.2050		3		1		4

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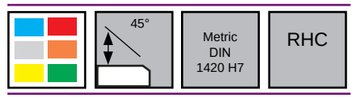
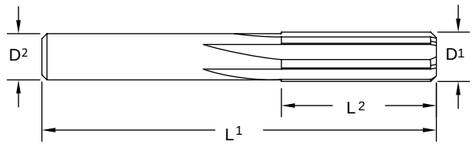
Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27220800	03304				0.2080	0.2050		3		1		4
27220850	03305				0.2085	0.2050		3		1		4
27220870	01721			5.30	0.2087	0.2050	5.21		76		25.5	4
27220900	01725		4		0.2090	0.2050		3		1		4
27220950	03306				0.2095	0.2050		3		1		4
27221000	03307				0.2100	0.2050		3		1		4
27221050	03308				0.2105	0.2050		3		1		4
27221060	01729			5.35	0.2106	0.2050	5.21		76		25.5	4
27221100	03309				0.2110	0.2050		3		1		4
27221150	03310				0.2115	0.2050		3		1		4
27221200	03311				0.2120	0.2050		3		1		4
27221250	03312				0.2125	0.2050		3		1		4
27221260	01733			5.40	0.2126	0.2050	5.21		76		25.5	4
27221300	01737		3		0.2130	0.2050		3		1		4
27221350	03313				0.2135	0.2050		3		1		4
27221400	03314				0.2140	0.2050		3		1		4
27221450	03315				0.2145	0.2130		3		1		4
27221460	01741			5.45	0.2146	0.2130	5.41		76		25.5	4
27221500	03316				0.2150	0.2130		3		1		4
27221550	03317				0.2155	0.2130		3		1		4
27221600	03318				0.2160	0.2130		3		1		4
27221650	01745			5.50	0.2165	0.2130	5.41		76		25.5	4
27221651	03634				0.2165	0.2130		3		1		4
27221700	03319				0.2170	0.2130		3		1		4
27221750	03320				0.2175	0.2130		3		1		4
27221800	03321				0.2180	0.2130		3		1		4
27221850	01749			5.55	0.2185	0.2130	5.41		76		25.5	4
27221851	03635				0.2185	0.2130		3		1		4
27221870	01753	7/32			0.2187	0.2130		3		1		4
27221900	03322				0.2190	0.2130		3		1		4
27221950	03323				0.2195	0.2130		3		1		4
27222000	03324				0.2200	0.2130		3		1		4
27222050	01757			5.60	0.2205	0.2130	5.41		76		25.5	4
27222051	03636				0.2205	0.2130		3		1		4
27222100	01761		2		0.2210	0.2130		3		1		4
27222150	03325				0.2215	0.2130		3		1		4
27222200	03326				0.2220	0.2130		3		1		4
27222240	01765			5.65	0.2224	0.2210	5.61		76		25.5	4
27222250	03327				0.2225	0.2210		3		1		4
27222300	03328				0.2230	0.2210		3		1		4
27222350	03329				0.2235	0.2210		3		1		4
27222400	03330				0.2240	0.2210		3		1		4
27222440	01769			5.70	0.2244	0.2210	5.61		76		25.5	4
27222450	03331				0.2245	0.2210		3		1		4
27222500	03332				0.2250	0.2210		3		1		4

Series 272 Continued





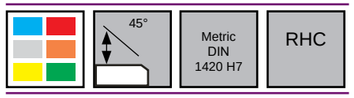
Technical information on page 279.

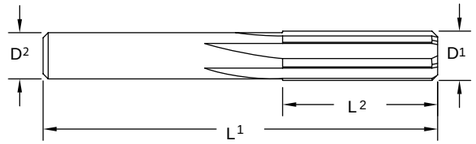
Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Flutes
27222550	03333				0.2255	0.2210		3		1		4
27222600	03334				0.2260	0.2210		3		1		4
27222640	01773			5.75	0.2264	0.2210	5.61		76		25.5	4
27222650	03335				0.2265	0.2210		3		1		4
27222700	03336				0.2270	0.2210		3		1		4
27222750	03337				0.2275	0.2210		3		1		4
27222800	01777		1		0.2280	0.2210		3		1		4
27222830	01781			5.80	0.2283	0.2210	5.61		76		25.5	4
27222850	03338				0.2285	0.2210		3		1		4
27222900	03339				0.2290	0.2210		3		1		4
27222950	03340				0.2295	0.2210		3		1		4
27223000	03341				0.2300	0.2210		3		1		4
27223030	01785			5.85	0.2303	0.2290	5.82		76		25.5	4
27223050	03342				0.2305	0.2290		3		1		4
27223100	03343				0.2310	0.2290		3		1		4
27223150	03344				0.2315	0.2290		3		1		4
27223200	03345				0.2320	0.2290		3		1		4
27223230	01789			5.90	0.2323	0.2290	5.82		76		25.5	4
27223250	03346				0.2325	0.2290		3		1		4
27223300	03347				0.2330	0.2290		3		1		4
27223350	03348				0.2335	0.2290		3		1		4
27223400	01793		A		0.2340	0.2290		3		1		4
27223430	01797			5.95	0.2343	0.2290	5.82		76		25.5	4
27223440	01801	15/64			0.2344	0.2290		3		1		4
27223450	03349				0.2345	0.2290		3		1		4
27223500	03350				0.2350	0.2290		3		1		4
27223550	03351				0.2355	0.2290		3		1		4
27223600	03352				0.2360	0.2290		3		1		4
27223620	01805			6.00	0.2362	0.2290	5.82		76		25.5	4
27223650	03353				0.2365	0.2290		3		1		4
27223700	03354				0.2370	0.2290		3		1		4
27223750	03355				0.2375	0.2360		3		1		4
27223800	01809		B		0.2380	0.2360		3		1		4
27223820	01810			6.05	0.2382	0.2360	5.99		76		25.5	4
27223850	03356				0.2385	0.2360		3		1		4
27223900	03357				0.2390	0.2360		3		1		4
27223950	03358				0.2395	0.2360		3		1		4
27224000	03359				0.2400	0.2360		3		1		4
27224020	01813			6.10	0.2402	0.2360	5.99		76		25.5	4

Technical information on page 279.

Tool No.	EDP	Diameter D1 Fraction	Diameter D1 Wire	Diameter D1 mm	Diameter D1 Decimal	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm	Flutes
27224050	03360				0.2405	0.2360		3		1		4
27224100	03361				0.2410	0.2360		3		1		4
27224150	03362				0.2415	0.2360		3		1		4
27224200	01817		C		0.2420	0.2360		3		1		4
27224210	01818			6.15	0.2421	0.2360	5.99		76		25.5	4
27224250	03363				0.2425	0.2360		3		1		4
27224300	03364				0.2430	0.2360		3		1		4
27224350	03365				0.2435	0.2360		3		1		4
27224400	03366				0.2440	0.2360		3		1		4
27224410	01821			6.20	0.2441	0.2360	5.99		76		25.5	4
27224450	03367				0.2445	0.2360		3		1		4
27224500	03368				0.2450	0.2360		3		1		4
27224550	03369				0.2455	0.2440		3		1		4
27224600	01825		D		0.2460	0.2440		3		1		4
27224610	01829			6.25	0.2461	0.2440	6.20		76		25.5	4
27224650	03370				0.2465	0.2440		3		1		4
27224700	03371				0.2470	0.2440		3		1		4
27224750	03372				0.2475	0.2440		3		1		4
27224800	01833			6.30	0.2480	0.2440	6.20		76		25.5	4
27224801	03637				0.2480	0.2440		3		1		4
27224850	03373				0.2485	0.2440		3		1		4
27224900	03374				0.2490	0.2440		3		1		4
27224950	03375	1/4 DP2			0.2495	0.2440		3		1		4
27224980	03376	1/4 DP1			0.2498	0.2440		3		1		4
27224990	03377	1/4 US			0.2499	0.2440		3		1		4
27225000	01837	1/4	E		0.2500	0.2440		3		1		4
27225001	03378			6.35	0.2500	0.2440	6.20		76		25.5	4
27225050	03379				0.2505	0.2440		3		1		4
27225100	03380	1/4 OS			0.2510	0.2440		3		1		4
27225150	03381				0.2515	0.2440		3		1		4
27225190	01841			6.40	0.2519	0.2440	6.20		76		25.5	4
27225200	03382				0.2520	0.2440		3		1		4
27225250	03383				0.2525	0.2440		3		1		4
27225300	03384				0.2530	0.2440		3		1		4
27225390	01844			6.45	0.2539	0.2520	6.40		83		28.5	6
27225400	03385				0.2540	0.2520		3-1/4		1-1/8		6
27225500	03386				0.2550	0.2520		3-1/4		1-1/8		6
27225590	01845			6.50	0.2559	0.2520	6.40		83		28.5	6
27225600	03387				0.2560	0.2520		3-1/4		1-1/8		6
27225700	01849		F		0.2570	0.2520		3-1/4		1-1/8		6
27225800	03388				0.2580	0.2520		3-1/4		1-1/8		6
27225900	03389				0.2590	0.2520		3-1/4		1-1/8		6
27226000	03390				0.2600	0.2520		3-1/4		1-1/8		6
27226100	01853		G		0.2610	0.2520		3-1/4		1-1/8		6
27226200	03391				0.2620	0.2520		3-1/4		1-1/8		6
27226300	03392				0.2630	0.2520		3-1/4		1-1/8		6

Series 272 Continued





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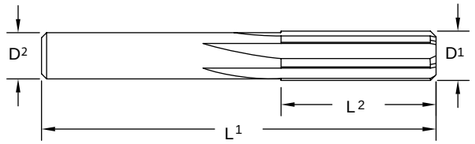
Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27226400	03393				0.2640	0.2520		3-1/4		1-1/8		6
27226500	03394				0.2650	0.2520		3-1/4		1-1/8		6
27226560	01857	17/64			0.2656	0.2520		3-1/4		1-1/8		6
27226600	01861		H		0.2660	0.2520		3-1/4		1-1/8		6
27226700	03395				0.2670	0.2520		3-1/4		1-1/8		6
27226800	03396				0.2680	0.2520		3-1/4		1-1/8		6
27226900	03397				0.2690	0.2520		3-1/4		1-1/8		6
27227000	03398				0.2700	0.2520		3-1/4		1-1/8		6
27227100	03399				0.2710	0.2520		3-1/4		1-1/8		6
27227200	01865		I		0.2720	0.2700		3-1/4		1-1/8		6
27227300	03400				0.2730	0.2700		3-1/4		1-1/8		6
27227400	03401				0.2740	0.2700		3-1/4		1-1/8		6
27227500	03402				0.2750	0.2700		3-1/4		1-1/8		6
27227560	01869			7.00	0.2756	0.2700	6.86		83		28.5	6
27227600	03403				0.2760	0.2700		3-1/4		1-1/8		6
27227700	01873		J		0.2770	0.2700		3-1/4		1-1/8		6
27227800	03404				0.2780	0.2700		3-1/4		1-1/8		6
27227900	03405				0.2790	0.2700		3-1/4		1-1/8		6
27228000	03406				0.2800	0.2700		3-1/4		1-1/8		6
27228100	01877		K		0.2810	0.2700		3-1/4		1-1/8		6
27228120	01881	9/32			0.2812	0.2700		3-1/4		1-1/8		6
27228200	03407				0.2820	0.2700		3-1/4		1-1/8		6
27228300	03408				0.2830	0.2700		3-1/4		1-1/8		6
27228400	03409				0.2840	0.2700		3-1/4		1-1/8		6
27228500	03410				0.2850	0.2700		3-1/4		1-1/8		6
27228600	03411				0.2860	0.2700		3-1/4		1-1/8		6
27228700	03412				0.2870	0.2850		3-1/4		1-1/8		6
27228800	03413				0.2880	0.2850		3-1/4		1-1/8		6
27228900	03414				0.2890	0.2850		3-1/4		1-1/8		6
27229000	01885		L		0.2900	0.2850		3-1/4		1-1/8		6
27229100	03415				0.2910	0.2850		3-1/4		1-1/8		6
27229200	03416				0.2920	0.2850		3-1/4		1-1/8		6
27229300	03417				0.2930	0.2850		3-1/4		1-1/8		6
27229400	03418				0.2940	0.2850		3-1/4		1-1/8		6
27229500	01889		M		0.2950	0.2850		3-1/4		1-1/8		6
27229530	01893			7.50	0.2953	0.2850	7.24		83		28.5	6
27229600	03419				0.2960	0.2850		3-1/4		1-1/8		6
27229680	01897	19/64			0.2968	0.2850		3-1/4		1-1/8		6
27229700	03420				0.2970	0.2850		3-1/4		1-1/8		6

Series 272 Continued

Technical information on page 279.

Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27229800	03421				0.2980	0.2850		3-1/4		1-1/8		6
27229900	03422				0.2990	0.2850		3-1/4		1-1/8		6
27230000	03423				0.3000	0.2850		3-1/4		1-1/8		6
27230100	03424				0.3010	0.2850		3-1/4		1-1/8		6
27230200	01901		N		0.3020	0.2850		3-1/4		1-1/8		6
27230300	03425				0.3030	0.3010		3-1/4		1-1/8		6
27230400	03426				0.3040	0.3010		3-1/4		1-1/8		6
27230500	03427				0.3050	0.3010		3-1/4		1-1/8		6
27230600	03428				0.3060	0.3010		3-1/4		1-1/8		6
27230700	03429				0.3070	0.3010		3-1/4		1-1/8		6
27230800	03430				0.3080	0.3010		3-1/4		1-1/8		6
27230900	03431				0.3090	0.3010		3-1/4		1-1/8		6
27231000	03432				0.3100	0.3010		3-1/4		1-1/8		6
27231050	01903				0.3105	0.3010		3-1/4		1-1/8		6
27231100	03433				0.3110	0.3010		3-1/4		1-1/8		6
27231150	01904				0.3115	0.3010		3-1/4		1-1/8		6
27231200	03434	5/16 DP2			0.3120	0.3010		3-1/4		1-1/8		6
27231230	03435	5/16 DP1			0.3123	0.3010		3-1/4		1-1/8		6
27231240	03436	5/16 US			0.3124	0.3010		3-1/4		1-1/8		6
27231250	01905	5/16			0.3125	0.3010		3-1/4		1-1/8		6
27231300	03437				0.3130	0.3010		3-1/4		1-1/8		6
27231350	03438	5/16 OS			0.3135	0.3010		3-1/4		1-1/8		6
27231400	03439				0.3140	0.3010		3-1/4		1-1/8		6
27231500	01909			8.00	0.3150	0.3010	7.65		83		28.5	6
27231501	03638				0.3150	0.3010		3-1/4		1-1/8		6
27231600	01913		O		0.3160	0.3010		3-1/4		1-1/8		6
27231700	03440				0.3170	0.3010		3-1/4		1-1/8		6
27231800	03441				0.3180	0.3010		3-1/4		1-1/8		6
27231900	03442				0.3190	0.3170		3-1/2		1-1/4		6
27232000	03443				0.3200	0.3170		3-1/2		1-1/4		6
27232100	03444				0.3210	0.3170		3-1/2		1-1/4		6
27232200	03445				0.3220	0.3170		3-1/2		1-1/4		6
27232300	01917		P		0.3230	0.3170		3-1/2		1-1/4		6
27232400	03446				0.3240	0.3170		3-1/2		1-1/4		6
27232500	03447				0.3250	0.3170		3-1/2		1-1/4		6
27232600	03448				0.3260	0.3170		3-1/2		1-1/4		6
27232700	03449				0.3270	0.3170		3-1/2		1-1/4		6
27232800	03450				0.3280	0.3170		3-1/2		1-1/4		6
27232810	01921	21/64			0.3281	0.3170		3-1/2		1-1/4		6
27232900	03451				0.3290	0.3170		3-1/2		1-1/4		6
27233000	03452				0.3300	0.3170		3-1/2		1-1/4		6
27233100	03453				0.3310	0.3170		3-1/2		1-1/4		6
27233200	01925		Q		0.3320	0.3170		3-1/2		1-1/4		6
27233300	03454				0.3330	0.3170		3-1/2		1-1/4		6
27233400	03455				0.3340	0.3320		3-1/2		1-1/4		6
27233460	01929			8.50	0.3346	0.3320	8.43		89		32.0	6

Series 272 Continued



Technical information on page 279.

Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27233500	03456				0.3350	0.3320		3-1/2		1-1/4		6
27233600	03457				0.3360	0.3320		3-1/2		1-1/4		6
27233700	03458				0.3370	0.3320		3-1/2		1-1/4		6
27233800	03459				0.3380	0.3320		3-1/2		1-1/4		6
27233900	01933		R		0.3390	0.3320		3-1/2		1-1/4		6
27234000	03460				0.3400	0.3320		3-1/2		1-1/4		6
27234100	03461				0.3410	0.3320		3-1/2		1-1/4		6
27234200	03462				0.3420	0.3320		3-1/2		1-1/4		6
27234300	03463				0.3430	0.3320		3-1/2		1-1/4		6
27234370	01937	11/32			0.3437	0.3320		3-1/2		1-1/4		6
27234400	03464				0.3440	0.3320		3-1/2		1-1/4		6
27234500	03465				0.3450	0.3320		3-1/2		1-1/4		6
27234600	03466				0.3460	0.3320		3-1/2		1-1/4		6
27234700	03467				0.3470	0.3320		3-1/2		1-1/4		6
27234800	01941		S		0.3480	0.3320		3-1/2		1-1/4		6
27234900	03468				0.3490	0.3320		3-1/2		1-1/4		6
27235000	03469				0.3500	0.3480		3-1/2		1-1/4		6
27235100	03470				0.3510	0.3480		3-1/2		1-1/4		6
27235200	03471				0.3520	0.3480		3-1/2		1-1/4		6
27235300	03472				0.3530	0.3480		3-1/2		1-1/4		6
27235400	03473				0.3540	0.3480		3-1/2		1-1/4		6
27235430	01945			9.00	0.3543	0.3480	8.84		89		32.0	6
27235500	03474				0.3550	0.3480		3-1/2		1-1/4		6
27235600	03475				0.3560	0.3480		3-1/2		1-1/4		6
27235700	03476				0.3570	0.3480		3-1/2		1-1/4		6
27235800	01949		T		0.3580	0.3480		3-1/2		1-1/4		6
27235900	03477				0.3590	0.3480		3-1/2		1-1/4		6
27235940	01953	23/64			0.3594	0.3480		3-1/2		1-1/4		6
27236000	03478				0.3600	0.3480		3-1/2		1-1/4		6
27236100	03479				0.3610	0.3480		3-1/2		1-1/4		6
27236200	03480				0.3620	0.3480		3-1/2		1-1/4		6
27236300	03481				0.3630	0.3480		3-1/2		1-1/4		6
27236400	03482				0.3640	0.3480		3-1/2		1-1/4		6
27236500	03483				0.3650	0.3630		3-1/2		1-1/4		6
27236600	03484				0.3660	0.3630		3-1/2		1-1/4		6
27236700	03485				0.3670	0.3630		3-1/2		1-1/4		6
27236800	01957		U		0.3680	0.3630		3-1/2		1-1/4		6
27236900	03486				0.3690	0.3630		3-1/2		1-1/4		6
27237000	03487				0.3700	0.3630		3-1/2		1-1/4		6

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Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27237100	03488				0.3710	0.3630		3-1/2		1-1/4		6
27237200	03489				0.3720	0.3630		3-1/2		1-1/4		6
27237300	03490				0.3730	0.3630		3-1/2		1-1/4		6
27237400	01961			9.50	0.3740	0.3630	9.22		89		32.0	6
27237401	03639				0.3740	0.3630		3-1/2		1-1/4		6
27237450	03491	3/8 DP2			0.3745	0.3630		3-1/2		1-1/4		6
27237480	03492	3/8 DP1			0.3748	0.3630		3-1/2		1-1/4		6
27237490	03493	3/8 US			0.3749	0.3630		3-1/2		1-1/4		6
27237500	01965	3/8			0.3750	0.3630		3-1/2		1-1/4		6
27237600	03494	3/8 OS			0.3760	0.3630		3-1/2		1-1/4		6
27237700	01969		V		0.3770	0.3630		3-1/2		1-1/4		6
27237800	03495				0.3780	0.3630		3-1/2		1-1/4		6
27237900	03496				0.3790	0.3630		3-1/2		1-1/4		6
27238000	03497				0.3800	0.3630		3-1/2		1-1/4		6
27238100	03498				0.3810	0.3630		3-1/2		1-1/4		6
27238200	03499				0.3820	0.3630		3-1/2		1-1/4		6
27238300	03500				0.3830	0.3630		3-1/2		1-1/4		6
27238400	03501				0.3840	0.3630		3-1/2		1-1/4		6
27238500	03502				0.3850	0.3630		3-1/2		1-1/4		6
27238600	01973		W		0.3860	0.3630		3-1/2		1-1/4		6
27238700	03503				0.3870	0.3800		3-1/2		1-1/4		6
27238800	03504				0.3880	0.3800		3-1/2		1-1/4		6
27238900	03505				0.3890	0.3800		3-1/2		1-1/4		6
27239000	03506				0.3900	0.3800		3-1/2		1-1/4		6
27239060	01977	25/64			0.3906	0.3800		3-1/2		1-1/4		6
27239100	03507				0.3910	0.3800		3-1/2		1-1/4		6
27239200	03508				0.3920	0.3800		3-1/2		1-1/4		6
27239300	03509				0.3930	0.3800		3-1/2		1-1/4		6
27239370	01979			10.00	0.3937	0.3800	9.65		89		32.0	6
27239400	03510				0.3940	0.3800		3-1/2		1-1/4		6
27239500	03511				0.3950	0.3800		3-1/2		1-1/4		6
27239600	03512				0.3960	0.3800		3-1/2		1-1/4		6
27239700	01981		X		0.3970	0.3800		3-1/2		1-1/4		6
27239800	03513				0.3980	0.3800		3-1/2		1-1/4		6
27239900	03514				0.3990	0.3800		3-1/2		1-1/4		6
27240000	03515				0.4000	0.3800		3-1/2		1-1/4		6
27240100	03516				0.4010	0.3800		3-1/2		1-1/4		6
27240200	03517				0.4020	0.3800		3-1/2		1-1/4		6
27240300	03518				0.4030	0.3800		3-1/2		1-1/4		6
27240400	01983		Y		0.4040	0.3800		3-1/2		1-1/4		6
27240500	03519				0.4050	0.3800		3-1/2		1-1/4		6
27240600	03520				0.4060	0.3800		3-1/2		1-1/4		6
27240620	01985	13/32			0.4062	0.3800		3-1/2		1-1/4		6
27240700	03521				0.4070	0.3800		3-1/2		1-1/4		6
27240800	03522				0.4080	0.3800		3-1/2		1-1/4		6

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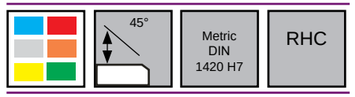

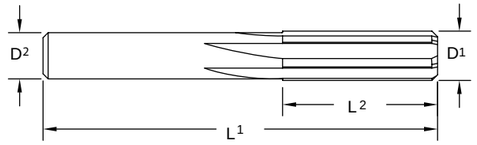

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Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27240900	03523				0.4090	0.3800		3-1/2		1-1/4		6
27241000	03524				0.4100	0.3800		3-1/2		1-1/4		6
27241100	03525				0.4110	0.3800		3-1/2		1-1/4		6
27241200	03526				0.4120	0.3800		3-1/2		1-1/4		6
27241300	01987		Z		0.4130	0.3800		3-1/2		1-1/4		6
27241340	01989			10.50	0.4134	0.3800	9.65		89		32.0	6
27241400	03527				0.4140	0.3800		3-1/2		1-1/4		6
27241500	03528				0.4150	0.3800		3-1/2		1-1/4		6
27241600	03529				0.4160	0.4100		3-3/4		1-3/8		6
27241700	03530				0.4170	0.4100		3-3/4		1-3/8		6
27241800	03531				0.4180	0.4100		3-3/4		1-3/8		6
27241900	03532				0.4190	0.4100		3-3/4		1-3/8		6
27242000	03533				0.4200	0.4100		3-3/4		1-3/8		6
27242100	03534				0.4210	0.4100		3-3/4		1-3/8		6
27242190	01991	27/64			0.4219	0.4100		3-3/4		1-3/8		6
27242200	03535				0.4220	0.4100		3-3/4		1-3/8		6
27242300	03536				0.4230	0.4100		3-3/4		1-3/8		6
27242400	03537				0.4240	0.4100		3-3/4		1-3/8		6
27242500	03538				0.4250	0.4100		3-3/4		1-3/8		6
27242600	03539				0.4260	0.4100		3-3/4		1-3/8		6
27242700	03540				0.4270	0.4100		3-3/4		1-3/8		6
27242800	03541				0.4280	0.4100		3-3/4		1-3/8		6
27242900	03542				0.4290	0.4100		3-3/4		1-3/8		6
27243000	03543				0.4300	0.4100		3-3/4		1-3/8		6
27243100	03544				0.4310	0.4100		3-3/4		1-3/8		6
27243200	03545				0.4320	0.4100		3-3/4		1-3/8		6
27243300	03546				0.4330	0.4100		3-3/4		1-3/8		6
27243310	01993			11.00	0.4331	0.4100	10.41		95		35.0	6
27243400	03547				0.4340	0.4100		3-3/4		1-3/8		6
27243500	03548				0.4350	0.4100		3-3/4		1-3/8		6
27243600	03549				0.4360	0.4100		3-3/4		1-3/8		6
27243700	03550	7/16 DP2			0.4370	0.4100		3-3/4		1-3/8		6
27243730	03551	7/16 DP1			0.4373	0.4100		3-3/4		1-3/8		6
27243740	03552	7/16 US			0.4374	0.4100		3-3/4		1-3/8		6
27243750	01995	7/16			0.4375	0.4100		3-3/4		1-3/8		6
27243800	03553				0.4380	0.4100		3-3/4		1-3/8		6
27243850	03619	7/16 OS			0.4385	0.4100		3-3/4		1-3/8		6
27243900	03554				0.4390	0.4100		3-3/4		1-3/8		6
27244000	03555				0.4400	0.4100		3-3/4		1-3/8		6

Technical information on page 279.

Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27244100	03556				0.4410	0.4100		3-3/4		1-3/8		6
27244200	03557				0.4420	0.4100		3-3/4		1-3/8		6
27244300	03558				0.4430	0.4100		3-3/4		1-3/8		6
27244400	03559				0.4440	0.4100		3-3/4		1-3/8		6
27244500	03560				0.4450	0.4100		3-3/4		1-3/8		6
27244600	03561				0.4460	0.4400		3-3/4		1-3/8		6
27244700	03562				0.4470	0.4400		3-3/4		1-3/8		6
27244800	03563				0.4480	0.4400		3-3/4		1-3/8		6
27244900	03564				0.4490	0.4400		3-3/4		1-3/8		6
27245000	03565				0.4500	0.4400		3-3/4		1-3/8		6
27245100	03566				0.4510	0.4400		3-3/4		1-3/8		6
27245200	03567				0.4520	0.4400		3-3/4		1-3/8		6
27245270	01997			11.50	0.4527	0.4400	11.18		95		35.0	6
27245300	03568				0.4530	0.4400		3-3/4		1-3/8		6
27245310	01999	29/64			0.4531	0.4400		3-3/4		1-3/8		6
27245400	03569				0.4540	0.4400		3-3/4		1-3/8		6
27245500	03570				0.4550	0.4400		3-3/4		1-3/8		6
27245600	03571				0.4560	0.4400		3-3/4		1-3/8		6
27245700	03572				0.4570	0.4400		3-3/4		1-3/8		6
27245800	03573				0.4580	0.4400		3-3/4		1-3/8		6
27245900	03574				0.4590	0.4400		3-3/4		1-3/8		6
27246000	03575				0.4600	0.4400		3-3/4		1-3/8		6
27246100	03576				0.4610	0.4400		3-3/4		1-3/8		6
27246200	03577				0.4620	0.4400		3-3/4		1-3/8		6
27246300	03578				0.4630	0.4400		3-3/4		1-3/8		6
27246400	03579				0.4640	0.4400		3-3/4		1-3/8		6
27246500	03580				0.4650	0.4400		3-3/4		1-3/8		6
27246600	03581				0.4660	0.4400		3-3/4		1-3/8		6
27246700	03582				0.4670	0.4400		3-3/4		1-3/8		6
27246800	03583				0.4680	0.4400		3-3/4		1-3/8		6
27246880	02001	15/32			0.4688	0.4400		3-3/4		1-3/8		6
27246900	03584				0.4690	0.4400		3-3/4		1-3/8		6
27247000	03585				0.4700	0.4400		3-3/4		1-3/8		6
27247100	03586				0.4710	0.4400		3-3/4		1-3/8		6
27247200	03587				0.4720	0.4400		3-3/4		1-3/8		6
27247240	02003			12.00	0.4724	0.4400	11.18		95		35.0	6
27247300	03588				0.4730	0.4400		3-3/4		1-3/8		6
27247400	03589				0.4740	0.4400		3-3/4		1-3/8		6
27247500	03590				0.4750	0.4400		3-3/4		1-3/8		6
27247600	03591				0.4760	0.4700		4		1-1/2		6
27247700	03592				0.4770	0.4700		4		1-1/2		6
27247800	03593				0.4780	0.4700		4		1-1/2		6
27247900	03594				0.4790	0.4700		4		1-1/2		6
27248000	03595				0.4800	0.4700		4		1-1/2		6
27248100	03596				0.4810	0.4700		4		1-1/2		6

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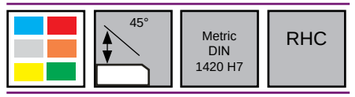

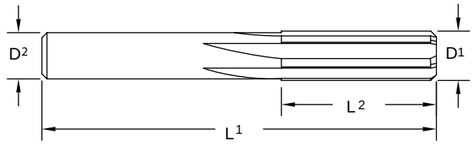

Technical information on page 279.

Tool No.	EDP	Diameter D1 Fraction	Wire	mm	Decimal	Shank D2 Inch	mm	OAL L1 Inch	mm	Flute Length L2 Inch	mm	Flutes
27248200	03597				0.4820	0.4700		4		1-1/2		6
27248300	03598				0.4830	0.4700		4		1-1/2		6
27248400	03599				0.4840	0.4700		4		1-1/2		6
27248440	02005	31/64			0.4844	0.4700		4		1-1/2		6
27248500	03600				0.4850	0.4700		4		1-1/2		6
27248600	03601				0.4860	0.4700		4		1-1/2		6
27248700	03602				0.4870	0.4700		4		1-1/2		6
27248800	03603				0.4880	0.4700		4		1-1/2		6
27248900	03604				0.4890	0.4700		4		1-1/2		6
27249000	03605				0.4900	0.4700		4		1-1/2		6
27249100	03606				0.4910	0.4700		4		1-1/2		6
27249200	03607				0.4920	0.4700		4		1-1/2		6
27249300	03608				0.4930	0.4700		4		1-1/2		6
27249400	03609				0.4940	0.4700		4		1-1/2		6
27249500	03610				0.4950	0.4700		4		1-1/2		6
27249600	03611				0.4960	0.4700		4		1-1/2		6
27249700	03612				0.4970	0.4700		4		1-1/2		6
27249800	03613				0.4980	0.4700		4		1-1/2		6
27249900	03614				0.4990	0.4700		4		1-1/2		6
27249950	03615	1/2 DP2			0.4995	0.4700		4		1-1/2		6
27249980	03616	1/2 DP1			0.4998	0.4700		4		1-1/2		6
27249990	03617	1/2 US			0.4999	0.4700		4		1-1/2		6
27250000	02007	1/2			0.5000	0.4700		4		1-1/2		6
27250100	03618	1/2 OS			0.5010	0.4700		4		1-1/2		6
27251180	02009			13.00	0.5118	0.5050	12.83		102		38.0	6
27251560	02011	33/64			0.5156	0.5050		4		1-1/2		6
27253120	02013	17/32			0.5312	0.5050		4		1-1/2		6
27254690	02015	35/64			0.5469	0.5350		4		1-1/2		6
27255120	02017			14.00	0.5512	0.5350	13.59		102		38.0	6
27256250	02019	9/16			0.5625	0.5350		4		1-1/2		6
27257810	02021	37/64			0.5781	0.5650		4		1-3/4		6
27259050	02023			15.00	0.5905	0.5650	14.35		102		44.5	6
27259380	02025	19/32			0.5938	0.5650		4		1-3/4		6
27260940	02027	39/64			0.6094	0.5950		4		1-3/4		6
27262500	02029	5/8			0.6250	0.5950		4		1-3/4		6
27262990	02031			16.00	0.6299	0.5950	15.11		102		44.5	6

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Troubleshooting Chart

Problem	Speed & Feed: Reduce Feed	Speed & Feed: Increase Feed	Speed & Feed: Reduce Speed	Speed & Feed: Increase Speed	Speed & Feed: Use Larger Reamer	Speed & Feed: Use Smaller Reamer	Speed & Feed: Bad Speed & Feed	Tool Geometry: Worn Tool Margin	Tool Geometry: Worn Cutting Edge	Tool Geometry: Uneven Lip Height	Tool Geometry: Chip Capacity of Reamer	Tool Geometry: Too Much Clearance	Tool Geometry: Grind Larger Back Taper	Tool Geometry: Bent Reamer	Coolant & Stock Removal: Insufficient Stock	Coolant & Stock Removal: Too Much Stock	Coolant & Stock Removal: Use Coolant	Coolant & Stock Removal: Run Dry	Coolant & Stock Removal: Poor Hole Prep
Burnishing		X									X				X				
Reamer Wear	X		X				X									X	X		X
Hole Quality	X		X				X	X	X	X					X	X	X		X
Hole Undersize	X		X		X			X	X						X	X	X		
Hole Oversize		X		X		X		X	X					X		X	X	X	X
Accuracy	X					X				X							X		
Chatter		X	X							X	X	X			X		X		
Out of Round Hole					X			X	X	X	X				X	X	X		
Hole Taper						X		X	X	X			X			X	X		
Bell Mouth		X					X	X	X		X		X	X			X		
Reamer Life		X	X				X			X		X					X		
Scoring in Bore							X	X	X	X					X	X	X		X
Deflection																			

Problem	Set Up: Alignment	Set Up: Holder Accuracy	Set Up: Concentricity	Set Up: Use Adjustable Holder	Set Up: Use Floating Holder	Set Up: Lack of Rigidity in Set-Up	Set Up: Work Holding Error	Set Up: Spindle Bearings	Set Up: Tool Extended Too Far	Cutting Errors: Poor Regrind	Cutting Errors: Poor Machinability	Cutting Errors: Built Up Edge	Cutting Errors: Wrong Tool	Cutting Errors: Poor Chip Removal
Burnishing	X						X			X				
Reamer Wear	X	X					X			X	X		X	
Hole Quality	X		X				X			X	X	X	X	
Hole Undersize	X										X			
Hole Oversize	X		X				X			X	X	X	X	
Accuracy							X			X				
Chatter	X	X				X	X	X	X	X				
Out of Round Hole	X						X			X				
Hole Taper	X	X	X	X	X		X			X	X	X		
Bell Mouth	X	X	X	X	X		X			X	X			
Reamer Life	X	X	X			X	X	X	X	X				
Scoring in Bore			X								X	X		X
Deflection	X													

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Total Stock Allowance
Inch

Material		Drill Decimal Equivalent/Size										
		.0135	.029/.028	.055/.052	.113	.238	.3594	.4844	.6094	.7344	.8594	.9844/1.480
		#80	#69/#70	#54/#55	#33	LET "B"	23/64	31/64	39/64	47/64	55/64	63/64
		Reamer Diameter										
		.0150	.0320	.0625	.1250	.2500	.3750	.5000	.6250	.7500	.8750	1.000-1.500
		Total Stock Allowance										
Magnesium		.0014	.0030	.0060	.0110	.0120	.0150	.0160	.0180	.0200	.0210	.0220
Aluminum	<5%Sl	.0014	.0030	.0060	.0110	.0120	.0150	.0160	.0180	.0200	.0210	.0220
	>5%Sl	.0014	.0030	.0060	.0110	.0120	.0130	.0150	.0160	.0180	.0190	.0200
Brass & Soft Bronze	Brass	.0014	.0030	.0060	.0110	.0120	.0130	.0150	.0160	.0180	.0190	.0200
	Bronze	.0014	.0030	.0060	.0110	.0120	.0140	.0150	.0170	.0190	.0200	.0210
Copper & Hard Bronze		.0014	.0030	.0060	.0110	.0120	.0140	.0150	.0170	.0190	.0200	.0210
Cast Iron	Cast	.0013	.0028	.0055	.0099	.0110	.0130	.0140	.0160	.0180	.0190	.0200
	Ductile	.0013	.0028	.0055	.0099	.0110	.0130	.0140	.0150	.0170	.0180	.0190
Steel	<35% C	.0013	.0028	.0055	.0099	.0110	.0130	.0140	.0160	.0170	.0180	.0190
	>35% C	.0012	.0025	.0049	.0089	.0100	.0120	.0130	.0150	.0170	.0180	.0190
	Tool	.0012	.0025	.0049	.0089	.0100	.0120	.0130	.0150	.0170	.0180	.0190
	Hard	.0009	.0020	.0040	.0072	.0080	.0100	.0110	.0130	.0140	.0150	.0160
Stainless		.0012	.0025	.0049	.0089	.0100	.0120	.0130	.0150	.0160	.0170	.0180
High Temp Alloys	Soft	.0012	.0025	.0049	.0089	.0100	.0110	.0130	.0140	.0160	.0170	.0180
	Hard	.0010	.0023	.0044	.0081	.0090	.0100	.0120	.0130	.0140	.0150	.0160
Titanium		.0013	.0028	.0055	.0099	.0110	.0130	.0140	.0160	.0170	.0180	.0190

Total Stock Allowance
Metric

Material		Drill Size (mm)										
		0.30	0.90	1.80	2.70	3.70	4.70	5.70	7.60	9.60	11.60	15.50
		Reamer Diameter										
		0.35	1.00	2.00	3.00	4.00	5.00	6.00	8.00	10.00	12.00	16.00
		Total Stock Allowance										
Magnesium		.04	.09	.19	.27	.29	.29	.30	.34	.38	.40	.46
Aluminum	<5%Sl	.04	.09	.19	.27	.29	.29	.30	.34	.38	.40	.46
	>5%Sl	.04	.09	.19	.27	.29	.29	.30	.32	.34	.37	.41
Brass & Soft Bronze	Brass	.04	.09	.19	.27	.29	.29	.30	.32	.34	.37	.41
	Bronze	.04	.09	.19	.27	.29	.29	.30	.33	.36	.38	.43
Copper & Hard Bronze		.04	.09	.19	.27	.29	.29	.30	.33	.36	.38	.43
Cast Iron	Cast	.03	.09	.17	.24	.26	.27	.28	.31	.33	.35	.41
	Ductile	.03	.09	.17	.24	.26	.27	.28	.31	.33	.35	.38
Steel	<35% C	.03	.09	.17	.24	.26	.27	.28	.31	.33	.35	.41
	>35% C	.03	.08	.15	.21	.23	.24	.25	.28	.31	.32	.38
	Tool	.03	.08	.15	.21	.23	.24	.25	.28	.31	.32	.38
	Hard	.02	.06	.12	.17	.19	.19	.20	.23	.26	.27	.33
Stainless		.03	.08	.15	.21	.23	.24	.25	.28	.31	.32	.38
High Temp Alloys	Soft	.03	.08	.15	.21	.23	.24	.25	.27	.29	.32	.36
	Hard	.03	.07	.14	.20	.21	.22	.23	.24	.26	.29	.33
Titanium		.03	.09	.17	.24	.26	.27	.28	.31	.33	.35	.41

Dowel Pin Chart
Inch

Dowel Pin	Nominal Dowel Decimal	Tight Press Fit Reamer		Tight Press Fit Reamer 0.0005		Loose Press Fit Reamer		Tight Slip Fit		Loose Slip Fit Reamer	
Size	Decimal	0.0005	Tool No.	DP(2)	Tool No.	DP(1)	Tool No.	Reamer	Tool No.	OS	Tool No.
1/8	.1250	.1230	27212300	.1245	27212450	.1248	27212480	.1255	27212550	.1260	27212601
3/16	.1875	.1855	27218550	.1870	27218701	.1873	27218730	.1880	27218800	.1885	27218850
1/4	.2500	.2480	27224801	.2495	27224950	.2498	27224980	.2505	27225050	.2510	27225100
5/16	.3125	.3110	27231100	.3120	27231200	.3123	27231230	.3130	27231300	.3135	27231350
3/8	.3750	.3740	27237401	.3745	27237450	.3748	27237480	.3750	27237500	.3760	27237600
7/16	.4735	.4360	27243600	.4370	27243700	.4373	27243730	.4380	27243800	.4385	27243850
1/2	.5000	.4990	27249900	.4995	27249950	.4998	27249980	.5000	27250000	.5010	27250100
+ 0.0001/ +0.0003 Tolerance (Reamer) Normal Dowels are nominal Size +.0001/ -.0001											

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.

Dowel Pin Chart
Metric

Dowel Pin	Nominal Dowel Decimal	Tight Press Fit Reamer		Tight Press Fit Reamer 0.013		Loose Press Fit Reamer		Tight Slip Fit		Loose Slip Fit Reamer	
Size (mm)	Decimal	0.013	Tool No.	DP(2)	Tool No.	DP(1)	Tool No.	Reamer	Tool No.	OS	Tool No.
2	0.0787	1.95	27207670	1.98	27207810	1.99	27207850	2.01	27207900	2.02	27207950
3	0.1181	2.95	27211610	2.98	27211750	3.00	27211800	3.01	27211850	3.02	27211900
4	0.1575	3.95	27215550	3.99	27215700	4.00	27215750	4.01	27215800	4.03	27215850
5	0.1969	4.95	27219490	4.99	27219650	5.00	27219690	5.02	27219750	5.03	27219800
6	0.2362	5.95	27223430	5.98	27223550	5.99	27223600	6.01	27223650	6.02	27223700
8	0.3150	7.95	27231300	7.98	27231400	8.00	27231500	8.00	27231500	8.03	27231600
10	0.3937	9.96	27239200	9.98	27239300	10.00	27239370	10.01	27239400	10.03	27239500
12	0.4724	11.96	27247100	11.99	27247200	12.00	27247240	12.01	27247300	12.01	27247300
Tolerance (Reamer) Per **DIN 1420 H7** Normal Dowels are nominal size +.0001" / -.0001" (+.0025/-.0025mm)											

Inch

Workpiece Material Group		Examples	SFM	Diameter IPR ≥ 1/16	>1/16 - 1/8	>1/8 - 1/4	>1/4 - 1/2	>1/2 - 1
Steels	P	Steel - Mild (.2-.3 Carbon) 1018	200-300	.0005-.0030	.002-.006	.004-.010	.006-.015	.010-.030
		Alloy Steel up to 35 Rc 4140	125-200	.0005-.0020	.0020-.0040	.0040-.0060	.0060-.0100	.0100-.0200
		Alloy Steel 36-45 Rc 4140/A2/D2	50-125	.0002-.0010	.0010-.0020	.0020-.0040	.0040-.0060	.0060-.0100
Stainless Steels	M	Free Machining/Austenitic Stainless 304/316	120-190	.0005-.0020	.0020-.0040	.0040-.0060	.0060-.0100	.0100-.0200
		Ferritic/Martensitic	80-120					
		17-4 PH	60-100	.0002-.0020	.0010-.0040	.0020-.0060	.0040-.0100	.0060-.0200
Special Alloys	S	Inconel 625/718	40-70	.0002-.0010	.0010-.0020	.0020-.0040	.0040-.0060	.0060-.0100
		Stellite/Cobalt Chrome	30-45					
		Titanium 6AL-4V	35-50	.0002-.0020	.0010-.0040	.0020-.0060	.0040-.0100	.0060-.0200
Cast Iron	K	Gray Cast Iron A48 Class 20/G4000	150-250	.0002-.0020	.0010-.0040	.0020-.0060	.0040-.0100	.0060-.0200
		Malleable/Ductile Cast Iron A536/60-40-18	125-200	.0005-.0020	.0020-.0040	.0040-.0060	.0060-.0100	.0100-.0200
		Hard (Martensitic) Cast Iron	50-75	.0002-.0010	.0010-.0020	.0020-.0040	.0040-.0060	.0060-.0100
Non-Ferrous	N	Aluminum/Aluminum Alloys	500-1000	.0005-.0030	.0020-.0060	.0040-.0100	.0060-.0150	.0100-.0300
		Brass/Bronze Free Machining	250-400	.0005-.0020	.0020-.0040	.0040-.0060	.0060-.0100	.0100-.0200
		Brass/Bronze (Hard)	150-250					
		Magnesium/Magnesium Alloys/Plastics/Bakelite Plastic-Glass Filled	500-1000	.0005-.0030	.0020-.0060	.0040-.0100	.0060-.0150	.0100-.0300
		Copper/Hard Bronze	100-150	.0002-.0010	.0010-.0020	.0020-.0040	.0040-.0060	.0060-.0100
Hardened Steel	H	Hardened Steels 23-32 Rc	125-200	.0005-.0020	.0020-.0040	.0040-.0060	.0060-.0100	.0100-.0200
		Hardened Steels 32-43 Rc	50-125	.0002-.0010	.0010-.0020	.0020-.0040	.0040-.0060	.0060-.0100
		Hardened Steels 43-52 Rc	35-50					
		Hardened Steels 50+ Rc	15-35	.0002-.0010	.0010-.0020	.0020-.0040	.0040-.0060	.0060-.0100

Metric

Workpiece Material Group		Examples	SMM	Diameter(mm) mm/rev. ≥ 1.5	>1.5 - 3.0	>3.0 - 6.0	>6.0 - 12.0	>12.0 - 25.0
Steels	P	Steel - Mild (.2-.3 Carbon) 1018	60-90	.010-.080	.050-.150	.100-.250	.150-.380	.250-.760
		Alloy Steel up to 35 Rc 4140	40-60	.010-.050	.050-.100	.100-.150	.150-.250	.250-.510
		Alloy Steel 36-45 Rc 4140/A2/D2	15-40	.010-.030	.030-.050	.050-.100	.100-.150	.150-.250
Stainless Steels	M	Free Machining/Austenitic Stainless 304/316	35-60	.010-.050	.050-.100	.100-.150	.150-.250	.250-.500
		Ferritic/Martensitic	25-35					
		17-4 PH	20-30	.010-.050	.030-.100	.050-.150	.100-.250	.150-.500
Special Alloys	S	Inconel 625/718	15-20	.010-.030	.030-.050	.050-.100	.100-.150	.150-.250
		Stellite/Cobalt Chrome	10-15					
		Titanium 6AL-4V	10-15	.010-.050	.030-.100	.050-.150	.100-.250	.150-.500
Cast Iron	K	Gray Cast Iron A48 Class 20/G4000	45-75	.010-.050	.030-.100	.050-.150	.100-.250	.150-.500
		Malleable/Ductile Cast Iron A536/60-40-18	40-60	.010-.050	.050-.100	.100-.150	.150-.250	.250-.500
		Hard (Martensitic) Cast Iron	15-25	.010-.030	.030-.050	.050-.100	.100-.150	.150-.250
Non-Ferrous	N	Aluminum/Aluminum Alloys	150-300	.010-.080	.050-.150	.100-.250	.150-.380	.250-.760
		Brass/Bronze Free Machining	75-120	.010-.050	.050-.100	.100-.150	.150-.250	.250-.500
		Brass/Bronze (Hard)	45-75					
		Magnesium/Magnesium Alloys/Plastics/Bakelite Plastic-Glass Filled	150-300	.010-.080	.050-.150	.100-.250	.150-.380	.250-.760
		Copper/Hard Bronze	30-45	.010-.030	.030-.050	.050-.100	.100-.150	.150-.250
Hardened Steel	H	Hardened Steels 23-32 Rc	40-60	.010-.050	.050-.100	.100-.150	.150-.250	.250-.500
		Hardened Steels 32-43 Rc	15-40	.010-.030	.030-.050	.050-.100	.100-.150	.150-.250
		Hardened Steels 43-52 Rc	10-15					
		Hardened Steels 50+ Rc	5-10	.010-.030	.030-.050	.050-.100	.100-.150	.150-.250

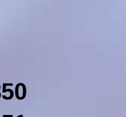
Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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

Countersinks

Uniflute® Series 60
Uniflute® Series 61
NEW Uniflute® Series 61B
NEW Uniflute® Series 61T
Uniflute® Series 64 (61 Sets)
Uniflute® Series 62
Unicam Series 65
Tri-Flute Series 66
Single Cutting Edge Series 67
Six Flute Series 78
Six Flute Series 79/79 Sets
NEW Six Flute Series 79B
NEW Six Flute Series 79T
Three Flute Aircraft Series 92/92 Sets
Single Flute Series 880 60°
Single Flute Series 882 82°
Single Flute Series 883 90°
Three Flute Series 890 60°
Three Flute Series 892 82°
Three Flute Series 893 90°

Micro-Stop Series 83
Micro-Stop Series 83TC
Micro-Stop Series 84
Micro-Stop Series 84TC
Micro-Stop Series 86
Micro-Stop Series 87
Countersink Pilot Series 850
Countersink Pilot Series 851
Micro-Stop Fixtures Series 80
Non-Marking Pads

Designed and Manufactured in the USA

ISO 9001:2000 Certified

An ESOP Company

The Original Countersink from M.A. Ford®

For Machine or Hand Countersinking

M.A. Ford® provides one of the most complete lines of high-speed steel and carbide countersinks. Tools are available in a variety of flute designs for countersinking virtually any material by machine or by hand.

Heat Treated Countersinks Deliver Increased Productivity and Tool Life

All M.A. Ford® HSS countersinks are heat treated in an electronically controlled vacuum furnace. This assures precise hardening and eliminates the possibility of decarburization. All heat treating is done in our own facilities for maximum control and assurance of desired hardness and toughness.

Most M.A. Ford® HSS countersinks receive an additional heat treat process known as the Steam Homogeneous Process. This process is like a final tempering, relieving internal grinding stresses. The result is a much tougher cutting edge that stays sharper, longer. Additionally, the Steam Homogeneous Process provides a tough, hard, porous oxide film on the tool that is sufficient enough to retain cutting oil, further reducing frictional heat and extending tool life.

NEW

Coated Countersinks

ALtima® Blaze

TiN coating

See pages 287-288 and 293-294 for coated countersinks

Coating Properties

	TiN	ALtima® Blaze
Micro Hardness (HV)	2300	3200
Max. Working Temperature	600° C 1112° F	1100° C 2012° F
Friction Coefficient	0.40	0.35

ALtima® Blaze
features high temperature hardness and oxidation resistance that provides extreme wear resistance under all machining conditions.

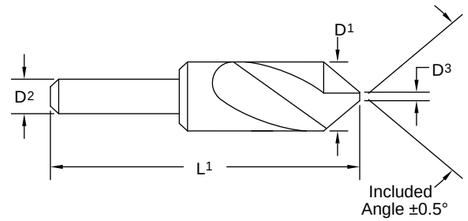
TiN
provides a higher surface hardness and increased lubricity over an uncoated tool.

Uniflute® Series 60

C | Z1 | 60° 82° 90° 100°

Recommended for use on abrasive, non-metallic and non-ferrous materials.

- Easily resharpened.
- Can be used on hardened steel and work hardening alloys.
- Rigid set-ups and good machinery maintenance are a must.
- Not recommended for use in hand-held tools.

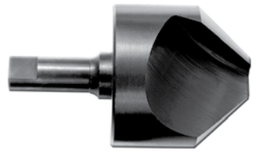


60°		82°		90°		100°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
60012501	60001	60012502	60006	60012503	60011	60012504	60016	1/8	1/8	.030*	1-1/2
60018701	60021	60018702	60026	60018703	60031	60018704	60036	3/16	3/16	.045	1-1/2
60025001	60041	60025002	60046	60025003	60051	60025004	60056	1/4	1/4	.045	2
60037501	60061	60037502	60066	60037503	60071	60037504	60076	3/8	1/4	.060	2
60050001	60081	60050002	60086	60050003	60091	60050004	60096	1/2	1/4	.060	2-3/8
60075001	60101	60075002	60106	60075003	60111	60075004	60116	3/4	1/2	.120	3
60100001	60121	60100002	60126	60100003	60131	60100004	60136	1	1/2	.120	3

*60° - .015 max.
Standard angles may be modified from 55° to 120°.

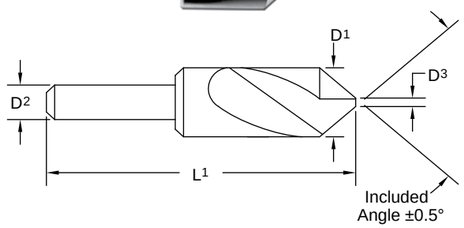
HSS Uniflute® Series 61

HSS | Z1 | 60° 82° 90° 100° 120°



This is the original single flute countersink designed for general purpose countersinking, chamfering or deburring.

- Self piloting and completely chatterless.
- No secondary burs formed.
- Each size may be used on a wide range of hole diameters.
- Use on machine tool or in hand-held tool applications.
- Easily resharpened.
- Steam homogeneous surface treatment (blackening) to prolong tool life and prevent galling.



60°		82°		90°		100°		120°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
61012501	61001	61012502	61006	61012503	61011	61012504	61016	61012506	61021	1/8	1/8	.030	1-1/2
61018701	61026	61018702	61031	61018703	61036	61018704	61041	61018706	61046	3/16	3/16	.045	1-1/2
61025001	61051	61025002	61056	61025003	61061	61025004	61066	61025006	61071	1/4	1/4	.045	2
61037501	61076	61037502	61081	61037503	61086	61037504	61091	61037506	61096	3/8	1/4	.060	2
61050001	61101	61050002	61106	61050003	61111	61050004	61116	61050006	61121	1/2	1/4	.060	2
61062501	61126	61062502	61131	61062503	61136	61062504	61141	61062506	61146	5/8	1/4	.060	2-1/4
61075001	61151	61075002	61156	61075003	61161	61075004	61166	61075006	61171	3/4	1/2	.120	2-3/4
61100001	61176	61100002	61181	61100003	61186	61100004	61191	61100006	61196	1	1/2	.120	2-3/4
61125001	61201	61125002	61206	61125003	61211					1-1/4	1/2*	.120	3
61150001	61216	61150002	61221	61150003	61226					1-1/2	3/4*	.250	3-1/2
61200001	61231	61200002	61236	61200003	61241					2	3/4*	.500	3-3/4
61250001	61246	61250002	61251	61250003	61256					2-1/2	3/4*	.750	5
61300001	61261	61300002	61266	61300003	61271					3	3/4*	1.000	5-1/4

*Straight shank with tang drive.
Standard angles may be modified from 55° to 119°.

Technical information on page 304.

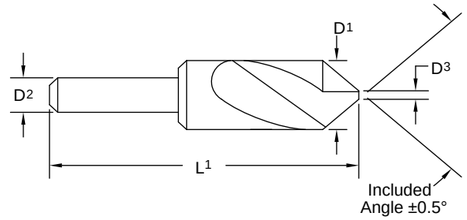
NEW

HSS Uniflute® Series 61B

HSS | ALtima® Blaze | Z1 | 60° 82° 90° 100° 120°

This is the original single flute countersink designed for general purpose countersinking, chamfering or deburring.

