

TOLERANCES

$d1$	$\leq .030"$	$+0.000" - .001"$ (+.000 - .025mm)
	$\geq 1/32"$	$+0.000" - .002"$ (+.000 - .050mm)
$d2$	h6	



Series 160M, 170M, 860M, 870M

.0050" - .0787"
(0.127mm - 2.000mm)

END MILLS

Stub Length - Square End

Solid submicron grain carbide end mill - center cutting

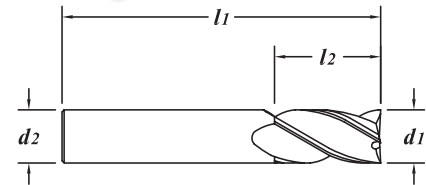
Shorter flute length for rigidity

Extremely versatile

TiAlN Coated - page 177

Standard Length - page 184

Extended length - page 210



(160M/860M) 2 Flute EDP#	(170M/870M) 4 Flute EDP#	$d1$ †		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Diameter Metric								
01200	-	.0050	.0050"	0.127	1/8"	1-1/2"	.008"	21.28	20.35	19.43	18.50
01210	-	.0060	.0060"	0.152	1/8"	1-1/2"	.009"	21.28	20.35	19.43	18.50
01220	-	.0070	.0070"	0.178	1/8"	1-1/2"	.011"	20.02	19.15	18.28	17.41
01230	-	.0080	.0080"	0.203	1/8"	1-1/2"	.012"	20.02	19.15	18.28	17.41
01250	-	.0100	.0100"	0.254	1/8"	1-1/2"	.015"	18.89	18.07	17.25	16.43
01260	-	.0110	.0110"	0.279	1/8"	1-1/2"	.017"	17.49	16.73	15.97	15.21
01270	-	.0120	.0120"	0.305	1/8"	1-1/2"	.018"	17.49	16.73	15.97	15.21
01280	-	.0130	.0130"	0.330	1/8"	1-1/2"	.020"	17.40	16.64	15.89	15.13
01290	-	.0140	.0140"	0.356	1/8"	1-1/2"	.021"	17.40	16.64	15.89	15.13
01300	-	.0150	.0150"	0.381	1/8"	1-1/2"	.023"	17.40	16.64	15.89	15.13
01310	-	.0160	.0160"	0.406	1/8"	1-1/2"	.024"	17.17	16.42	15.68	14.93
01320	-	.0170	.0170"	0.432	1/8"	1-1/2"	.026"	17.17	16.42	15.68	14.93
01330	-	.0180	.0180"	0.457	1/8"	1-1/2"	.027"	16.85	16.12	15.38	14.65
01340	-	.0190	.0190"	0.483	1/8"	1-1/2"	.029"	16.85	16.12	15.38	14.65
01350	-	.0200	.0200"	0.508	1/8"	1-1/2"	.030"	16.85	16.12	15.38	14.65
01360	-	.0210	.0210"	0.533	1/8"	1-1/2"	.032"	16.85	16.12	15.38	14.65
01370	-	.0220	.0220"	0.559	1/8"	1-1/2"	.033"	16.65	15.93	15.20	14.48
01380	-	.0230	.0230"	0.584	1/8"	1-1/2"	.035"	16.65	15.93	15.20	14.48
01390	-	.0240	.0240"	0.610	1/8"	1-1/2"	.036"	16.65	15.93	15.20	14.48
01400	-	.0250	.0250"	0.635	1/8"	1-1/2"	.038"	15.71	15.03	14.34	13.66
01410	-	.0260	.0260"	0.660	1/8"	1-1/2"	.039"	15.71	15.03	14.34	13.66
01420	-	.0270	.0270"	0.686	1/8"	1-1/2"	.041"	14.09	13.48	12.86	12.25
01430	-	.0280	.0280"	0.711	1/8"	1-1/2"	.042"	14.09	13.48	12.86	12.25
01440	-	.0290	.0290"	0.737	1/8"	1-1/2"	.044"	14.09	13.48	12.86	12.25
01450	-	.0300	.0300"	0.762	1/8"	1-1/2"	.045"	14.09	13.48	12.86	12.25
01010	02010	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	10.25	9.80	9.36	8.91
01510	02510	.0394		1.000	3.0	38	2	10.76	10.30	9.83	9.36
01020	02020	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	10.25	9.80	9.36	8.91
01520	02520	.0591		1.500	3.0	38	3	10.76	10.30	9.83	9.36
01030	02030	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	8.13	7.78	7.42	7.07
01530	02530	.0787		2.000	3.0	38	4	8.56	8.18	7.81	7.44

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MATERIAL HARDNESS (Rc)

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continued →

Series 160M, 170M, 860M, 870M (continued)

.0938" - 1.000"
(2.383mm - 25.400mm)

END MILLS

(160M/860M) 2 Flute EDP#	(170M/870M) 4 Flute EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
01040	02040	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	7.69	7.36	7.02	6.69
01540	02540	.0984		2.500	3.0	38	5	8.10	7.74	7.39	7.04
01550	02550	.1181		3.000	3.0	38	6	7.90	7.56	7.21	6.87
01050	02050	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	7.49	7.16	6.84	6.51
01560	02560	.1378		3.500	4.0	50	7	11.05	10.57	10.09	9.61
01060	02060	.1562	5/32"	3.967	3/16"	2"	5/16"	10.51	10.05	9.60	9.14
01570	02570	.1575		4.000	4.0	50	8	10.45	10.00	9.54	9.09
01580	02580	.1772		4.500	5.0	50	9.5	13.87	13.27	12.66	12.06
01070	02070	.1875	3/16"	4.763	3/16"	2"	3/8"	9.95	9.52	9.08	8.65
01590	02590	.1969		5.000	5.0	50	10	12.94	12.38	11.81	11.25
01080	02080	.2188	7/32"	5.558	1/4"	2"	7/16"	13.19	12.62	12.04	11.47
01600	02600	.2362		6.000	6.0	50	12	13.70	13.10	12.51	11.91
01090	02090	.2500	1/4"	6.350	1/4"	2"	1/2"	13.00	12.43	11.87	11.30
01610	02610	.2756		7.000	7.0	50	12	17.81	17.04	16.26	15.49
01100	02100	.3125	5/16"	7.938	5/16"	2"	1/2"	17.79	17.02	16.24	15.47
01620	02620	.3150		8.000	8.0	50	12	18.70	17.89	17.07	16.26
01630	02630	.3543		9.000	9.0	50	14	23.10	22.10	21.09	20.09
01110	02110	.3750	3/8"	9.525	3/8"	2"	5/8"	21.97	21.01	20.06	19.10
01640	02640	.3937		10.000	10.0	50	16	25.53	24.42	23.31	22.20
01650	02650	.4331		11.000	11.0	65	19	29.83	28.53	27.24	25.94
01120	02120	.4375	7/16"	11.113	7/16"	2-1/2"	5/8"	27.16	25.98	24.80	23.62
01660	02660	.4724		12.000	12.0	65	19	38.12	36.47	34.81	33.15
01130	02130	.5000	1/2"	12.700	1/2"	2-1/2"	5/8"	36.23	34.65	33.08	31.50
01140	02140	.6250	5/8"	15.875	5/8"	3"	3/4"	69.24	66.23	63.22	60.21
01670	02670	.6299		16.000	16.0	75	19	72.88	69.71	66.54	63.37
01150	02150	.7500	3/4"	19.050	3/4"	3"	1"	99.59	95.26	90.93	86.60
01680	02680	.7874		20.000	20.0	75	25	135.07	129.20	123.32	117.45
-	02160	1.000	1"	25.400	1"	3"	1"	171.37	163.92	156.47	149.02

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MATERIAL HARDNESS (Rc)

