

NEW

M.A. FORD JobShop



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



Catalog 2022

www.maford.com

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



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

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



ISO 9001:2015 Certified



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

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 www.maford.com

 sales@maford.com

 563-391-6220/800-553-8024

YOUR ^{M.A.}FORD JobShop CATALOG

Featuring M.A. Ford® cutting tools designed for short run manufacturing at an economical price point.

Series Number by Page

HP Drills		
Series No.	Cat. Pg.	Tech Pg.
HPDSS	6	25
HPDCS	6	26
HPDSR	11	25
HPDCR	11	26

GP Drills		
Series No.	Cat. Pg.	Tech Pg.
204	16	27
205	19	28
206	22	27

HP End Mills		
Series No.	Cat. Pg.	Tech Pg.
177	30	47
178	34	49
178N	37	49
179	39	47

GP End Mills		
Series No.	Cat. Pg.	Tech Pg.
111	41	51
140	43	51
121	44	51
150	46	51

HP Chamfer Mills		
Series No.	Cat. Pg.	Tech Pg.
3HC	59	61
5HC	59	61
Kits & Sets	60	61

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. **Read applicable SDS.**



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Twister® HP Drills - Page 5 - 15

Series	Tool Illustration	Coolant	Size Range	Length	Drill Point Angle	Helix Angle	Material Group	Page
HPDSS	 Single Margin		3.0mm - 16.0mm #31-5/8"		140°	30°		6
HPDCS	 Single Margin		3.0mm - 16.0mm #31-5/8"		140°	30°		6
HPDSR	 Single Margin		3.0mm - 16.0mm #31-5/8"		140°	30°		11
HPDCR	 Single Margin		3.0mm - 16.0mm #31-5/8"		140°	30°		11
Technical Information								25

Twister® GP Drills - Page 16 - 24

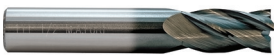
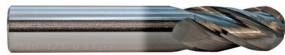
Series	Tool Illustration	Coolant	Size Range	Length	Drill Point Angle	Helix Angle	Material Group	Page
204	 Jobbers Drill		1/8"-5/8"		118°	21°		16
205	 Hi-Tuff®		1/8"-25/32"		135°	12°		19
206	 Stub		1/8"-5/8"		118°	21°		22
Technical Information								27

TuffCut® HP End Mills - Page 29 - 39

Series	Tool Illustration	Z	Size Range	Length	Corner Type	Helix Angle	Material Group	Page
177	 Center Cutting	4	1/16" - 1"		Square End Corner Radius	35°/38° Variable		30
178	 Center Cutting	5	1/8" - 1"		Square End Corner Radius	38°		34
178N	 Center Cutting Neck Relief	5	1/4" - 1"		Corner Radius	38°		37
179	 Center Cutting	4	1/16" - 1"		Ball Nose	35°/38° Variable		39
Technical Information								47

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TuffCut® GP End Mills - Page 40 - 46

Series	Tool Illustration	Z	Size Range	Length	Corner Type	Helix Angle	Material Group	Page
111	 Center Cutting	4	1/8" - 1"		Square End Corner Radius	30°		41
140	 Center Cutting	4	1/8" - 1"		Ball Nose	30°		43
121	 Center Cutting	2	1/8" - 1"		Square End Corner Radius	30°		44
150	 Center Cutting	2	1/8" - 1"		Ball Nose	30°		46
Technical Information								51

Chamfer Mills - Page 58 - 60

Series	Tool Illustration	Z	Size Range	Point Angle	Helix Angle	Material Group	Page
3HC		3	1/8" - 1/2"	60° 90°	Helical		59
5HC		5	1/4" - 1/2"	60° 90°	Helical		59
Kits & Sets			1/8" - 1/2"	60° 90°	Helical		60
Technical Information							61



Icon Glossary

Drill Icons

	Solid Carbide		12° Helix Angle
	Coolant Fed		Coatings
	Drill Length		DIN Specs
	Drill Point Angle		

Workpiece Material Group

		Steels
		Hardened Steels (35-65Rc)
		Stainless Steels
		Cast Iron
		Special Alloys
		Non-Ferrous

End Mill Icons

	Number of Flutes		Neck Relief
	Center Cutting		Corner Radius
	Lengths		Shank
	Coatings		Shank/DIN
	Helix Angle		Chipbreaker
	Ball Nose		

Workpiece Material Group

		Steels
		Hardened Steels (35-65Rc)
		Stainless Steels
		Cast Iron
		Special Alloys
		Non-Ferrous

For product information, call your local distributor.

Need a coated tool?

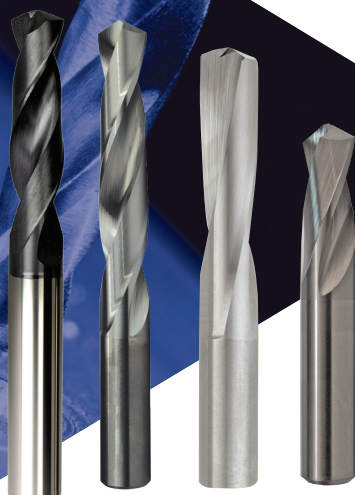
Any uncoated standard catalog tool can be coated - Contact Customer Service for available options.

Available coatings



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Twister® 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.
- Available in a wide range of styles, sizes, lengths and coatings.
- Size ranges #102 (.0039") to 25/32" and 0.1mm to 20.0mm.
- See full line catalog or visit www.maford.com for complete offering.

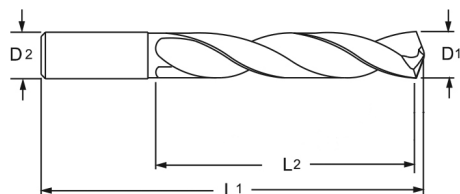


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Series HPDSS & HPDCS



- Self centering point that eliminates the need for spot drilling.
- 45° corner chamfer angle helps material break out on through hole applications and minimizes burs.
- h7 OD tolerance for precision holes.
- ALtima® Coating provides high toughness with low friction.
- 3X Diameter with solid and coolant through options.
- $\geq 4.1\text{mm}$ (.1614") manufactured to DIN 6537K.
- h6 Shank OD Tolerance for shrink fit applications.
- Material Applications:
Steels, Stainless Steels, Cast Iron and Titanium.
- An economical choice perfect for job shop and batch production work requiring a high performance drill option.
- Max drill depth = $L2 - 1.5 \times D1$

ALtima®				Diameter			Shank	OAL	Flute Length
HPDSS		HPDCS		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSS 0300A	19147	HPDCS 0300A	19000	-	3	.1181	3	62	20
HPDSS1200A	19277	HPDCS1200A	19130	#31	-	.1200	4	62	20
HPDSS 0310A	19148	HPDCS 0310A	19001	-	3.1	.1220	4	62	20
HPDSS1250A	19278	HPDCS1250A	19131	1/8	-	.1250	4	62	20
HPDSS 0320A	19149	HPDCS 0320A	19002	-	3.2	.1260	4	62	20
HPDSS1285A	19279	HPDCS1285A	19132	#30	-	.1285	4	62	20
HPDSS 0330A	19150	HPDCS 0330A	19003	-	3.3	.1299	4	62	20
HPDSS 0340A	19151	HPDCS 0340A	19004	-	3.4	.1339	4	62	20
HPDSS1360A	19280	HPDCS1360A	19133	#29	-	.1360	4	62	20
HPDSS 0350A	19152	HPDCS 0350A	19005	-	3.5	.1378	4	62	20
HPDSS 0360A	19153	HPDCS 0360A	19006	-	3.6	.1417	4	62	20
HPDSS 0370A	19154	HPDCS 0370A	19007	-	3.7	.1457	4	62	20
HPDSS 0380A	19155	HPDCS 0380A	19008	-	3.8	.1496	4	66	24
HPDSS 0390A	19156	HPDCS 0390A	19009	-	3.9	.1535	4	66	24
HPDSS1562A	19281	HPDCS1562A	19134	5/32	-	.1562	4	66	24
HPDSS 0400A	19157	HPDCS 0400A	19010	-	4	.1575	4	66	24
HPDSS1590A	19282	HPDCS1590A	19135	#21	-	.1590	6	66	24



Series HPDSS & HPDCS Continued

Altima®				Diameter			Shank	OAL	Flute Length
 HPDSS		 HPDCS		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSS 0410A	19158	HPDCS 0410A	19011	-	4.1	.1614	6	66	24
HPDSS 0420A	19159	HPDCS 0420A	19012	-	4.2	.1654	6	66	24
HPDSS 0430A	19160	HPDCS 0430A	19013	-	4.3	.1693	6	66	24
HPDSS 0440A	19161	HPDCS 0440A	19014	-	4.4	.1732	6	66	24
HPDSS 0450A	19162	HPDCS 0450A	19015	-	4.5	.1772	6	66	24
HPDSS 0460A	19163	HPDCS 0460A	19016	-	4.6	.1811	6	66	24
HPDSS 0470A	19164	HPDCS 0470A	19017	-	4.7	.1850	6	66	24
HPDSS1875A	19283	HPDCS1875A	19136	3/16	-	.1875	6	66	28
HPDSS 0480A	19165	HPDCS 0480A	19018	-	4.8	.1890	6	66	28
HPDSS 0490A	19166	HPDCS 0490A	19019	-	4.9	.1929	6	66	28
HPDSS 0500A	19167	HPDCS 0500A	19020	-	5	.1968	6	66	28
HPDSS 0510A	19168	HPDCS 0510A	19021	-	5.1	.2008	6	66	28
HPDSS2031A	19284	HPDCS2031A	19137	13/64	-	.2031	6	66	28
HPDSS 0520A	19169	HPDCS 0520A	19022	-	5.2	.2047	6	66	28
HPDSS 0530A	19170	HPDCS 0530A	19023	-	5.3	.2087	6	66	28
HPDSS 0540A	19171	HPDCS 0540A	19024	-	5.4	.2126	6	66	28
HPDSS 0550A	19172	HPDCS 0550A	19025	-	5.5	.2165	6	66	28
HPDSS2187A	19285	HPDCS2187A	19138	7/32	-	.2187	6	66	28
HPDSS 0560A	19173	HPDCS 0560A	19026	-	5.6	.2205	6	66	28
HPDSS 0570A	19174	HPDCS 0570A	19027	-	5.7	.2244	6	66	28
HPDSS 0580A	19175	HPDCS 0580A	19028	-	5.8	.2283	6	66	28
HPDSS 0590A	19176	HPDCS 0590A	19029	-	5.9	.2323	6	66	28
HPDSS 0600A	19177	HPDCS 0600A	19030	-	6	.2362	6	66	28
HPDSS 0610A	19178	HPDCS 0610A	19031	-	6.1	.2402	8	79	34
HPDSS 0620A	19179	HPDCS 0620A	19032	-	6.2	.2441	8	79	34
HPDSS 0630A	19180	HPDCS 0630A	19033	-	6.3	.2480	8	79	34
HPDSS2500A	19286	HPDCS2500A	19139	1/4	-	.2500	8	79	34
HPDSS 0640A	19181	HPDCS 0640A	19034	-	6.4	.2520	8	79	34
HPDSS 0650A	19182	HPDCS 0650A	19035	-	6.5	.2559	8	79	34
HPDSS2570A	19287	HPDCS2570A	19140	F	-	.2570	8	79	34
HPDSS 0660A	19183	HPDCS 0660A	19036	-	6.6	.2598	8	79	34
HPDSS 0670A	19184	HPDCS 0670A	19037	-	6.7	.2638	8	79	34
HPDSS 0680A	19185	HPDCS 0680A	19038	-	6.8	.2677	8	79	34
HPDSS 0690A	19186	HPDCS 0690A	19039	-	6.9	.2717	8	79	34
HPDSS 0700A	19187	HPDCS 0700A	19040	-	7	.2756	8	79	34
HPDSS 0710A	19188	HPDCS 0710A	19041	-	7.1	.2795	8	79	41
HPDSS2812A	19288	HPDCS2812A	19141	9/32	-	.2812	8	79	41

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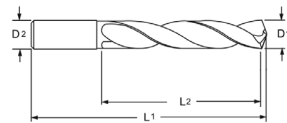
Series HPDSS & HPDCS Continued

Altima®				Diameter			Shank	OAL	Flute Length
HPDSS		HPDCS		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSS 0720A	19189	HPDCS 0720A	19042	-	7.2	.2835	8	79	41
HPDSS 0730A	19190	HPDCS 0730A	19043	-	7.3	.2874	8	79	41
HPDSS 0740A	19191	HPDCS 0740A	19044	-	7.4	.2913	8	79	41
HPDSS 0750A	19192	HPDCS 0750A	19045	-	7.5	.2953	8	79	41
HPDSS 0760A	19193	HPDCS 0760A	19046	-	7.6	.2992	8	79	41
HPDSS 0770A	19194	HPDCS 0770A	19047	-	7.7	.3031	8	79	41
HPDSS 0780A	19195	HPDCS 0780A	19048	-	7.8	.3071	8	79	41
HPDSS 0790A	19196	HPDCS 0790A	19049	-	7.9	.3110	8	79	41
HPDSS3125A	19289	HPDCS3125A	19142	5/16	-	.3125	8	79	41
HPDSS 0800A	19197	HPDCS 0800A	19050	-	8	.3150	8	79	41
HPDSS 0810A	19198	HPDCS 0810A	19051	-	8.1	.3189	10	89	47
HPDSS 0820A	19199	HPDCS 0820A	19052	-	8.2	.3228	10	89	47
HPDSS 0830A	19200	HPDCS 0830A	19053	-	8.3	.3268	10	89	47
HPDSS 0840A	19201	HPDCS 0840A	19054	-	8.4	.3307	10	89	47
HPDSS 0850A	19202	HPDCS 0850A	19055	-	8.5	.3346	10	89	47
HPDSS 0860A	19203	HPDCS 0860A	19056	-	8.6	.3386	10	89	47
HPDSS 0870A	19204	HPDCS 0870A	19057	-	8.7	.3425	10	89	47
HPDSS 0880A	19205	HPDCS 0880A	19058	-	8.8	.3465	10	89	47
HPDSS 0890A	19206	HPDCS 0890A	19059	-	8.9	.3504	10	89	47
HPDSS 0900A	19207	HPDCS 0900A	19060	-	9	.3543	10	89	47
HPDSS 0910A	19208	HPDCS 0910A	19061	-	9.1	.3583	10	89	47
HPDSS 0920A	19209	HPDCS 0920A	19062	-	9.2	.3622	10	89	47
HPDSS 0930A	19210	HPDCS 0930A	19063	-	9.3	.3661	10	89	47
HPDSS 0940A	19211	HPDCS 0940A	19064	-	9.4	.3701	10	89	47
HPDSS 0950A	19212	HPDCS 0950A	19065	-	9.5	.3740	10	89	47
HPDSS3750A	19290	HPDCS3750A	19143	3/8	-	.3750	10	89	47
HPDSS 0960A	19213	HPDCS 0960A	19066	-	9.6	.3780	10	89	47
HPDSS 0970A	19214	HPDCS 0970A	19067	-	9.7	.3819	10	89	47
HPDSS 0980A	19215	HPDCS 0980A	19068	-	9.8	.3858	10	89	47
HPDSS 0990A	19216	HPDCS 0990A	19069	-	9.9	.3898	10	89	47
HPDSS 1000A	19217	HPDCS 1000A	19070	-	10	.3937	10	89	47
HPDSS 1010A	19218	HPDCS 1010A	19071	-	10.1	.3976	12	102	55
HPDSS 1020A	19219	HPDCS 1020A	19072	-	10.2	.4016	12	102	55
HPDSS 1030A	19220	HPDCS 1030A	19073	-	10.3	.4055	12	102	55
HPDSS 1040A	19221	HPDCS 1040A	19074	-	10.4	.4094	12	102	55
HPDSS 1050A	19222	HPDCS 1050A	19075	-	10.5	.4134	12	102	55
HPDSS 1060A	19223	HPDCS 1060A	19076	-	10.6	.4173	12	102	55