- Self piloting and completely chatterless.
- No secondary burs formed.
- Each size may be used on a wide range of hole diameters.
- Use on machine tool or in hand-held tool applications.
- Easily resharpened.
- ALtima® Blaze for extreme wear resistance under all machining conditions.



60°		82°		90°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
61B012501	61003	61B012502	61008	61B012503	61013	1/8	1/8	.030	1-1/2
61B018701	61028	61B018702	61033	61B018703	61038	3/16	3/16	.045	1-1/2
61B025001	61053	61B025002	61058	61B025003	61063	1/4	1/4	.045	2
61B037501	61078	61B037502	61083	61B037503	61088	3/8	1/4	.060	2
61B050001	61103	61B050002	61108	61B050003	61113	1/2	1/4	.060	2
61B062501	61128	61B062502	61133	61B062503	61138	5/8	1/4	.060	2-1/4
61B075001	61153	61B075002	61158	61B075003	61163	3/4	1/2	.120	2-3/4
61B100001	61178	61B100002	61183	61B100003	61188	1	1/2	.120	2-3/4

100°		120°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
61B012504	61018	61B012506	61023	1/8	1/8	.030	1-1/2
61B018704	61043	61B018706	61048	3/16	3/16	.045	1-1/2
61B025004	61068	61B025006	61073	1/4	1/4	.045	2
61B037504	61093	61B037506	61098	3/8	1/4	.060	2
61B050004	61118	61B050006	61123	1/2	1/4	.060	2
61B062504	61143	61B062506	61148	5/8	1/4	.060	2-1/4
61B075004	61168	61B075006	61173	3/4	1/2	.120	2-3/4
61B100004	61193	61B100006	61198	1	1/2	.120	2-3/4

Angles modified from 55° to 119° available as a special.
Contact customer service for details.

Technical information on page 304.

Coating Properties

	TiN	ALtima® Blaze
Micro Hardness (HV)	2300	3200
Max. Working Temperature	600° C 1112° F	1100° C 2012° F
Friction Coefficient	0.40	0.35

Countersinks

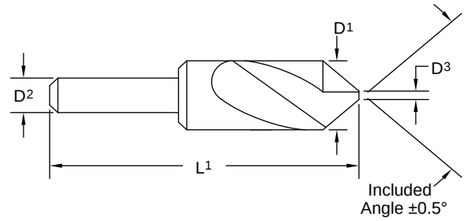
NEW

HSS Uniflute® Series 61T

HSS | TiN | Z1 | 60° 82° 90° 100° 120°

This is the original single flute countersink designed for general purpose countersinking, chamfering or deburring.

- Self piloting and completely chatterless.
- No secondary burs formed.
- Each size may be used on a wide range of hole diameters.
- Use on machine tool or in hand-held tool applications.
- Easily resharpened.
- TiN coating for higher surface hardness and increased lubricity.



60°		82°		90°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
61T012501	61002	61T012502	61007	61T012503	61012	1/8	1/8	.030	1-1/2
61T018701	61027	61T018702	61032	61T018703	61037	3/16	3/16	.045	1-1/2
61T025001	61052	61T025002	61057	61T025003	61062	1/4	1/4	.045	2
61T037501	61077	61T037502	61082	61T037503	61087	3/8	1/4	.060	2
61T050001	61102	61T050002	61107	61T050003	61112	1/2	1/4	.060	2
61T062501	61127	61T062502	61132	61T062503	61137	5/8	1/4	.060	2-1/4
61T075001	61152	61T075002	61157	61T075003	61162	3/4	1/2	.120	2-3/4
61T100001	61177	61T100002	61182	61T100003	61187	1	1/2	.120	2-3/4

100°		120°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
61T012504	61017	61T012506	61022	1/8	1/8	.030	1-1/2
61T018704	61042	61T018706	61047	3/16	3/16	.045	1-1/2
61T025004	61067	61T025006	61072	1/4	1/4	.045	2
61T037504	61092	61T037506	61097	3/8	1/4	.060	2
61T050004	61117	61T050006	61122	1/2	1/4	.060	2
61T062504	61142	61T062506	61147	5/8	1/4	.060	2-1/4
61T075004	61167	61T075006	61172	3/4	1/2	.120	2-3/4
61T100004	61192	61T100006	61197	1	1/2	.120	2-3/4

Modified angles from 55° to 119° available as a special.
Contact customer service for details.

Technical information on page 304.

Designed and Manufactured in the USA

Uniflute® Series 64 Sets

HSS | TiN | Z1 | 60° 82° 90° 100° 120°

Set of four Series 61 Uniflute® countersinks includes 1/4”, 1/2”, 3/4” and 1” diameter tools. Sets are available with 60°, 82°, 90°, 100° or 120° included angles. TiN coated sets available. Tools are packaged in plastic cases.

4 Piece Set No.	EDP	Included Angle
64100001	64001	60°
64100002	64006	82°
64100003	64011	90°
64100004	64016	100°
64100006	64021	120°

Set of seven Series 61 Uniflute® countersinks includes 3/16”, 1/4”, 3/8”, 1/2”, 5/8”, 3/4” and 1” diameter tools. Sets are available with 60°, 82°, 90°, 100° or 120° included angles. Tools are packaged in plastic cases.

7 Piece Set No.	EDP	Included Angle
64100071	64003	60°
64100072	64008	82°
64100073	64013	90°
64100074	64018	100°
64100076	64023	120°

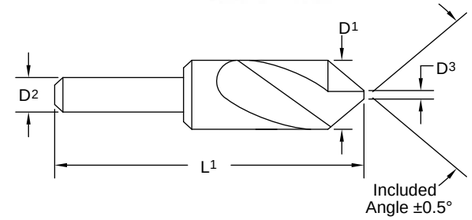
TiN 4 Piece Set No.	EDP	Included Angle
64T100001	64025	60°
64T100002	64027	82°
64T100003	64029	90°

Uniflute® Series 62

HI Alloy HSS | Z1 | 60° 82° 90°

Manufactured from a high alloy steel for machining stainless steel and high temperature alloys.

- Fewer tool changes on long run production jobs.
- Easily resharpened.
- Steam homogeneous surface treatment (blackening) to prolong tool life and prevent galling.



60°		82°		90°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
62025001	62001	62025002	62006	62025003	62011	1/4	1/4	.045	2
62050001	62016	62050002	62021	62050003	62026	1/2	1/4	.060	2
62075001	62031	62075002	62036	62075003	62041	3/4	1/2	.120	2-3/4
62100001	62046	62100002	62051	62100003	62056	1	1/2	.120	2-3/4

Standard angles may be modified from 55° to 120°.

Technical information on page 304.

Factory Regrinding Service Available.
Call Customer Service for Details.

Unicam
Series 65 | Resharpening Fixture

The Unicam Resharpening Fixture is designed to resharpen Uniflute® countersinks. The unique cam relief is quickly and easily reground on dull tools, greatly extending tool life.

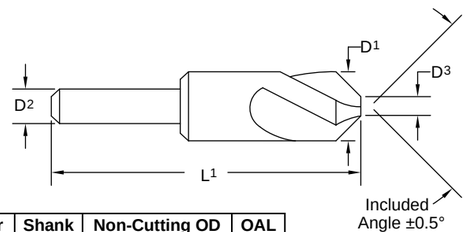
- Can be used on a tool and cutter grinder, surface grinder or a pedestal grinder.
- Resharpens tools with 1/4", 1/2" or 3/4" shanks.
- Packaged in plastic case.
- Includes detailed instructions on set-up and operation.
- Not recommended for 2-1/2" or 3" tools.

Unicam Resharpening Fixture	
Tool No.	EDP
65000000	65001

Tri-flute
Series 66 | HSS | Z3 | 60° 82° 90°

Designed for general purpose machining at higher feed rates than are possible with the Uniflute® design.

- Cam relief geometry allows machining at greater feed rates.
- Steam homogeneous surface treatment (blackening) to prolong tool life and prevent galling.



60°		82°		90°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
66025001	66001	66025002	66006	66025003	66011	1/4	1/4	0.06	2
66037501	66016	66037502	66021	66037503	66026	3/8	1/4	0.09	2
66050001	66031	66050002	66036	66050003	66041	1/2	1/4	0.15	2
66062501	66046	66062502	66051	66062503	66056	5/8	1/4	0.18	2-1/4
66075001	66061	66075002	66066	66075003	66071	3/4	1/2	0.21	2-3/4
66100001	66076	66100002	66081	66100003	66086	1	1/2	0.25	2-3/4
66125001	66091	66125002	66096	66125003	66101	1-1/4	1/2*	0.37	3
66150001	66106	66150002	66111	66150003	66116	1-1/2	3/4*	0.50	3-1/2

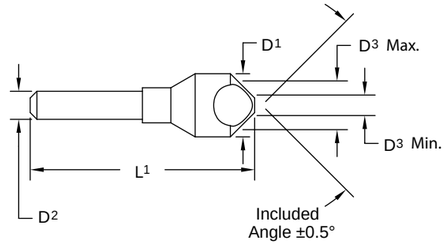
*Straight Shank with tang drive.
Standard angles may be modified from 55° to 120°.

Technical information on page 304.

Single Cutting Edge
Series 67 | HSS | Z1 | 60° 82° 90°

Designed for general purpose countersinking, chamfering or deburring.

- Efficient stock removal, chatter-free finish.
- 3/16" and 1/4" tools are double ended.
- Bright finish helps reduce chip build-up on cutting edge.



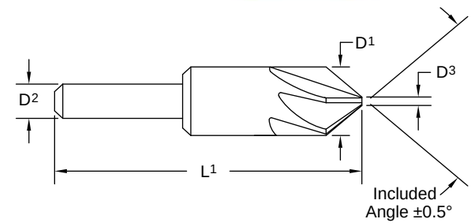
60°		82°		90°		Diameter	Shank	Non-Cutting OD		OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Min.**	D3 Max.	L1
67018701	67001	67018702	67006	67018703	67011	3/16	3/16	.06	.17	1-1/2
67025001	67016	67025002	67021	67025003	67026	1/4	1/4	.09	.23	2
67043701	67031	67043702	67036	67043703	67041	7/16	1/4	.15	.40	2
67056201	67046	67056202	67051	67056203	67056	9/16	1/4	.19	.53	2
67081201	67061	67081202	67066	67081203	67071	13/16	1/2	.25	.78	2-5/8
67112501	67076	67112502	67081	67112503	67086	1-1/8	1/2	.44	1.03	2-7/8
67150001	67091	67150002	67096	67150003	67101	1-1/2	1/2	.50	1.46	3-1/2

**15% to 30% greater for 60° countersinks only.

Chatterless Six Flute
Series 78 | C | Z6 | 60° 82° 90° 100° 120°

Solid Carbide construction (steel shanks on tools 3/8" diameter and larger) makes this countersink ideal for hardened steel, high temperature alloys and other tough jobs.

- Rigid set-ups and good machine tool maintenance are a must.
- Not recommended for hand-held applications.



60°		82°		90°		100°		120°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
78012501	78001	78012502	78006	78012503	78011	78012504	78016	78012506	78021	1/8	1/8	0.03	1-1/2
78018701	78026	78018702	78031	78018703	78036	78018704	78041	78018706	78046	3/16	3/16	0.04	1-1/2
78025001	78051	78025002	78056	78025003	78061	78025004	78066	78025006	78071	1/4	1/4	0.06	2
78037501	78076	78037502	78081	78037503	78086	78037504	78091	78037506	78096	3/8	1/4	0.09	2
78050001	78101	78050002	78106	78050003	78111	78050004	78116	78050006	78121	1/2	3/8	0.15	2-1/8
78062501	78126	78062502	78131	78062503	78136	78062504	78141	78062506	78146	5/8	3/8	0.18	2-3/8
78075001	78151	78075002	78156	78075003	78161	78075004	78166	78075006	78171	3/4	1/2	0.21	2-3/4
78100001	78176	78100002	78181	78100003	78186	78100004	78191	78100006	78196	1	1/2	0.25	2-3/4
78125001	78201	78125002	78206	78125003	78211					1-1/4	1/2*	0.37	3
78150001	78216	78150002	78221	78150003	78226					1-1/2	3/4*	0.43	3-1/2

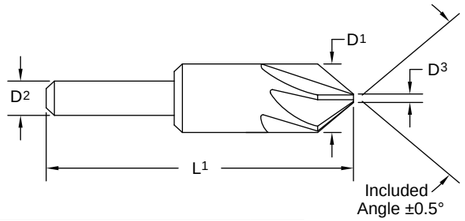
*Straight shank with tang drive.

Technical information on page 304.

Chatterless Six Flute
Series 79

HSS | Z6 | 60° 82° 90° 100° 120°

Standard six flute countersinks are designed for economical, general purpose countersinking, chamfering or deburring. Because of the multiple flute design, chip loads are generally smaller. Even at maximum speeds, chatter-free machining is possible. Steam homogeneous surface treatment (blackening) is used to prolong tool life and prevent galling.



60°		82°		90°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
79012501	79021	79012502	79026	79012503	79031	1/8	1/8	0.03	1-1/2
79018701	79046	79018702	79051	79018703	79056	3/16	3/16	0.04	1-1/2
79025001	79071	79025002	79076	79025003	79081	1/4	1/4	0.06	2
79031201	79096	79031202	79101	79031203	79106	5/16	1/4	0.08	2
79037501	79121	79037502	79126	79037503	79131	3/8	1/4	0.09	2
79050001	79146	79050002	79151	79050003	79156	1/2	3/8	0.15	2
79062501	79171	79062502	79176	79062503	79181	5/8	3/8	0.18	2-1/4
79075001	79196	79075002	79201	79075003	79206	3/4	1/2	0.21	2-3/4
79087501	79221	79087502	79226	79087503	79231	7/8	1/2	0.23	2-3/4
79100001	79246	79100002	79251	79100003	79256	1	1/2	0.25	2-3/4
79125001	79271	79125002	79276	79125003	79281	1-1/4	1/2**	0.37	3
79150001	79296	79150002	79301	79150003	79306	1-1/2	3/4**	0.43	3-1/2
79200001	79321	79200002	79326	79200003	79331	2	3/4**	0.62	3-3/4
79250001	79346	79250002	79351	79250003	79356	2-1/2	3/4**	0.75	5
79300001	79361	79300002	79366	79300003	79371	3	3/4**	1	5-1/4

100°		120°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
79012504	79036	79012506	79041	1/8	1/8	0.03	1-1/2
79018704	79061	79018706	79066	3/16	3/16	0.04	1-1/2
79025004	79086	79025006	79091	1/4	1/4	0.06	2
79031204	79111	79031206	79116	5/16	1/4	0.08	2
79037504	79136	79037506	79141	3/8	1/4	0.09	2
79050004	79161	79050006	79166	1/2	3/8	0.15	2
79062504	79186	79062506	79191	5/8	3/8	0.18	2-1/4
79075004	79211	79075006	79216	3/4	1/2	0.21	2-3/4
79087504	79236	79087506	79241	7/8	1/2	0.23	2-3/4
79100004	79261	79100006	79266	1	1/2	0.25	2-3/4
79125004	79286	79125006	79291	1-1/4	1/2**	0.37	3
79150004	79311	79150006	79316	1-1/2	3/4**	0.43	3-1/2
79200004	79336	79200006	79341	2	3/4**	0.62	3-3/4

**Straight shank with tang drive.

Technical information on page 304.

Factory Regrinding Service Available.
Call Customer Service for Details.
800-553-8024/563-391-6220

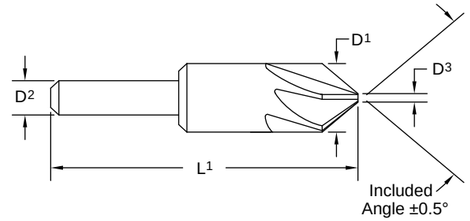
NEW

Chatterless Six Flute
Series 79B

HSS | ALtima® Blaze | Z6 | 60° 82° 90° 100° 120°

Standard six flute countersinks are designed for economical, general purpose countersinking, chamfering or deburring. Because of the multiple flute design, chip loads are generally smaller. Even at maximum speeds, chatter-free machining is possible.

ALtima® Blaze for extreme wear resistance under all machining conditions.



60°		82°		90°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
79B012501	79023	79B012502	79028	79B012503	79033	1/8	1/8	0.03	1-1/2
79B018701	79048	79B018702	79053	79B018703	79058	3/16	3/16	0.04	1-1/2
79B025001	79073	79B025002	79078	79B025003	79083	1/4	1/4	0.06	2
79B037501	79123	79B037502	79128	79B037503	79133	3/8	1/4	0.09	2
79B050001	79148	79B050002	79153	79B050003	79158	1/2	3/8	0.15	2
79B062501	79173	79B062502	79178	79B062503	79183	5/8	3/8	0.18	2-1/4
79B075001	79198	79B075002	79203	79B075003	79208	3/4	1/2	0.21	2-3/4
79B100001	79248	79B100002	79253	79B100003	79258	1	1/2	0.25	2-3/4

100°		120°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
79B012504	79038	79B012506	79043	1/8	1/8	0.03	1-1/2
79B018704	79063	79B018706	79068	3/16	3/16	0.04	1-1/2
79B025004	79088	79B025006	79093	1/4	1/4	0.06	2
79B037504	79139	79B037506	79143	3/8	1/4	0.09	2
79B050004	79163	79B050006	79168	1/2	3/8	0.15	2
79B062504	79188	79B062506	79193	5/8	3/8	0.18	2-1/4
79B075004	79213	79B075006	79218	3/4	1/2	0.21	2-3/4
79B100004	79263	79B100006	79268	1	1/2	0.25	2-3/4

Technical information on page 304.

Coating Properties

	TiN	ALtima® Blaze
Micro Hardness (HV)	2300	3200
Max. Working Temperature	600° C 1112° F	1100° C 2012° F
Friction Coefficient	0.40	0.35

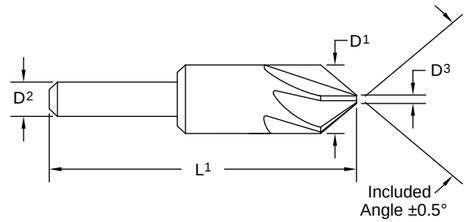
NEW

Chatterless Six Flute Series 79T

HSS | TiN | Z6 | 60° 82° 90° 100° 120°

Standard six flute countersinks are designed for economical, general purpose countersinking, chamfering or deburring. Because of the multiple flute design, chip loads are generally smaller. Even at maximum speeds, chatter-free machining is possible.

TiN coating for higher surface hardness and increased lubricity.



60°		82°		90°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
79T012501	79022	79T012502	79027	79T012503	79032	1/8	1/8	0.03	1-1/2
79T018701	79047	79T018702	79052	79T018703	79057	3/16	3/16	0.04	1-1/2
79T025001	79072	79T025002	79077	79T025003	79082	1/4	1/4	0.06	2
79T037501	79122	79T037502	79127	79T037503	79132	3/8	1/4	0.09	2
79T050001	79147	79T050002	79152	79T050003	79157	1/2	3/8	0.15	2
79T062501	79172	79T062502	79177	79T062503	79182	5/8	3/8	0.18	2-1/4
79T075001	79197	79T075002	79202	79T075003	79207	3/4	1/2	0.21	2-3/4
79T100001	79247	79T100002	79252	79T100003	79257	1	1/2	0.25	2-3/4

100°		120°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
79T012504	79037	79T012506	79042	1/8	1/8	0.03	1-1/2
79T018704	79062	79T018706	79067	3/16	3/16	0.04	1-1/2
79T025004	79087	79T025006	79092	1/4	1/4	0.06	2
79T037504	79137	79T037506	79142	3/8	1/4	0.09	2
79T050004	79162	79T050006	79167	1/2	3/8	0.15	2
79T062504	79187	79T062506	79192	5/8	3/8	0.18	2-1/4
79T075004	79212	79T075006	79217	3/4	1/2	0.21	2-3/4
79T100004	79262	79T100006	79267	1	1/2	0.25	2-3/4

Technical information on page 304.

Factory Regrinding Service Available.
Call Customer Service for Details.
800-553-8024/563-391-6220

Chatterless Six Flute Series 79 Set

HSS | TiN | Z6 | 60° 82° 90° 100°

Set of four Series 79 countersinks includes 1/4”, 1/2”, 3/4” and 1” diameter tools. Sets are available with 60°, 82°, 90°, or 100° included angles. Tools are packaged in plastic cases. TiN coated sets available.

4 Piece Set No.	EDP	Included Angle
79000011	79003	60°
79000012	79008	82°
79000013	79013	90°
79000014	79019	100°

Set of seven Series 79 countersinks includes 1/4”, 5/16, 3/8”, 1/2”, 5/8”, 3/4” and 1” diameter tools. Sets are available with 60°, 82°, 90°, or 100° included angles. Tools are packaged in plastic cases.

7 Piece Set No.	EDP	Included Angle
79000001	79001	60°
79000002	79006	82°
79000003	79011	90°
79000004	79016	100°

TiN 4 Piece Set No.	EDP	Included Angle
79T000011	79380	60°
79T000012	79382	82°
79T000013	79384	90°

Technical information on page 304.

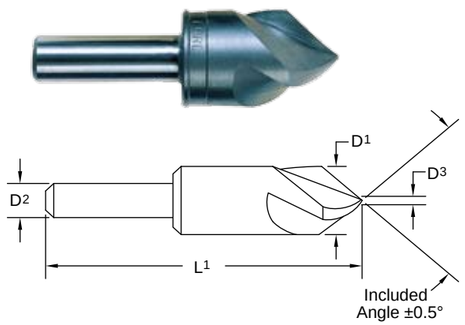
Extend the Life of Your Cutting Tools with
M.A.Ford®'s Reconditioning Service

Aircraft
Series 92

HSS | Z3 | 60° 82° 90° 100° 120° | TiN

Designed for countersinking, chamfering and deburring aircraft type metals.

- Bright finish helps reduce chip build-up on the cutting edge.
- Spiral flute geometry for a clean, chatterless finish.
- Each size may be used on a wide range of hole diameters.



60°		82°		90°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
92025001	94101	92025002	94103	92025003	94105	1/4	1/4	0.07	1-1/4
92037501	94113	92037502	94115	92037503	94117	3/8	1/4	0.11	1-5/8
92050001	94125	92050002	94127	92050003	94129	1/2	1/4	0.15	2
92062501	94137	92062502	94139	92062503	94141	5/8	1/4	0.19	2-1/4
92075001	94149	92075002	94151	92075003	94153	3/4	1/2	0.23	3
92087501	94161	92087502	94163	92087503	94165	7/8	1/2	0.26	3
92100001	94173	92100002	94175	92100003	94177	1	1/2	0.30	3-1/4
92112501	94185	92112502	94187	92112503	94189	1-1/8	1/2	0.34	3-1/4
92125001	94197	92125002	94199	92125003	94201	1-1/4	5/8	0.38	3-1/2
92150001	94209	92150002	94211	92150003	94213	1-1/2	3/4	0.45	3-7/8
92200001	94221	92200002	94223	92200003	94225	2	3/4	0.60	4-1/4

100°		120°		Diameter	Shank	Non-Cutting OD	OAL
Tool No.	EDP	Tool No.	EDP	D1	D2	D3 Max.	L1
92025004	94107	92025006	94111	1/4	1/4	0.07	1-1/4
92037504	94119	92037506	94123	3/8	1/4	0.11	1-5/8
92050004	94131	92050006	94135	1/2	1/4	0.15	2
92062504	94143	92062506	94147	5/8	1/4	0.19	2-1/4
92075004	94155	92075006	94159	3/4	1/2	0.23	3
92087504	94167	92087506	94171	7/8	1/2	0.26	3
92100004	94179	92100006	94183	1	1/2	0.30	3-1/4
92112504	94191	92112506	94195	1-1/8	1/2	0.34	3-1/4
92125004	94203	92125006	94207	1-1/4	5/8	0.38	3-1/2
92150004	94215	92150006	94219	1-1/2	3/4	0.45	3-7/8
92200004	94227	92200006	94231	2	3/4	0.60	4-1/4

Standard angles may be modified from 55° to 119°.

Aircraft
Series 92 Set

HSS | Z3 | 60° 82° 90° 100° 120° | TiN

Set of five Series 92 countersinks include 1/4", 3/8", 1/2", 5/8" and 3/4" diameter tools. Sets are available with 60°, 82°, 90°, 100° or 120° included angles. Tools are packaged in plastic cases.

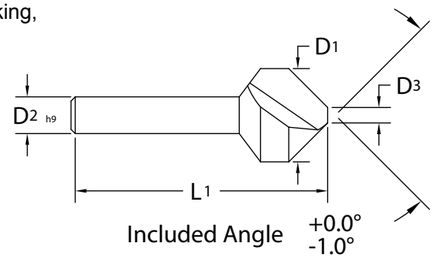
5 Piece Set No.	EDP	Included Angle
92000011	96380	60°
92000012	96381	82°
92000013	96382	90°
92000014	96383	100°
92000016	96385	120°

Technical information on page 304.

Single Flute
Series 880/882/883

HSS | TiN | Z1 | 60° 82° 90° | 60° DIN 334

Single flute countersink designed for general purpose countersinking, chamfering or deburring. Metric Sizes.



- Self piloting and completely chatterless.
- No secondary burs formed.
- Each size may be used on a wide range of hole diameters.
- Use on a machine tool or in hand-held tool applications.
- Bright finish helps reduce chip build-up on cutting edge.

60° Included Angle

Uncoated		TiN		Diameter	Shank Dia. h9	Non-Cutting OD	OAL	Fastner Size
Tool No.	EDP	Tool No.	EDP	D1	D2	Max. D3	L1	
88000630	88007	88000630T	88008	6.3	5	1.6	45	M3
88000800	88011	88000800T	88012	8.0	6	2.0	50	M4
88001250	88025	88001250T	88026	12.5	8	3.2	56	M6
88001600	88029	88001600T	88020	16.0	10	4.0	63	M8
88002000	88037	88002000T	88038	20.0	10	5.0	67	M10
88002500	88045	88002500T	88046	25.0	10	6.3	71	M12

82° Included Angle

Uncoated		TiN		Diameter	Shank Dia. h9	Non-Cutting OD	OAL	Fastner Size
Tool No.	EDP	Tool No.	EDP	D1	D2	Max. D3	L1	
88200630	88207	88200630T	88208	6.3	5	1.5	45	M3
88200830	88213	88200830T	88214	8.3	6	2.0	50	M4
88201040	88219	88201040T	88220	10.4	6	2.5	50	M5
88201240	88223	88201240T	88224	12.4	8	2.8	56	M6
88201650	88233	88201650T	88234	16.5	10	3.2	60	M8
88202050	88239	88202050T	88240	20.5	10	3.5	63	M10
88202500	88243	88202500T	88244	25.0	10	3.8	67	M12

90° Included Angle

Uncoated		TiN		Diameter	Shank Dia. h9	Non-Cutting OD	OAL	Fastner Size
Tool No.	EDP	Tool No.	EDP	D1	D2	Max. D3	L1	
88300430	88301	88300430T	88302	4.3	4	1.3	40	M2
88300500	88303	88300500T	88304	5.0	4	1.5	40	M2.5
88300600	88305	88300600T	88306	6.0	5	1.5	45	M3
88300630	88307	88300630T	88308	6.3	5	1.5	45	M3
88300700	88309	88300700T	88310	7.0	6	1.8	50	M3.5
88300800	88311	88300800T	88312	8.0	6	2.0	50	M4
88300830	88313	88300830T	88314	8.3	6	2.0	50	M4
88301000	88315	88301000T	88316	10.0	6	2.5	50	M5
88301040	88319	88301040T	88320	10.4	6	2.5	50	M5
88301150	88321	88301150T	88322	11.5	8	2.8	56	M6
88301240	88323	88301240T	88324	12.4	8	2.8	56	M6
88301500	88327	88301500T	88328	15.0	10	3.2	60	M8
88301650	88333	88301650T	88334	16.5	10	3.2	60	M8
88301900	88335	88301900T	88336	19.0	10	3.5	63	M10
88302050	88339	88302050T	88340	20.5	10	3.5	63	M10
88302300	88341	88302300T	88342	23.0	10	3.8	67	M12
88302500	88343	88302500T	88344	25.0	10	3.8	67	M12
88303100	88353	88303100T	88354	31.0	12	4.2	71	M16

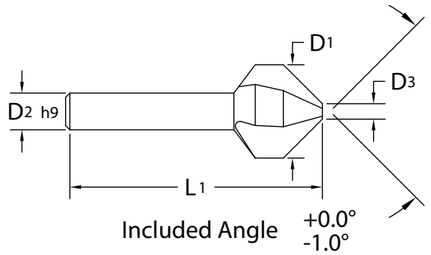
Technical information on page 304.