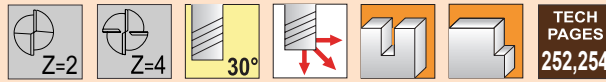


End Mill Manufacturing

TOLERANCES

d_1	+0.000" -0.002" (+0.000 -0.050mm)
d_2	h6

Series 160MA, 170MA, 860MA, 870MA



END MILLS

Stub Length - Square End

TiAlN Coating

Solid submicron grain carbide end mill - center cutting

Shorter flute length for rigidity

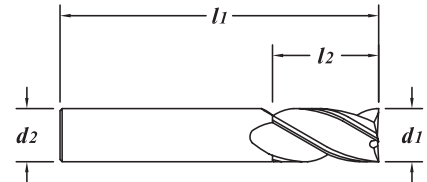
Dry or semi-dry machining

Extremely versatile

Uncoated - page 175

Standard Length - page 188

Extended length - page 213



(160MA/860MA) 2 Flute EDP#	(170MA/870MA) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
01017	02017	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	12.72	12.17	11.61	11.06
01517	02517	.0394		1.000	3.0	38	2	13.25	12.67	12.10	11.52
01027	02027	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	12.72	12.17	11.61	11.06
01527	02527	.0591		1.500	3.0	38	3	13.25	12.67	12.10	11.52
01037	02037	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	10.60	10.14	9.68	9.22
01537	02537	.0787		2.000	3.0	38	4	11.03	10.55	10.07	9.59
01047	02047	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	10.17	9.72	9.28	8.84
01547	02547	.0984		2.500	3.0	38	5	10.56	10.10	9.64	9.18
01557	02557	.1181		3.000	3.0	38	6	10.35	9.90	9.45	9.00
01057	02057	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	9.95	9.52	9.08	8.65
01567	02567	.1378		3.500	4.0	50	7	13.51	12.93	12.34	11.75
01067	02067	.1562	5/32"	3.967	3/16"	2"	5/16"	12.97	12.41	11.84	11.28
01577	02577	.1575		4.000	4.0	50	8	12.94	12.38	11.81	11.25
01587	02587	.1772		4.500	5.0	50	9.5	17.72	16.95	16.18	15.41
01077	02077	.1875	3/16"	4.763	3/16"	2"	3/8"	12.42	11.88	11.34	10.80
01597	02597	.1969		5.000	5.0	50	10	16.77	16.04	15.31	14.58
01087	02087	.2188	7/32"	5.558	1/4"	2"	7/16"	17.04	16.30	15.56	14.82
01607	02607	.2362		6.000	6.0	50	12	17.54	16.78	16.01	15.25
01097	02097	.2500	1/4"	6.350	1/4"	2"	1/2"	16.85	16.12	15.38	14.65
01617	02617	.2756		7.000	7.0	50	12	23.30	22.29	21.27	20.26
01107	02107	.3125	5/16"	7.938	5/16"	2"	1/2"	23.28	22.26	21.25	20.24
01627	02627	.3150		8.000	8.0	50	12	24.21	23.16	22.10	21.05
01637	02637	.3543		9.000	9.0	50	14	28.59	27.35	26.10	24.86
01117	02117	.3750	3/8"	9.525	3/8"	2"	5/8"	27.45	26.26	25.06	23.87
01647	02647	.3937		10.000	10.0	50	16	31.75	30.37	28.99	27.61
01657	02657	.4331		11.000	11.0	65	19	38.49	36.82	35.14	33.47
01127	02127	.4375	7/16"	11.113	7/16"	2-1/2"	5/8"	35.81	34.25	32.70	31.14
01667	02667	.4724		12.000	12.0	65	19	46.78	44.75	42.71	40.68
01137	02137	.5000	1/2"	12.700	1/2"	2-1/2"	5/8"	44.88	42.93	40.98	39.03
01147	02147	.6250	5/8"	15.875	5/8"	3"	3/4"	79.28	75.83	72.39	68.94
01677	02677	.6299		16.000	16.0	75	19	82.89	79.29	75.68	72.08
01157	02157	.7500	3/4"	19.050	3/4"	3"	1"	111.61	106.76	101.90	97.05
-	02687	.7874		20.000	20.0	75	25	154.00	147.30	140.61	133.91
-	02167	1.000	1"	25.400	1"	3"	1"	190.31	182.04	173.76	165.49

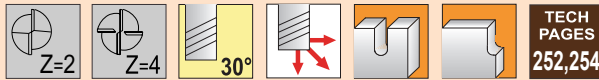
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MATERIAL HARDNESS (Rc)

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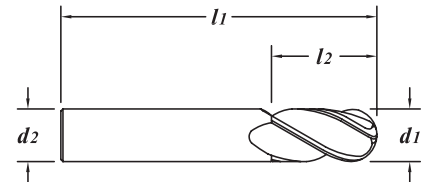
Series 180M, 190M, 980M, 990M



TOLERANCES		
d_1	$\leq .030"$	$+0.000"-0.001"$ (+.000-.025mm)
	$\geq 1/32"$	$+0.000"-0.002"$ (+.000-.050mm)
d_2	h6	
ball radius	$+0.000"-0.001"$ (+.000-.025mm)	

Stub Length - Ball End

- Solid submicron grain carbide end mill - center cutting
- Shorter flute length for rigidity
- Extremely versatile
- TiAlN Coating - page 179
- Standard Length - page 195
- Extended length - page 221



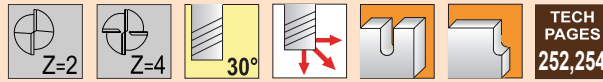
MATERIAL HARDNESS (Rc) 70
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(180M/980M) 2 Flute EDP#	(190M/990M) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
03250	-	.0100	.0100"	0.254	1/8"	1-1/2"	.015"	21.71	20.77	19.82	18.88
03300	-	.0150	.0150"	0.381	1/8"	1-1/2"	.023"	21.62	20.68	19.74	18.80
03350	-	.0200	.0200"	0.508	1/8"	1-1/2"	.030"	21.05	20.13	19.22	18.30
03400	-	.0250	.0250"	0.635	1/8"	1-1/2"	.038"	20.34	19.46	18.57	17.69
03450	-	.0300	.0300"	0.762	1/8"	1-1/2"	.045"	17.53	16.76	16.00	15.24
03010	04010	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	13.00	12.43	11.87	11.30
03510	04510	.0394		1.000	3.0	38	2	13.65	13.06	12.46	11.87
03020	04020	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	13.00	12.43	11.87	11.30
03520	-	.0591		1.500	3.0	38	3	13.65	13.06	12.46	11.87
03030	04030	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	9.58	9.16	8.75	8.33
03530	04530	.0787		2.000	3.0	38	4	10.07	9.64	9.20	8.76
03040	04040	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	9.05	8.66	8.26	7.87
03540	04540	.0984		2.500	3.0	38	5	9.51	9.10	8.68	8.27
03550	04550	.1181		3.000	3.0	38	6	9.27	8.87	8.46	8.06
03050	04050	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	8.82	8.44	8.05	7.67
03560	04560	.1378		3.500	4.0	50	7	12.98	12.42	11.85	11.29
03060	04060	.1562	5/32"	3.967	3/16"	2"	5/16"	12.34	11.80	11.27	10.73
03570	04570	.1575		4.000	4.0	50	8	12.33	11.79	11.26	10.72
03580	04580	.1772		4.500	5.0	50	9.5	16.30	15.59	14.88	14.17
03070	04070	.1875	3/16"	4.763	3/16"	2"	3/8"	11.71	11.20	10.69	10.18
03590	04590	.1969		5.000	5.0	50	10	15.35	14.69	14.02	13.35
03080	04080	.2188	7/32"	5.558	1/4"	2"	7/16"	15.53	14.85	14.18	13.50
03600	04600	.2362		6.000	6.0	50	12	16.12	15.42	14.72	14.02
03090	04090	.2500	1/4"	6.350	1/4"	2"	1/2"	15.28	14.62	13.95	13.29
03610	04610	.2756		7.000	7.0	50	12	21.09	20.17	19.26	18.34
03100	04100	.3125	5/16"	7.938	5/16"	2"	1/2"	20.91	20.00	19.09	18.18
03620	04620	.3150		8.000	8.0	50	12	22.01	21.05	20.10	19.14
03630	04630	.3543		9.000	9.0	50	14	27.19	26.00	24.82	23.64
03110	04110	.3750	3/8"	9.525	3/8"	2"	5/8"	25.83	24.71	23.58	22.46
03640	04640	.3937		10.000	10.0	50	16	30.04	28.73	27.43	26.12
03120	04120	.4375	7/16"	11.113	7/16"	2-1/2"	5/8"	31.95	30.56	29.17	27.78
03660	04660	.4724		12.000	12.0	65	19	44.82	42.87	40.92	38.97
03130	04130	.5000	1/2"	12.700	1/2"	2-1/2"	5/8"	42.60	40.74	38.89	37.04
03150	04150	.7500	3/4"	19.050	3/4"	3"	1"	117.19	112.09	107.00	101.90

TOLERANCES

<i>d1</i>	+0.000" -0.002" (+0.000 -0.050mm)
<i>d2</i>	h6
ball radius	+0.000" -0.001" (+0.000 -0.025mm)