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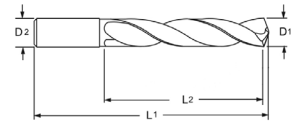
Series HPDSS & HPDCS Continued



Altima®				Diameter			Shank	OAL	Flute Length
HPDSS		HPDCS		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSS 1070A	19224	HPDCS 1070A	19077	-	10.7	.4213	12	102	55
HPDSS 1080A	19225	HPDCS 1080A	19078	-	10.8	.4252	12	102	55
HPDSS 1090A	19226	HPDCS 1090A	19079	-	10.9	.4291	12	102	55
HPDSS 1100A	19227	HPDCS 1100A	19080	-	11	.4331	12	102	55
HPDSS 1110A	19228	HPDCS 1110A	19081	-	11.1	.4370	12	102	55
HPDSS4375A	19291	HPDCS4375A	19144	7/16	-	.4375	12	102	55
HPDSS 1120A	19229	HPDCS 1120A	19082	-	11.2	.4409	12	102	55
HPDSS 1130A	19230	HPDCS 1130A	19083	-	11.3	.4449	12	102	55
HPDSS 1140A	19231	HPDCS 1140A	19084	-	11.4	.4488	12	102	55
HPDSS 1150A	19232	HPDCS 1150A	19085	-	11.5	.4527	12	102	55
HPDSS 1160A	19233	HPDCS 1160A	19086	-	11.6	.4567	12	102	55
HPDSS 1170A	19234	HPDCS 1170A	19087	-	11.7	.4606	12	102	55
HPDSS 1180A	19235	HPDCS 1180A	19088	-	11.8	.4646	12	102	55
HPDSS 1190A	19236	HPDCS 1190A	19089	-	11.9	.4685	12	102	55
HPDSS 1200A	19237	HPDCS 1200A	19090	-	12	.4724	12	102	55
HPDSS 1210A	19238	HPDCS 1210A	19091	-	12.1	.4764	14	107	60
HPDSS 1220A	19239	HPDCS 1220A	19092	-	12.2	.4803	14	107	60
HPDSS 1230A	19240	HPDCS 1230A	19093	-	12.3	.4842	14	107	60
HPDSS 1240A	19241	HPDCS 1240A	19094	-	12.4	.4882	14	107	60
HPDSS 1250A	19242	HPDCS 1250A	19095	-	12.5	.4921	14	107	60
HPDSS 1260A	19243	HPDCS 1260A	19096	-	12.6	.4961	14	107	60
HPDSS5000A	19292	HPDCS5000A	19145	1/2	-	.5000	14	107	60
HPDSS 1280A	19244	HPDCS 1280A	19097	-	12.8	.5039	14	107	60
HPDSS 1290A	19245	HPDCS 1290A	19098	-	12.9	.5079	14	107	60
HPDSS 1300A	19246	HPDCS 1300A	19099	-	13	.5118	14	107	60
HPDSS 1310A	19247	HPDCS 1310A	19100	-	13.1	.5157	14	107	60
HPDSS 1320A	19248	HPDCS 1320A	19101	-	13.2	.5197	14	107	60
HPDSS 1330A	19249	HPDCS 1330A	19102	-	13.3	.5236	14	107	60
HPDSS 1340A	19250	HPDCS 1340A	19103	-	13.4	.5276	14	107	60
HPDSS 1350A	19251	HPDCS 1350A	19104	-	13.5	.5315	14	107	60
HPDSS 1360A	19252	HPDCS 1360A	19105	-	13.6	.5354	14	107	60
HPDSS 1370A	19253	HPDCS 1370A	19106	-	13.7	.5394	14	107	60
HPDSS 1380A	19254	HPDCS 1380A	19107	-	13.8	.5433	14	107	60
HPDSS 1390A	19255	HPDCS 1390A	19108	-	13.9	.5472	14	107	60
HPDSS 1400A	19256	HPDCS 1400A	19109	-	14	.5512	14	107	60
HPDSS 1410A	19257	HPDCS 1410A	19110	-	14.1	.5551	16	115	65
HPDSS 1420A	19258	HPDCS 1420A	19111	-	14.2	.5591	16	115	65

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Series HPDSS & HPDCS Continued



Altima®				Diameter			Shank	OAL	Flute Length
HPDSS		HPDCS		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSS 1430A	19259	HPDCS 1430A	19112	-	14.3	.5630	16	115	65
HPDSS 1440A	19260	HPDCS 1440A	19113	-	14.4	.5669	16	115	65
HPDSS 1450A	19261	HPDCS 1450A	19114	-	14.5	.5709	16	115	65
HPDSS 1460A	19262	HPDCS 1460A	19115	-	14.6	.5748	16	115	65
HPDSS 1470A	19263	HPDCS 1470A	19116	-	14.7	.5787	16	115	65
HPDSS 1480A	19264	HPDCS 1480A	19117	-	14.8	.5827	16	115	65
HPDSS 1490A	19265	HPDCS 1490A	19118	-	14.9	.5866	16	115	65
HPDSS 1500A	19266	HPDCS 1500A	19119	-	15	.5905	16	115	65
HPDSS 1510A	19267	HPDCS 1510A	19120	-	15.1	.5945	16	115	65
HPDSS 1520A	19268	HPDCS 1520A	19121	-	15.2	.5984	16	115	65
HPDSS 1530A	19269	HPDCS 1530A	19122	-	15.3	.6024	16	115	65
HPDSS 1540A	19270	HPDCS 1540A	19123	-	15.4	.6063	16	115	65
HPDSS 1550A	19271	HPDCS 1550A	19124	-	15.5	.6102	16	115	65
HPDSS 1560A	19272	HPDCS 1560A	19125	-	15.6	.6142	16	115	65
HPDSS 1570A	19273	HPDCS 1570A	19126	-	15.7	.6181	16	115	65
HPDSS 1580A	19274	HPDCS 1580A	19127	-	15.8	.6220	16	115	65
HPDSS6250A	19293	HPDCS6250A	19146	5/8	-	.6250	16	115	65
HPDSS 1590A	19275	HPDCS 1590A	19128	-	15.9	.6260	16	115	65
HPDSS 1600A	19276	HPDCS 1600A	19129	-	16	.6299	16	115	65



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

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

Metric (mm)	
D1	Tolerance (h7)
0 - 3	+0/- .010
3.01 - 6	+0/- .012
6.01 - 10.0	+0/- .015
10.01 - 16.0	+0/- .018

Metric (mm)	
D2	Tolerance (h6)
0 - 3	+0/- .006
3.01 - 6	+0/- .008
6.01 - 10.0	+0/- .009
10.01 - 16.0	+0/- .011

Corner Chamfer Width	
D1	Width Inch
3.0 - 4.0	.003 - .007
4.1 - 6.0	.005 - .009
6.1 - 8.0	.007 - .012
8.1 - 10.0	.009 - .015
10.1 - 12.0	.012 - .018
12.1 - 16.0	.014 - .020

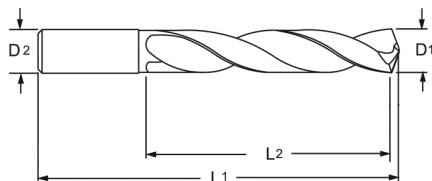
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Series HPDSR & HPDCR



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



- Self centering point that eliminates the need for spot drilling.
- 45° corner chamfer angle helps material break out on through hole applications and minimizes burs.
- h7 OD tolerance for precision holes.
- ALtima® Coating provides high toughness with low friction.
- 5X Diameter with solid and coolant through options.
- 4.1mm-16.0mm manufactured to DIN 6537L.
- h6 Shank OD Tolerance for shrink fit applications.
- Material Applications:
Steels, Stainless Steels, Cast Iron and Titanium.
- An economical choice perfect for job shop and batch production work requiring a high performance drill option.
- Max drill depth = $L2 - 1.5 \times D1$

ALtima®				Diameter			Shank	OAL	Flute Length
HPDSR		HPDCR		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSR 0300A	21840	HPDCR 0300A	21700	-	3.0	.1181	3	66	28
HPDSR1200A	21972	HPDCR1200A	21628	#31	-	.1200	4	66	28
HPDSR 0310A	21841	HPDCR 0310A	21701	-	3.1	.1220	4	66	28
HPDSR1250A	21973	HPDCR1250A	21629	1/8	-	.1250	4	66	28
HPDSR 0320A	21842	HPDCR 0320A	21702	-	3.2	.1260	4	66	28
HPDSR1285A	21974	HPDCR1285A	21630	#30	-	.1285	4	66	28
HPDSR 0330A	21843	HPDCR 0330A	21703	-	3.3	.1299	4	66	28
HPDSR 0340A	21844	HPDCR 0340A	21704	-	3.4	.1339	4	66	28
HPDSR1360A	21975	HPDCR1360A	21631	#29	-	.1360	4	66	28
HPDSR 0350A	21845	HPDCR 0350A	21705	-	3.5	.1378	4	66	28
HPDSR 0360A	21846	HPDCR 0360A	21706	-	3.6	.1417	4	66	28
HPDSR 0370A	21847	HPDCR 0370A	21707	-	3.7	.1457	4	66	28
HPDSR 0380A	21848	HPDCR 0380A	21708	-	3.8	.1496	4	74	36
HPDSR 0390A	21849	HPDCR 0390A	21709	-	3.9	.1535	4	74	36
HPDSR1562A	21976	HPDCR1562A	21632	5/32	-	.1562	4	74	36
HPDSR 0400A	21850	HPDCR 0400A	21710	-	4.0	.1575	4	74	36
HPDSR1590A	21977	HPDCR1590A	21633	#21	-	.1590	6	74	36



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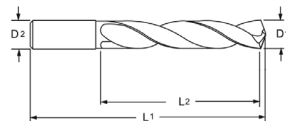
Series HPDSR & HPDCR Continued

Altima®				Diameter			Shank	OAL	Flute Length
 HPDSR		 HPDCR		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSR 0410A	21851	HPDCR 0410A	21711	-	4.1	.1614	6	74	36
HPDSR 0420A	21852	HPDCR 0420A	21712	-	4.2	.1654	6	74	36
HPDSR 0430A	21853	HPDCR 0430A	21713	-	4.3	.1693	6	74	36
HPDSR 0440A	21854	HPDCR 0440A	21714	-	4.4	.1732	6	74	36
HPDSR 0450A	21855	HPDCR 0450A	21715	-	4.5	.1772	6	74	36
HPDSR 0460A	21856	HPDCR 0460A	21716	-	4.6	.1811	6	74	36
HPDSR 0470A	21857	HPDCR 0470A	21717	-	4.7	.1850	6	74	36
HPDSR1875A	21978	HPDCR1875A	21634	3/16	-	.1875	6	82	44
HPDSR 0480A	21858	HPDCR 0480A	21718	-	4.8	.1890	6	82	44
HPDSR 0490A	21859	HPDCR 0490A	21719	-	4.9	.1929	6	82	44
HPDSR 0500A	21860	HPDCR 0500A	21720	-	5.0	.1968	6	82	44
HPDSR 0510A	21861	HPDCR 0510A	21721	-	5.1	.2008	6	82	44
HPDSR2031A	21979	HPDCR2031A	21635	13/64	-	.2031	6	82	44
HPDSR 0520A	21862	HPDCR 0520A	21722	-	5.2	.2047	6	82	44
HPDSR 0530A	21863	HPDCR 0530A	21723	-	5.3	.2087	6	82	44
HPDSR 0540A	21864	HPDCR 0540A	21724	-	5.4	.2126	6	82	44
HPDSR 0550A	21865	HPDCR 0550A	21725	-	5.5	.2165	6	82	44
HPDSR2187A	21980	HPDCR2187A	21636	7/32	-	.2187	6	82	44
HPDSR 0560A	21866	HPDCR 0560A	21726	-	5.6	.2205	6	82	44
HPDSR 0570A	21867	HPDCR 0570A	21727	-	5.7	.2244	6	82	44
HPDSR 0580A	21868	HPDCR 0580A	21728	-	5.8	.2283	6	82	44
HPDSR 0590A	21869	HPDCR 0590A	21729	-	5.9	.2323	6	82	44
HPDSR 0600A	21870	HPDCR 0600A	21730	-	6.0	.2362	6	82	44
HPDSR 0610A	21871	HPDCR 0610A	21731	-	6.1	.2402	8	91	53
HPDSR 0620A	21872	HPDCR 0620A	21732	-	6.2	.2441	8	91	53
HPDSR 0630A	21873	HPDCR 0630A	21733	-	6.3	.2480	8	91	53
HPDSR2500A	21981	HPDCR2500A	21637	1/4	-	.2500	8	91	53
HPDSR 0640A	21874	HPDCR 0640A	21734	-	6.4	.2520	8	91	53
HPDSR 0650A	21875	HPDCR 0650A	21735	-	6.5	.2559	8	91	53
HPDSR2570A	21982	HPDCR2570A	21638	F	-	.2570	8	91	53
HPDSR 0660A	21876	HPDCR 0660A	21736	-	6.6	.2598	8	91	53
HPDSR 0670A	21877	HPDCR 0670A	21737	-	6.7	.2638	8	91	53
HPDSR 0680A	21878	HPDCR 0680A	21738	-	6.8	.2677	8	91	53
HPDSR 0690A	21879	HPDCR 0690A	21739	-	6.9	.2717	8	91	53
HPDSR 0700A	21880	HPDCR 0700A	21740	-	7.0	.2756	8	91	53
HPDSR 0710A	21881	HPDCR 0710A	21741	-	7.1	.2795	8	91	53
HPDSR2812A	21983	HPDCR2812A	21639	9/32	-	.2812	8	91	53