Countersinks

3 Flute
Series 890/892/893

HSS | TiN | Z3 | 60° 82° 90° | 60° DIN 334 | 90° DIN 335

Designed for general purpose machining at greater feed rates than are possible with the single flute design. Metric Sizes.



- Cam relief geometry for machining at greater feed rates.
- Bright finish helps reduce chip build-up on cutting edge.

60° Included Angle

Uncoated		TiN		Diameter	Shank Dia. h9	Non-Cutting OD	OAL	Fastner Size
Tool No.	EDP	Tool No.	EDP	D1	D2	Max. D3	L1	
89000630	89007	89000630T	89008	6.3	5	1.6	45	M3
89000800	89011	89000800T	89012	8.0	6	2.0	50	M4
89001250	89025	89001250T	89026	12.5	8	3.2	56	M6
89001600	89029	89001600T	89020	16.0	10	4.0	63	M8
89002000	89037	89002000T	89038	20.0	10	5.0	67	M10
89002500	89045	89002500T	89046	25.0	10	6.3	71	M12

82° Included Angle

Uncoated		TiN		Diameter	Shank Dia. h9	Non-Cutting OD	OAL	Fastner Size
Tool No.	EDP	Tool No.	EDP	D1	D2	Max. D3	L1	
89200630	89207	89200630T	89208	6.3	5	1.5	45	M3
89200830	89213	89200830T	89214	8.3	6	2.0	50	M4
89201040	89219	89201040T	89220	10.4	6	2.5	50	M5
89201240	89223	89201240T	89224	12.4	8	2.8	56	M6
89201650	89233	89201650T	89234	16.5	10	3.2	60	M8
89202050	89239	89202050T	89240	20.5	10	3.5	63	M10
89202500	89243	89202500T	89244	25.0	10	3.8	67	M12

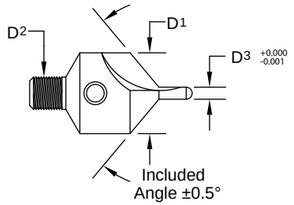
90° Included Angle

Uncoated		TiN		Diameter	Shank Dia. h9	Non-Cutting OD	OAL	Fastner Size
Tool No.	EDP	Tool No.	EDP	D1	D2	Max. D3	L1	
89300430	89301	89300430T	89302	4.3	4	1.3	40	M2
89300500	89303	89300500T	89304	5.0	4	1.5	40	M2.5
89300600	89305	89300600T	89306	6.0	5	1.5	45	M3
89300630	89307	89300630T	89308	6.3	5	1.5	45	M3
89300700	89309	89300700T	89310	7.0	6	1.8	50	M3.5
89300800	89311	89300800T	89312	8.0	6	2.0	50	M4
89300830	89313	89300830T	89314	8.3	6	2.0	50	M4
89301000	89315	89301000T	89316	10.0	6	2.5	50	M5
89301040	89319	89301040T	89320	10.4	6	2.5	50	M5
89301150	89321	89301150T	89322	11.5	8	2.8	56	M6
89301240	89323	89301240T	89324	12.4	8	2.8	56	M6
89301500	89327	89301500T	89328	15.0	10	3.2	60	M8
89301650	89333	89301650T	89334	16.5	10	3.2	60	M8
89301900	89335	89301900T	89336	19.0	10	3.5	63	M10
89302050	89339	89302050T	89340	20.5	10	3.5	63	M10
89302300	89341	89302300T	89342	23.0	10	3.8	67	M12
89302500	89343	89302500T	89344	25.0	10	3.8	67	M12
89303100	89353	89303100T	89354	31.0	12	4.2	71	M16

Technical information on page 304.

Micro-Stop
Series 83

HSS | Z2 | 82° 90° 100° 120°



- Integral pilot size must be specified to any diameter within the indicated range.
- May be ordered with a radius blend between the pilot and countersink angle. Specify any radius between .020” and .070”.

82°	90°	100°	120°	Diameter	Shank	Pilot Size Range
Tool No.	Tool No.	Tool No.	Tool No.	D1	D2	D3
83E00002	83E00003	83E00004	83E00006	3/8	1/4-28	1/16-3/16
83F00002	83F00003	83F00004	83F00006	7/16	1/4-28	3/32-3/16
83G00002	83G00003	83G00004	83G00006	1/2	1/4-28	3/32-1/4
83H00002	83H00003	83H00004	83H00006	5/8	1/4-28	5/32-3/8

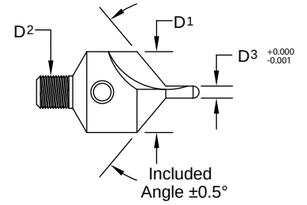
Standard angles may be modified from 78° to 119°.

Micro-Stop
Series 83TC

C | Z2 | 82° 90° 100° 120°

Solid carbide construction (steel shank) makes these tools ideal for machining titanium, high temperature alloys, hardened steel and many of the new composite materials.

- Integral pilot size must be specified to any diameter within the indicated range.



82°	90°	100°	120°	Diameter	Shank	Pilot Size Range
Tool No.	Tool No.	Tool No.	Tool No.	D1	D2	D3
83E00002TC	83E00003TC	83E00004TC	83E00006TC	3/8	1/4-28	3/32-3/16
83F00002TC	83F00003TC	83F00004TC	83F00006TC	7/16	1/4-28	3/32-3/16
83G00002TC	83G00003TC	83G00004TC	83G00006TC	1/2	1/4-28	3/32-1/4
83H00002TC	83H00003TC	83H00004TC	83H00006TC	5/8	1/4-28	1/8-3/8

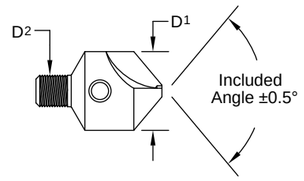
Technical information on page 304.

Factory Regrinding Service Available.
Call Customer Service for Details.
800-553-8024/563-391-6220

Micro-Stop Series 84

HSS | Z2 | 82° 90° 100° 120°

Use interchangeable steel pilots as shown on page 302.



82°		90°		100°		120°		Diameter	Shank	Pilot Series
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	
84375002	84049	84375003	84055	84375004	84061	84375006	84067	3/8	1/4-28	850
84437502	84073	84437503	84079	84437504	84085	84437506	84091	7/16	1/4-28	850
84500002	84097	84500003	84103	84500004	84109	84500006	84115	1/2	1/4-28	850
84625002	84121	84625003	84127	84625004	84133	84625006	84139	5/8	1/4-28	851

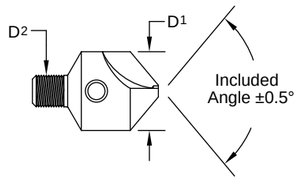
Standard angles may be modified from 78° to 99°.

Micro-Stop Series 84TC

C | Z2 | 82° 90° 100° 120°

Solid carbide construction (steel shank) makes these tools ideal for machining titanium, high temperature alloys, hardened steel and many of the new composite materials.

- Use interchangeable steel pilots as shown on page 302.



82°		90°		100°		120°		Diameter	Shank	Pilot Series
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	
84375002TC	84552	84375003TC	84558	84375004TC	84564	84375006TC	84570	3/8	1/4-28	850
84437502TC	84576	84437503TC	84582	84437504TC	84588	84437506TC	84594	7/16	1/4-28	850
84500002TC	84600	84500003TC	84606	84500004TC	84612	84500006TC	84618	1/2	1/4-28	850
84625002TC	84624	84625003TC	84630	84625004TC	84636	84625006TC	84642	5/8	1/4-28	851

Technical information on page 304.

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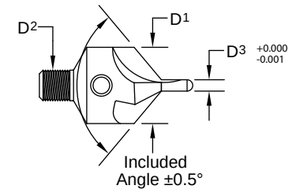
Micro-Stop Series 86

HSS | Z3 | 82° 90° 100° 120°

- Integral pilot size must be specified to any diameter within the indicated range.
- May be ordered with a radius blend between the pilot and countersink angle. Specify any radius between .020" and .070".



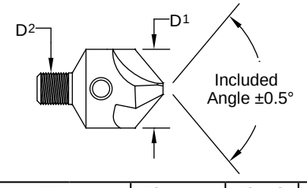
82°	90°	100°	120°	Diameter	Shank	Pilot Size Range
Tool No.	Tool No.	Tool No.	Tool No.	D1	D2	D3
86E00002	86E00003	86E00004	86E00006	3/8	1/4-28	1/16-3/16
86F00002	86F00003	86F00004	86F00006	7/16	1/4-28	3/32-3/16
86G00002	86G00003	86G00004	86G00006	1/2	1/4-28	3/32-1/4
86H00002	86H00003	86H00004	86H00006	5/8	1/4-28	5/32-3/8

Standard angles may be modified from 78° to 119°.

Micro-Stop Series 87

HSS | Z3 | 82° 90° 100° 120°

Use interchangeable steel pilots as shown on page 302.



82°		90°		100°		120°		Diameter	Shank	Pilot Series
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	D1	D2	
87375002	87049	87375003	87052	87375004	87055	87375006	87058	3/8	1/4-28	850
87437502	87061	87437503	87064	87437504	87067	87437506	87070	7/16	1/4-28	850
87500002	87073	87500003	87076	87500004	87079	87500006	87082	1/2	1/4-28	850
87625002	87085	87625003	87088	87625004	87091	87625006	87094	5/8	1/4-28	851

Standard angles may be modified from 78° to 99°.

Technical information on page 304.

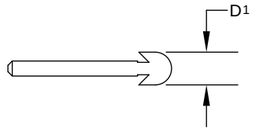
Countersinks

Countersink Pilot
Series 850
HSS | .086" Shank

Countersink Pilot
Series 851
HSS | .093" Shank

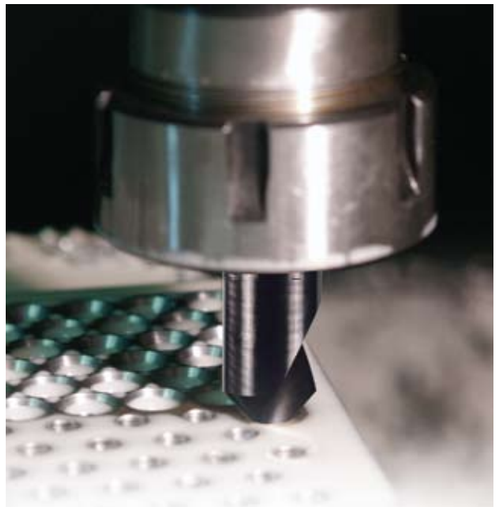
Special pilot diameters available on request.

Tool No.	EDP	Tool No.	EDP	D1 Size	D1 Decimal
85009370	85001	85109370	85034	3/32	.0937
85009800	85004			40	.0980
85012500	85007	85112500	85037	1/8	.1250
85012850	85010			30	.1285
85015620	85013			5/32	.1562
85015900	85016			21	.1590
85018750	85019	85118750	85040	3/16	.1875
85019350	85022			10	.1935
85021870	85025			7/32	.2187
85025000	85028	85125000	85043	1/4	.2500
85025700	85031			F	.2570
		85131250	85046	5/16	.3125
		85137500	85049	3/8	.3750



Technical information on page 304.

Factory Regrinding Service Available.
Call Customer Service for Details.
800-553-8024/563-391-6220



Micro-Stop Fixtures
Series 80

Micro-Stop fixtures are designed for precise countersinking and deburring operations that ensures perpendicular alignment with the workpiece and exact depth of cut control. When the fixture is properly adjusted, only the pilot or tip end of the cutter will extend beyond the end of the fixture. However, when the tool is fed into the hole, the cutting edge is exposed, and a cut is made to a pre-determined depth.

- Accommodates a complete selection of Micro-Stop countersinks and burring cutters.
- 120° seating angle ensures precise axial alignment of threaded shank tools.
- Use in hand tool or machine tool applications.
- Depth of cut control in .001" increments.

Non-Marking Pad
Series 80000006
Steel

EDP 80011
- Steel non-marking pads offer long life.
- Designed for 80000002 Micro-Stop Fixtures.

Non-Marking Pad
Series 80000007
Plastic

EDP 80016
- Plastic non-marking pads afford maximum workpiece protection.
- Designed for 80000002 Micro-Stop Fixtures.

Non-Marking Pads are designed to protect workpiece surface finishes. They also help ensure perpendicular alignment with the workpiece.

Tool No.	EDP	Cutter Diameter Min.	Cutter Diameter Max.	Shank	Thread
80000002	80006	N.A.	5/8	1/4	1/4-28
80000008	80021	3/4	7/8	3/8	7/16-20
80000009	80026	3/4	7/8	3/8	3/8-24
80000010	80031	3/4	1-1/8	3/8	7/16-20
80000011	80036	3/4	1-1/8	3/8	3/8-24
80000006	80011	Steel Non-Marking Pad			
80000007	80016	Plastic Non-Marking Pad			

Countersinks

Application Data

Uniflute® Feed Rates

Uniflute® countersinks are designed with cam relief; therefore feed rates should not exceed .005" per revolution on larger diameter holes. Reduced feeds also are recommended for smaller holes. A controlled feed results in the chatter-free finishes associated with the Uniflute®.

Multiple Flute Feeds

Multiple flute countersinks are designed for increased feed rates. Because there is more than one cutting edge, chip loads are not excessive, and chatter can be controlled, allowing higher feeds.

Speeds

To determine optimum speed, start at the lower end of the speed range, and then increase speeds until performance is maximized. When a countersink is operated at excessive RPM, chatter may result, and cutting edges can overheat and become prematurely dull.

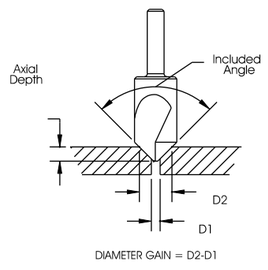
Material	SFM			
	HSS	HSS TiN Coated	HSS ALtima® Blaze Coated	Carbide
Aluminum / Aluminum Alloys	150-250	190-315	240-400	300-500
Brass / Bronze (ordinary)	75-125	90-160	120-200	150-250
Iron - Cast (soft)	75-125	90-160	120-200	125-225
Iron - Cast (medium hard)	50-100	65-125	80-160	100-175
Iron - Hard Chilled	10-20	15-25	20-35	20-35
Iron - Malleable	80-90	100-115	130-145	90-150
Magnesium / Magnesium Alloys	125-250	160-310	200-400	250-400
Monel, High Nickel Steel	30-50	40-65	50-80	50-75
Plastics, Bakelite	100-250	125-315	160-400	250-400
Steel - Mild (.2 - .3 carbon)	80-100	100-125	130-160	120-170
Steel - Mild (.4 - .5 carbon)	70-80	85-100	115-130	80-150
Tool Steels (1.2 carbon)	50-60	65-75	80-100	60-100
Steel - Forgings	40-50	50-65	65-80	50-80
Steel - Alloys (300 - 400 Brinnell)	20-30	25-40	35-50	30-50
Steel - High Tensile (35 - 40 Rc)	30-40	40-50	50-65	40-60
Steel - High Tensile (40 - 45 Rc)	25-35	30-45	40-56	35-55
Steel - High Tensile (45 - 50 Rc)	15-25	20-30	25-40	25-40
Steel - High Tensile (50 - 55 Rc)	7-15	10-20	15-30	15-20
Stainless Steel - Free Machining	30-80	40-100	50-130	80-125
Stainless Steel - Work Hardening	15-50	20-65	30-80	50-75
Ti-75A (commercially pure Titanium)	50-60	65-75	80-100	60-90
Inconel Alloys	15-20	20-25	25-35	25-35

Minimum Body Diameter For 82° Flat Head Cap Screws

Screw Size	Series 67 Size	All other C'sinks Size
#4	7/16	1/4
#5	9/16	5/16
#6	9/16	5/16
#8	9/16	3/8
#10	9/16	1/2
#12	13/16	1/2
1/4	13/16	5/8
5/16	1-1/8	3/4
3/8	1-1/8	7/8
7/16	1-1/8	7/8
1/2	1-1/2	1
5/8	1-1/2	1-1/4
3/4	1-1/2	1-1/2

Diameter Gain in Size For Each .001" of Axial Depth in Hole

Included Angle	Axial Depth	Diameter Gain
30°	0.001	0.0005
45°	0.001	0.0008
60°	0.001	0.0010
82°	0.001	0.0017
90°	0.001	0.0020
100°	0.001	0.0028
120°	0.001	0.0034



ISO 9001:2000 Certified

Material	m/min.			
	HSS	HSS TiN Coated	HSS ALtima® Blaze Coated	Carbide
Aluminum / Aluminum Alloys	45-75	60-100	75-120	90-155
Brass / Bronze (ordinary)	25-40	30-50	35-60	45-80
Iron - Cast (soft)	25-40	30-50	35-60	40-70
Iron - Cast (medium hard)	15-30	20-40	25-50	30-55
Iron - Hard Chilled	3-10	5-10	5-10	5-10
Iron - Malleable	25-30	30-35	40-45	30-45
Magnesium / Magnesium Alloys	40-75	50-95	60-120	75-125
Monel, High Nickel Steel	10-15	10-20	15-25	15-25
Plastics, Bakelite	30-75	40-100	50-120	80-120
Steel - Mild (.2 - .3 carbon)	25-30	30-40	40-50	40-50
Steel - Mild (.4 - .5 carbon)	20-25	25-30	35-40	25-45
Tool Steels (1.2 carbon)	15-20	20-25	25-30	20-30
Steel - Forgings	10-15	15-20	20-25	15-25
Steel - Alloys (300 - 400 Brinnell)	5-10	10-15	10-15	10-15
Steel - High Tensile (35 - 40 Rc)	10-15	10-15	15-20	15-20
Steel - High Tensile (40 - 45 Rc)	8-15	10-15	10-20	10-20
Steel - High Tensile (45 - 50 Rc)	5-10	5-10	8-10	8-15
Steel - High Tensile (50 - 55 Rc)	2-5	3-5	5-10	5-6
Stainless Steel - Free Machining	10-25	10-30	15-40	25-40
Stainless Steel - Work Hardening	5-10	5-20	10-25	15-25
Ti-75A (commercially pure Titanium)	15-20	20-25	25-30	20-30
Inconel Alloys	5-6	5-10	5-10	8-15

Conversion Formulas
(SMM X 318.057)/ Tool Diameter*=RPM
(SFM X 3.82)/Tool Diameter=RPM

***Tool Diameter must be in mm.**

Minimum Body Diameter For 90° Flat Head Cap Screws (mm)

Screw Size(mm)	C'sink Diameter
3	7
4	10
5	12
6	14
8	19
10	23
12	31

Diameter Gain in Size For Each .025mm of Axial Depth in Hole

Included Angle	Axial Depth mm	Diameter Gain mm
30°	.025	.0127
45°	.025	.0203
60°	.025	.0254
82°	.025	.0432
90°	.025	.0508
100°	.025	.0711
120°	.025	.0864

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.

Designed and Manufactured in the USA

Factory Regrinding Service Available.
Call Customer Service for Details.
800-553-8024/563-391-6220

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

Edge Hog® Burs

Carbide Burs And Grinding Tools

M.A. Ford® manufactures a complete line of Solid Carbide Burs and Diamond-Pattern Grinding Tools for a broad range of materials, applications and finishes.

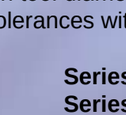
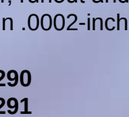
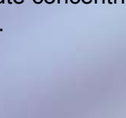
Grinding Tools are designed for precision grinding and profiling, especially in hardened steels, up to 65 Rc. Precise tolerances on tool diameter, runout and flute concentricity, allow machining tolerances within .0002-inches.

Series 290
Series 291
Series 291E

Carbide Burs are available in three different cuts - Standard, Fine and Shear - to provide a range of finishes on ferrous, non-ferrous and non-metallic materials. Double Cut (Alternate Diamond Grind) Burs are available with left-hand flutes added to help break up chips. These burs are available in Standard and Fine Cut Versions. The following shapes are available:

- **SA - Cylindrical Flat End**
- **SB - Cylindrical Flat End With End Cut**
- **SC - Cylindrical Radius End**
- **SD - Spherical**
- **SE - Elliptical**
- **SF - Tree Shape Radius End**
- **SG - Tree Shape Pointed End**
- **SH - Flame**
- **SJ - 60° Angle Tool**
- **SK - 90° Angle Tool**
- **SL - Conical Radius End**
- **SM - Conical**
- **SN - Back Taper**

Bur Sets

Designed and Manufactured in the USA

ISO 9001:2000 Certified

An ESOP Company

Types of Cuts and Recommended Applications

Following are general guidelines for selecting the correct bur based upon material being machined.

Single (Standard)

A general-purpose right hand flute style is recommended when rapid stock removal and good workpiece finish are the parameters.

Fine

A general-purpose right hand flute style designed for producing higher quality finishes, when removing less stock, with more operator control.

Shear

A right hand flute style bur is recommended for rapid stock removal on softer, non-ferrous and non-metallic materials.

Double (Alternate Diamond Grind)

M.A. Ford® Carbide Burs are available in a Standard Alternate Diamond (Double Cut) and Fine Alternate Diamond style. An alternate diamond grind has left hand fluting added to standard or fine cut fluting. This additional fluting helps break up chips when working steel weldments or other materials that can produce small or sliver-type chips. A slight left hand cutting action typically provides the operator more control of the bur and grinder.

Optional Diamond Grind Available Upon Request

Diamond grind is left hand fluting added to single or fine cut burs. Like an alternate diamond grind, a diamond grind will also break up bothersome chips into an almost granular powder. More precise deburring is possible because of a more balanced left and right hand cutting action. The most rapid penetration achieved with a carbide bur is with diamond grind. A diamond grind will, however, reduce tool life. Recommended for ferrous and stainless steel materials.

Bur Application Chart

Material	Type of Cut			
	Single	Double	Fine	Shear
Steel, Carbon & Alloys	X	X		
Steel, Nickel Chrome	X	X		
Steel, Stainless	X	X	x	
Steel, Weldments	X	X		
Cast Iron	X			
Titanium	X	X		
Steel, 40-60 Rc	X	X	x	
Wood				X
Aluminum	X	X		X
Brass, Bronze, Copper	X	X		
Carbon	X			
Fiberglass	X			
Hard Rubber	X			X
Magnesium				X
Masonite	X			X
Plastics	X			X
Zinc				X

All burs available with coating.

See page 357 for our coating options.

Contact M.A. Ford at
800-553-8024/563-391-6220
for all your application questions.

Specify type of cut when ordering.

Order by EDP No. or SCTI No.

SCTI No. -D Double Cut
SCTI No. -F Fine Cut

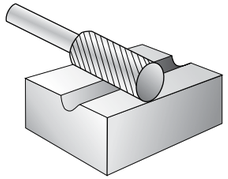
Example:
SA-41 Single Cut
SA-41-D Double Cut
SA-41-F Fine Cut

For product information, call your local distributor.

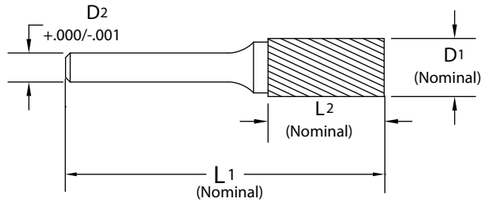
Edge Hog® Series SA Inch

Includes Micro Sizes

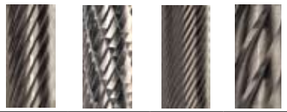
Previously: Series 41, 69, 70, 72 and 74



Cylindrical Flat End



Specify type of cut when ordering.



SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SA-41	69001	69009	69017		1/16	1/8	1-1/2	1/4
SA-42	69049	69057	69065		3/32	1/8	1-1/2	7/16
SA-43	69025	69033	69041		1/8	1/8	1-1/2	9/16
SA-43L3	69801	69803			1/8	1/8	3	9/16
SA-11	41037	41049	41061		1/8	1/4	2	1/2
SA-52	72001	72009	72017		5/32	1/8	1-1/2	1/2
SA-13	41073	41085	41097		5/32	1/4	2	5/8
SA-53	72049	72057	72065		3/16	1/8	1-1/2	1/2
SA-81	74001	74005	74009		3/16	3/16	2	5/8
SA-14	41109	41121	41133		3/16	1/4	2	5/8
SA-51	70013	70021	70029		1/4	1/8	2	1/2
SA-1	41145	41157	41169		1/4	1/4	2	5/8
SA-2	41181	41193	41205		5/16	1/4	2-3/4	3/4
SA-3	41217	41229	41241		3/8	1/4	2-3/4	3/4
SA-3NF				41601	3/8	1/4	2-3/4	3/4
SA-4	41273	41285	41297		7/16	1/4	3	1
SA-5	41309	41321	41333		1/2	1/4	3	1
SA-5NF				41616	1/2	1/4	3	1
SA-6	41365	41377	41389		5/8	1/4	3	1
SA-6NF				41631	5/8	1/4	3	1
SA-15	41457	41469	41481		3/4	1/4	2-1/2	1/2
SA-16	41493	41505	41517		3/4	1/4	2-3/4	3/4
SA-7	41421	41433	41445		3/4	1/4	3	1
SA-9	41001	41013	41025		1	1/4	3	1

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Technical information on page 334.

Bur Cross Reference Chart on page 335.