Series 180MA, 190MA, 980MA, 990MA



Stub Length - Ball End

TiALN Coating

Solid submicron grain carbide end mill - center cutting

Shorter flute length for rigidity

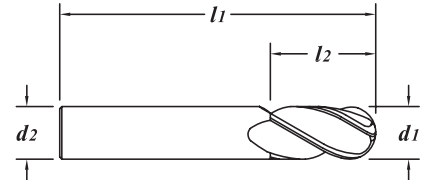
Dry or semi-dry machining

Extremely versatile

Uncoated - page 178

Standard Length - page 199

Extended length - page 224



(180MA/980MA) 2 Flute EDP#	(190MA/990MA) 4 Flute EDP#	<i>d1</i> †		<i>d2</i> Shank Diameter	<i>l1</i> Overall Length	<i>l2</i> Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Diameter Metric								
03017	04017	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	15.48	14.81	14.13	13.46
03517	04517	.0394		1.000	3.0	38	2	16.12	15.42	14.72	14.02
03027	04027	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	15.48	14.81	14.13	13.46
03527	04527	.0591		1.500	3.0	38	3	16.12	15.42	14.72	14.02
03037	04037	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	12.04	11.52	10.99	10.47
03537	04537	.0787		2.000	3.0	38	4	12.54	11.99	11.45	10.90
03047	04047	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	11.51	11.01	10.51	10.01
03547	04547	.0984		2.500	3.0	38	5	11.98	11.46	10.94	10.42
03557	04557	.1181		3.000	3.0	38	6	11.73	11.22	10.71	10.20
03057	04057	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	11.28	10.79	10.30	9.81
03567	04567	.1378		3.500	4.0	50	7	15.46	14.78	14.11	13.44
03067	04067	.1562	5/32"	3.967	3/16"	2"	5/16"	14.80	14.16	13.51	12.87
03577	04577	.1575		4.000	4.0	50	8	14.79	14.15	13.50	12.86
03587	04587	.1772		4.500	5.0	50	9.5	20.14	19.26	18.39	17.51
03077	04077	.1875	3/16"	4.763	3/16"	2"	3/8"	14.17	13.55	12.94	12.32
03597	04597	.1969		5.000	5.0	50	10	19.19	18.36	17.52	16.69
03087	04087	.2188	7/32"	5.558	1/4"	2"	7/16"	19.38	18.54	17.69	16.85
03607	04607	.2362		6.000	6.0	50	12	19.95	19.09	18.22	17.35
03097	04097	.2500	1/4"	6.350	1/4"	2"	1/2"	19.15	18.32	17.48	16.65
03617	04617	.2756		7.000	7.0	50	12	26.59	25.43	24.28	23.12
03107	04107	.3125	5/16"	7.938	5/16"	2"	1/2"	26.39	25.25	24.10	22.95
03627	04627	.3150		8.000	8.0	50	12	27.50	26.30	25.11	23.91
03637	04637	.3543		9.000	9.0	50	14	32.68	31.26	29.84	28.42
03117	04117	.3750	3/8"	9.525	3/8"	2"	5/8"	31.31	29.95	28.59	27.23
03647	04647	.3937		10.000	10.0	50	16	36.26	34.68	33.11	31.53
03657	04657	.4331		11.000	11.0	65	19	43.21	41.33	39.45	37.57
03127	04127	.4375	7/16"	11.113	7/16"	2-1/2"	5/8"	40.61	38.84	37.08	35.31
03667	04667	.4724		12.000	12.0	65	19	53.49	51.16	48.84	46.51
03137	04137	.5000	1/2"	12.700	1/2"	2-1/2"	5/8"	51.24	49.02	46.79	44.56
-	04147	.6250	5/8"	15.875	5/8"	3"	3/4"	91.52	87.54	83.56	79.58
-	04157	.7500	3/4"	19.050	3/4"	3"	1"	129.21	123.60	117.98	112.36
-	04687	.7874		20.000	20.0	75	25	177.82	170.09	162.36	154.63

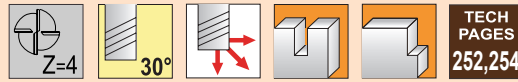
70

35

MATERIAL HARDNESS (Rc)

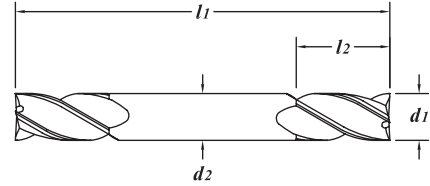
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d_1	+0.000" -0.002" (+0.000 -0.050mm)
d_2	h6



Stub Length - Double End

Solid submicron grain carbide end mill - center cutting
 Shorter flute length for rigidity
 Extremely versatile
 TiALN Coating - page 181
 Standard Length - page 206



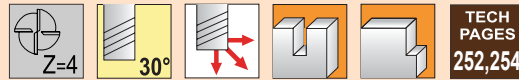
MATERIAL HARDNESS (Rc) 70
35
0

EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
	Decimal	Metric								
06010	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	18.42	17.62	16.82	16.02
06510	.0394		1.000	3.0	38	2	19.39	18.55	17.70	16.86
06020	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	18.42	17.62	16.82	16.02
06520	.0591		1.500	3.0	38	3	19.39	18.55	17.70	16.86
06030	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	18.42	17.62	16.82	16.02
06530	.0787		2.000	3.0	38	4	19.39	18.55	17.70	16.86
06040	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	18.42	17.62	16.82	16.02
06540	.0984		2.500	3.0	38	5	19.39	18.55	17.70	16.86
06550	.1181		3.000	3.0	38	6	12.02	11.50	10.97	10.45
06050	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	11.41	10.91	10.42	9.92
06560	.1378		3.500	4.0	50	7	21.36	20.43	19.50	18.57
06060	.1562	5/32"	3.967	3/16"	2"	5/16"	20.27	19.39	18.51	17.63
06570	.1575		4.000	4.0	50	8	17.42	16.67	15.91	15.15
06580	.1772		4.500	5.0	65	9.5	24.89	23.80	22.72	21.64
06070	.1875	3/16"	4.763	3/16"	2"	3/8"	16.55	15.83	15.11	14.39
06590	.1969		5.000	5.0	65	10	21.99	21.03	20.08	19.12
06080	.2188	7/32"	5.558	1/4"	2-1/2"	1/2"	23.64	22.62	21.59	20.56
06600	.2362		6.000	6.0	65	12	22.67	21.68	20.70	19.71
06090	.2500	1/4"	6.350	1/4"	2-1/2"	1/2"	21.53	20.59	19.66	18.72
06610	.2756		7.000	7.0	65	12	27.31	26.13	24.94	23.75
06100	.3125	5/16"	7.938	5/16"	2-1/2"	1/2"	26.80	25.63	24.47	23.30
06620	.3150		8.000	8.0	65	12	28.20	26.97	25.75	24.52
06630	.3543		9.000	9.0	75	14	31.42	30.05	28.69	27.32
06110	.3750	3/8"	9.525	3/8"	2-1/2"	1/2"	28.50	27.26	26.02	24.78
06640	.3937		10.000	10.0	75	14	41.23	39.44	37.64	35.85
06120	.4375	7/16"	11.113	7/16"	2-3/4"	9/16"	40.80	39.03	37.25	35.48
06660	.4724		12.000	12.0	75	16	50.97	48.75	46.54	44.32
06130	.5000	1/2"	12.700	1/2"	3"	5/8"	48.43	46.32	44.22	42.11

TOLERANCES

d_1	+0.000" -0.002" (+.000 -0.050mm)
d_2	h6

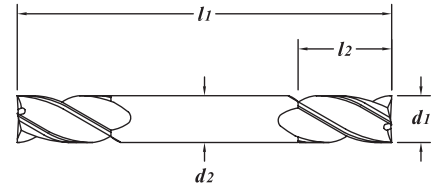
Series 175MA, 875MA



Stub Length - Double End

TiAlN Coating

- Solid submicron grain carbide end mill - center cutting
- Shorter flute length for rigidity
- Dry or semi-dry machining
- Extremely versatile
- Uncoated - page 180
- Standard Length - page 207



EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
	Decimal	Metric								
06017	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	22.11	21.15	20.19	19.23
06517	.0394		1.000	3.0	38	2	23.09	22.09	21.08	20.08
06027	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	22.11	21.15	20.19	19.23
06527	.0591		1.500	3.0	38	3	23.09	22.09	21.08	20.08
06037	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	22.11	21.15	20.19	19.23
06537	.0787		2.000	3.0	38	4	23.09	22.09	21.08	20.08
06047	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	22.11	21.15	20.19	19.23
06547	.0984		2.500	3.0	38	5	23.09	22.09	21.08	20.08
06557	.1181		3.000	3.0	38	6	15.72	15.04	14.35	13.67
06057	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	15.11	14.45	13.80	13.14
06567	.1378		3.500	4.0	50	7	25.06	23.97	22.88	21.79
06067	.1562	5/32"	3.967	3/16"	2"	5/16"	23.98	22.94	21.89	20.85
06577	.1575		4.000	4.0	50	8	21.10	20.19	19.27	18.35
06587	.1772		4.500	5.0	65	9.5	32.52	31.11	29.69	28.28
06077	.1875	3/16"	4.763	3/16"	2"	3/8"	20.25	19.37	18.49	17.61
06597	.1969		5.000	5.0	65	10	29.61	28.33	27.04	25.75
06087	.2188	7/32"	5.558	1/4"	2-1/2"	1/2"	31.28	29.92	28.56	27.20
06607	.2362		6.000	6.0	65	12	30.29	28.97	27.66	26.34
06097	.2500	1/4"	6.350	1/4"	2-1/2"	1/2"	29.15	27.89	26.62	25.35
06617	.2756		7.000	7.0	65	12	38.73	37.05	35.36	33.68
06107	.3125	5/16"	7.938	5/16"	2-1/2"	1/2"	38.20	36.54	34.88	33.22
06627	.3150		8.000	8.0	65	12	39.62	37.90	36.17	34.45
06637	.3543		9.000	9.0	75	14	42.85	40.99	39.12	37.26
06117	.3750	3/8"	9.525	3/8"	2-1/2"	1/2"	39.93	38.19	36.46	34.72
06647	.3937		10.000	10.0	75	14	54.21	51.85	49.50	47.14
06657	.4331		11.000	11.0	75	14	57.02	54.54	52.06	49.58
06127	.4375	7/16"	11.113	7/16"	2-3/4"	9/16"	53.77	51.44	49.10	46.76
06667	.4724		12.000	12.0	75	16	63.97	61.19	58.41	55.63
06137	.5000	1/2"	12.700	1/2"	3"	5/8"	61.42	58.75	56.08	53.41

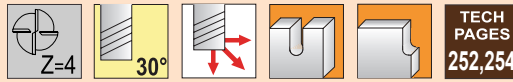
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MATERIAL HARDNESS (Rc)

0

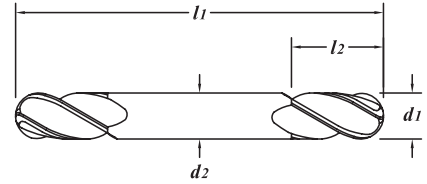
Series 195M, 995M



TOLERANCES	
d_1	+0.000" -0.002" (+0.000 -0.050mm)
d_2	h6
ball radius	+0.000" -0.001" (+0.000 -0.025mm)

Stub Length - Ball End - Double End

Solid submicron grain carbide end mill - center cutting
 Shorter flute length for rigidity
 Extremely versatile
 TiAlN Coating - page 183
 Standard Length - page 208



MATERIAL HARDNESS (Rc)

70

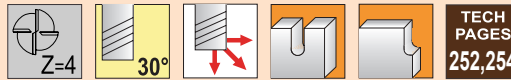
35

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EDP#	d_1 †		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
	Decimal	Diameter								Metric
08010	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	21.63	20.69	19.75	18.81
08510	.0394		1.000	3.0	38	2	22.77	21.78	20.79	19.80
08020	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	21.63	20.69	19.75	18.81
08520	.0591		1.500	3.0	38	3	22.77	21.78	20.79	19.80
08030	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	21.63	20.69	19.75	18.81
08530	.0787		2.000	3.0	38	4	22.77	21.78	20.79	19.80
08040	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	21.63	20.69	19.75	18.81
08550	.1181		3.000	3.0	38	6	14.13	13.52	12.90	12.29
08050	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	13.42	12.84	12.25	11.67
08560	.1378		3.500	4.0	50	7	25.09	24.00	22.91	21.82
08060	.1562	5/32"	3.967	3/16"	2"	5/16"	23.83	22.79	21.76	20.72
08570	.1575		4.000	4.0	50	8	20.50	19.61	18.72	17.83
08070	.1875	3/16"	4.763	3/16"	2"	3/8"	19.48	18.63	17.79	16.94
08590	.1969		5.000	5.0	65	10	25.99	24.86	23.73	22.60
08080	.2188	7/32"	5.558	1/4"	2-1/2"	1/2"	27.83	26.62	25.41	24.20
08600	.2362		6.000	6.0	65	12	26.68	25.52	24.36	23.20
08090	.2500	1/4"	6.350	1/4"	2-1/2"	1/2"	25.33	24.23	23.13	22.03
08100	.3125	5/16"	7.938	5/16"	2-1/2"	1/2"	31.53	30.16	28.79	27.42
08620	.3150		8.000	8.0	65	12	33.21	31.77	30.32	28.88
08630	.3543		9.000	9.0	75	14	36.71	35.11	33.52	31.92
08110	.3750	3/8"	9.525	3/8"	2-1/2"	1/2"	33.53	32.08	30.62	29.16
08640	.3937		10.000	10.0	75	14	48.82	46.70	44.57	42.45
08120	.4375	7/16"	11.113	7/16"	2-3/4"	9/16"	47.99	45.90	43.82	41.73
08130	.5000	1/2"	12.700	1/2"	3"	5/8"	56.98	54.51	52.03	49.55

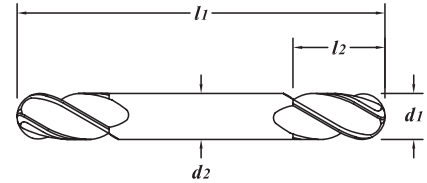
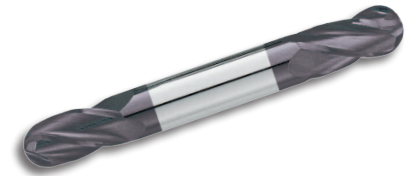
TOLERANCES

d_1	+0.000" -0.002" (+0.000 -0.050mm)
d_2	h6
ball radius	+0.000" -0.001" (+0.000 -0.025mm)



Stub Length - Ball End - Double End
TiAlN Coating

- Solid submicron grain carbide end mill - center cutting
- Shorter flute length for rigidity
- Dry or semi-dry machining
- Extremely versatile
- Uncoated - page 182
- Standard Length - page 209



EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
	Decimal	Metric								
08017	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	25.33	24.23	23.13	22.03
08517	.0394		1.000	3.0	38	2	26.47	25.32	24.17	23.02
08027	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	25.33	24.23	23.13	22.03
08527	.0591		1.500	3.0	38	3	26.47	25.32	24.17	23.02
08037	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	25.33	24.23	23.13	22.03
08537	.0787		2.000	3.0	38	4	26.47	25.32	24.17	23.02
08047	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	25.33	24.23	23.13	22.03
08547	.0984		2.500	3.0	38	5	26.47	25.32	24.17	23.02
08557	.1181		3.000	3.0	38	6	17.84	17.06	16.29	15.51
08057	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	17.12	16.38	15.63	14.89
08567	.1378		3.500	4.0	50	7	28.80	27.54	26.29	25.04
08067	.1562	5/32"	3.967	3/16"	2"	5/16"	27.53	26.33	25.14	23.94
08577	.1575		4.000	4.0	50	8	24.21	23.16	22.10	21.05
08587	.1772		4.500	5.0	65	9.5	36.90	35.30	33.69	32.09
08077	.1875	3/16"	4.763	3/16"	2"	3/8"	23.17	22.17	21.16	20.15
08597	.1969		5.000	5.0	65	10	33.61	32.15	30.69	29.23
08087	.2188	7/32"	5.558	1/4"	2-1/2"	1/2"	35.44	33.90	32.36	30.82
08607	.2362		6.000	6.0	65	12	34.29	32.80	31.31	29.82
08097	.2500	1/4"	6.350	1/4"	2-1/2"	1/2"	32.97	31.54	30.10	28.67
08617	.2756		7.000	7.0	65	12	43.73	41.83	39.93	38.03
08107	.3125	5/16"	7.938	5/16"	2-1/2"	1/2"	42.94	41.07	39.21	37.34
08627	.3150		8.000	8.0	65	12	44.62	42.68	40.74	38.80
08117	.3750	3/8"	9.525	3/8"	2-1/2"	1/2"	44.95	43.00	41.04	39.09
08647	.3937		10.000	10.0	75	14	61.80	59.11	56.43	53.74
08127	.4375	7/16"	11.113	7/16"	2-3/4"	9/16"	60.97	58.32	55.67	53.02
08667	.4724		12.000	12.0	75	16	72.98	69.81	66.63	63.46
08137	.5000	1/2"	12.700	1/2"	3"	5/8"	69.99	66.95	63.90	60.86