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Series HPDSR & HPDCR Continued



Altima®				Diameter			Shank	OAL	Flute Length
HPDSR		HPDCR		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSR 0720A	21882	HPDCR 0720A	21742	-	7.2	.2835	8	91	53
HPDSR 0730A	21883	HPDCR 0730A	21743	-	7.3	.2874	8	91	53
HPDSR 0740A	21884	HPDCR 0740A	21744	-	7.4	.2913	8	91	53
HPDSR 0750A	21885	HPDCR 0750A	21745	-	7.5	.2953	8	91	53
HPDSR 0760A	21886	HPDCR 0760A	21746	-	7.6	.2992	8	91	53
HPDSR 0770A	21887	HPDCR 0770A	21747	-	7.7	.3031	8	91	53
HPDSR 0780A	21888	HPDCR 0780A	21748	-	7.8	.3071	8	91	53
HPDSR 0790A	21889	HPDCR 0790A	21749	-	7.9	.3110	8	91	53
HPDSR3125A	21984	HPDCR3125A	21640	5/16	-	.3125	8	91	53
HPDSR 0800A	21890	HPDCR 0800A	21750	-	8.0	.3150	8	91	53
HPDSR 0810A	21891	HPDCR 0810A	21751	-	8.1	.3189	10	103	61
HPDSR 0820A	21892	HPDCR 0820A	21752	-	8.2	.3228	10	103	61
HPDSR 0830A	21893	HPDCR 0830A	21753	-	8.3	.3268	10	103	61
HPDSR 0840A	21894	HPDCR 0840A	21754	-	8.4	.3307	10	103	61
HPDSR 0850A	21895	HPDCR 0850A	21755	-	8.5	.3346	10	103	61
HPDSR 0860A	21896	HPDCR 0860A	21756	-	8.6	.3386	10	103	61
HPDSR 0870A	21897	HPDCR 0870A	21757	-	8.7	.3425	10	103	61
HPDSR 0880A	21898	HPDCR 0880A	21758	-	8.8	.3465	10	103	61
HPDSR 0890A	21899	HPDCR 0890A	21759	-	8.9	.3504	10	103	61
HPDSR 0900A	21900	HPDCR 0900A	21760	-	9.0	.3543	10	103	61
HPDSR 0910A	21901	HPDCR 0910A	21761	-	9.1	.3583	10	103	61
HPDSR 0920A	21902	HPDCR 0920A	21762	-	9.2	.3622	10	103	61
HPDSR 0930A	21903	HPDCR 0930A	21763	-	9.3	.3661	10	103	61
HPDSR 0940A	21904	HPDCR 0940A	21764	-	9.4	.3701	10	103	61
HPDSR 0950A	21905	HPDCR 0950A	21765	-	9.5	.3740	10	103	61
HPDSR3750A	21985	HPDCR3750A	21641	3/8	-	.3750	10	103	61
HPDSR 0960A	21906	HPDCR 0960A	21766	-	9.6	.3780	10	103	61
HPDSR 0970A	21907	HPDCR 0970A	21767	-	9.7	.3819	10	103	61
HPDSR 0980A	21908	HPDCR 0980A	21768	-	9.8	.3858	10	103	61
HPDSR 0990A	21909	HPDCR 0990A	21769	-	9.9	.3898	10	103	61
HPDSR 1000A	21910	HPDCR 1000A	21770	-	10.0	.3937	10	103	61
HPDSR 1010A	21911	HPDCR 1010A	21771	-	10.1	.3976	12	118	71
HPDSR 1020A	21912	HPDCR 1020A	21772	-	10.2	.4016	12	118	71
HPDSR 1030A	21913	HPDCR 1030A	21773	-	10.3	.4055	12	118	71
HPDSR 1040A	21914	HPDCR 1040A	21774	-	10.4	.4094	12	118	71
HPDSR 1050A	21915	HPDCR 1050A	21775	-	10.5	.4134	12	118	71
HPDSR 1060A	21916	HPDCR 1060A	21776	-	10.6	.4173	12	118	71

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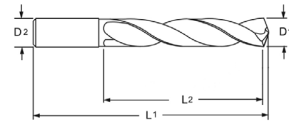
Series HPDSR & HPDCR Continued

Altima®				Diameter			Shank	OAL	Flute Length
HPDSR		HPDCR		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSR 1070A	21917	HPDCR 1070A	21777	-	10.7	.4213	12	118	71
HPDSR 1080A	21918	HPDCR 1080A	21778	-	10.8	.4252	12	118	71
HPDSR 1090A	21919	HPDCR 1090A	21779	-	10.9	.4291	12	118	71
HPDSR 1100A	21920	HPDCR 1100A	21780	-	11.0	.4331	12	118	71
HPDSR 1110A	21921	HPDCR 1110A	21781	-	11.1	.4370	12	118	71
HPDSR4375A	21986	HPDCR4375A	21642	7/16	-	.4375	12	118	71
HPDSR 1120A	21922	HPDCR 1120A	21782	-	11.2	.4409	12	118	71
HPDSR 1130A	21923	HPDCR 1130A	21783	-	11.3	.4449	12	118	71
HPDSR 1140A	21924	HPDCR 1140A	21784	-	11.4	.4488	12	118	71
HPDSR 1150A	21925	HPDCR 1150A	21785	-	11.5	.4527	12	118	71
HPDSR 1160A	21926	HPDCR 1160A	21786	-	11.6	.4567	12	118	71
HPDSR 1170A	21927	HPDCR 1170A	21787	-	11.7	.4606	12	118	71
HPDSR 1180A	21928	HPDCR 1180A	21788	-	11.8	.4646	12	118	71
HPDSR 1190A	21929	HPDCR 1190A	21789	-	11.9	.4685	12	118	71
HPDSR 1200A	21930	HPDCR 1200A	21790	-	12.0	.4724	12	118	71
HPDSR 1210A	21989	HPDCR 1210A	21645	-	12.1	.4764	14	124	77
HPDSR 1220A	21990	HPDCR 1220A	21646	-	12.2	.4803	14	124	77
HPDSR 1230A	21991	HPDCR 1230A	21647	-	12.3	.4842	14	124	77
HPDSR 1240A	21992	HPDCR 1240A	21648	-	12.4	.4882	14	124	77
HPDSR 1250A	21933	HPDCR 1250A	21793	-	12.5	.4921	14	124	77
HPDSR 1260A	21993	HPDCR 1260A	21649	-	12.6	.4961	14	124	77
HPDSR5000A	21987	HPDCR5000A	21643	1/2	-	.5000	14	124	77
HPDSR 1280A	21935	HPDCR 1280A	21795	-	12.8	.5039	14	124	77
HPDSR 1290A	21994	HPDCR 1290A	21650	-	12.9	.5079	14	124	77
HPDSR 1300A	21939	HPDCR 1300A	21799	-	13.0	.5118	14	124	77
HPDSR 1310A	21995	HPDCR 1310A	21651	-	13.1	.5157	14	124	77
HPDSR 1320A	21996	HPDCR 1320A	21652	-	13.2	.5197	14	124	77
HPDSR 1330A	21997	HPDCR 1330A	21653	-	13.3	.5236	14	124	77
HPDSR 1340A	21998	HPDCR 1340A	21654	-	13.4	.5276	14	124	77
HPDSR 1350A	21940	HPDCR 1350A	21800	-	13.5	.5315	14	124	77
HPDSR 1360A	21999	HPDCR 1360A	21655	-	13.6	.5354	14	124	77
HPDSR 1370A	22000	HPDCR 1370A	21656	-	13.7	.5394	14	124	77
HPDSR 1380A	21945	HPDCR 1380A	21805	-	13.8	.5433	14	124	77
HPDSR 1390A	22001	HPDCR 1390A	21657	-	13.9	.5472	14	124	77
HPDSR 1400A	21950	HPDCR 1400A	21810	-	14.0	.5512	14	124	77
HPDSR 1410A	22002	HPDCR 1410A	21658	-	14.1	.5551	16	133	83
HPDSR 1420A	22003	HPDCR 1420A	21659	-	14.2	.5591	16	133	83

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Series HPDSR & HPDCR Continued



Altima®				Diameter			Shank	OAL	Flute Length
HPDSR		HPDCR		D1 (h7)			D2 (h6)	L1	L2
Tool No.	EDP	Tool No.	EDP	Inch	mm	Decimal	mm	mm	mm
HPDSR 1430A	22004	HPDCR 1430A	21660	-	14.3	.5630	16	133	83
HPDSR 1440A	22005	HPDCR 1440A	21661	-	14.4	.5669	16	133	83
HPDSR 1450A	21955	HPDCR 1450A	21815	-	14.5	.5709	16	133	83
HPDSR 1460A	22006	HPDCR 1460A	21662	-	14.6	.5748	16	133	83
HPDSR 1470A	22007	HPDCR 1470A	21663	-	14.7	.5787	16	133	83
HPDSR 1480A	21960	HPDCR 1480A	21820	-	14.8	.5827	16	133	83
HPDSR 1490A	22008	HPDCR 1490A	21664	-	14.9	.5866	16	133	83
HPDSR 1500A	21963	HPDCR 1500A	21823	-	15.0	.5905	16	133	83
HPDSR 1510A	22009	HPDCR 1510A	21665	-	15.1	.5945	16	133	83
HPDSR 1520A	22010	HPDCR 1520A	21666	-	15.2	.5984	16	133	83
HPDSR 1530A	22011	HPDCR 1530A	21667	-	15.3	.6024	16	133	83
HPDSR 1540A	22012	HPDCR 1540A	21668	-	15.4	.6063	16	133	83
HPDSR 1550A	21965	HPDCR 1550A	21825	-	15.5	.6102	16	133	83
HPDSR 1560A	22014	HPDCR 1560A	21669	-	15.6	.6142	16	133	83
HPDSR 1570A	22015	HPDCR 1570A	21670	-	15.7	.6181	16	133	83
HPDSR 1580A	21968	HPDCR 1580A	21828	-	15.8	.6220	16	133	83
HPDSR6250A	21988	HPDCR6250A	21644	5/8	-	.6250	16	133	83
HPDSR 1590A	22016	HPDCR 1590A	21671	-	15.9	.6260	16	133	83
HPDSR 1600A	21970	HPDCR 1600A	21830	-	16.0	.6299	16	133	83

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

Metric (mm)	
D1	Tolerance (h7)
0 - 3	+0/- .010
3.01 - 6	+0/- .012
6.01 - 10.0	+0/- .015
10.01 - 16.0	+0/- .018

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

Metric (mm)	
D2	Tolerance (h6)
0 - 3	+0/- .006
3.01 - 6	+0/- .008
6.01 - 10.0	+0/- .009
10.01 - 16.0	+0/- .011

Corner Chamfer Width	
D1	Width Inch
3.0 - 4.0	.003 - .007
4.1 - 6.0	.005 - .009
6.1 - 8.0	.007 - .012
8.1 - 10.0	.009 - .015
10.1 - 12.0	.012 - .018
12.1 - 16.0	.014 - .020



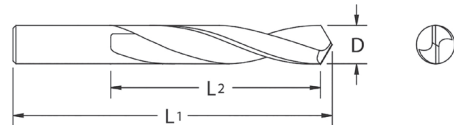
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Series 204



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

- ALtima® coating upon request.



Tool No.	EDP	Diameter			OAL	Flute Length
		D			L1	L2
		Inch	Wire	Decimal	Inch	Inch
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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Series 204 Continued

Tool No.	EDP	Diameter			OAL	Flute Length
		D			L1	L2
		Inch	Wire	Decimal	Inch	Inch
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	-	.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



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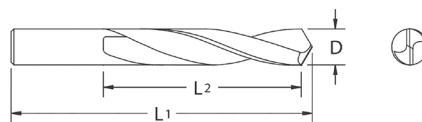
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Series 204 Continued



Series 204

Twister® GP

2 Flute

JOB SHOP

Tool No.	EDP	Diameter			OAL	Flute Length	
		D			L1	L2	
		Inch	Wire	Decimal	Inch	Inch	
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	

Inch	
D	Tolerance
.1250-.6250	+.0000/- .0005



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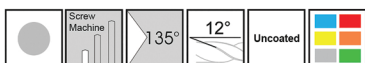


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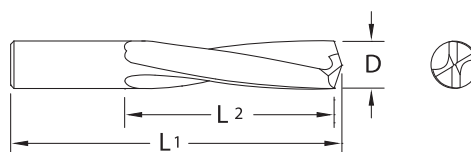
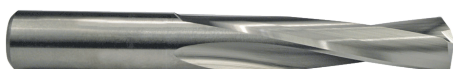
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Series 205



- Slow spiral.
- ALTIMA® coating upon request.

- 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.