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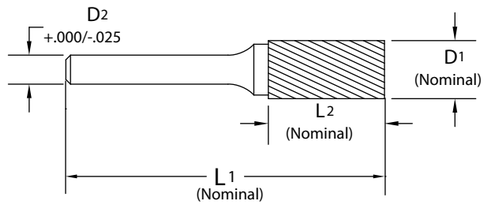
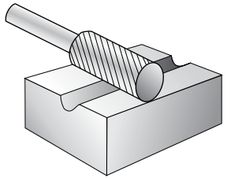
Edge Hog® Series SA Metric

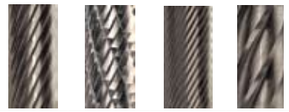
Includes Micro Sizes

Previously: Series 41, 69, 70, 72 and 74





Cylindrical Flat End



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SA-41M	69005	69013	69021		1.6	3.0	38.0	6.0
SA-42M	69053	69061	69069		2.4	3.0	38.0	11.1
SA-11M	41045	41057	41069		3.0	6.0	50.0	12.7
SA-43L76M	69802	69804			3.0	3.0	76.0	14.3
SA-43M	69029	69037	69045		3.0	3.0	38.0	14.3
SA-52M	72005	72013	72021		4.0	3.0	38.0	12.7
SA-13M	41081	41093	41105		4.0	6.0	50.0	16.0
SA-53M	72053	72061	72069		4.8	3.0	38.0	12.7
SA-14M	41117	41129	41141		4.8	6.0	50.0	16.0
SA-1M	41153	41165	41177		6.0	6.0	50.0	16.0
SA-51M	70017	70025	70033		6.4	3.0	51.0	12.7
SA-2M	41189	41201	41213		8.0	6.0	64.0	19.0
SA-3M	41225	41237	41249		9.5	6.0	64.0	19.0
SA-3NFM				41269	9.5	6.0	64.0	19.0
SA-3MZ	41250	41252	41254		10.0	6.0	65.0	20.0
SA-4M	41281	41293	41305		11.0	6.0	70.0	25.0
SA-5MZ	41262	41264	41266		12.0	6.0	70.0	25.0
SA-5M	41317	41329	41341		12.7	6.0	70.0	25.0
SA-5NFM				41361	12.7	6.0	70.0	25.0
SA-6M	41373	41385	41397		16.0	6.0	70.0	25.0
SA-6NFM				41417	16.0	6.0	70.0	25.0
SA-15M	41465	41477	41489		19.0	6.0	58.0	12.7
SA-16M	41501	41513	41525		19.0	6.0	64.0	19.0
SA-7M	41429	41441	41453		19.0	6.0	70.0	25.0
SA-9M	41009	41021	41033		25.0	6.0	70.0	25.0

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Technical information on page 334.

Bur Cross Reference Chart on page 335.

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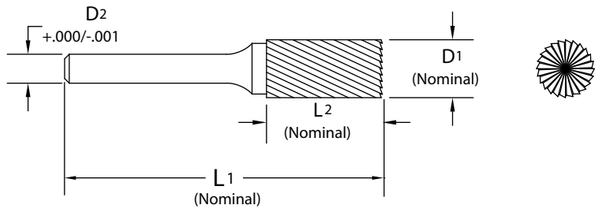
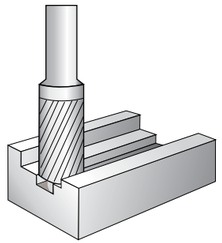
Edge Hog® Series SB Inch

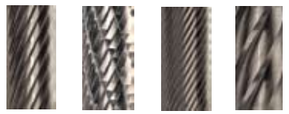
Includes Micro Sizes

Previously: Series 41E, 69, 70, 72 and 74





Cylindrical Flat End
End Cut



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SB-11	41041	41053	41065		1/8	1/4	2	1/2
SB-13	41077	41089	41101		5/32	1/4	2	5/8
SB-14	41113	41125	41137		3/16	1/4	2	5/8
SB-51	70001	70005	70009		1/4	1/8	1-11/16	3/16
SB-1	41149	41161	41173		1/4	1/4	2	5/8
SB-2	41185	41197	41209		5/16	1/4	2-3/4	3/4
SB-3	41221	41233	41245		3/8	1/4	2-3/4	3/4
SB-3NF				41606	3/8	1/4	2-3/4	3/4
SB-4	41277	41289	41301		7/16	1/4	3	1
SB-5	41313	41325	41337		1/2	1/4	3	1
SB-5NF				41621	1/2	1/4	3	1
SB-6	41369	41381	41393		5/8	1/4	3	1
SB-6NF				41636	5/8	1/4	3	1
SB-15	41461	41473	41485		3/4	1/4	2-1/2	1/2
SB-16	41497	41509	41521		3/4	1/4	2-3/4	3/4
SB-7	41425	41437	41449		3/4	1/4	3	1
SB-9	41005	41017	41029		1	1/4	3	1

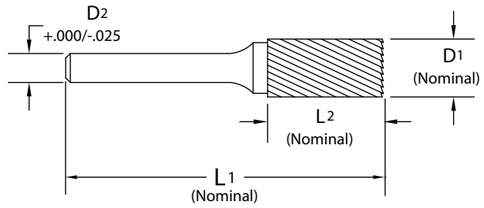
Technical information on page 334.
Bur Cross Reference Chart on page 335.

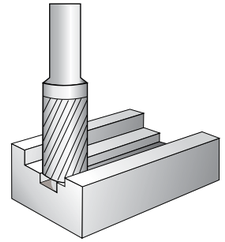
Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Edge Hog® Series SB Metric

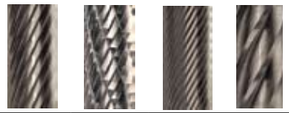
Includes Micro Sizes

Previously: Series 41E, 69, 70, 72 and 74





Cylindrical Flat End
End Cut



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SB-11M	41042	41054	41066		3.0	6.0	50.0	12.7
SB-13M	41078	41090	41102		4.0	6.0	50.0	16.0
SB-14M	41114	41126	41138		4.8	6.0	50.0	16.0
SB-1M	41150	41162	41174		6.0	6.0	50.0	16.0
SB-51M	70003	70007	70011		6.4	3.0	43.0	4.8
SB-2M	41186	41198	41210		8.0	6.0	64.0	19.0
SB-3M	41222	41234	41246		9.5	6.0	64.0	19.0
SB-3NFM				41271	9.5	6.0	64.0	19.0
SB-3MZ	41256	41258	41260		10.0	6.0	65.0	20.0
SB-4M	41278	41290	41302		11.0	6.0	70.0	25.0
SB-5MZ	41268	41270	41272		12.0	6.0	70.0	25.0
SB-5M	41314	41326	41338		12.7	6.0	70.0	25.0
SB-5NFM				41363	12.7	6.0	70.0	25.0
SB-6M	41370	41382	41394		16.0	6.0	70.0	25.0
SB-6NFM				41419	16.0	6.0	70.0	25.0
SB-15M	41462	41474	41486		19.0	6.0	58.0	12.7
SB-16M	41498	41510	41522		19.0	6.0	64.0	19.0
SB-7M	41426	41438	41450		19.0	6.0	70.0	25.0
SB-9M	41006	41018	41030		25.0	6.0	70.0	25.0

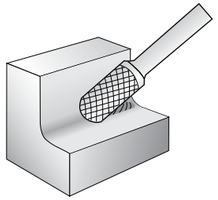
Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Technical information on page 334.
Bur Cross Reference Chart on page 335.

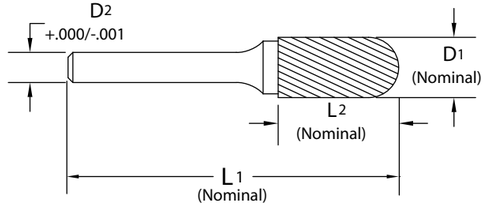
Edge Hog® Series SC Inch

Includes Micro Sizes

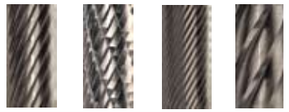
Previously: Series 42, 69, 70, 72 and 74



Cylindrical Radius End



Specify type of cut when ordering.



SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SC-41	69097	69105	69113		3/32	1/8	1-1/2	7/16
SC-11	42021	42029	42037		1/8	1/4	2	1/2
SC-42	69073	69081	69089		1/8	1/8	1-1/2	9/16
SC-42L3	69805	69807			1/8	1/8	3	9/16
SC-52	72025	72033	72041		5/32	1/8	1-1/2	1/2
SC-13	42045	42053	42061		5/32	1/4	2	5/8
SC-53	72073	72081	72089		3/16	1/8	1-1/2	1/2
SC-81	74013	74017	74021		3/16	3/16	2	5/8
SC-14	42069	42077	42085		3/16	1/4	2	5/8
SC-51	70037	70045	70053		1/4	1/8	2	1/2
SC-1	42093	42105	42117		1/4	1/4	2	5/8
SC-1L6	42801	42806	42811		1/4	1/4	6-5/8	5/8
SC-2	42129	42141	42153		5/16	1/4	2-3/4	3/4
SC-2L6	42816	42821	42826		5/16	1/4	6-3/4	3/4
SC-3	42165	42177	42189		3/8	1/4	2-3/4	3/4
SC-3L6	42831	42836	42841		3/8	1/4	6-3/4	3/4
SC-3NF				42601	3/8	1/4	2-3/4	3/4
SC-4	42213	42221	42229		7/16	1/4	3	1
SC-5	42237	42253	42265		1/2	1/4	3	1
SC-5L6	42846	42851	42856		1/2	1/4	7	1
SC-5NF				42621	1/2	1/4	3	1
SC-6	42289	42297	42305		5/8	1/4	3	1
SC-6NF				42641	5/8	1/4	3	1
SC-7	42325	42333	42341		3/4	1/4	3	1
SC-9	42001	42009	42017		1	1/4	3	1

Technical information on page 334.

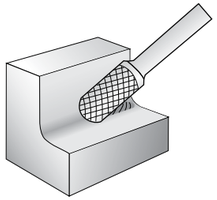
Bur Cross Reference Chart on page 336.

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

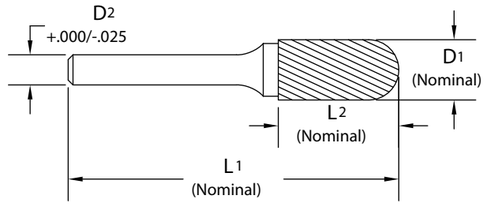
Edge Hog® Series SC Metric

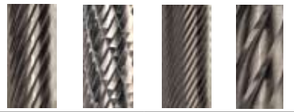
Includes Micro Sizes

Previously: Series 42, 69, 70, 72 and 74



Cylindrical Radius End





Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SC-41M	69101	69109	69117		2.4	3.0	38.0	11.1
SC-11M	42025	42033	42041		3.0	6.0	50.0	12.7
SC-42M	69077	69085	69093		3.0	3.0	38.0	14.3
SC-42L76M	69806	69808			3.0	3.0	76.0	14.3
SC-52M	72029	72037	72045		4.0	3.0	38.0	12.7
SC-13M	42049	42057	42066		4.0	6.0	50.0	16.0
SC-53M	72077	72085	72093		4.8	3.0	38.0	12.7
SC-14M	42073	42081	42089		4.8	6.0	50.0	16.0
SC-1M	42101	42113	42125		6.0	6.0	50.0	16.0
SC-1L6M	42802	42807	42812		6.0	6.0	166.0	16.0
SC-51M	70041	70049	70057		6.4	3.0	51.0	12.7
SC-2M	42137	42149	42161		8.0	6.0	64.0	19.0
SC-2L6M	42817	42822	42827		8.0	6.0	169.0	19.0
SC-3M	42173	42185	42197		9.5	6.0	64.0	19.0
SC-3NFM				42209	9.5	6.0	64.0	19.0
SC-3L6M	42832	42837	42842		9.5	6.0	169.0	19.0
SC-3MZ	42198	42200	42202		10.0	6.0	65.0	20.0
SC-4M	42217	42225	42233		11.0	6.0	70.0	25.0
SC-5MZ	42204	42206	42208		12.0	6.0	70.0	25.0
SC-5M	42245	42261	42273		12.7	6.0	70.0	25.0
SC-5NFM				42285	12.7	6.0	70.0	25.0
SC-5L6M	42847	42852	42857		12.7	6.0	175.0	25.0
SC-6M	42293	42301	42309		16.0	6.0	70.0	25.0
SC-6NFM				42321	16.0	6.0	70.0	25.0
SC-7M	42329	42337	42345		19.0	6.0	70.0	25.0
SC-9M	42005	42013			25.0	6.0	70.0	25.0

Technical information on page 334.

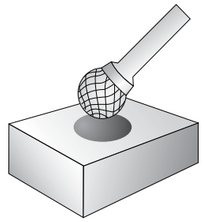
Bur Cross Reference Chart on page 336.

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

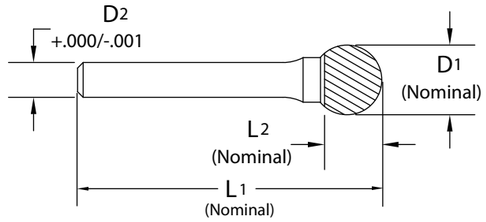
Edge Hog® Series SD Inch

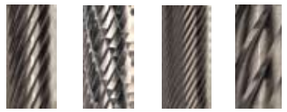
Includes Micro Sizes

Previously: Series 43, 69, 70, 72 and 74



Spherical





Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SD-41	69121	69129	69137		3/32	1/8	1-1/2	5/64
SD-11	43025	43033	43041		1/8	1/4	2	7/64
SD-42	69145	69153	69161		1/8	1/8	1-1/2	7/64
SD-42L3	69809	69811			1/8	1/8	3	7/64
SD-14	43049	43057	43065		3/16	1/4	2	5/32
SD-53	72097	72105	72113		3/16	1/8	1-1/2	5/32
SD-81	74025	74029	74033		3/16	3/16	2	5/32
SD-1	43073	43085	43097		1/4	1/4	2	7/32
SD-1L6	43801	43806	43811		1/4	1/4	6-7/32	7/32
SD-51	70061	70069	70077		1/4	1/8	1-23/32	7/32
SD-2	43109	43121	43133		5/16	1/4	2-9/32	9/32
SD-2L6	43816	43821	43826		5/16	1/4	6-9/32	9/32
SD-3	43145	43157	43169		3/8	1/4	2-5/16	5/16
SD-3L6	43831	43836	43841		3/8	1/4	6-5/16	5/16
SD-3NF				43601	3/8	1/4	2-5/16	5/16
SD-4	43189	43197	43205		7/16	1/4	2-3/8	3/8
SD-5	43213	43225	43237		1/2	1/4	2-7/16	7/16
SD-5L6	43846	43851	43856		1/2	1/4	6-7/16	7/16
SD-5NF				43621	1/2	1/4	2-7/16	7/16
SD-6	43257	43265	43273		5/8	1/4	2-9/16	9/16
SD-6NF				43641	5/8	1/4	2-9/16	9/16
SD-7	43289	43297	43305		3/4	1/4	2-11/16	11/16
SD-9	43001	43009	43017		1	1/4	2-15/16	15/16

Technical information on page 334.

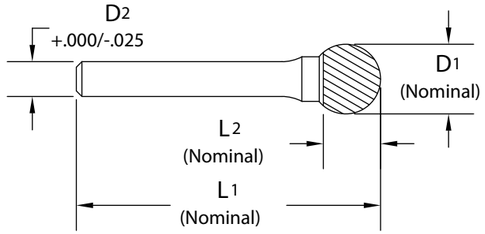
Bur Cross Reference Chart on page 336.

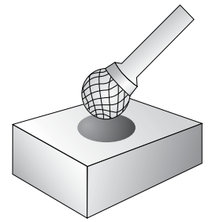
Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Edge Hog® Series SD Metric

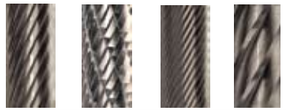
Includes Micro Sizes

Previously: Series 43, 69, 70, 72 and 74





Spherical



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SD-41M	69125	69133	69141		2.4	3.0	38.0	2.0
SD-11M	43029	43037	43045		3.0	6.0	50.0	2.8
SD-42M	69149	69157	69165		3.0	3.0	38.0	2.8
SD-42L76M	69810	69812			3.0	3.0	76.0	2.8
SD-14M	43053	43061	43069		4.8	6.0	50.0	4.0
SD-53M	72101	72109	72117		4.8	3.0	38.0	4.0
SD-1M	43081	43093	43105		6.0	6.0	50.0	5.0
SD-1L6M	43802	43807	43812		6.0	6.0	155.0	5.0
SD-51M	70065	70073	70081		6.4	3.0	44.0	5.6
SD-2M	43117	43129	43141		8.0	6.0	51.0	6.0
SD-2L6M	43817	43822	43827		8.0	6.0	159.0	6.0
SD-3M	43153	43165	43177		9.5	6.0	53.0	7.0
SD-3L6M	43832	43837	43842		9.5	6.0	161.0	7.0
SD-3NFM				43185	9.5	6.0	53.0	7.0
SD-3MZ	43178	43180	43182		10.0	6.0	54.0	7.0
SD-4M	43193	43201	43209		11.0	6.0	54.0	9.0
SD-5MZ	43184	43186	43188		12.0	6.0	56.0	10.0
SD-5M	43221	43233	43245		12.7	6.0	56.0	10.0
SD-5L6M	43847	43852	43857		12.7	6.0	160.0	10.0
SD-5NFM				43253	12.7	6.0	56.0	10.0
SD-6M	43261	43269	43277		16.0	6.0	59.0	13.0
SD-6NFM				43285	16.0	6.0	59.0	13.0
SD-7M	43293	43301	43309		19.0	6.0	62.0	16.0
SD-9M	43005	43013	43021		25.0	6.0	68.0	21.0

Technical information on page 334.

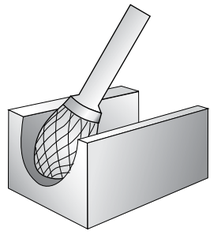
Bur Cross Reference Chart on page 336.

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

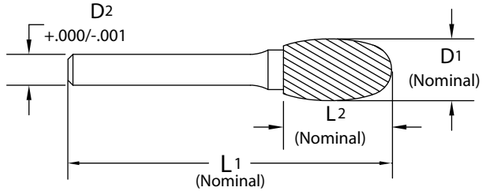
Edge Hog® Series SE Inch

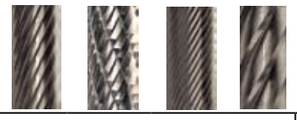
Includes Micro Sizes

Previously: Series 44, 69, 70, 72 and 74



Elliptical





Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SE-41	69169	69177	69185		1/8	1/8	1-1/2	7/32
SE-41L3	69813	69815			1/8	1/8	3	7/32
SE-53	72121	72129	72137		3/16	1/8	1-1/2	9/32
SE-81	74037	74041	74045		3/16	3/16	2	9/32
SE-1	44001	44013	44025		1/4	1/4	2	3/8
SE-1L6	44801	44806	44811		1/4	1/4	6-3/8	3/8
SE-51	70085	70093	70101		1/4	1/8	1-7/8	3/8
SE-2	44037	44049	44061		5/16	1/4	2-5/8	5/8
SE-3	44073	44085	44097		3/8	1/4	2-5/8	5/8
SE-3L6	44831	44836	44841		3/8	1/4	6-5/8	5/8
SE-3NF				44601	3/8	1/4	2-5/8	5/8
SE-5	44117	44129	44141		1/2	1/4	2-7/8	7/8
SE-5L6	44846	44851	44856		1/2	1/4	6-7/8	7/8
SE-5NF				44621	1/2	1/4	2-7/8	7/8
SE-6	44161	44173	44185		5/8	1/4	3	1
SE-6NF				44641	5/8	1/4	3	1
SE-7	44205	44213	44221		3/4	1/4	3	1

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

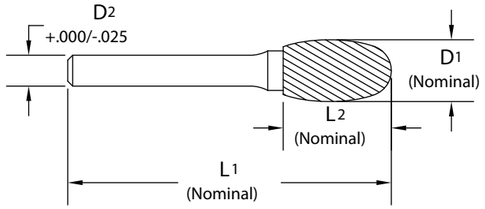
Technical information on page 334.

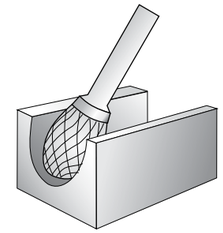
Bur Cross Reference Chart on page 336.

Edge Hog® Series SE Metric

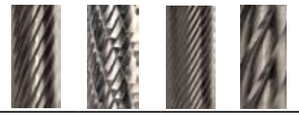
Includes Micro Sizes

Previously: Series 44, 69, 70, 72 and 74





Elliptical



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SE-41M	69173	69181	69189		3.0	3.0	38.0	5.6
SE-41L76M	69814	69816			3.0	3.0	76.0	5.6
SE-53M	72125	72133	72141		4.8	3.0	38.0	7.0
SE-1M	44009	44021	44033		6.0	6.0	50.0	9.5
SE-1L6M	44802	44807	44812		6.0	6.0	159.0	9.5
SE-51M	70089	70097	70105		6.4	3.0	48.0	9.5
SE-2M	44045	44057	44069		8.0	6.0	60.0	16.0
SE-3M	44081	44093	44105		9.5	6.0	60.0	16.0
SE-3L6M	44832	44837	44842		9.5	6.0	166.0	16.0
SE-3NFM				44113	9.5	6.0	60.0	16.0
SE-5M	44125	44137	44149		12.7	6.0	67.0	22.0
SE-5L6M	44847	44852	44857		12.7	6.0	172.0	22.0
SE-5NFM				44157	12.7	6.0	67.0	22.0
SE-6M	44169	44181	44193		16.0	6.0	70.0	25.0
SE-6NFM				44201	16.0	6.0	70.0	25.0
SE-7M	44209	44217	44225		19.0	6.0	70.0	25.0

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

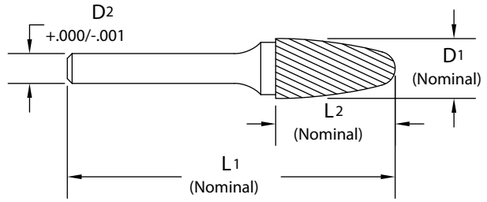
Technical information on page 334.

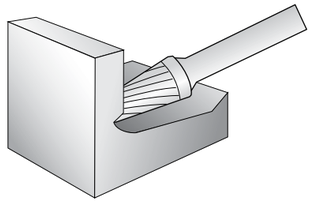
Bur Cross Reference Chart on page 336.

Edge Hog® Series SF Inch

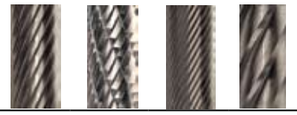
Includes Micro Sizes

Previously: Series 45, 69, 70, 72 and 74





Tree Shape
Radius End



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SF-41	69193	69201	69209		1/8	1/8	1-1/2	1/4
SF-42	69217	69225	69233		1/8	1/8	1-1/2	1/2
SF-42L3	69817	69819			1/8	1/8	3	1/2
SF-11	45001	45009	45017		1/8	1/4	2	1/2
SF-53	72169	72177	72185		3/16	1/8	1-1/2	1/2
SF-81	74061	74065	74069		3/16	3/16	2	1/2
SF-51	70109	70117	70125		1/4	1/8	2	1/2
SF-1	45025	45037	45049		1/4	1/4	2	5/8
SF-1L6	45801	45806	45811		1/4	1/4	6-5/8	5/8
SF-3	45097	45109	45121		3/8	1/4	2-3/4	3/4
SF-3L6	45831	45836	45841		3/8	1/4	6-3/4	3/4
SF-3NF				45601	3/8	1/4	2-3/4	3/4
SF-4	45145	45153	45161		7/16	1/4	3	1
SF-13	45205	45213	45221		1/2	1/4	2-3/4	3/4
SF-5	45169	45181	45193		1/2	1/4	3	1
SF-5L6	45846	45851	45856		1/2	1/4	7	1
SF-5NF				45621	1/2	1/4	3	1
SF-6	45241	45253	45265		5/8	1/4	3	1
SF-6NF				45641	5/8	1/4	3	1
SF-7	45313	45321	45329		3/4	1/4	3	1
SF-14	45289	45297	45305		3/4	1/4	3-1/4	1-1/4
SF-15	45337	45345	45353		3/4	1/4	3-1/2	1-1/2

Technical information on page 334.

Bur Cross Reference Chart on page 337.

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

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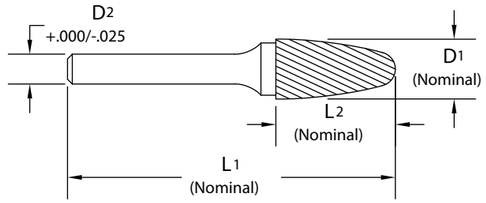
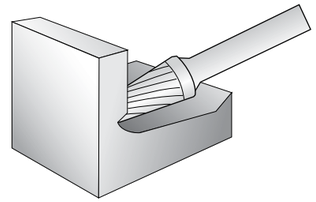
Edge Hog® Series SF Metric

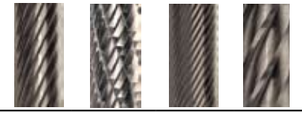
Includes Micro Sizes

Previously: Series 45, 69, 70, 72 and 74





Tree Shape
Radius End



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SF-41M	69197	69205	69213		3.0	3.0	38.0	6.0
SF-42M	69221	69229	69237		3.0	3.0	38.0	12.7
SF-42L76M	69818	69820			3.0	3.0	76.0	12.7
SF-11M	45005	45013	45021		3.0	6.0	50.0	12.7
SF-51M	70113	70121	70129		6.4	3.0	51.0	12.7
SF-53M	72173	72181	72189		4.8	3.0	38.0	12.7
SF-1M	45033	45045	45057		6.0	6.0	50.0	16.0
SF-1L6M	45802	45807	45812		6.0	6.0	166.0	16.0
SF-13M	45209	45217	45225		12.7	6.0	64.0	19.0
SF-3M	45105	45117	45129		9.5	6.0	64.0	19.0
SF-3L6M	45832	45837	45842		9.5	6.0	169.0	19.0
SF-3NFM				45141	9.5	6.0	64.0	19.0
SF-4M	45149	45157	45165		11.0	6.0	70.0	25.0
SF-5M	45177	45189	45201		12.7	6.0	70.0	25.0
SF-5L6M	45847	45852	45857		12.7	6.0	175.0	25.0
SF-5MZ	45130	45132	45134		12.0	6.0	70.0	25.0
SF-5NFM				45237	12.7	6.0	70.0	25.0
SF-6M	45249	45261	45273		16.0	6.0	70.0	25.0
SF-6NFM				45285	16.0	6.0	70.0	25.0
SF-7M	45317	45325	45333		19.0	6.0	70.0	25.0
SF-14M	45293	45301	45309		19.0	6.0	76.0	31.0
SF-15M	45341	45349	45357		19.0	6.0	84.0	38.0

Technical information on page 334.

Bur Cross Reference Chart on page 337.

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

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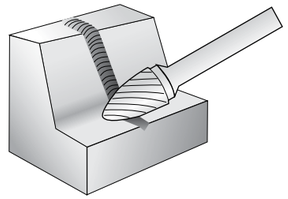
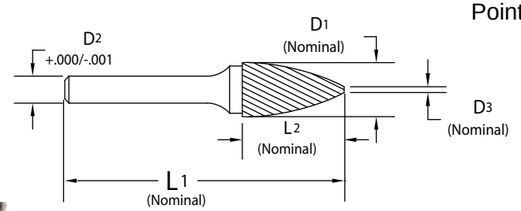
Edge Hog® Series SG Inch

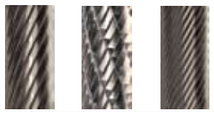
Includes Micro Sizes

Previously: Series 46, 69, 70, 72 and 74



Tree Shape
Pointed End





Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	End Diameter D3	OAL L1	Flute Length L2
SG-41	69241	69249	69257	1/8	1/8	.018	1-1/2	1/4
SG-43	69289	69297	69305	1/8	1/8	.018	1-1/2	3/8
SG-43L3	69825	69827		1/8	1/8	.018	3	3/8
SG-42	69265	69273	69281	1/8	1/8	.018	1-1/2	5/16
SG-42L3	69821	69823		1/8	1/8	.018	3	5/16
SG-53	72193	72201	72209	3/16	1/8	.025	1-1/2	1/2
SG-81	74073	74077	74081	3/16	3/16	.023	2	1/2
SG-51	70133	70141	70149	1/4	1/8	.030	2	1/2
SG-1	46001	46013	46025	1/4	1/4	.030	2	5/8
SG-1L6	46801	46806	46811	1/4	1/4	.030	6-5/8	5/8
SG-2	46037	46049	46061	5/16	1/4	.040	2-3/4	3/4
SG-3	46073	46085	46097	3/8	1/4	.040	2-3/4	3/4
SG-3L6	46831	46836	46841	3/8	1/4	.040	6-3/4	3/4
SG-5	46109	46121	46133	1/2	1/4	.050	3	1
SG-5L6	46846	46851	46856	1/2	1/4	.050	7	1
SG-13	46145	46153	46161	1/2	1/4	.050	2-3/4	3/4
SG-6	46169	46181	46193	5/8	1/4	.050	3	1
SG-7	46205	46213	46221	3/4	1/4	.050	3	1
SG-15	46229	46237	46245	3/4	1/4	.070	3-1/2	1-1/2

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

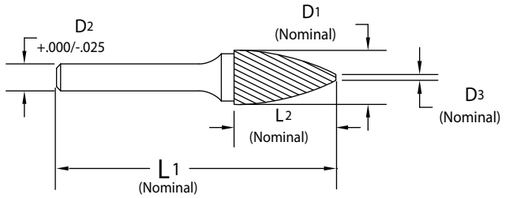
Technical information on page 334.