70

35

MATERIAL HARDNESS (Rc)

0

Series 220M, 223M, 230M, 820M, 823M, 830M

.0050" - .0984"
(0.127mm - 2.500mm)



TECH
PAGES
252,254

TOLERANCES

d_1	$\leq .030"$	$+0.000" - .001" (+0.000 - .025mm)$
	$\geq 1/32"$	$+0.000" - .002" (+0.000 - .050mm)$
d_2	h6	

Standard Length - Square End

Solid submicron grain carbide end mill - center cutting

Extremely versatile

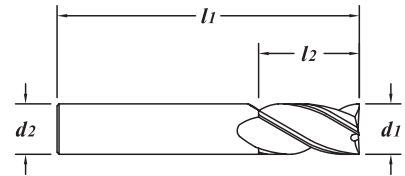
TiN Coating - page 186

TiCN Coating - page 187

TiAlN Coating - page 188

Stub Length - page 175

Extended length - page 210



(220M/820M) 2 Flute EDP#	(223M/823M) 3 Flute EDP#	(230M/830M) 4 Flute EDP#	Decimal	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100
				Metric								
11500	-	-	.0050	.0050"	0.127	1/8"	1-1/2"	.015"	21.28	20.35	19.43	18.50
11510	-	-	.0060	.0060"	0.152	1/8"	1-1/2"	.018"	21.28	20.35	19.43	18.50
11520	-	-	.0070	.0070"	0.178	1/8"	1-1/2"	.021"	20.02	19.15	18.28	17.41
11530	-	-	.0080	.0080"	0.203	1/8"	1-1/2"	.024"	20.02	19.15	18.28	17.41
11540	-	-	.0090	.0090"	0.229	1/8"	1-1/2"	.027"	18.89	18.07	17.25	16.43
11550	-	13550	.0100	.0100"	0.254	1/8"	1-1/2"	.030"	18.89	18.07	17.25	16.43
11560	-	-	.0110	.0110"	0.279	1/8"	1-1/2"	.033"	17.49	16.73	15.97	15.21
11570	-	-	.0120	.0120"	0.305	1/8"	1-1/2"	.036"	17.49	16.73	15.97	15.21
11580	-	-	.0130	.0130"	0.330	1/8"	1-1/2"	.039"	17.40	16.64	15.89	15.13
11590	-	-	.0140	.0140"	0.356	1/8"	1-1/2"	.042"	17.40	16.64	15.89	15.13
11600	-	13600	.0150	.0150"	0.381	1/8"	1-1/2"	.045"	17.40	16.64	15.89	15.13
11610	-	-	.0160	.0160"	0.406	1/8"	1-1/2"	.048"	17.17	16.42	15.68	14.93
11620	-	-	.0170	.0170"	0.432	1/8"	1-1/2"	.051"	17.17	16.42	15.68	14.93
11630	-	-	.0180	.0180"	0.457	1/8"	1-1/2"	.054"	16.85	16.12	15.38	14.65
11640	-	-	.0190	.0190"	0.483	1/8"	1-1/2"	.057"	16.85	16.12	15.38	14.65
11650	-	13650	.0200	.0200"	0.508	1/8"	1-1/2"	.060"	16.85	16.12	15.38	14.65
11660	-	-	.0210	.0210"	0.533	1/8"	1-1/2"	.063"	16.85	16.12	15.38	14.65
11670	-	-	.0220	.0220"	0.559	1/8"	1-1/2"	.066"	16.65	15.93	15.20	14.48
11680	-	-	.0230	.0230"	0.584	1/8"	1-1/2"	.069"	16.65	15.93	15.20	14.48
11690	-	-	.0240	.0240"	0.610	1/8"	1-1/2"	.072"	16.65	15.93	15.20	14.48
11700	-	13700	.0250	.0250"	0.635	1/8"	1-1/2"	.075"	15.71	15.03	14.34	13.66
11710	-	-	.0260	.0260"	0.660	1/8"	1-1/2"	.078"	15.71	15.03	14.34	13.66
11720	-	-	.0270	.0270"	0.686	1/8"	1-1/2"	.081"	14.09	13.48	12.86	12.25
11730	-	-	.0280	.0280"	0.711	1/8"	1-1/2"	.084"	14.09	13.48	12.86	12.25
11740	-	-	.0290	.0290"	0.737	1/8"	1-1/2"	.087"	14.09	13.48	12.86	12.25
11750	-	13750	.0300	.0300"	0.762	1/8"	1-1/2"	.090"	14.09	13.48	12.86	12.25
11010	12010	13010	.0312	1/32"	0.792	1/8"	1-1/2"	3/32"	10.25	9.80	9.36	8.91
45010	37010	46010	.0394		1.000	3.0	38	4	10.76	10.30	9.83	9.36
11020	12020	13020	.0469	3/64"	1.191	1/8"	1-1/2"	1/8"	10.25	9.80	9.36	8.91
45020	37020	46020	.0591		1.500	3.0	38	6	10.76	10.30	9.83	9.36
11030	12030	13030	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	9.51	9.10	8.68	8.27
11040	12040	13040	.0781	5/64"	1.984	1/8"	1-1/2"	1/4"	9.51	9.10	8.68	8.27
45030	37030	46030	.0787		2.000	3.0	38	8	9.98	9.55	9.11	8.68
11050	12050	13050	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	8.99	8.60	8.21	7.82
45040	37040	46040	.0984		2.500	3.0	38	12	9.44	9.03	8.62	8.21

MATERIAL HARDNESS (Rc)

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0

Series 220M, 223M, 230M, 820M, 823M, 830M (continued)

.1094" - 1.250"
(2.779mm - 31.750mm)