Tool No.	EDP	Diameter			OAL	Flute Length
		D			L1	L2
		Inch	Wire	Decimal	Inch	Inch
20512500	25295	1/8	-	.1250	1-7/8	7/8
20512850	25301	-	#30	.1285	1-15/16	15/16
20513600	25310	-	#29	.1360	1-15/16	15/16
20514050	25316	-	#28	.1405	1-15/16	15/16
20514060	25319	9/64	-	.1406	1-15/16	15/16
20514400	25325	-	#27	.1440	2-1/16	1
20514700	25331	-	#26	.1470	2-1/16	1
20514950	25334	-	#25	.1495	2-1/16	1
20515200	25340	-	#24	.1520	2-1/16	1
20515400	25346	-	#23	.1540	2-1/16	1
20515620	25349	5/32	-	.1562	2-1/16	1
20515700	25352	-	#22	.1570	2-1/8	1-1/16
20515900	25358	-	#21	.1590	2-1/8	1-1/16
20516100	25361	-	#20	.1610	2-1/8	1-1/16
20516600	25370	-	#19	.1660	2-1/8	1-1/16
20516950	25376	-	#18	.1695	2-1/8	1-1/16
20517190	25379	11/64	-	.1719	2-1/8	1-1/16
20517300	25382	-	#17	.1730	2-3/16	1-1/8
20517700	25388	-	#16	.1770	2-3/16	1-1/8
20518000	25394	-	#15	.1800	2-3/16	1-1/8
20518200	25400	-	#14	.1820	2-3/16	1-1/8
20518500	25403	-	#13	.1850	2-3/16	1-1/8
20518750	25406	3/16	-	.1875	2-3/16	1-1/8
20518900	25412	-	#12	.1890	2-1/4	1-3/16
20519100	25415	-	#11	.1910	2-1/4	1-3/16



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Series 205 Continued

Series 205

Hi-Tuff®

2 Flute

JOB SHOP

Tool No.	EDP	Diameter			OAL	Flute Length
		D			L1	L2
		Inch	Wire	Decimal	Inch	Inch
20519350	25421	-	#10	.1935	2-1/4	1-3/16
20519600	25424	-	#9	.1960	2-1/4	1-3/16
20519900	25430	-	#8	.1990	2-1/4	1-3/16
20520100	25436	-	#7	.2010	2-1/4	1-3/16
20520310	25439	13/64	-	.2031	2-1/4	1-3/16
20520400	25442	-	#6	.2040	2-3/8	1-1/4
20520550	25448	-	#5	.2055	2-3/8	1-1/4
20520900	25454	-	#4	.2090	2-3/8	1-1/4
20521300	25460	-	#3	.2130	2-3/8	1-1/4
20521870	25466	7/32	-	.2187	2-3/8	1-1/4
20522100	25472	-	#2	.2210	2-7/16	1-5/16
20522800	25478	-	#1	.2280	2-7/16	1-5/16
20523400	25487	-	A	.2340	2-7/16	1-5/16
20523440	25490	15/64	-	.2344	2-7/16	1-5/16
20523800	25496	-	B	.2380	2-1/2	1-3/8
20524200	25502	-	C	.2420	2-1/2	1-3/8
20524600	25508	-	D	.2460	2-1/2	1-3/8
20525000	25514	1/4	-	.2500	2-1/2	1-3/8
20525700	25523	-	F	.2570	2-5/8	1-7/16
20526100	25529	-	G	.2610	2-5/8	1-7/16
20526560	25535	17/64	-	.2656	2-5/8	1-7/16
20526600	25538	-	H	.2660	2-11/16	1-1/2
20527200	25547	-	I	.2720	2-11/16	1-1/2
20527700	25553	-	J	.2770	2-11/16	1-1/2
20528100	25559	-	K	.2810	2-11/16	1-1/2
20528120	25562	9/32	-	.2812	2-11/16	1-1/2
20529000	25571	-	L	.2900	2-3/4	1-9/16
20529500	25577	-	M	.2950	2-3/4	1-9/16
20529690	25583	19/64	-	.2969	2-3/4	1-9/16
20530200	25589	-	N	.3020	2-13/16	1-5/8
20531250	25601	5/16	-	.3125	2-13/16	1-5/8
20531600	25607	-	O	.3160	2-15/16	1-11/16
20532300	25616	-	P	.3230	2-15/16	1-11/16
20532810	25622	21/64	-	.3281	2-15/16	1-11/16
20533200	25628	-	Q	.3320	2-15/16	1-11/16
20533900	25637	-	R	.3390	2-15/16	1-11/16
20534380	25643	11/32	-	.3438	2-15/16	1-11/16



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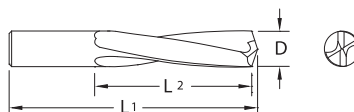
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Series 205 Continued



Tool No.	EDP	Diameter			OAL	Flute Length
		D1			L1	L2
		Inch	Wire	Decimal	Inch	Inch
20534800	25649	-	S	.3480	3-1/16	1-3/4
20535800	25658	-	T	.3580	3-1/16	1-3/4
20535940	25664	23/64	-	.3594	3-1/16	1-3/4
20536800	25673	-	U	.3680	3-1/8	1-13/16
20537500	25682	3/8	-	.3750	3-1/8	1-13/16
20537700	25685	-	V	.3770	3-1/4	1-7/8
20538600	25697	-	W	.3860	3-1/4	1-7/8
20539060	25703	25/64	-	.3906	3-1/4	1-7/8
20539700	25709	-	X	.3970	3-5/16	1-15/16
20540400	25718	-	Y	.4040	3-5/16	1-15/16
20540620	25724	13/32	-	.4062	3-5/16	1-15/16
20541300	25730	-	Z	.4130	3-3/8	2
20542190	25742	27/64	-	.4219	3-3/8	2
20543750	25757	7/16	-	.4375	3-7/16	2-1/16
20545310	25772	29/64	-	.4531	3-5/8	2-1/8
20546880	25787	15/32	-	.4688	3-5/8	2-1/8
20548440	25793	31/64	-	.4844	3-11/16	2-3/16
20550000	25799	1/2	-	.5000	3-3/4	2-1/4
20551560	25805	33/64	-	.5156	3-7/8	2-3/8
20553120	25808	17/32	-	.5312	3-7/8	2-3/8
20554690	25814	35/64	-	.5469	4	2-1/2
20556250	25820	9/16	-	.5625	4	2-1/2
20557810	25826	37/64	-	.5781	4-1/8	2-5/8
20559380	25832	19/32	-	.5938	4-1/8	2-5/8
20560940	25835	39/64	-	.6094	4-1/4	2-3/4
20562500	25841	5/8	-	.6250	4-1/4	2-3/4
20564060	25847	41/64	-	.6406	4-1/2	2-7/8
20565620	25853	21/32	-	.6562	4-1/2	2-7/8
20567190	25859	43/64	-	.6719	4-5/8	2-7/8
20568750	25862	11/16	-	.6875	4-5/8	2-7/8
20570310	25868	45/64	-	.7031	4-3/4	3
20571880	25874	23/32	-	.7188	4-3/4	3
20573440	25880	47/64	-	.7344	5	3-1/8
20575000	25886	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

Inch	
D	Tolerance
.1250 - .7812	+.0000/- .0005



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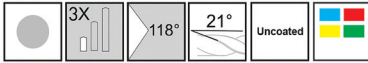


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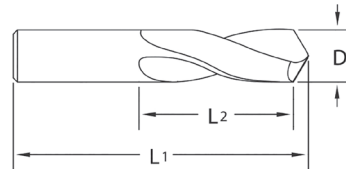
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Series 206



- ALtima® coating upon request.

- 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.



Tool No.	EDP	Diameter			OAL	Flute Length	
		D			L1	L2	
		Inch	Wire	Decimal	Inch	Inch	
20612500	26187	1/8	-	.1250	2	5/8	
20612850	26193	-	#30	.1285	2	5/8	
20613600	26202	-	#29	.1360	2	5/8	
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	



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Series 206 Continued

Tool No.	EDP	Diameter			OAL	Flute Length	
		D			L1	L2	
		Inch	Wire	Decimal	Inch	Inch	
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	
20624600	26400	-	D	.2460	2-1/2	1	
20625000	26406	1/4	-	.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	



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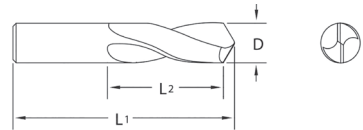


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Series 206 Continued



Tool No.	EDP	Diameter			OAL	Flute Length
		D			L1	L2
		Inch	Wire	Decimal	Inch	Inch
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
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

Inch	
D	Tolerance
.1250 - .6250	+.0000/- .0005



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Recommended Cutting Data Series HPDSS & HPDSR - Inch 3xD & 5xD, Solid Drilling

Material Group	ISO	Hardness	Vc - SFM			Drill Diameter (inch)						
			Low	Mid	High	1/8	3/16	1/4	5/16	3/8	1/2	5/8
						Feed (in/rev)						
Low Carbon Steels 12L14, 1018, A36	P	≤ 180 HB	260	320	380	.0025 - .0038	.0038 - .0056	.0050 - .0075	.0063 - .0094	.0075 - .0113	.0100 - .0150	.0125 - .0188
Med Carbon / Alloy Steels		≤ 38 HRC	210	260	310	.0025 - .0038	.0038 - .0056	.0050 - .0075	.0063 - .0094	.0075 - .0113	.0100 - .0150	.0125 - .0188
Die / Tool Steels A2, D2, H13, P20		≤ 45 HRC	130	165	200	.0019 - .0031	.0028 - .0047	.0038 - .0063	.0047 - .0078	.0056 - .0094	.0075 - .0125	.0094 - .0156
Ferritic / Martensitic Stainless	M	≤ 28 HRC	180	220	260	.0023 - .0035	.0034 - .0053	.0045 - .0070	.0056 - .0088	.0068 - .0105	.0090 - .0140	.0113 - .0175
Austenitic Stainless 300 Series			100	120	140	.0023 - .0035	.0034 - .0053	.0045 - .0070	.0056 - .0088	.0068 - .0105	.0090 - .0140	.0113 - .0175
PH Stainless 15-5 PH, 17-4 PH,		≤ 45 HRC	80	100	120	.0016 - .0029	.0024 - .0043	.0033 - .0058	.0041 - .0072	.0049 - .0086	.0065 - .0115	.0081 - .0144
High Temp Alloys Inconel, Hastelloy,	S	≤ 42 HRC	50	60	70	.0011 - .0018	.0017 - .0026	.0023 - .0035	.0028 - .0035	.0034 - .0053	.0045 - .0070	.0056 - .0088
Titanium Alloys 6Al-4V			70	90	110	.0016 - .0025	.0024 - .0038	.0033 - .0050	.0041 - .0063	.0049 - .0075	.0065 - .0100	.0081 - .0125
Cast Iron - Gray	K	≤ 240 HB	280	350	420	.0031 - .0044	.0047 - .0066	.0063 - .0088	.0078 - .0109	.0094 - .0131	.0125 - .0175	.0156 - .0219
Cast Iron - Ductile & Malleable		> 240 HB	160	200	240	.0025 - .0038	.0038 - .0056	.0050 - .0075	.0063 - .0094	.0075 - .0113	.0100 - .0150	.0125 - .0188



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Recommended Cutting Data Series HPDCS & HPDCR - Inch 3xD & 5xD, Coolant-Fed Drilling

Material Group	ISO	Hardness	Vc - SFM			Drill Diameter (inch)						
						1/8	3/16	1/4	5/16	3/8	1/2	5/8
			Low	Mid	High	Feed (in/rev)						
Low Carbon Steels 12L14, 1018, A36	P	≤ 180 HB	450	560	670	.0025 - .0038	.0038 - .0056	.0050 - .0075	.0063 - .0094	.0075 - .0113	.0100 - .0150	.0125 - .0188
Med Carbon / Alloy Steels 1045, 1050, 4140, 4340		≤ 38 HRC	260	330	400	.0025 - .0038	.0038 - .0056	.0050 - .0075	.0063 - .0094	.0075 - .0113	.0100 - .0150	.0125 - .0188
Die / Tool Steels A2, D2, H13, P20		≤ 45 HRC	160	200	240	.0019 - .0031	.0028 - .0047	.0038 - .0063	.0047 - .0078	.0056 - .0094	.0075 - .0125	.0094 - .0156
Ferritic / Martensitic Stainless	M	≤ 28 HRC	290	360	430	.0023 - .0035	.0034 - .0053	.0045 - .0070	.0056 - .0088	.0068 - .0105	.0090 - .0140	.0113 - .0175
Austenitic Stainless 300 Series			160	200	240	.0023 - .0035	.0034 - .0053	.0045 - .0070	.0056 - .0088	.0068 - .0105	.0090 - .0140	.0113 - .0175
PH Stainless 15-5 PH, 17-4 PH, 17-7 PH		≤ 45 HRC	140	180	220	.0016 - .0029	.0024 - .0043	.0033 - .0058	.0041 - .0072	.0049 - .0086	.0065 - .0115	.0081 - .0144
High Temp Alloys Inconel, Hastelloy, Monel	S	≤ 42 HRC	60	75	90	.0011 - .0018	.0017 - .0026	.0023 - .0035	.0028 - .0044	.0034 - .0053	.0045 - .0070	.0056 - .0088
Titanium Alloys 6Al-4V			120	150	180	.0016 - .0025	.0024 - .0038	.0033 - .0050	.0041 - .0063	.0049 - .0075	.0065 - .0100	.0081 - .0125
Cast Iron - Gray	K	≤ 240 HB	370	460	550	.0031 - .0044	.0047 - .0066	.0063 - .0088	.0078 - .0109	.0094 - .0131	.0125 - .0175	.0156 - .0219
Cast Iron - Ductile & Malleable		> 240 HB	240	300	360	.0025 - .0038	.0038 - .0056	.0050 - .0075	.0063 - .0094	.0075 - .0113	.0100 - .0150	.0125 - .0188



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Recommended Cutting Data 204 / 206 - Inch

Workpiece Material Group	I S O	H a r d n e s s	Tool Series	T Y P E	D E P T H	vc - SFM	1/8	1/4	3/8	1/2	5/8
							f - IPR				
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	206		3	175	.0030	.0060	.0080	.0100	.0110
			204		5						
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, 01, 02, 06, 52, W1 to W310	P	28 to 38 Rc	206		3	165	.0030	.0060	.0080	.0100	.0110
			204		5						
Tool Steels & Die Steels 07, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	206		3	150	.0030	.0060	.0080	.0100	.0110
			204		5						
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	206		3	195	.0030	.0060	.0080	.0100	.0110
			204		5						
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	206		3	125	.0030	.0060	.0080	.0100	.0110
			204		5						
Cast Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	206		3	275	.0030	.0060	.0080	.0100	.0110
			204		5						
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	206		3	175	.0030	.0060	.0080	.0100	.0110
			204		5						
Plastics	N		206		3	400	.0020	.0040	.0050	.0060	.0080
			204		5						
			206		3						
Kevlar/Graphite	N		204		5	400	.0020	.0040	.0050	.0060	.0080



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Recommended Cutting Data 205 - Inch

Workpiece Material Group	ISO	Hardness	TYPE	DEPTH	vc - SFM	Drill Diameter (Inch)					
						1/8	1/4	3/8	1/2	5/8	3/4
						f - IPR					
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc		Screw Machine	175	.0030	.0060	.0080	.0100	.0110	.0120
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, 01, 02, 06, S2, 1 to W310	P	28 to 38 Rc		Screw Machine	165	.0030	.0060	.0080	.0100	.0110	.0120
Tool Steels & Die Steels 07, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc		Screw Machine	150	.0030	.0060	.0080	.0100	.0110	.0120
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc		Screw Machine	140	.0030	.0060	.0080	.0100	.0110	.0120
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	up to 28 Rc		Screw Machine	60	.0020	.0040	.0050	.0060	.0080	.0100
High Temp Alloys Nimonic, Inconel, Monel, Hastelloy	S	up to 42 Rc		Screw Machine	60	.0020	.0040	.0050	.0060	.0080	.0100
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc		Screw Machine	80	.0020	.0040	.0050	.0060	.0080	.0100
Cast Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB		Screw Machine	175	.0030	.0060	.0080	.0100	.0110	.0120
Cast Iron - Ductile & Malleable CGI, 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB		Screw Machine	175	.0030	.0060	.0080	.0100	.0110	.0120
Plastics	N			Screw Machine	300	.0020	.0040	.0050	.0060	.0080	.0100
Hardened Steel	H	45 to 65 Rc		Screw Machine	50	.0010	.0010	.0020	.0020	.0020	.0030



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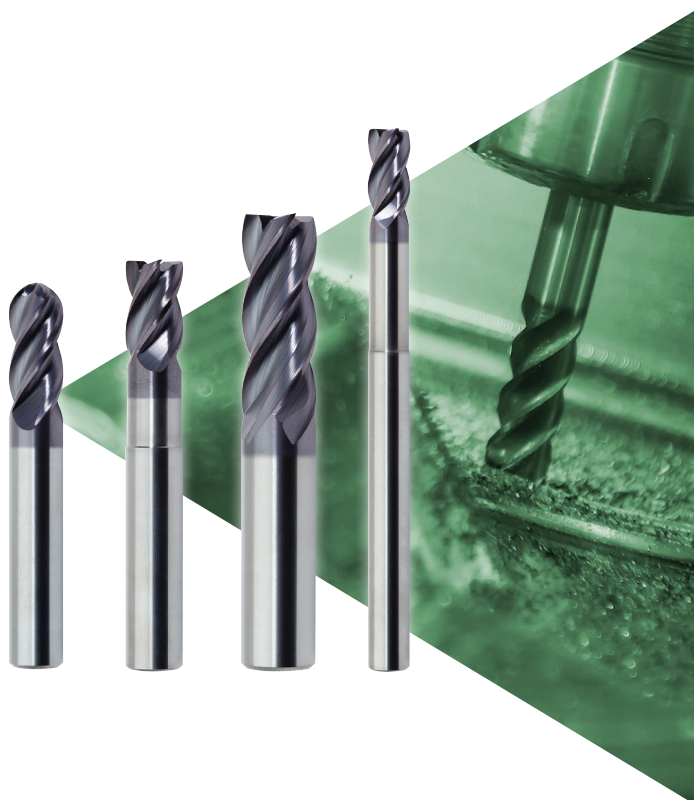


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TuffCut® End Mills

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, composite material, aluminum and softer alloys.