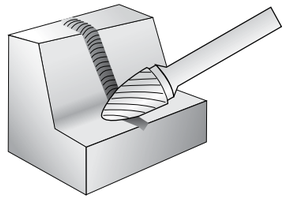
Bur Cross Reference Chart on page 337.

Edge Hog® Series SG Metric

Includes Micro Sizes

Previously: Series 46, 69, 70, 72 and 74





Tree Shape
Pointed End

Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	End Diameter D3	OAL L1	Flute Length L2
SG-41M	69245	69253	69261	3.0	3.0	0.46	38.0	6.0
SG-42M	69269	69277	69285	3.0	3.0	0.46	38.0	8.0
SG-42L76M	69822	69824		3.0	3.0	0.46	76.0	8.0
SG-43M	69293	69301	69309	3.0	3.0	0.46	38.0	9.5
SG-43L76M	69826	69828		3.0	3.0	0.46	76.0	9.5
SG-53M	72197	72205	72213	4.8	3.0	0.64	38.0	12.7
SG-1M	46009	46021	46033	6.0	6.0	0.76	50.0	16.0
SG-1L6M	46802	46807	46812	6.0	6.0	0.76	166.0	16.0
SG-51M	70137	70145	70153	6.4	3.0	0.76	51.0	12.7
SG-2M	46045	46057	46069	8.0	6.0	1.02	64.0	19.0
SG-3M	46081	46093	46105	9.5	6.0	1.02	64.0	19.0
SG-3L6M	46832	46837	46842	9.5	6.0	1.02	169.0	19.0
SG-3MZ	46098	46100	46102	10.0	6.0	1.14	65.0	20.0
SG-5MZ	46104	46106	46108	12.0	6.0	1.27	70.0	25.0
SG-13M	46149	46157	46165	12.7	6.0	1.27	64.0	19.0
SG-5M	46117	46129	46141	12.7	6.0	1.27	70.0	25.0
SG-5L6M	46847	46852	46857	12.7	6.0	1.27	175.0	25.0
SG-6M	46177	46189	46201	16.0	6.0	1.27	70.0	25.0
SG-7M	46209	46217	46225	19.0	6.0	1.27	70.0	25.0
SG-15M	46233	46241	46249	19.0	6.0	1.78	84.0	38.0

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

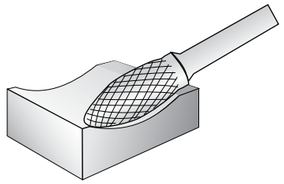
Technical information on page 334.

Bur Cross Reference Chart on page 337.

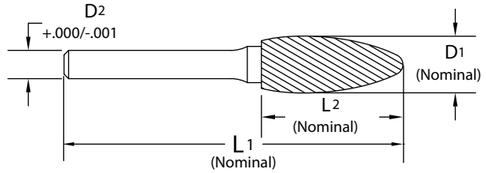
Edge Hog® Series SH Inch

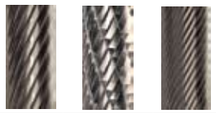
Includes Micro Sizes

Previously: Series 49, 72 and 74



Flame





Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SH-41	69513	69521	69529	1/8	1/8	1-1/2	1/4
SH-41L3	69837	69839		1/8	1/8	3	1/4
SH-53	72145	72153	72161	3/16	1/8	1-1/2	3/8
SH-81	74049	74053	74057	3/16	3/16	2	3/8
SH-1	49001	49013	49025	1/4	1/4	2	5/8
SH-2	49037	49049	49061	5/16	1/4	2-3/4	3/4
SH-2L6	49816	49821	49826	5/16	1/4	6-3/4	3/4
SH-3	49073	49085	49097	3/8	1/4	3	1
SH-5	49109	49121	49133	1/2	1/4	3-1/4	1-1/4
SH-5L6	49846	49851	49856	1/2	1/4	7-1/4	1-1/4
SH-6	49145	49157	49169	5/8	1/4	3-7/16	1-7/16
SH-7	49181	49189	49197	3/4	1/4	3-5/8	1-5/8

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

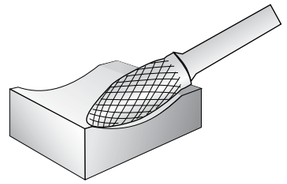
Technical information on page 334.

Bur Cross Reference Chart on page 338.

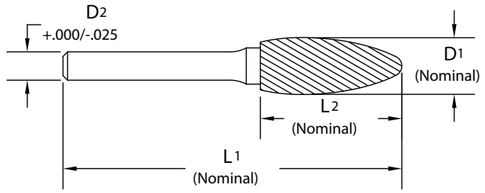
Edge Hog® Series SH Metric

Includes Micro Sizes

Previously: Series 49, 72 and 74



Flame



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
SH-41M	69517	69525	69533	3.0	3.0	38.0	6.0
SH-41L76M	69838	69840		3.0	3.0	76.0	6.0
SH-53M	72149	72157	72165	4.8	3.0	38.0	9.5
SH-1M	49009	49021	49033	6.0	6.0	50.0	16.0
SH-2M	49045	49057	49069	8.0	6.0	64.0	19.0
SH-2L6M	49817	49822	49827	8.0	6.0	169.0	19.0
SH-3M	49081	49093	49105	9.5	6.0	70.0	25.0
SH-5M	49117	49129	49141	12.7	6.0	76.0	31.0
SH-5L6M	49847	49852	49857	12.7	6.0	181.0	31.0
SH-6M	49153	49165	49177	16.0	6.0	81.0	36.0
SH-7M	49185	49193	49201	19.0	6.0	86.0	41.0

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Technical information on page 334.

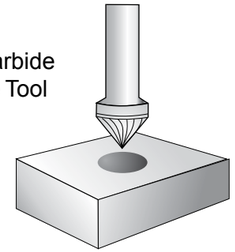
Bur Cross Reference Chart on page 338.

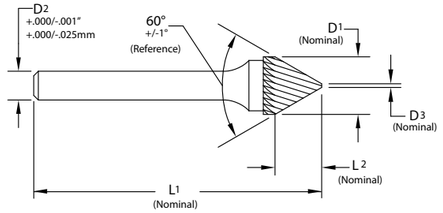
Edge Hog® Series SJ Inch

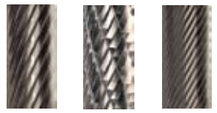
Includes Micro Sizes

Previously: Series 296 and 69

60° Carbide Angle Tool







Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Angle A
SJ-42	69313	69321	69329	1/8	1/8	1-1/2	3/32	60º
SJ-82*	69337	69345		1/8	1/8	1-1/2	3/32	60º
SJ-1	29601	29605		1/4	1/4	2	3/16	60º
SJ-3	29609	29613		3/8	1/4	2-7/16	5/16	60º
SJ-5	29617	29621		1/2	1/4	2-35/46	7/16	60º
SJ-6	29625	29629		5/8	1/4	2-11/16	1/2	60º
SJ-7	29633	29637		3/4	1/4	2-51/64	9/16	60º
SJ-9	29641	29645		1	1/4	2-31/32	13/16	60º

*Double End

Burs over 1/2" (12.7mm) are available with a 3/8" or 8mm shank as a non-stock standard.

Edge Hog® Series SJ Metric

Includes Micro Sizes

Previously: Series 296 and 69

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Angle A
SJ-42M	69317	69325	69333	3.0	3.0	38	2.4	60º
SJ-82M*	69341	69349		3.0	3.0	38	2.4	60º
SJ-1M	29603	29607		6.0	6.0	50	4.8	60º
SJ-3M	29611	29615		9.5	6.0	55	8.0	60º
SJ-5M	29619	29623		12.7	6.0	58	11.0	60º
SJ-6M	29627	29631		16.0	6.0	62	12.7	60º
SJ-7M	29635	29639		19.0	6.0	64	14.0	60º
SJ-9M	29643	29647		25.0	6.0	70	21.0	60º

*Double End

Technical information on page 334.

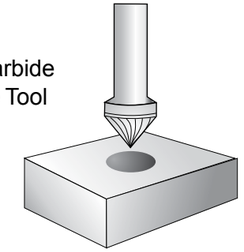
Bur Cross Reference Chart on page 335.

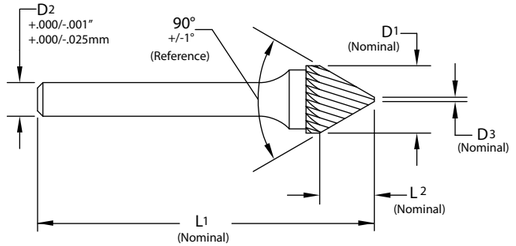
Edge Hog® Series SK Inch

Includes Micro Sizes

Previously: Series 297 and 69

90° Carbide Angle Tool





Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Angle A
SK-42	69366	69367	1/8	1/8	1-1/2	1/16	90º
SK-82*	69353	69361	1/8	1/8	1-1/2	1/16	90º
SK-1	29701	29705	1/4	1/4	2	1/8	90º
SK-3	29709	29713	3/8	1/4	2-5/16	3/16	90º
SK-5	29717	29721	1/2	1/4	2-5/8	1/4	90º
SK-6	29725	29729	5/8	1/4	2-31/64	5/16	90º
SK-7	29733	29737	3/4	1/4	2-35/64	3/8	90º
SK-9	29741	29745	1	1/4	2-41/64	1/2	90º

*Double End

Burs over 1/2" (12.7mm) are available with a 3/8" or 8mm shank as a non-stock standard.

Edge Hog® Series SK Metric

Includes Micro Sizes

Previously: Series 297 and 69

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Angle A
SK-42M	69370	69371	3.0	3.0	38.0	1.6	90º
SK-82M*	69357	69365	3.0	3.0	38.0	1.6	90º
SK-1M	29703	29707	6.0	6.0	50	3.0	90º
SK-3M	29711	29715	9.5	6.0	52	4.8	90º
SK-5M	29719	29723	12.7	6.0	53	6.4	90º
SK-6M	29727	29731	16.0	6.0	56	8.0	90º
SK-7M	29735	29739	19.0	6.0	58	9.5	90º
SK-9M	29743	29747	25.0	6.0	61	12.7	90º

*Double End

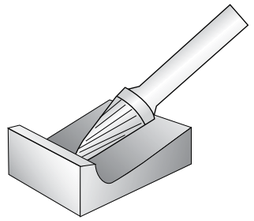
Technical information on page 334.

Bur Cross Reference Chart on page 335.

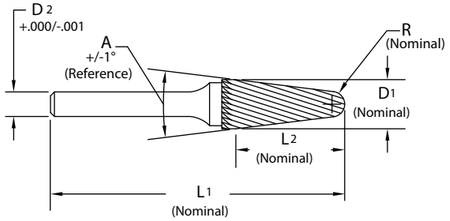
Edge Hog® Series SL Inch

Includes Micro Sizes

Previously: Series 48, 69, 72 and 74

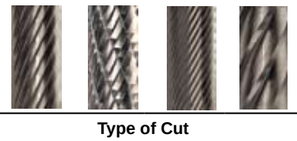


Conical Radius End



Technical information on page 334.

Bur Cross Reference Chart on page 338.



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Angle A	Radius R
SL-42	69489	69497	69505		1/8	1/8	1-1/2	1/2	8°	.025
SL-42L3	69833	69835			1/8	1/8	3	1/2	8°	.025
SL-41	69465	69473	69481		1/8	1/8	1-1/2	3/8	8°	.039
SL-53	72265	72273	72281		3/16	1/8	1-1/2	1/2	14°	.030
SL-81	74109	74113	74117		3/16	3/16	2	1/2	14°	.030
SL-1	48001	48013	48025		1/4	1/4	2	5/8	14°	.060
SL-2	48037	48049	48061		5/16	1/4	3	15/16	14°	.060
SL-2L6	48816	48821	48826		5/16	1/4	7	15/16	14°	.060
SL-3	48073	48085	48097		3/8	1/4	3-3/16	1-1/8	14°	.060
SL-3L6	48831	48836	48841		3/8	1/4	7-3/16	1-1/8	14°	.060
SL-3NF				48601	3/8	1/4	3-3/16	1-1/8	14°	.060
SL-4	48121	48133	48145		1/2	1/4	3-1/4	1-3/16	14°	.130
SL-4L6	48846	48851	48856		1/2	1/4	7-1/4	1-3/16	14°	.130
SL-4NF				48621	1/2	1/4	3-1/4	1-3/16	14°	.130
SL-6	48169	48177	48185		5/8	1/4	3-7/16	1-5/16	14°	.187
SL-6NF				48641	5/8	1/4	3-7/16	1-5/16	14°	.187
SL-7	48205	48213	48221		3/4	1/4	3-5/8	1-9/16	14°	.230

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

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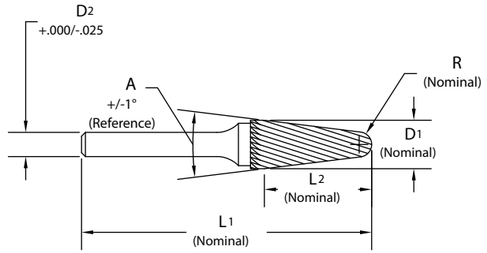
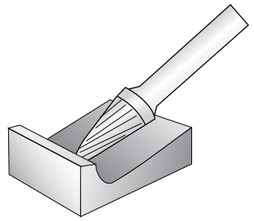
Edge Hog® Series SL Metric

Includes Micro Sizes

Previously: Series 48, 69, 72 and 74

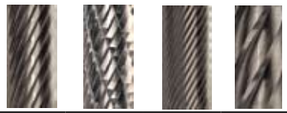




Conical Radius End

Technical information on page 334.

Bur Cross Reference Chart on page 338.



Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Double EDP	Fine EDP	Shear EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Angle A	Radius R
SL-41M	69469	69477	69485		3.0	3.0	38.0	9.5	8°	0.99
SL-42M	69493	69501	69509		3.0	3.0	38.0	12.7	8°	0.64
SL-42L76M	69834	69836			3.0	3.0	76.0	12.7	8°	0.64
SL-53M	72269	72277	72285		4.8	3.0	38.0	12.7	14°	0.76
SL-1M	48009	48021	48033		6.0	6.0	50.0	16.0	14°	1.52
SL-2M	48045	48057	48069		8.0	6.0	71.0	24.0	14°	1.52
SL-2L6M	48817	48822	48827		8.0	6.0	176.0	24.0	14°	1.52
SL-3M	48081	48093	48105		9.5	6.0	75.0	28.0	14°	1.52
SL-3L6M	48832	48837	48842		9.5	6.0	180.0	28.0	14°	1.52
SL-3NFM				48117	9.5	6.0	75.0	28.0	14°	1.52
SL-4M	48129	48141	48153		12.7	6.0	77.0	30.0	14°	3.30
SL-4L6M	48847	48852	48857		12.7	6.0	182.0	30.0	14°	3.30
SL-4NFM				48165	12.7	6.0	77.0	30.0	14°	3.30
SL-6M	48173	48181	48189		16.0	6.0	80.0	33.0	14°	4.75
SL-6NFM				48201	16.0	6.0	80.0	33.0	14°	4.75
SL-7M	48209	48217	48225		19.0	6.0	86.0	39.0	14°	5.84

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

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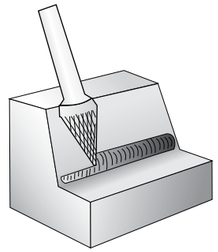
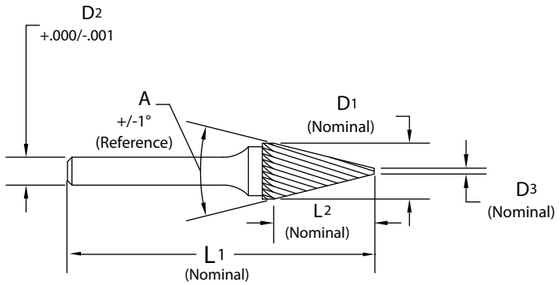
Edge Hog® Series SM Inch

Includes Micro Sizes

Previously: Series 47, 69, 70, 72 and 74



Conical



Technical information on page 334.

Bur Cross Reference Chart on page 338.

Specify type of cut when ordering.

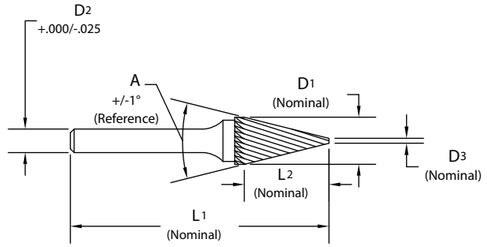
SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	End Diameter D3	OAL L1	Flute Length L2	Angle A
SM-45	69369	69377	69385	1/8	1/8	.018	1-1/2	3/16	32°
SM-41	69393	69401	69409	1/8	1/8	.043	1-1/2	3/8	12°
SM-43	69441	69449	69457	1/8	1/8	.045	1-1/2	5/8	7°
SM-42	69417	69425	69433	1/8	1/8	.014	1-1/2	7/16	14°
SM-42L3	69829	69831		1/8	1/8	.014	3	7/16	14°
SM-53	72217	72225	72233	3/16	1/8	.038	1-1/2	1/2	16°
SM-81	74085	74089	74093	3/16	3/16	.053	2	5/8	12°
SM-3	47049	47057	47065	1/4	1/4	.065	2	1	10°
SM-1	47001	47009	47017	1/4	1/4	.046	2	1/2	22°
SM-51	70157	70165	70173	1/4	1/8	.052	2-1/8	1/2	22°
SM-2	47025	47033	47041	1/4	1/4	.056	2	3/4	14°
SM-4	47073	47081	47089	3/8	1/4	.052	2-3/4	5/8	28°
SM-5	47097	47105	47113	1/2	1/4	.052	3	7/8	28°
SM-6	47121	47129	47137	5/8	1/4	.060	3-1/8	1	31°

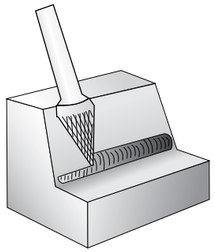
Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Edge Hog® Series SM Metric

Includes Micro Sizes

Previously: Series 47, 69, 70, 72 and 74





Conical

Technical information on page 334.

Bur Cross Reference Chart on page 338.

Specify type of cut when ordering.

SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	End Diameter D3	OAL L1	Flute Length L2	Angle A
SM-45M	69373	69381	69389	3.0	3.0	0.46	38	4.8	32°
SM-41M	69397	69405	69413	3.0	3.0	1.09	38	9.5	12°
SM-42M	69421	69429	69437	3.0	3.0	0.36	38	11.1	14°
SM-42L76M	69830	69832		3.0	3.0	0.36	76	11.1	14°
SM-43M	69445	69453	69461	3.0	3.0	1.14	38	16.0	7°
SM-53M	72221	72229	72237	4.8	3.0	0.97	38	12.7	16°
SM-1M	47005	47013	47021	6.0	6.0	1.17	50	12.7	22°
SM-2M	47029	47037	47045	6.0	6.0	1.42	50	19.0	14°
SM-3M	47053	47061	47069	6.0	6.0	1.65	50	25.0	10°
SM-51M	70161	70169	70177	6.4	3.0	1.32	54	12.7	22°
SM-4M	47077	47085	47093	9.5	6.0	1.32	63	16.0	28°
SM-5M	47101	47109	47117	12.7	6.0	1.32	69	22.0	28°
SM-6M	47125	47133	47141	16.0	6.0	1.52	72	25.0	31°

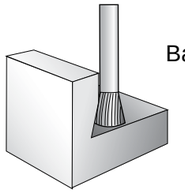
Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Edge Hog® Burs

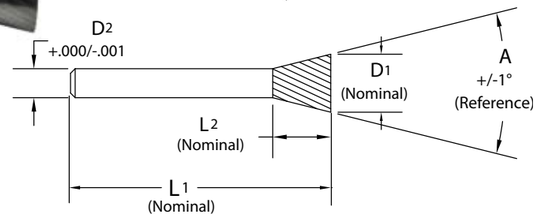
Edge Hog® Series SN Inch

Includes Micro Sizes

Previously: Series 50, 69, 70, 72 and 74



Backtaper



Specify type of cut when ordering.

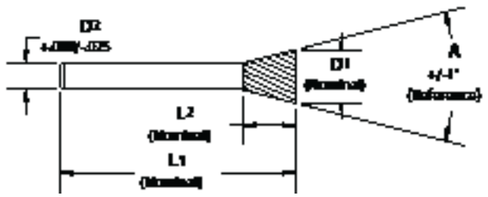
SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Angle A
SN-41	69537	69545	69553	3/32	1/8	1-1/2	1/8	10°
SN-42*	69561	69565	69569	1/8	1/8	1-1/2	3/16	10°
SN-53	72241	72249	72257	3/16	1/8	1-1/2	1/4	10°
SN-81	74097	74101	74105	3/16	3/16	2	1/4	10°
SN-51	70181	70189	70197	1/4	1/8	1-3/4	1/4	10°
SN-1	50001	50009	50017	1/4	1/4	2	5/16	10°
SN-2	50049	50057	50065	3/8	1/4	2-3/8	3/8	13°
SN-4	50073	50081	50089	1/2	1/4	2-1/2	1/2	28°
SN-6	50097	50105	50113	5/8	1/4	2-3/4	3/4	18°
SN-7	50121	50129	50137	3/4	1/4	2-5/8	5/8	30°

* End cut

Edge Hog® Series SN Metric

Includes Micro Sizes

Previously: Series 50, 69, 70, 72 and 74



SCTI	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Angle A
SN-41M	69541	69549	69557	2.4	3.0	38.0	3.0	10°
SN-42M*	69563	69567	69571	3.0	3.0	38.0	4.8	10°
SN-53M	72245	72253	72261	4.8	3.0	38.0	6.4	10°
SN-51M	70185	70193	70201	6.4	3.0	44.0	6.4	10°
SN-1M	50005	50013	50021	6.0	6.0	50.0	8.0	10°
SN-2M	50053	50061	50069	9.5	6.0	55.0	9.5	13°
SN-4M	50077	50085	50093	12.7	6.0	58.0	12.7	28°
SN-6M	50101	50109	50117	16.0	6.0	64.0	19.0	18°
SN-7M	50125	50133	50141	19.0	6.0	61.0	16.0	30°

* End cut

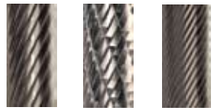
Technical information on page 334.

Bur Cross Reference Chart on page 338.

Burs over 1/2” (12.7mm) are available with a 3/8” or 8mm shank as a non-stock standard.

Edge Hog® Series 71/Bur Sets

Inch and Millimeter sizes



Specify type of cut when ordering.

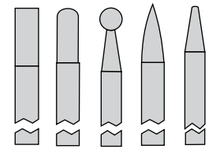
Set No.	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Tools In Set
One	71001	71009	71017	SA-1, SC-1, SD-1, SG-1, SM-1
Two	71025	71033	71041	SA-43, SC-42, SD-42, SG-41, SM-45, SL-42
Three	71049	71057	71065	SA-43, SC-42, SC-41, SD-42, SE-41, SF-41, SG-41, SM-45, SL-42, SN-42
Four	71073	71081	71089	SA-51, SC-51, SD-51, SE-51, SF-51, SG-51, SM-51, SN-51

Set No.	Type of Cut: Single EDP	Type of Cut: Double EDP	Type of Cut: Fine EDP	Tools In Set (mm)
One	71005	71013	71021	SA-1M, SC-1M, SD-1M, SG-1M, SM-1M
Two	71029	71037	71045	SA-43M, SC-42M, SD-42M, SG-41M, SM-45M, SL-42M
Three	71053	71061	71069	SA-43M, SC-42M, SC-41M, SD-42M, SE-41M, SF-41M, SG-41M, SM-45M, SL-42M, SN-42M
Four	71077	71085	71093	SA-51M, SC-51M, SD-51M, SE-51M, SF-51M, SG-51M, SM-51M, SN-51M

Technical information on page 334.

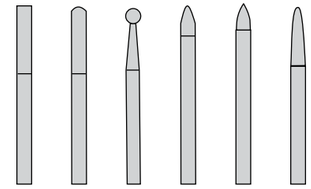
Bur Cross Reference Chart on page 339.

Set One



Inch: 1/4” Head/1/4” Shank
mm: 6mm Head/6mm Shank

Set Two

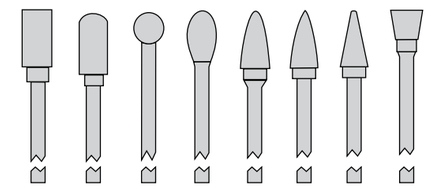


Inch: 1/8” Head/1/8” Shank
mm: 3mm Head/3mm Shank

Set Three

Inch: 1/8” Head/1/8” Shank
mm: 3mm Head/3mm Shank

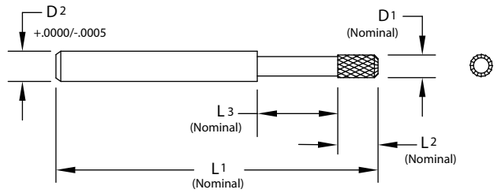
Set Four



Inch: 1/4” Head/1/8” Shank
mm: 6.4mm Head/3mm Shank

Carbide Grinding Tools Series 290

Diamond Pattern Lead Chamfer



Tool No.	EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Neck Length L3
29006250	92607	1/16	1/8	1-1/2	1/8	3/8
29007800	92610	5/64	1/8	1-1/2	5/32	3/8
29009370	92616	3/32	1/8	1-1/2	5/32	3/8
29010940	92622	7/64	1/8	1-1/2	3/16	7/16
29012500	92628	1/8	1/8	1-1/2	3/16	7/16
29014060	92631	9/64	3/16	2	1/4	1/2
29015620	92634	5/32	3/16	2	1/4	1/2
29018750	92640	3/16	3/16	2	1/4	9/16
29020310	92646	13/64	1/4	2	1/4	5/8
29021870	92649	7/32	1/4	2	1/4	5/8
29023430	92652	15/64	1/4	2	1/4	3/4
29025000	92658	1/4	1/4	2	1/4	3/4
29028120	92661	9/32	1/4	2-1/2	5/16	
29031250	92664	5/16	1/4	2-1/2	5/16	
29034370	92670	11/32	1/4	2-1/2	3/8	
29037500	92673	3/8	1/4	2-1/2	3/8	

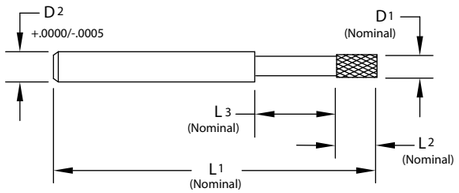
Designed for precision jig grinding and profilling in hardened steel applications.

Manufactured from a wear resistant carbide for long tool life and better workpiece finishes.

Diamond pattern for easy penetration in hardened steel and difficult to machine materials.