END MILLS

(220M/820M) 2 Flute EDP#	(223M/823M) 3 Flute EDP#	(230M/830M) 4 Flute EDP#	$d1$ †		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Diameter								Metric
11060	12060	13060	.1094	7/64"	2.779	1/8"	1-1/2"	3/8"	8.99	8.60	8.21	7.82
45050	37050	46050	.1181		3.000	3.0	38	12	8.72	8.34	7.96	7.58
11070	12070	13070	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	8.30	7.94	7.58	7.22
45060	37060	46060	.1378		3.500	4.0	50	12	12.90	12.34	11.78	11.22
11080	12080	13080	.1406	9/64"	3.571	3/16"	2"	9/16"	12.27	11.74	11.20	10.67
11090	12090	13090	.1562	5/32"	3.967	3/16"	2"	9/16"	12.27	11.74	11.20	10.67
45070	37070	46070	.1575		4.000	4.0	50	14	12.24	11.70	11.17	10.64
11100	12100	13100	.1719	11/64"	4.366	3/16"	2"	9/16"	12.27	11.74	11.20	10.67
45080	37080	46080	.1772		4.500	5.0	50	14	14.97	14.32	13.67	13.02
11110	12110	13110	.1875	3/16"	4.763	3/16"	2"	5/8"	11.64	11.13	10.63	10.12
45090	37090	46090	.1969		5.000	5.0	65	16	14.28	13.66	13.04	12.42
11120	12120	13120	.2031	13/64"	5.159	1/4"	2-1/2"	5/8"	15.42	14.75	14.08	13.41
11130	12130	13130	.2188	7/32"	5.558	1/4"	2-1/2"	5/8"	15.42	14.75	14.08	13.41
11140	12140	13140	.2344	15/64"	5.954	1/4"	2-1/2"	3/4"	15.42	14.75	14.08	13.41
45100	37100	46100	.2362		6.000	6.0	65	19	14.73	14.09	13.45	12.81
11150	12150	13150	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	14.03	13.42	12.81	12.20
11160	12160	13160	.2656	17/64"	6.746	5/16"	2-1/2"	7/8"	24.61	23.54	22.47	21.40
45110	37110	46110	.2756		7.000	7.0	65	22	20.24	19.36	18.48	17.60
11170	12170	13170	.2812	9/32"	7.142	5/16"	2-1/2"	7/8"	24.61	23.54	22.47	21.40
11180	12180	13180	.2969	19/64"	7.541	5/16"	2-1/2"	7/8"	24.61	23.54	22.47	21.40
11190	12190	13190	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	19.68	18.82	17.97	17.11
45120	37120	46120	.3150		8.000	8.0	65	22	20.67	19.77	18.87	17.97
11200	12200	13200	.3281	21/64"	8.334	3/8"	2-1/2"	7/8"	29.15	27.89	26.62	25.35
11210	12210	13210	.3438	11/32"	8.733	3/8"	2-1/2"	7/8"	29.15	27.89	26.62	25.35
45130	37130	46130	.3543		9.000	9.0	65	22	25.74	24.62	23.50	22.38
11220	12220	13220	.3594	23/64"	9.129	3/8"	2-1/2"	7/8"	29.15	27.89	26.62	25.35
11230	12230	13230	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	24.52	23.45	22.39	21.32
11240	12240	13240	.3906	25/64"	9.921	7/16"	2-3/4"	7/8"	34.86	33.34	31.83	30.31
45140	37140	46140	.3937		10.000	10.0	70	25	29.83	28.53	27.24	25.94
11250	12250	13250	.4062	13/32"	10.317	7/16"	2-3/4"	7/8"	34.86	33.34	31.83	30.31
11260	12260	13260	.4219	27/64"	10.716	7/16"	2-3/4"	7/8"	34.86	33.34	31.83	30.31
45150	37150	46150	.4331		11.000	11.0	75	25	31.41	30.04	28.68	27.31
11270	12270	13270	.4375	7/16"	11.113	7/16"	2-3/4"	1"	29.91	28.61	27.31	26.01
11280	12280	13280	.4531	29/64"	11.509	1/2"	3"	1"	46.95	44.91	42.87	40.83
11290	-	13290	.4688	15/32"	11.908	1/2"	3"	1"	46.95	44.91	42.87	40.83
45160	37160	46160	.4724		12.000	12.0	75	25	41.24	39.45	37.65	35.86
11300	12300	13300	.4844	31/64"	12.304	1/2"	3"	1"	46.95	44.91	42.87	40.83
11310	12310	13310	.5000	1/2"	12.700	1/2"	3"	1"	39.26	37.55	35.85	34.14
45170	37170	46170	.5512		14.000	14.0	88	32	70.41	67.35	64.29	61.23
11320	12320	13320	.5625	9/16"	14.288	9/16"	3-1/2"	1-1/4"	67.07	64.15	61.24	58.32
11330	12330	13330	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	75.72	72.42	69.13	65.84
45180	37180	46180	.6299		16.000	16.0	88	38	79.51	76.05	72.60	69.14
11340	12340	13340	.6875	11/16"	17.463	3/4"	4"	1-1/2"	126.10	120.62	115.13	109.65
45190	37190	46190	.7087		18.000	18.0	100	38	116.58	111.51	106.44	101.37
11350	12350	13350	.7500	3/4"	19.050	3/4"	4"	1-1/2"	111.01	106.18	101.36	96.53
45200	37200	46200	.7874		20.000	20.0	100	38	148.22	141.78	135.33	128.89
45210	37210	46210	.8661		22.000	22.0	100	38	164.70	157.54	150.38	143.22
11360	12360	13360	.8750	7/8"	22.225	7/8"	4"	1-1/2"	159.76	152.81	145.87	138.92
45220	37220	46220	.9843		25.000	25.0	100	38	172.20	164.71	157.23	149.74
11370	12370	13370	1.000	1"	25.400	1"	4"	1-1/2"	166.08	158.86	151.64	144.42
-	-	13390	1.250	1-1/4"	31.750	1-1/4"	4-1/2"	2"	484.89	463.80	442.72	421.64

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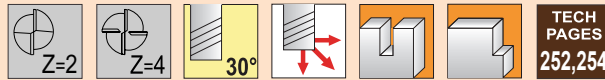
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MATERIAL HARDNESS (Rc)

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TOLERANCES

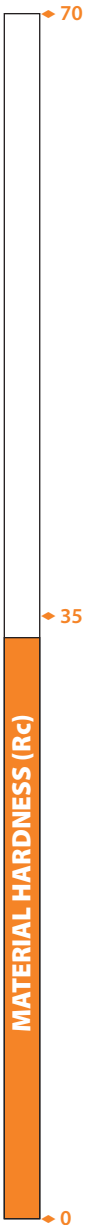
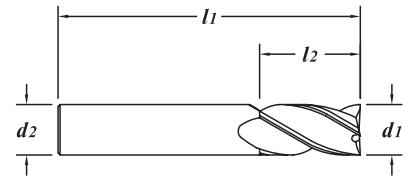
d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6



Standard Length - Square End

TiN Coating

- Solid submicron grain carbide end mill - center cutting
- Improved lubricity
- Extremely versatile
- Uncoated - page 184
- TiCN Coating - page 187
- TiALN Coating - page 188

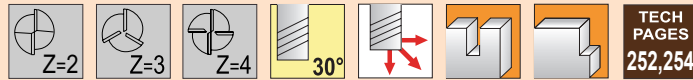


(220MT) 2 Flute EDP#	(230MT) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
11073	13073	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	9.76	9.34	8.91	8.49
11113	13113	.1875	3/16"	4.763	3/16"	2"	5/8"	13.08	12.51	11.94	11.37
11153	13153	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	16.96	16.23	15.49	14.75
11193	13193	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	23.62	22.59	21.57	20.54
11233	13233	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	28.46	27.23	25.99	24.75
11273	13273	.4375	7/16"	11.113	7/16"	2-3/4"	1"	34.68	33.18	31.67	30.16
11313	13313	.5000	1/2"	12.700	1/2"	3"	1"	44.05	42.13	40.22	38.30
11333	13333	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	83.06	79.45	75.84	72.23
11353	13353	.7500	3/4"	19.050	3/4"	4"	1-1/2"	119.43	114.24	109.04	103.85
-	13373	1.000	1"	25.400	1"	4"	1-1/2"	180.77	172.91	165.05	157.19

TOLERANCES

d_1	+0.000° -0.002° (+.000 -.050mm)
d_2	h6

Series 220MC, 223MC, 230MC



END MILLS

Standard Length - Square End

TiCN Coating

Solid submicron grain carbide end mill - center cutting

Improved abrasion resistance and lubricity

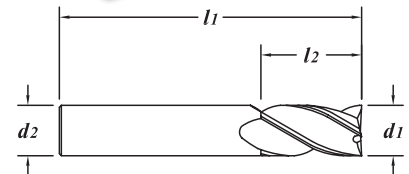
Extremely versatile

Uncoated - page 184

TiN Coating - page 186

TiALN Coating - page 188

Extended length - page 212



(220MC) 2 Flute EDP#	(223MC) 3 Flute EDP#	(230MC) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
11014	12014	13014	.0312	1/32"	0.792	1/8"	1-1/2"	3/32"	12.43	11.89	11.35	10.81
11024	12024	13024	.0469	3/64"	1.191	1/8"	1-1/2"	1/8"	12.43	11.89	11.35	10.81
11034	12034	13034	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	11.70	11.19	10.68	10.17
11044	12044	13044	.0781	5/64"	1.984	1/8"	1-1/2"	1/4"	11.70	11.19	10.68	10.17
11054	12054	13054	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	11.17	10.68	10.20	9.71
11064	12064	13064	.1094	7/64"	2.779	1/8"	1-1/2"	3/8"	11.17	10.68	10.20	9.71
11074	12074	13074	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	10.48	10.02	9.57	9.11
11084	12084	13084	.1406	9/64"	3.571	3/16"	2"	9/16"	14.44	13.82	13.19	12.56
11094	12094	13094	.1562	5/32"	3.967	3/16"	2"	9/16"	14.44	13.82	13.19	12.56
11104	12104	13104	.1719	11/64"	4.366	3/16"	2"	9/16"	14.44	13.82	13.19	12.56
11114	12114	13114	.1875	3/16"	4.763	3/16"	2"	5/8"	13.81	13.21	12.61	12.01
11124	12124	13124	.2031	13/64"	5.159	1/4"	2-1/2"	5/8"	19.84	18.98	18.11	17.25
11134	12134	13134	.2188	7/32"	5.558	1/4"	2-1/2"	5/8"	19.84	18.98	18.11	17.25
11144	12144	13144	.2344	15/64"	5.954	1/4"	2-1/2"	3/4"	19.84	18.98	18.11	17.25
11154	12154	13154	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	18.45	17.64	16.84	16.04
11164	12164	13164	.2656	17/64"	6.746	5/16"	2-1/2"	7/8"	30.51	29.18	27.86	26.53
11174	12174	13174	.2812	9/32"	7.142	5/16"	2-1/2"	7/8"	30.51	29.18	27.86	26.53
11184	12184	13184	.2969	19/64"	7.541	5/16"	2-1/2"	7/8"	30.51	29.18	27.86	26.53
11194	12194	13194	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	25.58	24.46	23.35	22.24
11204	12204	13204	.3281	21/64"	8.334	3/8"	2-1/2"	7/8"	35.05	33.53	32.00	30.48
11214	12214	13214	.3438	11/32"	8.733	3/8"	2-1/2"	7/8"	35.05	33.53	32.00	30.48
11224	12224	13224	.3594	23/64"	9.129	3/8"	2-1/2"	7/8"	35.05	33.53	32.00	30.48
11234	12234	13234	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	30.41	29.08	27.76	26.44
11244	12244	13244	.3906	25/64"	9.921	7/16"	2-1/2"	7/8"	41.94	40.12	38.29	36.47
11254	12254	13254	.4062	13/32"	10.317	7/16"	2-1/2"	7/8"	41.94	40.12	38.29	36.47
11264	-	13264	.4219	27/64"	10.716	7/16"	2-1/2"	7/8"	41.94	40.12	38.29	36.47
11274	12274	13274	.4375	7/16"	11.113	7/16"	2-3/4"	1"	37.01	35.40	33.79	32.18
11284	-	13284	.4531	29/64"	11.509	1/2"	3"	1"	54.03	51.68	49.33	46.98
11294	12294	13294	.4688	15/32"	11.908	1/2"	3"	1"	54.03	51.68	49.33	46.98
-	12304	13304	.4844	31/64"	12.304	1/2"	3"	1"	54.03	51.68	49.33	46.98
11314	12314	13314	.5000	1/2"	12.700	1/2"	3"	1"	46.36	44.34	42.33	40.31
11324	12324	13324	.5625	9/16"	14.288	9/16"	3-1/2"	1-1/4"	78.10	74.70	71.31	67.91
11334	12334	13334	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	86.74	82.97	79.20	75.43
11344	-	13344	.6875	11/16"	17.463	3/4"	4"	1-1/2"	138.69	132.66	126.63	120.60
11354	12354	13354	.7500	3/4"	19.050	3/4"	4"	1-1/2"	123.63	118.25	112.88	107.50
11364	12364	13364	.8750	7/8"	22.225	7/8"	4"	1-1/2"	178.70	170.93	163.16	155.39
11374	12374	13374	1.000	1"	25.400	1"	4"	1-1/2"	185.02	176.98	168.93	160.89
-	-	13394	1.250	1-1/4"	31.750	1-1/4"	4-1/2"	2"	515.50	493.09	470.67	448.26