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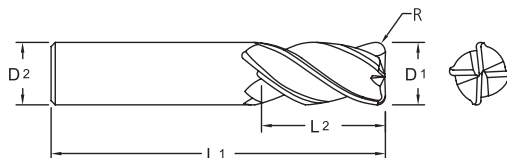


Series 177



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

Visit www.maford.com for weldon flat options.



Series 177

TuffCut® XR

4 Flute

JOB SHOP

ALtima®		Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2 (h6)	L1	L2	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
17706250A	17692	1/16	.0625	1/8	1-1/2	1/8	-
17707810A	17694	5/64	.0781	1/8	1-1/2	5/32	-
17709370A	17696	3/32	.0937	1/8	1-1/2	3/16	-
17712500A	17700	1/8	.1250	1/8	1-1/2	1/8	-
17712502A	17729	1/8	.1250	1/8	1-1/2	1/8	.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	.015
17715600A	17702	5/32	.1562	3/16	2	3/16	-
17715602A	17731	5/32	.1562	3/16	2	3/16	.015
17715610A	17703	5/32	.1562	3/16	2	7/16	-
17715612A	17732	5/32	.1562	3/16	2	7/16	.015
17718700A	17704	3/16	.1875	3/16	2	3/16	-
17718702A	17733	3/16	.1875	3/16	2	3/16	.015
17718704A	17734	3/16	.1875	3/16	2	3/16	.030
17718710A	17705	3/16	.1875	3/16	2	7/16	-
17718712A	17735	3/16	.1875	3/16	2	7/16	.015
17718714A	17736	3/16	.1875	3/16	2	7/16	.030
17721800A	17706	7/32	.2187	1/4	2	1/4	-
17721802A	17737	7/32	.2187	1/4	2	1/4	.015
17721804A	17738	7/32	.2187	1/4	2	1/4	.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	.015
17721814A	17740	7/32	.2187	1/4	2-1/2	7/16	.030
17725000A	17708	1/4	.2500	1/4	2	1/4	-



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Series 177 Continued

Altima®		Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2 (h6)	L1	L2	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
17725002A	17741	1/4	.2500	1/4	2	1/4	.015
17725004A	17742	1/4	.2500	1/4	2	1/4	.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	.015
17725014A	17744	1/4	.2500	1/4	2-1/2	1/2	.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	.015
17728104A	17746	9/32	.2812	5/16	2-1/2	5/8	.030
17731200A	17711	5/16	.3125	5/16	2	5/16	-
17731202A	17747	5/16	.3125	5/16	2	5/16	.015
17731204A	17748	5/16	.3125	5/16	2	5/16	.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	.015
17731214A	17750	5/16	.3125	5/16	2-1/2	13/16	.030
17734300A	17713	11/32	.3438	3/8	2-1/2	13/16	-
17734302A	17751	11/32	.3438	3/8	2-1/2	13/16	.015
17734304A	17752	11/32	.3438	3/8	2-1/2	13/16	.030
17737500A	17714	3/8	.3750	3/8	2	3/8	-
17737502A	17753	3/8	.3750	3/8	2	3/8	.015
17737504A	17754	3/8	.3750	3/8	2	3/8	.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	.015
17737514A	17756	3/8	.3750	3/8	2-1/2	7/8	.030
17740600A	17716	13/32	.4062	7/16	2-3/4	15/16	-
17740602A	17757	13/32	.4062	7/16	2-3/4	15/16	.015
17740604A	17758	13/32	.4062	7/16	2-3/4	15/16	.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	.015
17743704A	17760	7/16	.4375	7/16	2-1/2	7/16	.030
17743710A	17718	7/16	.4375	7/16	2-3/4	1	-
17743712A	17761	7/16	.4375	7/16	2-3/4	1	.015
17743714A	17762	7/16	.4375	7/16	2-3/4	1	.030
17746800A	17719	15/32	.4688	1/2	3	1	-
17746802A	17763	15/32	.4688	1/2	3	1	.015
17746804A	17764	15/32	.4688	1/2	3	1	.030
17750000A	17720	1/2	.5000	1/2	2-1/2	1/2	-
17750002A	17765	1/2	.5000	1/2	2-1/2	1/2	.015
17750004A	17766	1/2	.5000	1/2	2-1/2	1/2	.030



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Series 177

TuffCut® XR

4
Flute

JOB SHOP



Series 177 Continued

Series 177

TuffCut® XR

JOB SHOP

4
Flute

ALtima®		Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2 (h6)	L1	L2	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
17750010A	17721	1/2	.5000	1/2	3	1	-
17750012A	17767	1/2	.5000	1/2	3	1	.015
17750014A	17768	1/2	.5000	1/2	3	1	.030
17750016A	17901	1/2	.5000	1/2	3	1	.060
17750017A	17902	1/2	.5000	1/2	3	1	.090
17750018A	17903	1/2	.5000	1/2	3	1	.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
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	.015
17756204A	17770	9/16	.5625	9/16	3-1/2	1-1/8	.030
17762500A	17723	5/8	.6250	5/8	3	5/8	-
17762502A	18000	5/8	.6250	5/8	3	5/8	.015
17762504A	17771	5/8	.6250	5/8	3	5/8	.030
17762505A	17772	5/8	.6250	5/8	3	5/8	.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	.015
17762514A	17773	5/8	.6250	5/8	3-1/2	1-1/4	.030
17762515A	17774	5/8	.6250	5/8	3-1/2	1-1/4	.045
17762516A	17904	5/8	.6250	5/8	3-1/2	1-1/4	.060
17762517A	17905	5/8	.6250	5/8	3-1/2	1-1/4	.090
17762518A	17906	5/8	.6250	5/8	3-1/2	1-1/4	.125
17775000A	17725	3/4	.7500	3/4	3	3/4	-
17775002A	18002	3/4	.7500	3/4	3	3/4	.015
17775004A	17775	3/4	.7500	3/4	3	3/4	.030
17775005A	17776	3/4	.7500	3/4	3	3/4	.045
17775010A	17726	3/4	.7500	3/4	4	1-1/2	-
17775012A	18003	3/4	.7500	3/4	4	1-1/2	.015
17775014A	17777	3/4	.7500	3/4	4	1-1/2	.030
17775015A	17778	3/4	.7500	3/4	4	1-1/2	.045
17775016A	17907	3/4	.7500	3/4	4	1-1/2	.060
17775017A	17908	3/4	.7500	3/4	4	1-1/2	.090
17775018A	17909	3/4	.7500	3/4	4	1-1/2	.125
17710000A	17727	1	1.0000	1	4	1	-



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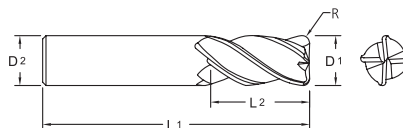
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Series 177 Continued



ALtima®		Diameter		Shank	OAL	Flute Length		Corner Radius
		D1		D2 (h6)	L1	L2	R	
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch
17710002A	18004	1	1.0000	1	4	1		.015
17710004A	17779	1	1.0000	1	4	1		.030
17710005A	17780	1	1.0000	1	4	1		.045
17710010A	17728	1	1.0000	1	4	1-1/2		-
17710012A	18005	1	1.0000	1	4	1-1/2		.015
17710014A	17781	1	1.0000	1	4	1-1/2		.030
17710015A	17782	1	1.0000	1	4	1-1/2		.045
17710016A	17910	1	1.0000	1	4	1-1/2		.060
17710017A	17911	1	1.0000	1	4	1-1/2		.090
17710018A	17912	1	1.0000	1	4	1-1/2		.125

Inch	
D1	Tolerance
1/16 - 1/4	+0.000/-0.002
> 1/4 - 1.0	+0.000/-0.003

Inch	
D2	Tolerance (h6)
.0625 - .1181	+0/-0.00023
.1182 - .2362	+0/-0.00031
.2363 - .3937	+0/-0.00035
.3938 - .7087	+0/-0.00043
.7088 - 1.000	+0/-0.00051

Inch	
R	Tolerance
1/8 - 1	+0.0000/-0.0016

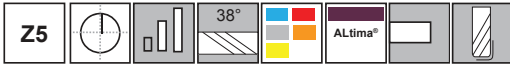


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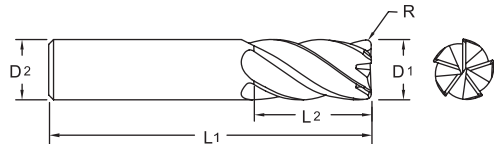
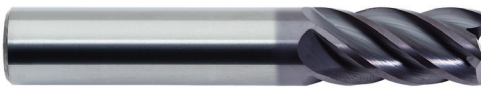


Series 178



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

Visit www.maford.com for weldon flat options.



ALtima®		Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2 (h6)	L1	L2	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
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	-
17818700A	17804	3/16	.1875	3/16	2	3/16	-
17818710A	17805	3/16	.1875	3/16	2	7/16	-
17821800A	17806	7/32	.2187	1/4	2	1/4	-
17821810A	17807	7/32	.2187	1/4	2-1/2	7/16	-
17825000A	17808	1/4	.2500	1/4	2	3/8	-
17825002A	17829	1/4	.2500	1/4	2	3/8	.015
17825004A	17830	1/4	.2500	1/4	2	3/8	.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	.015
17825014A	17832	1/4	.2500	1/4	2-1/2	5/8	.030
17825022A	18105	1/4	.2500	1/4	2-1/2	3/4	.015
17828100A	17810	9/32	.2812	5/16	2-1/2	5/8	-
17828102A	17835	9/32	.2812	5/16	2-1/2	5/8	.015
17828104A	17836	9/32	.2812	5/16	2-1/2	5/8	.030
17831200A	17811	5/16	.3125	5/16	2	7/16	-
17831202A	17837	5/16	.3125	5/16	2	7/16	.015
17831204A	17838	5/16	.3125	5/16	2	7/16	.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	.015
17831214A	17840	5/16	.3125	5/16	2-1/2	13/16	.030



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Series 178 Continued

ALtima®		Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2 (h6)	L1	L2	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
17834300A	17813	11/32	.3438	3/8	2-1/2	13/16	-
17834302A	17843	11/32	.3438	3/8	2-1/2	13/16	.015
17834304A	17844	11/32	.3438	3/8	2-1/2	13/16	.030
17837500A	17814	3/8	.3750	3/8	2	1/2	-
17837502A	17845	3/8	.3750	3/8	2	1/2	.015
17837504A	17846	3/8	.3750	3/8	2	1/2	.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	.015
17837514A	17848	3/8	.3750	3/8	2-1/2	7/8	.030
17840600A	17816	13/32	.4062	7/16	2-3/4	7/8	-
17840602A	17853	13/32	.4062	7/16	2-3/4	7/8	.015
17840604A	17854	13/32	.4062	7/16	2-3/4	7/8	.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	.015
17843704A	17856	7/16	.4375	7/16	2-1/2	9/16	.030
17843710A	17818	7/16	.4375	7/16	2-3/4	1	-
17843712A	17857	7/16	.4375	7/16	2-3/4	1	.015
17843714A	17858	7/16	.4375	7/16	2-3/4	1	.030
17846800A	17819	15/32	.4688	1/2	3	1	-
17846802A	17863	15/32	.4688	1/2	3	1	.015
17846804A	17864	15/32	.4688	1/2	3	1	.030
17850000A	17820	1/2	.5000	1/2	2-1/2	5/8	-
17850002A	17865	1/2	.5000	1/2	2-1/2	5/8	.015
17850004A	17866	1/2	.5000	1/2	2-1/2	5/8	.030
17850010A	17821	1/2	.5000	1/2	3	1	-
17850012A	17867	1/2	.5000	1/2	3	1	.015
17850014A	17868	1/2	.5000	1/2	3	1	.030
17850015A	17869	1/2	.5000	1/2	3	1	.045
17850016A	17913	1/2	.5000	1/2	3	1	.060
17850017A	17914	1/2	.5000	1/2	3	1	.090
17850018A	17915	1/2	.5000	1/2	3	1	.125
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	.015
17856204A	17876	9/16	.5625	9/16	3-1/2	1-1/8	.030
17862500A	17823	5/8	.6250	5/8	3	3/4	-
17862502A	18006	5/8	.6250	5/8	3	3/4	.015
17862504A	17877	5/8	.6250	5/8	3	3/4	.030
17862505A	17878	5/8	.6250	5/8	3	3/4	.045



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Series 178

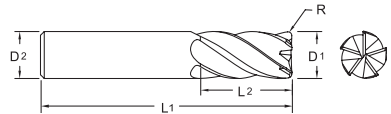
TuffCut® XR

5
Flute

JOB SHOP



Series 178 Continued



Series 178

TuffCut® XR

5 Flute

JOB SHOP

ALtima®		Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2 (h6)	L1	L2	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch
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	.015
17862514A	17879	5/8	.6250	5/8	3-1/2	1-1/4	.030
17862515A	17880	5/8	.6250	5/8	3-1/2	1-1/4	.045
17862516A	17916	5/8	.6250	5/8	3-1/2	1-1/4	.060
17862517A	17917	5/8	.6250	5/8	3-1/2	1-1/4	.090
17862518A	17918	5/8	.6250	5/8	3-1/2	1-1/4	.125
17875000A	17825	3/4	.7500	3/4	3	1	-
17875002A	18011	3/4	.7500	3/4	3	1	.015
17875004A	17887	3/4	.7500	3/4	3	1	.030
17875005A	17888	3/4	.7500	3/4	3	1	.045
17875010A	17826	3/4	.7500	3/4	4	1-1/2	-
17875012A	18012	3/4	.7500	3/4	4	1-1/2	.015
17875014A	17889	3/4	.7500	3/4	4	1-1/2	.030
17875015A	17890	3/4	.7500	3/4	4	1-1/2	.045
17875016A	17919	3/4	.7500	3/4	4	1-1/2	.060
17875017A	17920	3/4	.7500	3/4	4	1-1/2	.090
17875018A	17921	3/4	.7500	3/4	4	1-1/2	.125
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	.015
17810014A	17895	1	1.0000	1	4	1-1/2	.030
17810015A	17896	1	1.0000	1	4	1-1/2	.045
17810016A	17922	1	1.0000	1	4	1-1/2	.060
17810017A	17923	1	1.0000	1	4	1-1/2	.090
17810018A	17924	1	1.0000	1	4	1-1/2	.125

Inch	
D1	Tolerance
1/8 - 1/4	+0.000/-0.002
> 1/4 - 1.0	+0.000/-0.003

Inch	
D2	Tolerance (h6)
.1182 - .2362	+0/-0.00031
.2363 - .3937	+0/-0.00035
.3938 - .7087	+0/-0.00043
.7088 - 1.000	+0/-0.00051

Inch	
R	Tolerance
1/4 - 1	+0.0000/-0.0016



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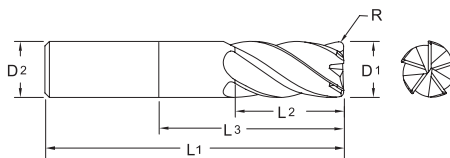




Series 178N



- Designed for extreme productivity.