Carbide Grinding Tools Series 291

Diamond Pattern Square End

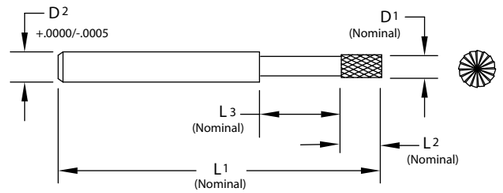


Tool No.	EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Neck Length L3
29106250	92707	1/16	1/8	1-1/2	1/8	3/8
29107800	92710	5/64	1/8	1-1/2	5/32	3/8
29109370	92716	3/32	1/8	1-1/2	5/32	3/8
29110940	92722	7/64	1/8	1-1/2	3/16	7/16
29112500	92728	1/8	1/8	1-1/2	3/16	7/16
29114060	92731	9/64	3/16	2	1/4	1/2
29115620	92734	5/32	3/16	2	1/4	1/2
29118750	92740	3/16	3/16	2	1/4	9/16
29120310	92746	13/64	1/4	2	1/4	5/8
29121870	92749	7/32	1/4	2	1/4	5/8
29123430	92752	15/64	1/4	2	1/4	3/4
29125000	92758	1/4	1/4	2	1/4	3/4
29128120	92761	9/32	1/4	2-1/2	5/16	
29131250	92764	5/16	1/4	2-1/2	5/16	
29134370	92770	11/32	1/4	2-1/2	3/8	
29137500	92773	3/8	1/4	2-1/2	3/8	

Technical information on page 334.

Carbide Grinding Tools Series 291E

Diamond Pattern Square End/End Cut



Tool No.	EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2	Neck Length L3
29106250E	92508	1/16	1/8	1-1/2	1/8	3/8
29107800E	92511	5/64	1/8	1-1/2	5/32	3/8
29109370E	92517	3/32	1/8	1-1/2	5/32	3/8
29110940E	92523	7/64	1/8	1-1/2	3/16	7/16
29112500E	92529	1/8	1/8	1-1/2	3/16	7/16
29114060E	92532	9/64	3/16	2	1/4	1/2
29115620E	92535	5/32	3/16	2	1/4	1/2
29118750E	92541	3/16	3/16	2	1/4	9/16
29120310E	92547	13/64	1/4	2	1/4	5/8
29121870E	92550	7/32	1/4	2	1/4	5/8
29123430E	92553	15/64	1/4	2	1/4	3/4
29125000E	92559	1/4	1/4	2	1/4	3/4
29128120E	92562	9/32	1/4	2-1/2	5/16	
29131250E	92565	5/16	1/4	2-1/2	5/16	
29134370E	92571	11/32	1/4	2-1/2	3/8	
29137500E	92574	3/8	1/4	2-1/2	3/8	

Technical information on page 334.

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.

Bur Troubleshooting Chart																			
	Possible Solution																		
Problem	Excessive Force	Heat From Rubbing Shank	Dull Tool	Improper Location In Collet	Bad Grinder Bearings	Bent Shank	Unstable Control of Process	Use a Coarser Bur	Working in Soft Material	Use Anti-Stick Agent	Faster RPM	Slower RPM	Lighter Cuts	Switch To Fine Cut	Don't Use Alternate/Diamond Grd.	Faster Feed	Slower Feed	Cutting Abrasive Materials	Lacking Rigid Setup
Broken Braze	X	X	X																
Chatter No Control				X	X	X	X												X
Plugged Flutes								X	X	X	X	X	X						
Excessive Vibration				X	X	X	X				X	X				X	X		X
Poor Finish				X	X	X	X				X	X		X	X	X			X
Poor Life		X		X	X	X	X				X	X			X	X	X	X	X

Bur Fluting Chart Number of Flutes (±10%)				
Tool Diameter		Single Cut	Fine Cut	Shear Cut
Inch	mm			
1/16	1.6	10	12	
5/64	2.0	10	12	
3/32	2.4	12	16	
1/8	3.0	12	20	
5/32	4.0	14	24	
3/16	4.8	15	24	
1/4	6.0	16	25	
5/16	8.0	18	30	
3/8	9.5	20	30	6
7/16	11.0	22	30	
1/2	12.7	24	35	8*
5/8	16.0	26	40	8**
3/4	19.0	30	40	
1	25.0	35	45	

Alternate Diamond Grind left hand fluting 40% of right hand fluting. Diamond Grind left hand fluting 80% of right hand fluting.

*except SL-4NF and SL-4NFM 6 flutes
**except SD-6NF, SD-6NFM, SE-6NF, SE-6NFM, SF-6NF and SF-6NFM 10 flutes

Operating Parameters			
Bur Tool Diameter		Speed	
		1,500 SFM	3,000 SFM
		460 m/min.	920 m/min.
Inch	mm	RPM	
1/8	3.0	45,000	90,000
1/4	6.0	23,000	45,000
3/8	9.5	15,000	30,000
1/2	12.7	11,000	22,000
3/4	19.0	7,500	15,000
1	25.0	5,500	10,000

Speeds and Feeds

Carbide burs should typically be operated between 1,500 and 3,000 SFM (460-920m/min.). For burs ranging in size from 3/16" (4.8mm) to 3/8" (9.5mm) diameter, a 30,000 RPM grinder is recommended. A 22,000 RPM grinder will work effectively with burs ranging in size from 1/4" (6mm) to 1/2" (12.7mm) in diameter. Solid carbide burs that are 1/8" (3mm) diameter or less, can typically be run at speeds up to 75,000 RPM. However, these are general speed recommendations that may need to be adjusted. For application questions, call 800-553-8024

SCTI Cross Reference

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29602500	SJ-1	29601	324
29602500M	SJ-1M	29603	324
29602507	SJ-1-D	29605	324
29602507M	SJ-1M-D	29607	324
29603750	SJ-3	29609	324
29603750M	SJ-3M	29611	324
29603757	SJ-3-D	29613	324
29603757M	SJ-3M-D	29615	324
29605000	SJ-5	29617	324
29605000M	SJ-5M	29619	324
29605007	SJ-5-D	29621	324
29605007M	SJ-5M-D	29623	324
29606250	SJ-6	29625	324
29606250M	SJ-6M	29627	324
29606257	SJ-6-D	29629	324
29606257M	SJ-6M-D	29631	324
29607500	SJ-7	29633	324
29607500M	SJ-7M	29635	324
29607507	SJ-7-D	29637	324
29607507M	SJ-7M-D	29639	324
29610000	SJ-9	29641	324
29610000M	SJ-9M	29643	324
29610007	SJ-9-D	29645	324
29610007M	SJ-9M-D	29647	324
29702500	SK-1	29701	325
29702500M	SK-1M	29703	325
29702507	SK-1-D	29705	325
29702507M	SK-1M-D	29707	325
29703750	SK-3	29709	325
29703750M	SK-3M	29711	325
29703757	SK-3-D	29713	325
29703757M	SK-3M-D	29715	325
29705000	SK-5	29717	325
29705000M	SK-5M	29719	325
29705007	SK-5-D	29721	325
29705007M	SK-5M-D	29723	325
29706250	SK-6	29725	325
29706250M	SK-6M	29727	325
29706257	SK-6-D	29729	325
29706257M	SK-6M-D	29731	325
29707500	SK-7	29733	325
29707500M	SK-7M	29735	325
29707507	SK-7-D	29737	325
29707507M	SK-7M-D	29739	325
29710000	SK-9	29741	325
29710000M	SK-9M	29743	325
29710007	SK-9-D	29745	325
29710007M	SK-9M-D	29747	325
41100020	SA-9	41001	308
41100020E	SB-9	41005	310
41100020EM	SB-9M	41006	311
41100020M	SA-9M	41009	309
41100027	SA-9-D	41013	308
41100027E	SB-9-D	41017	310
41100027EM	SB-9M-D	41018	311
41100027M	SA-9M-D	41021	309
41100030	SA-9-F	41025	308
41100030E	SB-9-F	41029	310
41100030EM	SB-9M-F	41030	311
41100030M	SA-9M-F	41033	309
41125020	SA-11	41037	308
41125020E	SB-11	41041	310
41125020EM	SB-11M	41042	311
41125020M	SA-11M	41045	309
41125027	SA-11-D	41049	308
41125027E	SB-11-D	41053	310
41125027EM	SB-11M-D	41054	311
41125027M	SA-11M-D	41057	309
41125030	SA-11-F	41061	308
41125030E	SB-11-F	41065	310
41125030EM	SB-11M-F	41066	311
41125030M	SA-11M-F	41069	309

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41156220	SA-13	41073	308
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41156220EM	SB-13M	41078	311
41156220M	SA-13M	41081	309
41156227	SA-13-D	41085	308
41156227E	SB-13-D	41089	310
41156227EM	SB-13M-D	41090	311
41156227M	SA-13M-D	41093	309
41156230	SA-13-F	41097	308
41156230E	SB-13-F	41101	310
41156230EM	SB-13M-F	41102	311
41156230M	SA-13M-F	41105	309
41187520	SA-14	41109	308
41187520E	SB-14	41113	310
41187520EM	SB-14M	41114	311
41187520M	SA-14M	41117	309
41187527	SA-14-D	41121	308
41187527E	SB-14-D	41125	310
41187527EM	SB-14M-D	41126	311
41187527M	SA-14M-D	41129	309
41187530	SA-14-F	41133	308
41187530E	SB-14-F	41137	310
41187530EM	SB-14M-F	41138	311
41187530M	SA-14M-F	41141	309
41250020	SA-1	41145	308
41250020E	SB-1	41149	310
41250020EM	SB-1M	41150	311
41250020M	SA-1M	41153	309
41250027	SA-1-D	41157	308
41250027E	SB-1-D	41161	310
41250027EM	SB-1M-D	41162	311
41250027M	SA-1M-D	41165	309
41250030	SA-1-F	41169	308
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41250030EM	SB-1M-F	41174	311
41250030M	SA-1M-F	41177	309
41312520	SA-2	41181	308
41312520E	SB-2	41185	310
41312520EM	SB-2M	41186	311
41312520M	SA-2M	41189	309
41312527	SA-2-D	41193	308
41312527E	SB-2-D	41197	310
41312527EM	SB-2M-D	41198	311
41312527M	SA-2M-D	41201	309
41312530	SA-2-F	41205	308
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41312530EM	SB-2M-F	41210	311
41312530M	SA-2M-F	41213	309
41375020	SA-3	41217	308
41375020E	SB-3	41221	310
41375020EM	SB-3M	41222	311
41375020M	SA-3M	41225	309
41375027	SA-3-D	41229	308
41375027E	SB-3-D	41233	310
41375027EM	SB-3M-D	41234	311
41375027M	SA-3M-D	41237	309
41375030	SA-3-F	41241	308
41375030E	SB-3-F	41245	310
41375030EM	SB-3M-F	41246	311
41375030M	SA-3M-F	41249	309
41375150	SA-3NF	41601	308
41375150E	SB-3NF	41606	310
41375150EM	SB-3NFM	41271	311
41375150M	SA-3NFM	41269	309
41393020EM	SB-3MZ	41256	311
41393020M	SA-3MZ	41250	309
41393027EM	SB-3MZ-D	41258	311
41393027M	SA-3MZ-D	41252	309
41393030EM	SB-3MZ-F	41260	311
41393030M	SA-3MZ-F	41254	309
41437520	SA-4	41273	308
41437520E	SB-4	41277	310

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41437520EM	SB-4M	41278	311
41437520M	SA-4M	41281	309
41437527	SA-4-D	41285	308
41437527E	SB-4-D	41289	310
41437527EM	SB-4M-D	41290	311
41437527M	SA-4M-D	41293	309
41437530	SA-4-F	41297	308
41437530E	SB-4-F	41301	310
41437530EM	SB-4M-F	41302	311
41437530M	SA-4M-F	41305	309
41472020EM	SB-5MZ	41268	311
41472020M	SA-5MZ	41262	309
41472027EM	SB-5MZ-D	41270	311
41472027M	SA-5MZ-D	41264	309
41472030EM	SB-5MZ-F	41272	311
41472030M	SA-5MZ-F	41266	309
41500020	SA-5	41309	308
41500020E	SB-5	41313	310
41500020EM	SB-5M	41314	311
41500020M	SA-5M	41317	309
41500027	SA-5-D	41321	308
41500027E	SB-5-D	41325	310
41500027EM	SB-5M-D	41326	311
41500027M	SA-5M-D	41329	309
41500030	SA-5-F	41333	308
41500030E	SB-5-F	41337	310
41500030EM	SB-5M-F	41338	311
41500030M	SA-5M-F	41341	309
41500150	SA-5NF	41616	308
41500150E	SB-5NF	41621	310
41500150EM	SB-5NFM	41363	311
41500150M	SA-5NFM	41361	309
41625020	SA-6	41365	308
41625020E	SB-6	41369	310
41625020EM	SB-6M	41370	311
41625020M	SA-6M	41373	309
41625027	SA-6-D	41377	308
41625027E	SB-6-D	41381	310
41625027EM	SB-6M-D	41382	311
41625027M	SA-6M-D	41385	309
41625030	SA-6-F	41389	308
41625030E	SB-6-F	41393	310
41625030EM	SB-6M-F	41394	311
41625030M	SA-6M-F	41397	309
41625150	SA-6NF	41631	308
41625150E	SB-6NF	41636	310
41625150EM	SB-6NFM	41419	311
41625150M	SA-6NFM	41417	309
41750020	SA-7	41421	308
41750020E	SB-7	41425	310
41750020EM	SB-7M	41426	311
41750020M	SA-7M	41429	309
41750027	SA-7-D	41433	308
41750027E	SB-7-D	41437	310
41750027EM	SB-7M-D	41438	311
41750027M	SA-7M-D	41441	309
41750030	SA-7-F	41445	308
41750030E	SB-7-F	41449	310
41750030EM	SB-7M-F	41450	311
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41750127EM	SB-15M-D	41474	311
41750127M	SA-15M-D	41477	309
41750130	SA-15-F	41481	308
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41750227E	SB-16-D	41509	310
41750227EM	SB-16M-D	41510	311
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41750230	SA-16-F	41517	308
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41750230M	SA-16M-F	41525	309
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42100020M	SC-9M	42005	313
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42125020	SC-11	42021	312
42125020M	SC-11M	42025	313
42125027	SC-11-D	42029	312
42125027M	SC-11M-D	42033	313
42125030	SC-11-F	42037	312
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42156220	SC-13	42045	312
42156220M	SC-13M	42049	313
42156227	SC-13-D	42053	312
42156227M	SC-13M-D	42057	313
42156230	SC-13-F	42061	312
42156230M	SC-13M-F	42066	313
42187520	SC-14	42069	312
42187520M	SC-14M	42073	313
42187527	SC-14-D	42077	312
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42187530	SC-14-F	42085	312
42187530M	SC-14M-F	42089	313
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42250027	SC-1-D	42105	312
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42250027L6M	SC-1L6M-D	42807	313
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42312520	SC-2	42129	312
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42312520L6M	SC-2L6M	42817	313
42312520M	SC-2M	42137	313
42312527	SC-2-D	42141	312
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42312527L6M	SC-2L6M-D	42822	313
42312527M	SC-2M-D	42149	313
42312530	SC-2-F	42153	312
42312530L6	SC-2L6-F	42826	312
42312530L6M	SC-2L6M-F	42827	313
42312530M	SC-2M-F	42161	313
42375020	SC-3	42165	312
42375020L6	SC-3L6	42831	312
42375020L6M	SC-3L6M	42832	313
42375020M	SC-3M	42173	313
42375027	SC-3-D	42177	312
42375027L6	SC-3L6-D	42836	312
42375027L6M	SC-3L6M-D	42837	313
42375027M	SC-3M-D	42185	313
42375030	SC-3-F	42189	312
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42393027M	SC-3MZ-D	42200	313
42393030M	SC-3MZ-F	42202	313
42437520	SC-4	42213	312
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42437527	SC-4-D	42221	312
42437527M	SC-4M-D	42225	313
42437530	SC-4-F	42229	312
42437530M	SC-4M-F	42233	313
42472020M	SC-5MZ	42204	313
42472027M	SC-5MZ-D	42206	313
42472030M	SC-5MZ-F	42208	313
42500020	SC-5	42237	312
42500020L6	SC-5L6	42846	312
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42500020M	SC-5M	42245	313
42500027	SC-5-D	42253	312
42500027L6	SC-5L6-D	42851	312
42500027L6M	SC-5L6M-D	42852	313
42500027M	SC-5M-D	42261	313
42500030	SC-5-F	42265	312
42500030L6	SC-5L6-F	42856	312
42500030L6M	SC-5L6M-F	42857	313
42500030M	SC-5M-F	42273	313
42500150	SC-5NF	42621	312
42500150M	SC-5NFM	42285	313
42625020	SC-6	42289	312
42625020M	SC-6M	42293	313
42625027	SC-6-D	42297	312
42625027M	SC-6M-D	42301	313
42625030	SC-6-F	42305	312
42625030M	SC-6M-F	42309	313
42625150	SC-6NF	42641	312
42625150M	SC-6NFM	42321	313
42750020	SC-7	42325	312
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42750030	SC-7-F	42341	312
42750030M	SC-7M-F	42345	313
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43100030	SD-9-F	43017	314
43100030M	SD-9M-F	43021	315
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43125020M	SD-11M	43029	315
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43125027M	SD-11M-D	43037	315
43125030	SD-11-F	43041	314
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43187527	SD-14-D	43057	314
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43187530M	SD-14M-F	43069	315
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43250020L6	SD-1L6	43801	314
43250020L6M	SD-1L6M	43802	315
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49625030	SH-6-F	49169	322
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69050030M	SD-42M-F	69165	315
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69150020L3	SL-42L3	69833	326
69150020L3M	SL-42L76M	69834	327
69150020M	SL-42M	69493	327
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69165020M	SN-41M	69541	330
69165027	SN-41-D	69545	330
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70060020M	SG-51M	70137	321
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70070020M	SM-51M	70161	329
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70070027M	SM-51M-D	70169	329
70070030	SM-51-F	70173	328
70070030M	SM-51M-F	70177	329
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70080020M	SN-51M	70185	330
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71020030	Set 2 Fine	71041	331
71020030M	Set 2 Fine mm	71045	331
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71030020M	Set 3 Std mm	71053	331
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71030027M	Set 3 Dbl mm	71061	331
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71040020M	Set 4 Std mm	71077	331
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72030027M	SA-53M-D	72061	309
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72030030M	SA-53M-F	72069	309
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72040020M	SC-53M	72077	313
72040027	SC-53-D	72081	312
72040027M	SC-53M-D	72085	313
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72040030M	SC-53M-F	72093	313
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72080030	SF-53-F	72185	318
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72110027	SN-53-D	72249	330
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72120020M	SL-53M	72269	327
72120027	SL-53-D	72273	326
72120027M	SL-53M-D	72277	327
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74020027	SC-81-D	74017	312
74020030	SC-81-F	74021	312
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74030027	SD-81-D	74029	314
74030030	SD-81-F	74033	314
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74040030	SE-81-F	74045	316
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74050027	SH-81-D	74053	322
74050030	SH-81-F	74057	322
74060020	SF-81	74061	318
74060027	SF-81-D	74065	318
74060030	SF-81-F	74069	318
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74070027	SG-81-D	74077	320
74070030	SG-81-F	74081	320
74080020	SM-81	74085	328
74080027	SM-81-D	74089	328
74080030	SM-81-F	74093	328
74090020	SN-81	74097	330
74090027	SN-81-D	74101	330
74090030	SN-81-F	74105	330
74100020	SL-81	74109	326
74100027	SL-81-D	74113	326
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High Precision Boring

M.A. Ford® Solid Carbide Boring Tools are designed for high-precision finish boring in a wide range of materials, including cast iron, stainless steel, alloy steels, and non-ferrous, non-metallic materials. Available in stub lengths, standard lengths, long lengths and metric shank sizes, M.A. Ford® solid carbide boring tools provide maximum rigidity, and feature hand-lapped cutting surfaces for high-precision finishes.

Speed and Feed Recommendations

Proper speed and feed rates are critical for achieving the desired finish when boring. Incorrect speeds typically result in one of two types of tool failure. If speeds are too slow, a built up edge can occur on the tool, resulting in potential damage to the tool and the workpiece finish. When speeds are too high, excessive tool wear will occur and poor surface finishes will ultimately result. As a general rule, speeds have to be reduced in hard or difficult to machine materials.

Incorrect feeds also can cause excessive tool wear and inferior surface finishes. Feed rates that are too slow allow excessive heat to build up, increasing tool wear. Having too high of a feed rate will increase the load on the tool, which can result in tool breakage and potential damage to the workpiece.

The minimum bore diameter (D1) of the tool is the minimum size that can be bored. The maximum bore depth (L2) is the maximum depth that can be bored.

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

Solid Carbide Boring Tool Series

Series 308
Series 308W
Series 309
Series 309W
Series 310
Series 310W
Series 330
Series 330W

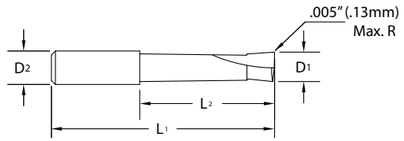
Designed and Manufactured in the USA

ISO 9001:2000 Certified

An ESOP Company

Carbide Boring Tool
Series 308

3/8” Steel Shank



Tool No.	EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
30820200	92901	.02	3/8	2	1/16
30820300	92903	.03	3/8	2	5/64
30820400	92905	.04	3/8	2	3/32
30820500	92907	.05	3/8	2	1/8
30820600	92909	.06	3/8	2	3/16
30820600L	92911	.06	3/8	2	5/16
30820700	92913	.07	3/8	2	1/4
30820800	92915	.08	3/8	2	3/8
30820900	92917	.09	3/8	2-1/2	1/2
30820900L	92919	.09	3/8	2-1/2	3/4
30821200	92921	.12	3/8	2-1/2	5/8
30821200L	92923	.12	3/8	2-3/4	1
30821500	92925	.15	3/8	2-1/2	3/4
30821500L	92927	.15	3/8	3	1-1/4
30821800	92929	.18	3/8	2-1/2	1
30821800L	92931	.18	3/8	3-1/4	1-1/2
30822100	92933	.21	3/8	2-1/2	1
30822100L	92935	.21	3/8	3-3/4	1-3/4
30822400	92937	.24	3/8	2-1/2	1
30822400L	92939	.24	3/8	3-3/4	2
30822700	92941	.27	3/8	2-1/2	1-1/4
30823000	92943	.30	3/8	2-1/2	1-1/4
30823000L	92945	.30	3/8	4-1/4	2-1/2

Technical information on page 341.

D1 Std. Length	Tolerance
.020-.060	+.000/-.002
.070-.300	+.000/-.003
D1 Long Length	**Tolerance**
.060-.300	+.000/-.002

D2	Tolerance
.020-.300	+.0000/-.0005

Carbide Boring Tool
Series 308W

3/8” Steel Shank With Weldon Flat

Tool No.	EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
30820200W	92902	.02	3/8	2	1/16
30820300W	92904	.03	3/8	2	5/64
30820400W	92906	.04	3/8	2	3/32
30820500W	92908	.05	3/8	2	1/8
30820600W	92910	.06	3/8	2	3/16
30820600LW	92912	.06	3/8	2	5/16
30820700W	92914	.07	3/8	2	1/4
30820800W	92916	.08	3/8	2	3/8
30820900W	92918	.09	3/8	2-1/2	1/2
30820900LW	92920	.09	3/8	2-1/2	3/4
30821200LW	92924	.12	3/8	2-3/4	1
30821200W	92922	.12	3/8	2-1/2	5/8
30821500W	92926	.15	3/8	2-1/2	3/4
30821500LW	92928	.15	3/8	3	1-1/4
30821800W	92930	.18	3/8	2-1/2	1
30821800LW	92932	.18	3/8	3-1/4	1-1/2
30822100LW	92936	.21	3/8	3-3/4	1-3/4
30822100W	92934	.21	3/8	2-1/2	1
30822400W	92938	.24	3/8	2-1/2	1
30822400LW	92940	.24	3/8	3-3/4	2
30822700W	92942	.27	3/8	2-1/2	1-1/4
30823000W	92944	.30	3/8	2-1/2	1-1/4
30823000LW	92946	.30	3/8	4-1/4	2-1/2

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.

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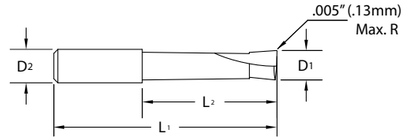
Carbide Boring Tool
Series 309

1/2” Steel Shank



Tool No.	EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
30920200	93001	.02	1/2	2	1/16
30920300	93003	.03	1/2	2	5/64
30920400	93005	.04	1/2	2	3/32
30920500	93007	.05	1/2	2	1/8
30920600	93009	.06	1/2	2-3/4	3/16
30920600L	93010	.06	1/2	2-3/4	5/16
30920700	93011	.07	1/2	2-3/4	1/4
30920800	93013	.08	1/2	2-3/4	3/8
30920900	93015	.09	1/2	3-1/4	1/2
30920900L	93016	.09	1/2	3-1/4	3/4
30921200	93017	.12	1/2	3-1/4	5/8
30921200L	93019	.12	1/2	3-1/2	1
30921500	93021	.15	1/2	3-1/4	3/4
30921500L	93023	.15	1/2	3-1/2	1-1/4
30921800	93025	.18	1/2	3-1/4	1
30921800L	93027	.18	1/2	4	1-1/2
30922100	93029	.21	1/2	3-1/4	1
30922100L	93031	.21	1/2	4-1/4	1-3/4
30922400	93033	.24	1/2	3-1/4	1
30922400L	93035	.24	1/2	4-1/4	2
30922700	93037	.27	1/2	3-1/4	1-1/4
30923000	93039	.30	1/2	3-1/4	1-1/4
30923000L	93041	.30	1/2	4-3/4	2-1/2
30923300	93043	.33	1/2	3-1/4	1-1/2
30923600	93045	.36	1/2	3-1/4	1-1/2
30923600L	93047	.36	1/2	5-1/2	3

Technical information on page 341.