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MATERIAL HARDNESS (Rc)

0

Series 220MA, 223MA, 230MA, 820MA, 823MA, 830MA

TOLERANCES

d1	+0.000" - .002" (+.000 - .050mm)
d2	h6

.0312" - .3594"
(0.792mm - 9.129mm)



TECH
PAGES
252, 254

Standard Length - Square End

TiAlN Coating

Solid submicron grain carbide end mill - center cutting

Dry or semi-dry machining

Extremely versatile

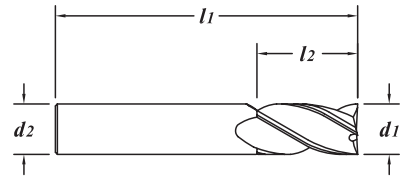
Uncoated - page 184

TiN Coating - page 186

TiCN Coating - page 187

Stub Length - page 177

Extended Length - page 213



(220MA/820MA) 2 Flute EDP#	(223MA/823MA) 3 Flute EDP#	(230MA/830MA) 4 Flute EDP#	d1 † Diameter		d2 Shank Diameter	l1 Overall Length	l2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
11017	12017	13017	.0312	1/32"	0.792	1/8"	1-1/2"	3/32"	12.72	12.17	11.61	11.06
45017	37017	46017	.0394		1.000	3.0	38	4	13.23	12.65	12.08	11.50
11027	12027	13027	.0469	3/64"	1.191	1/8"	1-1/2"	1/8"	12.72	12.17	11.61	11.06
45027	37027	46027	.0591		1.500	3.0	38	6	13.23	12.65	12.08	11.50
11037	12037	13037	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	11.98	11.46	10.94	10.42
11047	12047	13047	.0781	5/64"	1.984	1/8"	1-1/2"	1/4"	11.98	11.46	10.94	10.42
45037	37037	46037	.0787		2.000	3.0	38	8	12.44	11.90	11.36	10.82
11057	12057	13057	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	11.45	10.96	10.46	9.96
45047	37047	46047	.0984		2.500	3.0	38	12	11.91	11.40	10.88	10.36
11067	12067	13067	.1094	7/64"	2.779	1/8"	1-1/2"	3/8"	11.45	10.96	10.46	9.96
45057	37057	46057	.1181		3.000	3.0	38	12	11.19	10.70	10.22	9.73
11077	12077	13077	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	10.76	10.30	9.83	9.36
45067	37067	46067	.1378		3.500	4.0	50	12	15.36	14.70	14.03	13.36
11087	12087	13087	.1406	9/64"	3.571	3/16"	2"	9/16"	14.73	14.09	13.45	12.81
11097	12097	13097	.1562	5/32"	3.967	3/16"	2"	9/16"	14.73	14.09	13.45	12.81
45077	37077	46077	.1575		4.000	4.0	50	14	14.70	14.06	13.42	12.78
11107	12107	13107	.1719	11/64"	4.366	3/16"	2"	9/16"	14.73	14.09	13.45	12.81
45087	37087	46087	.1772		4.500	5.0	50	14	18.81	18.00	17.18	16.36
11117	12117	13117	.1875	3/16"	4.763	3/16"	2"	5/8"	14.10	13.49	12.87	12.26
45097	37097	46097	.1969		5.000	5.0	65	16	19.37	18.52	17.68	16.84
11127	12127	13127	.2031	13/64"	5.159	1/4"	2-1/2"	5/8"	20.53	19.64	18.74	17.85
11137	12137	13137	.2188	7/32"	5.558	1/4"	2-1/2"	5/8"	20.53	19.64	18.74	17.85
11147	12147	13147	.2344	15/64"	5.954	1/4"	2-1/2"	3/4"	20.53	19.64	18.74	17.85
45107	37107	46107	.2362		6.000	6.0	65	19	19.83	18.96	18.10	17.24
11157	12157	13157	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	19.12	18.29	17.46	16.63
11167	12167	13167	.2656	17/64"	6.746	5/16"	2-1/2"	7/8"	32.23	30.83	29.43	28.03
45117	37117	46117	.2756		7.000	7.0	65	22	27.84	26.63	25.42	24.21
11177	12177	13177	.2812	9/32"	7.142	5/16"	2-1/2"	7/8"	32.23	30.83	29.43	28.03
11187	12187	13187	.2969	19/64"	7.541	5/16"	2-1/2"	7/8"	32.23	30.83	29.43	28.03
11197	12197	13197	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	27.30	26.11	24.93	23.74
45127	37127	46127	.3150		8.000	8.0	65	22	28.29	27.06	25.83	24.60
11207	12207	13207	.3281	21/64"	8.334	3/8"	2-1/2"	7/8"	36.77	35.17	33.57	31.97
11217	12217	13217	.3438	11/32"	8.733	3/8"	2-1/2"	7/8"	36.77	35.17	33.57	31.97
45137	37137	46137	.3543		9.000	9.0	65	22	33.35	31.90	30.45	29.00
11227	12227	13227	.3594	23/64"	9.129	3/8"	2-1/2"	7/8"	36.77	35.17	33.57	31.97

MATERIAL HARDNESS (Rc)

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Series 220MA, 223MA, 230MA, 820MA, 823MA, 830MA (continued)

.3750" - 1.250"
(9.525mm - 31.750mm)