ALtima®		Diameter		Shank	OAL	Flute Length	Neck Length	Corner Radius
		D1		D2 (h6)	L1	L2	L3	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch
17825022NA	17833	1/4	.2500	1/4	4	3/4	2-1/8	.015
17825024NA	17834	1/4	.2500	1/4	4	3/4	2-1/8	.030
17831222NA	17841	5/16	.3125	5/16	4	1	2-1/8	.015
17831224NA	17842	5/16	.3125	5/16	4	1	2-1/8	.030
17837522NA	17849	3/8	.3750	3/8	4	1	2-1/8	.015
17837524NA	17850	3/8	.3750	3/8	4	1	2-1/8	.030
17837532NA	17851	3/8	.3750	3/8	6	1-1/4	3-3/8	.015
17837534NA	17852	3/8	.3750	3/8	6	1-1/4	3-3/8	.030
17843722NA	17859	7/16	.4375	7/16	4	1-1/4	2-1/8	.015
17843724NA	17860	7/16	.4375	7/16	4	1-1/4	2-1/8	.030
17843732NA	17861	7/16	.4375	7/16	6	1-1/2	3-3/8	.015
17843734NA	17862	7/16	.4375	7/16	6	1-1/2	3-3/8	.030
17850022NA	17925	1/2	.5000	1/2	4	1-1/4	2-1/8	.015
17850024NA	17870	1/2	.5000	1/2	4	1-1/4	2-1/8	.030
17850032NA	17871	1/2	.5000	1/2	5	1-3/8	3-1/8	.015
17850034NA	17872	1/2	.5000	1/2	5	1-3/8	3-1/8	.030
17850042NA	17873	1/2	.5000	1/2	6	1-1/2	4-1/8	.015
17850044NA	17874	1/2	.5000	1/2	6	1-1/2	4-1/8	.030
17862522NA	18008	5/8	.6250	5/8	4	1-1/2	2-1/8	.015
17862524NA	17881	5/8	.6250	5/8	4	1-1/2	2-1/8	.030
17862525NA	17882	5/8	.6250	5/8	4	1-1/2	2-1/8	.045
17862532NA	18009	5/8	.6250	5/8	5	1-3/4	3-1/8	.015
17862534NA	17883	5/8	.6250	5/8	5	1-3/4	3-1/8	.030
17862535NA	17884	5/8	.6250	5/8	5	1-3/4	3-1/8	.045
17862542NA	18010	5/8	.6250	5/8	6	2	4	.015
17862544NA	17885	5/8	.6250	5/8	6	2	4	.030
17862545NA	17886	5/8	.6250	5/8	6	2	4	.045



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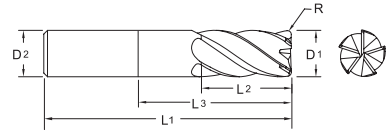
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Series 178N Continued



Altima®		Diameter		Shank	OAL	Flute Length	Neck Length	Corner Radius
		D1		D2 (h6)	L1	L2	L3	R
Tool No.	EDP	Inch	Decimal	Inch	Inch	Inch	Inch	Inch
17875022NA	18013	3/4	.7500	3/4	5	1-7/8	3	.015
17875024NA	17891	3/4	.7500	3/4	5	1-7/8	3	.030
17875025NA	17892	3/4	.7500	3/4	5	1-7/8	3	.045
17875032NA	18014	3/4	.7500	3/4	6	2-1/4	4	.015
17875034NA	17893	3/4	.7500	3/4	6	2-1/4	4	.030
17875035NA	17894	3/4	.7500	3/4	6	2-1/4	4	.045
17810022NA	18016	1	1.0000	1	5	2-1/4	3	.015
17810024NA	17897	1	1.0000	1	5	2-1/4	3	.030
17810025NA	17898	1	1.0000	1	5	2-1/4	3	.045
17810032NA	18017	1	1.0000	1	6	3	4	.015
17810034NA	17899	1	1.0000	1	6	3	4	.030
17810035NA	17900	1	1.0000	1	6	3	4	.045

Inch	
D1	Tolerance
1/4	+0.000/-0.002
> 1/4 - 1.0	+0.000/-0.003

Inch	
D2	Tolerance (h6)
.2363 - .3937	+0/-0.00035
.3938 - .7087	+0/-0.00043
.7088 - 1.000	+0/-0.00051

Inch	
R	Tolerance
1/4 - 1	+0.0000/-0.0016



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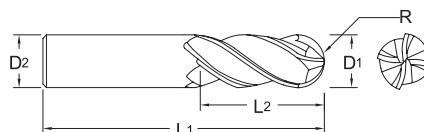




Series 179



- Designed for extreme productivity.
- Variable helix.



ALtima®		Diameter		Shank	OAL	Flute Length
		D1		D2 (h6)	L1	L2
Tool No	EDP	Inch	Decimal	Inch	Inch	Inch
17906250A	18284	1/16	.0625	1/8	1-1/2	1/8
17907810A	18286	5/64	.0781	1/8	1-1/2	5/32
17909370A	18288	3/32	.0937	1/8	1-1/2	3/16
17912500A	18034	1/8	.1250	1/8	1-1/2	1/4
17912510A	18035	1/8	.1250	1/8	1-1/2	3/8
17918700A	18038	3/16	.1875	3/16	2	3/8
17918710A	18039	3/16	.1875	3/16	2	5/8
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
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
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
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	+0.000/-0.002
> 1/4 - 1.0	+0.000/-0.003

Inch	
D2	Tolerance (h6)
.1182 - .2362	+0/-0.00031
.2363 - .3937	+0/-0.00035
.3938 - .7087	+0/-0.00043
.7088 - 1.000	+0/-0.00051

Inch	
R	Tolerance
1/16 - 1	+0/-0.001



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TuffCut® GP

General Purpose End Mills

4 Flute

TuffCut® GP Series 111 square end/corner radius

TuffCut® GP Series 140 ball nose

2 Flute

TuffCut® GP Series 121 square end/corner radius

TuffCut® GP Series 150 ball nose



All uncoated standard tools are available coated upon request. Contact customer service for details.



Available coatings
online QR CODE

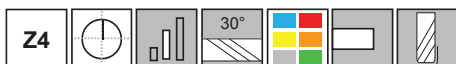
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Technical Information	51

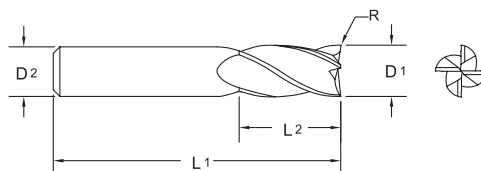
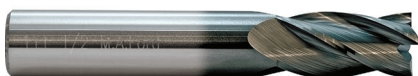
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Series 111



- Designed for aggressive milling of most materials.
- Micro sizes available.



Altima® Tool No.	EDP	Uncoated Tool No.	EDP	Diameter		Shank	OAL	Flute Length		Corner Radius
				D1		D2	L1	L2	R	
				Inch	Decimal	Inch	Inch	Inch	Inch	Inch
11112500A	11005	11112500	11105	1/8	.1250	1/8	1-1/2	3/8	-	
11112501A	75043	11112501	11108	1/8	.1250	1/8	1-1/2	1/2	-	
11112511A	76904	11112511	51401	1/8	.1250	1/8	1-1/2	3/8	0.015	
11112512A	75046	11112512	51403	1/8	.1250	1/8	1-1/2	3/8	0.020	
11114060A	75047	11114060	11112	9/64	.1406	3/16	2	1/2	-	
11115620A	10583	11115620	11113	5/32	.1562	3/16	2	1/2	-	
11117190A	75052	11117190	11116	11/64	.1719	3/16	2	5/8	-	
11118750A	11009	11118750	11119	3/16	.1875	3/16	2	5/8	-	
-	-	11118751	51405	3/16	.1875	3/16	2	5/8	0.015	
11118752A	75054	11118752	51407	3/16	.1875	3/16	2	5/8	0.020	
-	-	11118753	51409	3/16	.1875	3/16	2	5/8	0.030	
11120310A	75059	11120310	11122	13/64	.2031	1/4	2-1/2	5/8	-	
11121870A	75061	11121870	11125	7/32	.2187	1/4	2-1/2	5/8	-	
11123440A	75062	11123440	11126	15/64	.2344	1/4	2-1/2	3/4	-	
11125000A	11017	11125000	11129	1/4	.2500	1/4	2-1/2	3/4	-	
11125001A	75064	11125001	51411	1/4	.2500	1/4	2-1/2	3/4	0.015	
11125002A	75066	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	
11128120A	10057	11128120	11133	9/32	.2812	5/16	2-1/2	3/4	-	
11131250A	11019	11131250	11135	5/16	.3125	5/16	2-1/2	13/16	-	
11131251A	10058	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	
11131253A	10061	11131253	51423	5/16	.3125	5/16	2-1/2	13/16	0.030	



Metric Sizes
available online
QR CODE



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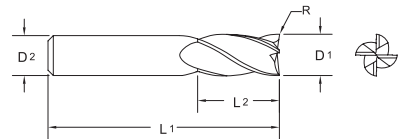
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Series 111 Continued



Series 111

TuffCut® GP

JOB SHOP

4 Flute

ALtma® Tool No.	EDP	Uncoated Tool No.	EDP	Diameter		Shank	OAL	Flute Length	Corner Radius
				D1		D2	L1	L2	R
				Inch	Decimal	Inch	Inch	Inch	Inch
11131254A	10062	11131254	51425	5/16	.3125	5/16	2-1/2	13/16	0.045
11137500A	11023	11137500	11141	3/8	.3750	3/8	2-1/2	1	-
11137501A	10075	11137501	51427	3/8	.3750	3/8	2-1/2	1	0.015
11137502A	10078	11137502	51429	3/8	.3750	3/8	2-1/2	1	0.020
11137503A	18677	11137503	51431	3/8	.3750	3/8	2-1/2	1	0.030
11137504A	10081	11137504	51433	3/8	.3750	3/8	2-1/2	1	0.045
11143750A	11029	11143750	11147	7/16	.4375	7/16	2-3/4	1	-
11150000A	11033	11150000	11151	1/2	.5000	1/2	3	1	-
11150001A	10104	11150001	51435	1/2	.5000	1/2	3	1	0.015
11150002A	10107	11150002	51437	1/2	.5000	1/2	3	1	0.020
11150003A	10108	11150003	51439	1/2	.5000	1/2	3	1	0.030
11150004A	10111	11150004	51441	1/2	.5000	1/2	3	1	0.045
11150005A	10112	11150005	51443	1/2	.5000	1/2	3	1	0.060
11156250A	10116	11156250	11155	9/16	.5625	9/16	3-1/2	1-1/8	-
11162500A	11037	11162500	11157	5/8	.6250	5/8	3-1/2	1-1/4	-
11162501A	10118	11162501	51445	5/8	.6250	5/8	3-1/2	1-1/4	0.015
11162502A	76923	11162502	51447	5/8	.6250	5/8	3-1/2	1-1/4	0.020
11162503A	10119	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
11162505A	10120	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
11175000A	11041	11175000	11163	3/4	.7500	3/4	4	1-1/2	-
11175001A	10135	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
11175003A	10136	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
11175005A	10137	11175005	51465	3/4	.7500	3/4	4	1-1/2	0.060
11175006A	12820	11175006	51467	3/4	.7500	3/4	4	1-1/2	0.090
11175007A	18149	11175007	51469	3/4	.7500	3/4	4	1-1/2	0.125
11187500A	10151	11187500	11169	7/8	.8750	7/8	4	1-1/2	-
11110000A	11001	11110000	11097	1	1.0000	1	4	1-1/2	-
-	-	11110001	51471	1	1.0000	1	4	1-1/2	0.015
-	-	11110002	51473	1	1.0000	1	4	1-1/2	0.020
-	-	11110003	51475	1	1.0000	1	4	1-1/2	0.030
-	-	11110004	51477	1	1.0000	1	4	1-1/2	0.045
-	-	11110005	51479	1	1.0000	1	4	1-1/2	0.060
11110006A	15689	11110006	51481	1	1.0000	1	4	1-1/2	0.090
-	-	11110007	51483	1	1.0000	1	4	1-1/2	0.125

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

Inch	
R	Tolerance
1/8 - 1	+.002/- .002



Metric Sizes
available online
QR CODE



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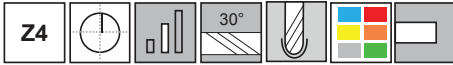
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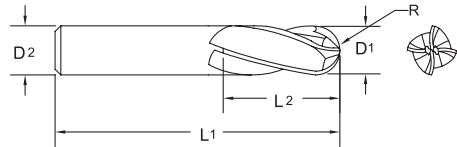
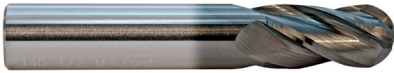
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Series 140



- 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.