D1 Std. Length	Tolerance
.020-.060	+.000/-.002
.070-.360	+.000/-.003
D1 Long Length	**Tolerance**
.060-.360	+.000/-.002

D2	Tolerance
.020-.360	+.0000/-.0005

Carbide Boring Tool
Series 309W

1/2” Steel Shank With Weldon Flat

Tool No.	EDP	Diameter D1	Shank D2	OAL L1	Flute Length L2
30920200W	93002	.02	1/2	2	1/16
30920300W	93004	.03	1/2	2	5/64
30920400W	93006	.04	1/2	2	3/32
30920500W	93008	.05	1/2	2	1/8
30920600W	93054	.06	1/2	2-3/4	3/16
30920600LW	93050	.06	1/2	2-3/4	5/16
30920700W	93012	.07	1/2	2-3/4	1/4
30920800W	93014	.08	1/2	2-3/4	3/8
30920900W	93056	.09	1/2	3-1/4	1/2
30920900LW	93052	.09	1/2	3-1/4	3/4
30921200W	93018	.12	1/2	3-1/4	5/8
30921200LW	93020	.12	1/2	3-1/2	1
30921500W	93022	.15	1/2	3-1/4	3/4
30921500LW	93024	.15	1/2	3-1/2	1-1/4
30921800W	93026	.18	1/2	3-1/4	1
30921800LW	93028	.18	1/2	4	1-1/2
30922100W	93030	.21	1/2	3-1/4	1
30922100LW	93032	.21	1/2	4-1/4	1-3/4
30922400W	93034	.24	1/2	3-1/4	1
30922400LW	93036	.24	1/2	4-1/4	2
30922700W	93038	.27	1/2	3-1/4	1-1/4
30923000W	93040	.30	1/2	3-1/4	1-1/4
30923000LW	93042	.30	1/2	4-3/4	2-1/2
30923300W	93044	.33	1/2	3-1/4	1-1/2
30923600W	93046	.36	1/2	3-1/4	1-1/2
30923600LW	93048	.36	1/2	5-1/2	3

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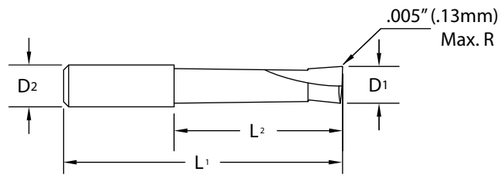
Carbide Boring Tool
Series 310



Tool No.	EDP	Diameter D1 Inch	Diameter D1 mm	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
31020200	92809	.02	.50	1/16	1.6	1-1/2	38	1/16	1.5
31020200S	95415	.02	.50	1/16	1.6	1-1/2	38	.04	1.0
31020300	92811	.03	.75	1/16	1.6	1-1/2	38	5/64	2.0
31020300S	95416	.03	.75	1/16	1.6	1-1/2	38	.06	1.5
31020400	92813	.04	1.00	3/32	2.4	1-1/2	38	3/32	2.4
31020400S	95417	.04	1.00	3/32	2.4	1-1/2	38	.08	2.0
31020500	92815	.05	1.25	3/32	2.4	1-1/2	38	1/8	3.0
31020500S	95418	.05	1.25	3/32	2.4	1-1/2	38	.10	2.5
31020600	92817	.06	1.50	1/8	3.2	1-1/2	38	3/16	4.5
31020600L	92819	.06	1.50	1/8	3.2	1-1/2	38	5/16	8.0
31020600S	95419	.06	1.50	1/8	3.2	1-1/2	38	.12	3.0
31020700	92821	.07	1.80	1/8	3.2	1-1/2	38	1/4	6.0
31020700S	95420	.07	1.80	1/8	3.2	1-1/2	38	.14	3.6
31020800	92823	.08	2.00	1/8	3.2	1-1/2	38	3/8	9.5
31020800S	95421	.08	2.00	1/8	3.2	1-1/2	38	.16	4.0
31020900	92825	.09	2.30	1/8	3.2	1-1/2	38	1/2	12.5
31020900L	92827	.09	2.30	1/8	3.2	2	51	3/4	19.0
31020900S	95422	.09	2.30	1/8	3.2	1-1/2	38	.18	4.6
31021200	92829	.12	3.00	1/8	3.2	1-1/2	38	5/8	16.0
31021200L	92831	.12	3.00	1/8	3.2	2	51	1	25.4
31021200S	95423	.12	3.00	1/8	3.2	1-1/2	38	.24	6.1
31021500	92833	.15	3.80	3/16	4.8	2	51	3/4	19.0
31021500L	92835	.15	3.80	3/16	4.8	2-3/16	56	1-1/4	31.8
31021500S	95424	.15	3.80	3/16	4.8	2	51	.30	7.6
31021800	92837	.18	4.50	3/16	4.8	2	51	1	25.5
31021800L	92839	.18	4.50	3/16	4.8	2-3/4	70	1-1/2	38.1
31021800S	95425	.18	4.50	3/16	4.8	2	51	.36	9.1
31022100	92841	.21	5.30	1/4	6.4	2	51	1	25.5
31022100L	92843	.21	5.30	1/4	6.4	3-1/4	83	1-3/4	44.5
31022100S	95426	.21	5.30	1/4	6.4	2	51	.42	10.7
31022400	92845	.24	6.10	1/4	6.4	2	51	1	25.5
31022400L	92847	.24	6.10	1/4	6.4	3-1/4	83	2	50.8
31022400S	95427	.24	6.10	1/4	6.4	2	51	.45	11.4
31022700	92849	.27	6.90	5/16	8.0	2-1/4	57	1-1/4	32.0
31022700S	95428	.27	6.90	5/16	8.0	2-1/4	57	.45	11.4
31023000	92851	.30	7.60	5/16	8.0	2-1/4	57	1-1/4	32.0
31023000L	92853	.30	7.60	5/16	8.0	3-7/8	98	2-1/2	63.5

Tool No.	EDP	Diameter D1 Inch	Diameter D1 mm	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
31023000S	95429	.30	7.60	5/16	8.0	2-1/4	57	.45	11.4
31023300	92855	.33	8.40	3/8	9.5	2-1/2	63	1-1/2	38.0
31023300S	95430	.33	8.40	3/8	9.5	2-1/2	63	.50	12.7
31023600	92857	.36	9.10	3/8	9.5	2-1/2	63	1-1/2	38.0
31023600L	92859	.36	9.10	3/8	9.5	4-3/4	121	3	76.2
31023600S	95431	.36	9.10	3/8	9.5	2-1/2	63	.54	13.7
31024200	92861	.42	10.70	1/2	12.7	3	76	1-3/4	45.0
31024200S	95432	.42	10.70	1/2	12.7	3	76	.63	16.0
31024800	92865	.48	12.20	1/2	12.7	3	76	2	50.0
31024800S	95433	.48	12.20	1/2	12.7	3	76	.72	18.3

Inch	
D1 Std/Stub Length	Tolerance
.020-.060	+.000/-.002
.070-.480	+.000/-.003
D1 Long Length	Tolerance
.060-.360	+.000/-.002

Inch	
D2	Tolerance
.020-.480	+.0000/-.0005

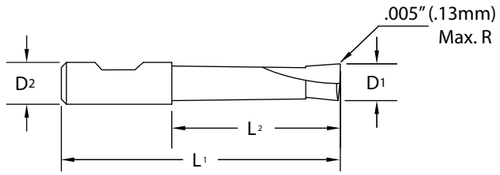
Metric	
D1 Std/Stub Length	Tolerance (mm)
0.50-1.50	+.000/-.051
1.80-12.20	+.000/-.076
D1 Long Length	Tolerance
1.50-9.10	+.000/-.051

Metric	
D2	Tolerance (mm)
0.50-12.20	+.000/-.013

Technical information on page 341.

Carbide Boring Tool
Series 310W

With Weldon Shank Flat



Tool No.	EDP	Diameter D1 Inch	Diameter D1 mm	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
31020200W	92810	.02	.50	1/16	1.6	1-1/2	38	1/16	1.5
31020200SW	92867	.02	.50	1/16	1.6	1-1/2	38	.04	1.0
31020300W	92812	.03	.75	1/16	1.6	1-1/2	38	5/64	2.0
31020300SW	92869	.03	.75	1/16	1.6	1-1/2	38	.06	1.5
31020400W	92814	.04	1.00	3/32	2.4	1-1/2	38	3/32	2.4
31020400SW	92870	.04	1.00	3/32	2.4	1-1/2	38	.08	2.0
31020500W	92816	.05	1.25	3/32	2.4	1-1/2	38	1/8	3.0
31020500SW	92872	.05	1.25	3/32	2.4	1-1/2	38	.10	2.5
31020600W	92818	.06	1.50	1/8	3.2	1-1/2	38	3/16	4.5
31020600LW	92820	.06	1.50	1/8	3.2	1-1/2	38	5/16	8.0
31020600SW	92874	.06	1.50	1/8	3.2	1-1/2	38	.12	3.0
31020700W	92822	.07	1.80	1/8	3.2	1-1/2	38	1/4	6.0
31020700SW	92876	.07	1.80	1/8	3.2	1-1/2	38	.14	3.6
31020800W	92824	.08	2.00	1/8	3.2	1-1/2	38	3/8	9.5
31020800SW	92878	.08	2.00	1/8	3.2	1-1/2	38	.16	4.0
31020900W	92826	.09	2.30	1/8	3.2	1-1/2	38	1/2	12.5
31020900LW	92828	.09	2.30	1/8	3.2	2	51	3/4	19.0
31020900SW	92880	.09	2.30	1/8	3.2	1-1/2	38	.18	4.6
31021200W	92830	.12	3.00	1/8	3.2	1-1/2	38	5/8	16.0
31021200LW	92832	.12	3.00	1/8	3.2	2	51	1	25.4
31021200SW	92882	.12	3.00	1/8	3.2	1-1/2	38	.24	6.1
31021500W	92834	.15	3.80	3/16	4.8	2	51	3/4	19.0
31021500LW	92836	.15	3.80	3/16	4.8	2-3/16	56	1-1/4	31.8
31021500SW	92884	.15	3.80	3/16	4.8	2	51	.30	7.6
31021800W	92838	.18	4.50	3/16	4.8	2	51	1	25.5
31021800LW	92840	.18	4.50	3/16	4.8	2-3/4	70	1-1/2	38.1
31021800SW	92886	.18	4.50	3/16	4.8	2	51	.36	9.1
31022100W	92842	.21	5.30	1/4	6.4	2	51	1	25.5
31022100LW	92844	.21	5.30	1/4	6.4	3-1/4	83	1-3/4	44.5
31022100SW	92888	.21	5.30	1/4	6.4	2	51	.42	10.7
31022400W	92846	.24	6.10	1/4	6.4	2	51	1	25.5
31022400LW	92848	.24	6.10	1/4	6.4	3-1/4	83	2	50.8
31022400SW	92890	.24	6.10	1/4	6.4	2	51	.45	11.4
31022700W	92850	.27	6.90	5/16	8.0	2-1/4	57	1-1/4	32.0
31022700SW	92892	.27	6.90	5/16	8.0	2-1/4	57	.45	11.4
31023000W	92852	.30	7.60	5/16	8.0	2-1/4	57	1-1/4	32.0

Tool No.	EDP	Diameter D1 Inch	Diameter D1 mm	Shank D2 Inch	Shank D2 mm	OAL L1 Inch	OAL L1 mm	Flute Length L2 Inch	Flute Length L2 mm
31023000LW	92854	.30	7.60	5/16	8.0	3-7/8	98	2-1/2	63.5
31023000SW	92894	.30	7.60	5/16	8.0	2-1/4	57	.45	11.4
31023300W	92856	.33	8.40	3/8	9.5	2-1/2	63	1-1/2	38.0
31023300SW	92896	.33	8.40	3/8	9.5	2-1/2	63	.50	12.7
31023600W	92858	.36	9.10	3/8	9.5	2-1/2	63	1-1/2	38.0
31023600LW	92860	.36	9.10	3/8	9.5	4-3/4	121	3	76.2
31023600SW	92898	.36	9.10	3/8	9.5	2-1/2	63	.54	13.7
31024200W	92862	.42	10.70	1/2	12.7	3	76	1-3/4	45.0
31024200SW	92800	.42	10.70	1/2	12.7	3	76	.63	16.0
31024800W	92866	.48	12.20	1/2	12.7	3	76	2	50.0
31024800SW	92868	.48	12.20	1/2	12.7	3	76	.72	18.3

Inch	
D1 Std/Stub Length	Tolerance
.020-.060	+.000/-.002
.070-.480	+.000/-.003
D1 Long Length	Tolerance
.060-.360	+.000/-.002

Inch	
D2	Tolerance
.020-.480	+.0000/-.0005

Metric	
D1 Std/Stub Length	Tolerance (mm)
0.50-1.50	+.000/-.051
1.80-12.20	+.000/-.076
D1 Long Length	Tolerance
1.50-9.10	+.000/-.051

Metric	
D2	Tolerance (mm)
0.50-12.20	+.000/-.013

Technical information on page 341.

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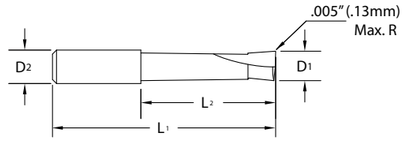
Carbide Boring Tool
Series 330

10mm Steel Shank



		Diameter		Shank		OAL		Flute Length	
		D1		D2		L1		L2	
Tool No.	EDP	Inch	mm	Inch	mm	Inch	mm	Inch	mm
33020200	93401	.02	.50	.3937	10	2	51	1/16	1.5
33020200S	95434	.02	.50	.3937	10	2	51	.04	1.0
33020300	93403	.03	.75	.3937	10	2	51	5/64	2.0
33020300S	95435	.03	.75	.3937	10	2	51	.06	1.5
33020400	93405	.04	1.00	.3937	10	2	51	3/32	2.4
33020400S	95436	.04	1.00	.3937	10	2	51	.08	2.0
33020500	93407	.05	1.25	.3937	10	2	51	1/8	3.0
33020500S	95437	.05	1.25	.3937	10	2	51	.10	2.5
33020600	93409	.06	1.50	.3937	10	2-3/4	70	3/16	4.5
33020600S	95438	.06	1.50	.3937	10	2-3/4	70	.12	3.0
33020700	93411	.07	1.80	.3937	10	2-3/4	70	1/4	6.0
33020700S	95439	.07	1.80	.3937	10	2-3/4	70	.14	3.6
33020800	93413	.08	2.00	.3937	10	2-3/4	70	3/8	9.5
33020800S	95440	.08	2.00	.3937	10	2-3/4	70	.16	4.0
33020900	93415	.09	2.30	.3937	10	3-1/4	83	1/2	12.5
33020900S	95441	.09	2.30	.3937	10	3-1/4	83	.18	4.6
33021200	93417	.12	3.00	.3937	10	3-1/4	83	5/8	16.0
33021200S	95442	.12	3.00	.3937	10	3-1/4	83	.24	6.1
33021500	93419	.15	3.80	.3937	10	3-1/4	83	3/4	19.0
33021500S	95443	.15	3.80	.3937	10	3-1/4	83	.30	7.6
33021800	93421	.18	4.50	.3937	10	3-1/4	83	1	25.5
33021800S	95444	.18	4.50	.3937	10	3-1/4	83	.36	9.1
33022100	93423	.21	5.30	.3937	10	3-1/4	83	1	25.5
33022100S	95445	.21	5.30	.3937	10	3-1/4	83	.42	10.7
33022400	93425	.24	6.10	.3937	10	3-1/4	83	1	25.5
33022400S	95446	.24	6.10	.3937	10	3-1/4	83	.45	11.4

Inch	
D1 Std/Stub Length	Tolerance
.020-.060	+.000/-.002
.070-.240	+.000/-.003

Inch	
D2	Tolerance
.020-.240	+.0000/-.0005

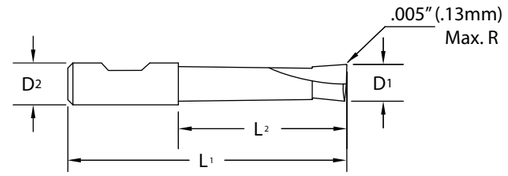
Metric	
D1 Std/Stub Length	Tolerance (mm)
0.50-1.50	+.000/-.051
1.80-6.10	+.000/-.076

Metric	
D2	Tolerance (mm)
0.50-6.10	+.000/-.013

Technical information on page 341.

Carbide Boring Tool
Series 330W

10mm Steel Shank With Weldon Flat



		Diameter		Shank		OAL		Flute Length	
		D1		D2		L1		L2	
Tool No.	EDP	Inch	mm	Inch	mm	Inch	mm	Inch	mm
33020200W	93402	.02	.50	.3937	10	2	51	1/16	1.5
33020200SW	95834	.02	.50	.3937	10	2	51	.04	1.0
33020300W	93404	.03	.75	.3937	10	2	51	5/64	2.0
33020300SW	95835	.03	.75	.3937	10	2	51	.06	1.5
33020400W	93406	.04	1.00	.3937	10	2	51	3/32	2.4
33020400SW	95836	.04	1.00	.3937	10	2	51	.08	2.0
33020500W	93408	.05	1.25	.3937	10	2	51	1/8	3.0
33020500SW	95837	.05	1.25	.3937	10	2	51	.10	2.5
33020600W	93410	.06	1.50	.3937	10	2-3/4	70	3/16	4.5
33020600SW	95838	.06	1.50	.3937	10	2-3/4	70	.12	3.0
33020700W	93412	.07	1.80	.3937	10	2-3/4	70	1/4	6.0
33020700SW	95839	.07	1.80	.3937	10	2-3/4	70	.14	3.6
33020800W	93414	.08	2.00	.3937	10	2-3/4	70	3/8	9.5
33020800SW	95840	.08	2.00	.3937	10	2-3/4	70	.16	4.0
33020900W	93416	.09	2.30	.3937	10	3-1/4	83	1/2	12.5
33020900SW	95841	.09	2.30	.3937	10	3-1/4	83	.18	4.6
33021200W	93418	.12	3.00	.3937	10	3-1/4	83	5/8	16.0
33021200SW	95842	.12	3.00	.3937	10	3-1/4	83	.24	6.1
33021500W	93420	.15	3.80	.3937	10	3-1/4	83	3/4	19.0
33021500SW	95843	.15	3.80	.3937	10	3-1/4	83	.30	7.6
33021800W	93422	.18	4.50	.3937	10	3-1/4	83	1	25.5
33021800SW	95844	.18	4.50	.3937	10	3-1/4	83	.36	9.1
33022100W	93424	.21	5.30	.3937	10	3-1/4	83	1	25.5
33022100SW	95845	.21	5.30	.3937	10	3-1/4	83	.42	10.7
33022400W	93426	.24	6.10	.3937	10	3-1/4	83	1	25.5
33022400SW	95846	.24	6.10	.3937	10	3-1/4	83	.45	11.4

Inch	
D1 Std/Stub Length	Tolerance
.020-.060	+.000/-.002
.070-.240	+.000/-.003

Inch	
D2	Tolerance
.020-.240	+.0000/-.0005

Metric	
D1 Std/Stub Length	Tolerance (mm)
0.50-1.50	+.000/-.051
1.80-6.10	+.000/-.076

Metric	
D2	Tolerance (mm)
0.50-6.10	+.000/-.013

Technical information on page 341.

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 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 SMM) - Approximately 30,000 RPM for a 3/32-inch (2.4mm) router and 23,000 RPM for a 1/8-inch (3.175mm) router. Speeds must be reduced for Teflon circuit boards.

Diamond Grind Routers should be fed approximately .002 inch-per-revolution (.05mm/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.).

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.

Diamond Grind Routers Series

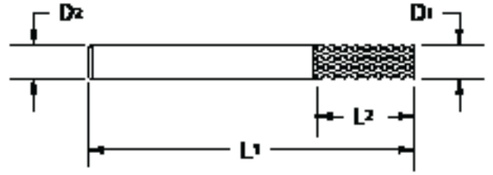
Series 230
Series 231
Series 231B
Series 231D
Series 231F

Designed and Manufactured in the USA

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

Diamond Grind Routers
Series 230/231

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



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

Series 230
Down Cut
Safe End

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

Series 230		Series 231		Series 231B		Series 231D		Series 231F		Diameter D1			Shank D2		OAL L1		Flute Length L2	
Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	Tool No.	EDP	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	

Technical information on page 348.

For product information, call your local distributor.

Custom Tool Division

Engineering and Manufacturing Excellence

The true value of a tool is measured by its ability to increase productivity through superior craftsmanship, performance and tool life.

The M.A. Ford® Custom Tool Division focuses on meeting the growing need for unique and increasingly complex special cutting tools. By partnering with select machine tool users the Custom Tool Division develops and supplies custom engineered carbide tools of unmatched quality which meet or exceed their productivity, delivery and utilized cost expectations. Custom tools are proven to increase speeds and feeds, save setup and handling time which in turn leads to faster run times, more efficient manufacturing and most importantly, INCREASED PROFITS.

Meeting the growing need for unique and increasingly complex high performance custom cutting tools in today's industry

To support your productivity improvement efforts, we offer the following services:

- Technical assistance in prototype custom tool design.
- Re-engineering of existing custom tooling to optimize tool performance.
- Tool manufacturing lead times which meet or exceed your delivery requirements.
- Immediate response to quotation request.
- Readily available technical phone support.
- Field representative support service.
- Emergency tool service.
- Custom tools of the highest quality.

We offer application development, design and manufacturing expertise in the following product classifications:

- High Performance Drills
- G-Drills
- Step Drill Reamers
- Coolant Thru Specials
- Step Reamers
- Coolant Thru Reamers
- Custom End Mills
- Custom Form Tools

Application Specific

Quality

Support

Call us today to increase your productivity and profits with Custom Tooling

1-877-522-2885

e-mail: customtools@maford.com

Rock Bit Photo Courtesy of Varel International

Custom Tool Division

M.A. FORD
High Performance Cutting Tools

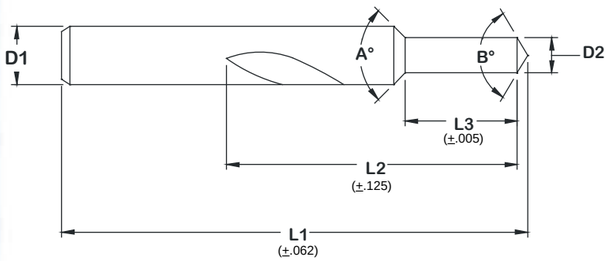
Custom Tool Division
Engineering & Manufacturing Excellence

Custom Tool Request Form

Step Drill Dimensions

1. Fill in information requested on drawing.
   (*Required Fields)
2. Fax to M.A. Ford® at: **877-502-9521**

☐ Request Approval Drawing



A= _____

B= _____

D1= _____

D2= _____

L1= _____

L2= _____

L3= _____

***Material**
☐Solid Carbide
☐Carbide Coolant Thru

***Number of Flutes**
☐Two
☐Three

***Margin Style**
☐Single
☐Double

***Major Diameter**
☐Cutting
☐Non-Cutting

***Flute Form**
☐ Straight / G-Drill
☐ Helical_____° Helix on Major Dia.

***Coating**
☐ TiN
☐ TiCN
☐ TiAlN
☐ None
Other_____

Note:
This information enables us to engineer and manufacture a tool for your specific requirements.

Customer Name: _____

Phone: _____

*Work Material Machined: _____

Hardness: _____

Distributor: _____

Quantities: (6 Piece Minimum) _____

Custom Tool Division

M.A. FORD
High Performance Cutting Tools

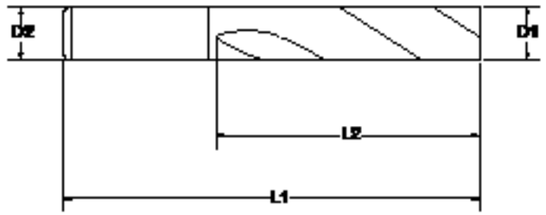
Custom Tool Division
Engineering & Manufacturing Excellence

Custom Tool Request Form

End Mill

1. Fill in information requested on drawing.
   (*Required Fields)
2. Fax to M.A. Ford® at: **877-502-9521**

☐ Request Approval Drawing



D1= _____

D2= _____

L1= _____

L2= _____

***Material**
☐Solid Carbide
☐Carbide Coolant Thru

***Number of Flutes**
_____

***Flute Form**
☐Straight
☐Helical _____ ° Helix

***Shank**
☐Cylindrical
☐Shank Flat
Flat Style _____

Other
☐Corner Radius_____ +/-.002”
☐Corner Chamfer____x ____°
☐Chipbreaker

***Coating**
☐ TiN
☐ TiCN
☐ TiAlN
☐ None
Other_____

Note:
This information enables us to engineer and manufacture a tool for your specific requirements.

Customer Name: _____

Phone: _____

*Work Material Machined: _____

Hardness: _____

Distributor: _____

Quantities: (6 Piece Minimum) _____

See something you would like to try?

Complete this form to request your FREE tool!*

Company Information:	
Distributor Name:	End User Name:
Requested By:	Contact :
Address:	Ship to Address:
City, State, Zip:	City, State, Zip:
Phone:	Phone: Ship Via:
Fax:	Fax:
e-mail Address:	e-mail Address:

M.A. Ford® Sales Rep.: _____

M.A. Ford® Trial Tool Requested:

Qty/Tool # _____ Qty/Tool # _____ Qty/Tool # _____

Comments: _____

_____

_____

Additional Information:			
Application Description:			
Machine Type	Horizontal ☐	Vertical ☐	Other ☐
RPM		Horsepower	
Condition	Good ☐	Fair ☐	Poor ☐
Material		Hardness	
Coolant?	Yes ☐	No ☐	Type

Current Tooling Appraisal:	
Current Tool:	
Mfg.	Part #
Feed Rate:	
RPM:	
Width/Depth of Cut:	
Hole Depth:	
No. Holes Produced:	
No. Parts Produced:	
Production Rate:	

*All requests subject to approval. An M.A. Ford® representative will contact you to discuss your application.

Please send this form to M.A. Ford® 7737 Northwest Blvd. Davenport, IA 52806 or
Fax to: 800-892-9522 / 563-386-7660.

Ph: 800-553-8024 / 563-391-6220 • www.maford.com • sales@maford.com

Trial Tool Results Form

Company Information:	
Contact:	Date:
Company Name:	Phone:
Address:	Order Number:
City, State, Zip	e-mail Address:

Work Material:
Hardness:
Machine Type:
Coolant Type:

Application		
Drilling ☐	Milling ☐	Other ☐
Explain:		
Spindle		
Horizontal ☐	Vertical ☐	Other ☐
Explain:		

	Competitor	M.A. Ford®
Company Name		
Tool Number		
Recommended SFM		
Recommended IPR		
RPM		
Feed Rate		
Tool Life		
Number of holes		
Number of inches		
Failure Type		

Comments:

For Internal Use:	
Results Approved?	Need More Information

FORM # TrialResults 3/31/09

RED BOX
Factory Reconditioning Service

Extend the life of your Cutting Tools with M.A. Ford®'s Factory Reconditioning / Recoating Service.


Before


After

Drills
End Mills
Countersinks
Burs

- Simplified Pricing Structure.
- No Minimum Order Value.
- Original Coatings.
- M.A. Ford® Quality Workmanship.
- Tools Reground to Factory Specifications.
- Quick Turnaround.

SAVE
and
***Go Green* with Red Box!**

RETURN • RECONDITION • REDUCE COST

See www.maford.com / Reconditioning for details.

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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® 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 Cromium 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.

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.

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 Coat
Amorphous Diamond. Gem is M.A. Ford®'s answer to diamond coated tooling. It has the hardness of diamond, the smoothness of typical PVD coatings, and excellent thermal stability. It is excellent for milling graphite and aluminum.

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.

Coating Properties

MA Ford® Coating	MA Ford® Tool Number Designation	Microhardness (HV)	Maximum Service Temp.	Friction Coefficient
ALtima®	A	3100	1100° C / 2012° F	0.42
ALtima® 52	A	3600	1200° C / 2192° F	0.40
ALtima® Blaze	B	3200	1100° C / 2012° F	0.35
TiN	T	2300	600° C / 1112° F	0.40
TiCN	C	3000	400° C / 752° F	0.40
Fordlube	F	4000	700° C / 1292° F	0.30
Gem	G	8000	700° C / 1292° F	0.10

Notes:

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 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 for your local M.A. Ford® representative.

For special or unique applications that require more than standard tooling, M.A. Ford®'s Custom Tooling Division can design a unique solution for your specific application, meeting the best possible solution for your manufacturing requirements. The Custom Tool Division is part of our on-going strategic focus on being the industry's Best Value Tooling Partner in Innovation for Today's Industries.

M.A. Ford®'s Complete Product Line

Twister® Drills
TuffCut® End Mills
TrueSize® Reamers
Countersinks
Edge Hog® Carbide Burs
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Micro Tools
Custom Tools




Innovation for Today's Industries

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ISO 9001:2000 Certified

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Fax: 563-386-7660 or 800-892-9522
email: sales@maford.com

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Thane (W) - 400607
Maharashtra, India
Ph: +91 22 41612222
Fax: +91 22 41612206
email: salesindia@maford.com

M.A. Ford® Europe Ltd.
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Pride Park, Derby DE24 8AJ
United Kingdom
Ph: +44 (0) 1332 267960
Fax: +44 (0) 1332 267969
email: sales@mafordeurope.com

www.maford.com

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