ALtima® Tool No.	EDP	Uncoated Tool No.	EDP	Diameter		Shank	OAL	Flute Length
				D1		D2	L1	L2
				Inch	Decimal	Inch	Inch	Inch
14012500A	14002	14012500	14025	1/8	.1250	1/8	1-1/2	3/8
14015620A	11498	14015620	14029	5/32	.1562	3/16	2	1/2
14018750A	14006	14018750	14035	3/16	.1875	3/16	2	5/8
14021870A	11502	14021870	14041	7/32	.2187	1/4	2-1/2	5/8
14025000A	14012	14025000	14045	1/4	.2500	1/4	2-1/2	3/4
14028120A	11505	14028120	14049	9/32	.2812	5/16	2-1/2	3/4
14031250A	14014	14031250	14051	5/16	.3125	5/16	2-1/2	13/16
14037500A	14018	14037500	14057	3/8	.3750	3/8	2-1/2	1
14043750A	14022	14043750	14063	7/16	.4375	7/16	2-3/4	1
14050000A	14026	14050000	14067	1/2	.5000	1/2	3	1
14056250A	59001	14056250	14071	9/16	.5625	9/16	3-1/2	1-1/8
14062500A	14028	14062500	14073	5/8	.6250	5/8	3-1/2	1-1/4
14068750A	11508	14068750	14077	11/16	.6875	3/4	4	1-3/8
14075000A	14032	14075000	14081	3/4	.7500	3/4	4	1-1/2
14087500A	11509	14087500	14087	7/8	.8750	7/8	4	1-1/2
14010000A	54001	14010000	14019	1	1.0000	1	4	1-1/2

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

Inch	
R	Tolerance
1/8	+.002/- .002
>1/8	+.003/- .003



Metric Sizes
available online
QR CODE

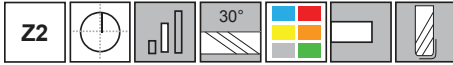


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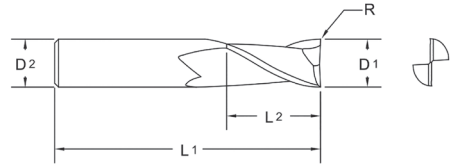
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Series 121



- Designed for aggressive milling of most materials.
- Coatings available upon request.
- Micro sizes available.



Tool No.	EDP	Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2	L1	L2	R
		Inch	Decimal	Inch	Inch	Inch	Inch
12112500	12153	1/8	.1250	1/8	1-1/2	3/8	-
12112511	52401	1/8	.1250	1/8	1-1/2	3/8	.015
12112512	52403	1/8	.1250	1/8	1-1/2	3/8	.020
12112501	12150	1/8	.1250	1/8	1-1/2	1/2	-
12114060	12187	9/64	.1406	3/16	2	1/2	-
12115620	12157	5/32	.1562	3/16	2	1/2	-
12117190	12188	11/64	.1719	3/16	2	5/8	-
12118750	12160	3/16	.1875	3/16	2	5/8	-
12118751	52405	3/16	.1875	3/16	2	5/8	.015
12118752	52407	3/16	.1875	3/16	2	5/8	.020
12118753	52409	3/16	.1875	3/16	2	5/8	.030
12120310	12189	13/64	.2031	1/4	2-1/2	5/8	-
12121870	12163	7/32	.2187	1/4	2-1/2	5/8	-
12123440	12190	15/64	.2344	1/4	2-1/2	3/4	-
12125000	12165	1/4	.2500	1/4	2-1/2	3/4	-
12125001	52411	1/4	.2500	1/4	2-1/2	3/4	.015
12125002	52413	1/4	.2500	1/4	2-1/2	3/4	.020
12125003	52415	1/4	.2500	1/4	2-1/2	3/4	.030
12125004	52417	1/4	.2500	1/4	2-1/2	3/4	.045
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	.015
12131252	52421	5/16	.3125	5/16	2-1/2	13/16	.020
12131253	52423	5/16	.3125	5/16	2-1/2	13/16	.030
12131254	52425	5/16	.3125	5/16	2-1/2	13/16	.045
12137500	12171	3/8	.3750	3/8	2-1/2	1	-
12137501	52427	3/8	.3750	3/8	2-1/2	1	.015



Metric Sizes
available online
QR CODE



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Series 121 Continued

Tool No.	EDP	Diameter		Shank	OAL	Flute Length	Corner Radius
		D1		D2	L1	L2	R
		Inch	Decimal	Inch	Inch	Inch	Inch
12137502	52429	3/8	.3750	3/8	2-1/2	1	.020
12137503	52431	3/8	.3750	3/8	2-1/2	1	.030
12137504	52433	3/8	.3750	3/8	2-1/2	1	.045
12143750	12174	7/16	.4375	7/16	2-3/4	1	-
12150000	12176	1/2	.5000	1/2	3	1	-
12150001	52435	1/2	.5000	1/2	3	1	.015
12150002	52437	1/2	.5000	1/2	3	1	.020
12150003	52439	1/2	.5000	1/2	3	1	.030
12150004	52441	1/2	.5000	1/2	3	1	.045
12150005	52443	1/2	.5000	1/2	3	1	.060
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	.015
12162502	52447	5/8	.6250	5/8	3-1/2	1-1/4	.020
12162503	52449	5/8	.6250	5/8	3-1/2	1-1/4	.030
12162504	52451	5/8	.6250	5/8	3-1/2	1-1/4	.045
12162505	52453	5/8	.6250	5/8	3-1/2	1-1/4	.060
12162506	52455	5/8	.6250	5/8	3-1/2	1-1/4	.090
12175000	12182	3/4	.7500	3/4	4	1-1/2	-
12175001	52457	3/4	.7500	3/4	4	1-1/2	.015
12175002	52459	3/4	.7500	3/4	4	1-1/2	.020
12175003	52461	3/4	.7500	3/4	4	1-1/2	.030
12175004	52463	3/4	.7500	3/4	4	1-1/2	.045
12175005	52465	3/4	.7500	3/4	4	1-1/2	.060
12175006	52467	3/4	.7500	3/4	4	1-1/2	.090
12175007	52469	3/4	.7500	3/4	4	1-1/2	.125
12187500	12185	7/8	.8750	7/8	4	1-1/2	-
12110000	12149	1	1.0000	1	4	1-1/2	-
12110001	52471	1	1.0000	1	4	1-1/2	.015
12110002	52473	1	1.0000	1	4	1-1/2	.020
12110003	52475	1	1.0000	1	4	1-1/2	.030
12110004	52477	1	1.0000	1	4	1-1/2	.045
12110005	52479	1	1.0000	1	4	1-1/2	.060
12110006	52481	1	1.0000	1	4	1-1/2	.090
12110007	52483	1	1.0000	1	4	1-1/2	.125

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

Inch	
R	Tolerance
1/8 - 1	+.002/- .002



Metric Sizes
available online
QR CODE

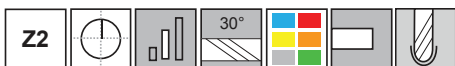


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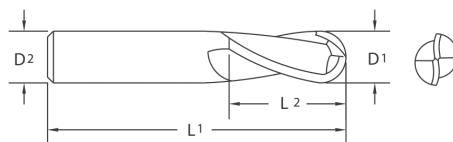
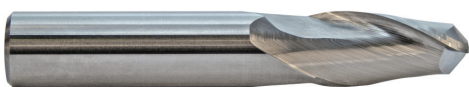
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Series 150



- Designed for milling fillets or similar rounded corners in the bottom of a cut. Ideal for most ferrous metal applications.
- Micro sizes available.
- Coating available upon request.



Series 150

TuffCut® GP

2 Flute

JOB SHOP

Tool No.	EDP	Diameter		Shank	OAL	Flute Length
		D1		D2	L1	L2
		Inch	Decimal	Inch	Inch	Inch
15012500	15025	1/8	.1250	1/8	1-1/2	3/8
15015620	15029	5/32	.1562	3/16	2	1/2
15018750	15035	3/16	.1875	3/16	2	5/8
15021870	15041	7/32	.2187	1/4	2-1/2	5/8
15025000	15045	1/4	.2500	1/4	2-1/2	3/4
15028120	15049	9/32	.2812	5/16	2-1/2	3/4
15031250	15051	5/16	.3125	5/16	2-1/2	13/16
15037500	15057	3/8	.3750	3/8	2-1/2	1
15043750	15063	7/16	.4375	7/16	2-3/4	1
15050000	15067	1/2	.5000	1/2	3	1
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
15068750	15077	11/16	.6875	3/4	4	1-3/8
15075000	15081	3/4	.7500	3/4	4	1-1/2
15087500	15087	7/8	.8750	7/8	4	1-1/2
15010000	15019	1	1.0000	1	4	1-1/2

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

Inch	
R	Tolerance
1/8	+.002/- .002
>1/8	+.003/- .003



Metric Sizes
available online
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563-391-6220/800-553-8024



177 / 179 Recommended Cutting Data - Profile Milling

Inch 179 Series - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Metric Data
available online
QR CODE



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

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:

(Calculated Feed x Spindle Maximum)/Calculated Speed

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

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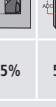
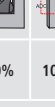
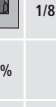
177 / 179 Recommended Cutting Data - Slotting

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

Metric Data
available online
QR CODE



Inch

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

Spindle Maximum - Should the calculated spindle speed be more than your actual spindle maximum, use this formula:

$$\text{Spindle Maximum} = \frac{\text{Calculated Feed} \times \text{Spindle Maximum}}{\text{Calculated Speed}}$$

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





178 / 178N Recommended Cutting Data - Profile Milling

Metric Data
available online
QR CODE



Inch

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

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

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



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178 / 178N Recommended Cutting Data - Slotting

Metric Data
available online
QR CODE



Inch

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

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

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





General Purpose End Mill Recommended Cutting Data - Profile Milling

Length	2 Flute Series		4 Flute Series	
Standard	121	150	111	140

Metric Data
available online
QR CODE



For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Inch

For diameters 1/4" and below, see Micro Charts starting on page 55.

Workpiece Material Group	ISO	H a r d n e s s	Coolant • Preferred o Possible x Not Possible			Profile Milling (ae)					End Mill Diameters					
											5/16	3/8	1/2	5/8	3/4	1
						5%	10%	20%	30%	50%	ae > .3D use < 1D ap ae < .2D use < 2D ap					
						2.3	1.8	1.2	1.1	1	Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.					
						Max.	Air	MMS	vc - SFM Increase speeds by 30% for ALtma® coated tools					fz - in/tooth		
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	•	•	•	1050	700	385	375	350	.0027	.0032	.0045	.0054	.0063	.0090
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	•	•	•	630	420	320	250	210	.0027	.0032	.0045	.0054	.0063	.0090
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	525	350	300	275	250	.0027	.0032	.0045	.0054	.0063	.0090
Hardened Steels	H	45-55 Rc	•	o	o	250	240	230	210	200	.0018	.0021	.0030	.0036	.0042	.0060
Hardened Steels		55-65 Rc	•	o	o	200	180	160	150	100	.0013	.0014	.0021	.0024	.0029	.0041
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	•	x	o	650	600	550	500	450	.0027	.0032	.0045	.0054	.0063	.0090
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	525	400	350	300	250	.0027	.0032	.0045	.0054	.0063	.0090
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	525	400	350	300	250	.0027	.0032	.0045	.0054	.0063	.0090

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



General Purpose End Mill Recommended Cutting Data - Profile Milling

Length	2 Flute Series		4 Flute Series	
Standard	121	150	111	140

Metric Data
available online
QR CODE



For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Inch Continued

For diameters 1/4" and below, see Micro Charts starting on page 55.

Workpiece Material Group	ISO	H a r d n e s s	Coolant • Preferred o Possible x Not Possible			Profile Milling (ae)					End Mill Diameter					
											5/16	3/8	1/2	5/8	3/4	1
						5%	10%	20%	30%	50%	ae > .3D use < 1D ap ae < .2D use < 2D ap					
						2.3	1.8	1.2	1.1	1	← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.					
						Max.	Air	MMS	vc - SFM Increase speeds by 30% for Altima® coated tools					fz - in/tooth		
High Temp Alloys Nimonic, Inconel, Monel, Hastelloy	S	up to 42 Rc	•	x	x	100	90	80	70	60	.0008	.0009	.0012	.0015	.0019	.0025
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	230	200	175	150	125	.0014	.0016	.0023	.0027	.0032	.0045
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	425	400	375	350	300	.0027	.0032	.0045	.0054	.0063	.0090
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	320	300	250	225	200	.0027	.0032	.0045	.0054	.0063	.0090
Non-Ferrous, Plastics, Graphite	N		•			1000	960	920	880	840	.0027	.0032	.0045	.0054	.0063	.0090

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General Purpose End Mill Recommended Cutting Data - Slotting

Length	2 Flute Series		4 Flute Series	
Standard	121	150	111	140

Metric Data
available online
QR CODE



For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Inch

For diameters 1/4" and below, see Micro Charts starting on page 55.

Workpiece Material Group	I S O	H a r d n e s s	Coolant • Preferred o Possible x Not Possible			Slotting			End Mill Diameter					
									5/16	3/8	1/2	5/8	3/4	1
						25%	50%	100%						
			Max.	Air	MMS	vc - SFM Increase speeds by 30% for ALtima® coated tools			fz - in/tooth					
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	•	•	•	385	370	350	.0016	.0019	.0025	.0031	.0038	.0050
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, 01, 02, 06, S2, W1 to W310	P	28 to 38 Rc	•	•	•	245	230	210	.0016	.0019	.0025	.0031	.0038	.0050
Tool Steels & Die Steels 07, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	210	195	175	.0016	.0019	.0025	.0031	.0038	.0050
Hardened Steels	H	35-45 Rc	•	o	o	245	230	210	.0016	.0019	.0025	.0031	.0038	.0050
Hardened Steels		45-55 Rc	•	o	o	175	160	140	.0008	.0010	.0013	.0016	.0020	.0025
Hardened Steels		55-65 Rc	•	o	o	150	125	100	.0004	.0005	.0008	.0008	.0010	.0012
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	•	x	o	385	370	350	.0016	.0019	.0025	.0031	.0038	.0050
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-SPH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	245	210	175	.0016	.0019	.0025	.0031	.0038	.0050
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitinols	M	over 28 Rc	•	x	o	210	195	175	.0016	.0019	.0025	.0031	.0038	.0050

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General Purpose End Mill Recommended Cutting Data - Slotting

Metric Data
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Length	2 Flute Series		4 Flute Series	
Standard	121	150	111	140

For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Inch Continued

For diameters 1/4" and below, see Micro Charts starting on page 55.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting			End Mill Diameter					
									5/16	3/8	1/2	5/8	3/4	1
						25%	50%	100%						
						Max.	Air	MMS	vc - SFM Increase speeds by 30% for ALtima® coated tools			fz - in/tooth		
High Temp Alloys Nimonic, Inconel, Monel, Hastelloy	S	up to 42 Rc	•	x	x	80	70	60	.0008	.0009	.0012	.0015	.0019	.0025
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	100	90	80	.0008	.0010	.0013	.0016	.0017	.0026
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	•	o	o	450	400	350	.0016	.0019	.0025	.0031	.0038	.0050
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	•	o	o	300	250	225	.0016	.0019	.0025	.0031	.0038	.0050
Non-Ferrous, Plastic, Graphite	N		•			750	600	450	.0016	.0019	.0025	.0031	.0038	.0050

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Micro End Mill Recommended Cutting Data - Profile Milling

Metric Data
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Length	2 Flute Series		4 Flute Series	
Standard	121	150	111	140

Ball Nose End Mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Inch - Standard Length

For diameters > 1/4", see Charts Starting on page 51.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Profile Milling	End Mill Diameter (Inch)		
							.1250	.1870	.2500
							25% Dia. ae		
							<2 Dia. ap		
							fz - in/tooth		
Max.	Air	MMS	vc - SFM Increase speed by 30% for ALtima® coated tools.						
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	●	●	●	400	0.00054	0.00081	0.00100
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	●	●	●	300	0.00054	0.00081	0.00100
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	●	●	●	200	0.00054	0.00081	0.00100
Hardened Steels	H	45-55 Rc	●	o	o	100	0.00300	0.00360	0.00420
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	●	x	o	400	0.00054	0.00081	0.00100
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	●	x	o	200	0.00054	0.00081	0.00100
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	●	x	o	150	0.00054	0.00081	0.00100
Cast Iron	K	160-200 HB	●	o	o	400	0.00054	0.00081	0.00100
Malleable / Ductile Cast Iron	K	200-250 HB	●	o	o	250	0.00054	0.00081	0.00100
High Temp Alloys Nimonics, Inconel, Monel, Hastelloy	S	up to 42 Rc	●	x	x	70	0.00040	0.00054	0.00080
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr-4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	●	x	x	150	0.00040	0.00054	0.00080
Aluminum < 10 % Si	N		●			750	0.00054	0.00081	0.00100
Aluminum > 10 % Si	N								

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





Micro End Mill Recommended Cutting Data - Slotting

Metric Data
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QR CODE



Length	2 Flute Series	
Standard	121	150

Ball Nose End Mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Inch - Standard 2 Flute

For diameters > 1/4", see Charts Starting on page 51.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting 	End Mill Diameter (Inch)		
							.1250	.1870	.2500
						35% Dia. ap			
			Max.	Air	MMS	vc - SFM Increase speed by 30% for ALtima® coated tools.	fz - in/tooth		
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	•	•	•	400	.0005	.0007	.0010
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	•	•	•	300	.0004	.0007	.0009
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	•	•	•	200	.0004	.0006	.0008
Hardened Steels	H	35-45 Rc	•	o	o	100	.0002	.0003	.0004
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	•	x	o	400	.0005	.0007	.0010
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, T5-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	•	x	o	200	.0004	.0007	.0009
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	•	x	o	150	.0003	.0004	.0005
Cast Iron	K	160-200 HB	•	o	o	400	.0005	.0007	.0010
Malleable / Ductile Cast Iron	K	200-250 HB	•	o	o	250	.0004	.0007	.0009
High Temp Alloys Nimonics, Inconel, Monel, Hastelloy	S	up to 42 Rc	•	x	x	70	.0003	.0004	.0005
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	•	x	x	150	.0003	.0004	.0005
Aluminum < 10 % Si	N		•			750	.0011	.0017	.0022
Aluminum > 10 % Si	N								

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Micro End Mill Recommended Cutting Data - Slotting

Metric Data
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Length	4 Flute Series	
Standard	111	140

Ball Nose End Mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter.

Inch - Standard Length 4 Flute

For diameters > 1/4", see Charts Starting on page 51.

Workpiece Material Group	ISO	Hardness	Coolant • Preferred o Possible x Not Possible			Slotting	End Mill Diameter (Inch)		
							.1250	.1870	.2500
							35% Dia. ap		
			Max.	Air	MMS	vc - SFM Increase speed by 30% for ALtimate® coated tools.	fz - in/tooth		
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	●	●	●	400	.0005	.0007	.0010
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, 01, 02, 06, S2, W1 to W310	P	28 to 38 Rc	●	●	●	300	.0004	.0007	.0009
Tool Steels & Die Steels 07, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	●	●	●	200	.0004	.0006	.0008
Hardened Steels	H	35-45 Rc	●	o	o	100	.0002	.0003	.0004
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	●	x	o	400	.0005	.0007	.0010
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	●	x	o	200	.0004	.0007	.0009
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	●	x	o	150	.0003	.0004	.0005
Cast Iron	K	160-200 HB	●	o	o	400	.0005	.0007	.0010
Malleable / Ductile Cast Iron	K	200-250 HB	●	o	o	250	.0004	.0007	.0009
High Temp Alloys Nimonics, Inconel, Monel, Hastelloy	S	up to 42 Rc	●	x	x	70	.0003	.0004	.0005
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	●	x	x	150	.0003	.0004	.0005
Aluminum < 10 % Si	N		●			750	.0011	.0017	.0022
Aluminum > 10 % Si	N								

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Chamfer Mills

High Performance Chamfer Mills

Series 3HC and 5HC Features and Benefits

Precision Tip Diameter

- Increased tip strength
- Easy programmability
- Excellent repeatability

Helical Flute Form

- Smooth cutting action
- Increased cutting conditions
- Excellent surface finish

Finish Option

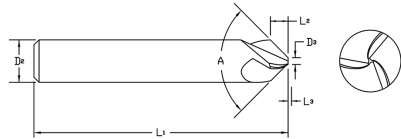
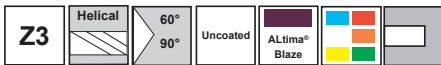
- Offered Uncoated and ALtima®
Blaze coated for an extensive
material range



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Chamfer Mills

Series 3HC



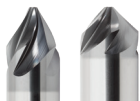
Uncoated		ALtima® Blaze		Included Angle	Shank Diameter	Flute Length	OAL	Theoretical Tip Length	Tip Diameter
Tool No.	EDP	Tool No.	EDP	A	D2 (h6)	L2	L1	L3 Ref.	D3
3HC012501	35000	3HC012501B	35010	60°	1/8	0.074	1-1/2	0.035	0.040
3HC018701	35001	3HC018701B	35011	60°	3/16	0.119	2	0.043	0.050
3HC025001	35002	3HC025001B	35012	60°	1/4	0.165	2-1/2	0.052	0.060
3HC037501	35003	3HC037501B	35013	60°	3/8	0.264	2-1/2	0.061	0.070
3HC050001	35004	3HC050001B	35014	60°	1/2	0.364	3	0.069	0.080
3HC012503	35005	3HC012503B	35015	90°	1/8	0.043	1-1/2	0.020	0.040
3HC018703	35006	3HC018703B	35016	90°	3/16	0.069	2	0.025	0.050
3HC025003	35007	3HC025003B	35017	90°	1/4	0.095	2-1/2	0.030	0.060
3HC037503	35008	3HC037503B	35018	90°	3/8	0.153	2-1/2	0.035	0.070
3HC050003	35009	3HC050003B	35019	90°	1/2	0.210	3	0.040	0.080

Diameter Tolerances	
D2	h6
D3	±.002



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Series 5HC



ALtima® Blaze		Included Angle	Shank Diameter	Flute Length	OAL	Theoretical Tip Length	Tip Diameter
Tool No.	EDP	A	D2 (h6)	L2	L1	L3 Ref.	D3
5HC025001B	35020	60°	1/4	0.165	2-1/2	0.052	0.060
5HC037501B	35021	60°	3/8	0.264	2-1/2	0.061	0.070
5HC050001B	35022	60°	1/2	0.364	3	0.069	0.080
5HC025003B	35023	90°	1/4	0.095	2-1/2	0.030	0.060
5HC037503B	35024	90°	3/8	0.153	2-1/2	0.035	0.070
5HC050003B	35025	90°	1/2	0.210	3	0.040	0.080

Diameter Tolerances	
D2	h6
D3	±.002



Metric sizes
available online
QR CODE



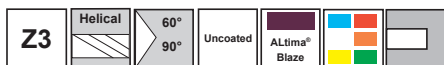
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Chamfer Mills

Series 3HC - Kits & Sets



Kit



Uncoated		ALtima® Blaze		No. Pieces	Angle	Sizes in Set/Kit			
Tool No.	EDP	Tool No.	EDP						
3HC000001SET	35031	3HC000001BSET	35033	4	60°	1/8	1/4	3/8	1/2
3HC000003SET	35032	3HC000003BSET	35034	4	90°	1/8	1/4	3/8	1/2
3HC025003 KIT	18880	-	-	4	90°	1/4			
3HC037503 KIT	18881	-	-	4	90°	3/8			
3HC050003 KIT	18882	-	-	4	90°	1/2			



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Series 5HC - Kits & Sets



Set



ALtima® Blaze		No. Pieces	Angle	Sizes in Set/Kit		
Tool No.	EDP					
5HC000001BSET	35035	3	60°	1/4	3/8	1/2
5HC000003BSET	35036	3	90°	1/4	3/8	1/2
5HC025003B KIT	18883	4	90°	1/4		
5HC037503B KIT	18884	4	90°	3/8		
5HC050003B KIT	18885	4	90°	1/2		



Metric sizes
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Recommended Cutting Data Series 3HC & 5HC - Inch

Material Group	ISO	Hardness	Vc - SFM		fz - in/tooth by Cutter Diameter				
			Uncoated	ALtima® Blaze	1/8	3/16	1/4	3/8	1/2
Low Carbon Steels 12L14, 1018, A36	P	≤ 28 HRC	805	1150	.0015	.0023	.0030	.0045	.0060
Medium Carbon & High Carbon Steels 1045, 1050, 1070		≤ 38 HRC	630	900	.0010	.0015	.0020	.0030	.0040
Alloy Steels 4130, 4140, 4340			590	840	.0010	.0015	.0020	.0030	.0040
Die / Tool Steels A2, D2, H13, P20		≤ 45 HRC	510	725	.0009	.0013	.0018	.0026	.0035
Stainless Steel - Easy to Machine 303, 400 Series	M	≤ 28 HRC	380	545	.0009	.0013	.0018	.0026	.0035
Stainless Steel - Moderately Difficult Austenitic 304, 316			300	430	.0008	.0011	.0015	.0023	.0030
Stainless Steel - Difficult to Machine A286, Duplex, Nitronics, Cobalt Chrome		≤ 45 HRC	140	200	.0006	.0009	.0013	.0019	.0025
PH Stainless Steel 15-5, 17-4			300	430	.0008	.0011	.0015	.0023	.0030
High Temp Alloys Inconel, Hastelloy, Monel	S	≤ 42 HRC	105	150	.0006	.0009	.0013	.0019	.0025
Titanium Alloys 6AL-4V			245	350	.0008	.0011	.0015	.0023	.0030
Cast Irons - Gray	K	≤ 240 HB	910	1300	.0018	.0026	.0035	.0053	.0070
Cast Irons - Ductile & Malleable		> 240 HB	380	540	.0013	.0019	.0025	.0038	.0050
Wrought Aluminum Alloys 6061, 7050, 7075	N	-	2000	2500	.0020	.0030	.0040	.0060	.0080
Cast Aluminum Alloys		-	1500	2000	.0015	.0023	.0030	.0045	.0060
Brass & Copper Alloys		-	900	1200	.0011	.0017	.0023	.0034	.0045

Decreased feeds and/or a finish pass may be necessary to reach desired surface finish requirements.
Decreased speeds and feeds may be necessary for slotting / heavy duty cutting.
Cutting speed (Vc) should be calculated off of the Effective cutting diameter.

Effective Cutting Diameter = 2 x Chosen "Z" depth x tan (Included Angle/2) + Tip Diameter

Example:

Tool: 5HC050003B
Included Angle = 90°
Tip Diameter = .080"
Length of Cut = .210"
Chosen "Z" Depth = .180"

Calculation:

$2 \times .180" \times \tan(90^\circ/2) + .080"$
Effective Cutting Diameter = .440"

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[Back to Series 5HC](#)

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

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QUALITY



CERTIFICATE OF REGISTRATION

This is to certify that the management system of:

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

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

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

ISO 9001:2015

The management system is applicable to:

The design and manufacture of precision rotary cutting tools.

Certificate Number:
98-1247g

Initial Certification Date:
30 October 1998

Date of Certification Decision:
02 September 2021

Issuing Date:
02 September 2021

Valid Until:
10 September 2024




Calin Moldovean
President, Business Assurance

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



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



The M.A. Ford® Quality Policy is:

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

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



Robert Hill, CEO



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

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[illegible]

Just Say **R-T-A**
Rapid Turn Around



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

When ordering to receive expedited delivery on these services

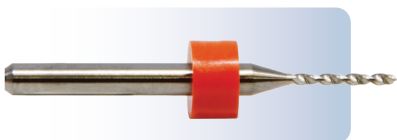
Phone Orders Only • No EDI or Web Orders • Ex. 3 Days: Order Monday, Ships Friday

» Add Coating:

ALtima® Ships Within 3 Days When Base Tool In Stock

ALtima Blaze® Ships Within 3 Days When Base Tool In Stock

Note: 50 Piece Order Max.



» Add Depth Setting Rings

Ships Within 3 Days When Base Tool In Stock

Note: 1/8" Shank Size X 1-1/2" OAL Tools Only,
100 Piece Order Max.

» 270 Series Range Reamers -

Ships Within 3 Days When Base Tool In Stock

Note: 25 Piece Order Max., no 270L or 270P



» Add Standard Shank Flat

Ships Within 3 Days When Base Tool In Stock

With These Shank Sizes:

Inch - 3/8", 1/2", 5/8", 3/4", 7/8" and 1"

mm - 6, 8, 10, 12, 14, 16, 18, 20 and 25

Note: 50 Piece Order Max.

» Add End Mill Corner Radius

Ships Within 3 Days When Uncoated Base Tool In Stock

Note: End Mill Diameters 6mm(.2362") And Above,
12 Piece Order Max.



► To place your R-T-A order:

Ph: 563-391-6220 or 800-553-8024

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M.A. Ford® Mfg. Co., Inc.
7737 Northwest Blvd.

Davenport, IA 52806
USA

Tel: 563-391-6220 or 800-553-8024
e-mail: sales@maford.com
www.maford.com

M.A. Ford® Europe Ltd.

650 City Gate
London Road, Derby
DE24 8WY
United Kingdom

Tel: +44 (0) 1332 267960
Fax: +44 (0) 1332 267969
e-mail: sales@mafordeurope.com
www.mafordeurope.com

M.A. Ford® Asia-Pacific Limited

Room 1709, Level 17
Millennium City 2
378 Kwun Tong Road
Kowloon, Hong Kong

Tel: +852-2167-7150
Fax: +852-2167-8150
e-mail: sales@mafordeurope.com

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