END MILLS

(220MA/820MA) 2 Flute EDP#	(223MA/823MA) 3 Flute EDP#	(230MA/830MA) 4 Flute EDP#	Decimal	$d1$ † Diameter	Metric	$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100
11237	12237	13237	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	32.12	30.72	29.33	27.93
11247	12247	13247	.3906	25/64"	9.921	7/16"	2-3/4"	7/8"	43.53	41.64	39.74	37.85
45147	37147	46147	.3937		10.000	10.0	70	25	38.49	36.82	35.14	33.47
11257	12257	13257	.4062	13/32"	10.317	7/16"	2-3/4"	7/8"	43.53	41.64	39.74	37.85
11267	12267	13267	.4219	27/64"	10.716	7/16"	2-3/4"	7/8"	43.53	41.64	39.74	37.85
45157	37157	46157	.4331		11.000	11.0	75	25	40.08	38.34	36.59	34.85
11277	12277	13277	.4375	7/16"	11.113	7/16"	2-3/4"	1"	38.58	36.91	35.23	33.55
11287	12287	13287	.4531	29/64"	11.509	1/2"	3"	1"	55.61	53.20	50.78	48.36
11297	12297	13297	.4688	15/32"	11.908	1/2"	3"	1"	55.61	53.20	50.78	48.36
45167	37167	46167	.4724		12.000	12.0	75	25	49.89	47.72	45.55	43.38
11307	12307	13307	.4844	31/64"	12.304	1/2"	3"	1"	55.61	53.20	50.78	48.36
11317	12317	13317	.5000	1/2"	12.700	1/2"	3"	1"	47.93	45.85	43.76	41.68
45177	37177	46177	.5512		14.000	14.0	88	32	82.93	79.32	75.72	72.11
11327	12327	13327	.5625	9/16"	14.288	9/16"	3-1/2"	1-1/4"	79.58	76.12	72.66	69.20
11337	12337	13337	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	88.25	84.41	80.58	76.74
45187	37187	46187	.6299		16.000	16.0	88	38	92.05	88.04	84.04	80.04
11347	12347	13347	.6875	11/16"	17.463	3/4"	4"	1-1/2"	140.88	134.75	128.63	122.50
45197	37197	46197	.7087		18.000	18.0	100	38	131.35	125.64	119.93	114.22
11357	12357	13357	.7500	3/4"	19.050	3/4"	4"	1-1/2"	125.80	120.33	114.86	109.39
45207	37207	46207	.7874		20.000	20.0	100	38	170.06	162.67	155.27	147.88
45217	37217	46217	.8661		22.000	22.0	100	38	186.53	178.42	170.31	162.20
11367	12367	13367	.8750	7/8"	22.225	7/8"	4"	1-1/2"	181.59	173.69	165.80	157.90
45227	37227	46227	.9843		25.000	25.0	100	38	194.03	185.59	177.16	168.72
11377	12377	13377	1.000	1"	25.400	1"	4"	1-1/2"	187.90	179.73	171.56	163.39
-	-	13397	1.250	1-1/4"	31.750	1-1/4"	4-1/2"	2"	516.51	494.05	471.60	449.14

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MATERIAL HARDNESS (Rc)

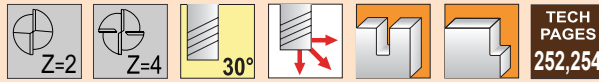
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End Mill Manufacturing

Series 220R, 230R

.0625" - .5000"
(1.588mm - 12.700mm)



TOLERANCES	
d1	+0.000" - .002" (+.000 - .050mm)
d2	h6
r	+0.001" - .001" (+.025 - .025mm)

Standard Length - Corner Radius

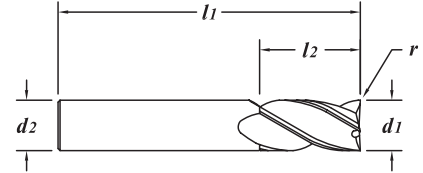
Solid submicron grain carbide end mill - center cutting

For stronger corners and part radius

Extremely versatile

TiALN Coating - page 192

Extended Length - page 215



MATERIAL HARDNESS (Rc) 70 35 0

(220R) 2 Flute EDP#	(230R) 4 Flute EDP#	d1 †		d2 Shank Diameter	l1 Overall Length	l2 Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
		Decimal	Metric									
79580	80580	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	.010"	12.27	11.74	11.20	10.67
79590	80590	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	.015"	12.27	11.74	11.20	10.67
79600	80600	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	.010"	11.73	11.22	10.71	10.20
79610	80610	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	.015"	11.73	11.22	10.71	10.20
79620	80620	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	.020"	11.73	11.22	10.71	10.20
79000	80000	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	.010"	10.65	10.19	9.72	9.26
79010	80010	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	.015"	10.65	10.19	9.72	9.26
79020	80020	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	.020"	10.65	10.19	9.72	9.26
79030	80030	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	.030"	10.65	10.19	9.72	9.26
79040	80040	.1875	3/16"	4.763	3/16"	2"	5/8"	.010"	14.03	13.42	12.81	12.20
79050	80050	.1875	3/16"	4.763	3/16"	2"	5/8"	.015"	14.03	13.42	12.81	12.20
79060	80060	.1875	3/16"	4.763	3/16"	2"	5/8"	.020"	14.03	13.42	12.81	12.20
79070	80070	.1875	3/16"	4.763	3/16"	2"	5/8"	.030"	14.03	13.42	12.81	12.20
-	80090	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.010"	17.42	16.67	15.91	15.15
79100	80100	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.015"	17.42	16.67	15.91	15.15
79110	80110	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.020"	17.42	16.67	15.91	15.15
79120	80120	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.030"	17.42	16.67	15.91	15.15
79130	80130	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.045"	17.42	16.67	15.91	15.15
79140	80140	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.060"	17.42	16.67	15.91	15.15
79160	80160	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.015"	22.85	21.86	20.86	19.87
79170	80170	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.020"	22.85	21.86	20.86	19.87
79180	80180	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.030"	22.85	21.86	20.86	19.87
79190	80190	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.045"	22.85	21.86	20.86	19.87
79200	80200	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.060"	22.85	21.86	20.86	19.87
-	80220	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.010"	27.96	26.74	25.53	24.31
79230	80230	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.015"	27.96	26.74	25.53	24.31
79240	80240	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.020"	27.96	26.74	25.53	24.31
79250	80250	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.030"	27.96	26.74	25.53	24.31
79260	80260	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.045"	27.96	26.74	25.53	24.31
79270	80270	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.060"	27.96	26.74	25.53	24.31
-	80290	.5000	1/2"	12.700	1/2"	3"	1"	.010"	52.05	49.79	47.52	45.26
79300	80300	.5000	1/2"	12.700	1/2"	3"	1"	.015"	52.05	49.79	47.52	45.26
79310	80310	.5000	1/2"	12.700	1/2"	3"	1"	.020"	52.05	49.79	47.52	45.26
79320	80320	.5000	1/2"	12.700	1/2"	3"	1"	.030"	52.05	49.79	47.52	45.26
79330	80330	.5000	1/2"	12.700	1/2"	3"	1"	.045"	52.05	49.79	47.52	45.26
79340	80340	.5000	1/2"	12.700	1/2"	3"	1"	.060"	52.05	49.79	47.52	45.26
79350	80350	.5000	1/2"	12.700	1/2"	3"	1"	.090"	52.05	49.79	47.52	45.26
79360	80360	.5000	1/2"	12.700	1/2"	3"	1"	.125"	52.05	49.79	47.52	45.26

(220R) 2 Flute EDP#	(230R) 4 Flute EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
		Decimal	Metric									
79370	80370	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.015"	84.18	80.52	76.86	73.20
79380	80380	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.020"	84.18	80.52	76.86	73.20
79390	80390	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.030"	84.18	80.52	76.86	73.20
79400	80400	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.045"	84.18	80.52	76.86	73.20
79410	80410	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.060"	84.18	80.52	76.86	73.20
79420	80420	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.090"	84.18	80.52	76.86	73.20
79440	80440	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.015"	123.88	118.49	113.11	107.72
79450	80450	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.020"	123.88	118.49	113.11	107.72
79460	80460	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.030"	123.88	118.49	113.11	107.72
79470	80470	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.045"	123.88	118.49	113.11	107.72
79480	80480	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.060"	123.88	118.49	113.11	107.72
79490	80490	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.090"	123.88	118.49	113.11	107.72
79500	80500	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.125"	123.88	118.49	113.11	107.72
79630	80630	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.250"	123.88	118.49	113.11	107.72
79510	80510	1.000	1"	25.400	1"	4"	1-1/2"	.015"	214.88	205.54	196.19	186.85
79520	80520	1.000	1"	25.400	1"	4"	1-1/2"	.020"	214.88	205.54	196.19	186.85
79530	80530	1.000	1"	25.400	1"	4"	1-1/2"	.030"	214.88	205.54	196.19	186.85
79540	80540	1.000	1"	25.400	1"	4"	1-1/2"	.045"	214.88	205.54	196.19	186.85
79550	80550	1.000	1"	25.400	1"	4"	1-1/2"	.060"	214.88	205.54	196.19	186.85
79560	80560	1.000	1"	25.400	1"	4"	1-1/2"	.090"	214.88	205.54	196.19	186.85
79570	80570	1.000	1"	25.400	1"	4"	1-1/2"	.125"	214.88	205.54	196.19	186.85
79640	80640	1.000	1"	25.400	1"	4"	1-1/2"	.250"	214.88	205.54	196.19	186.85

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MATERIAL HARDNESS (Rc)

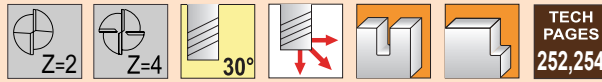
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*Tool Reconditioning
Prep Area*

Series 220RA, 230RA, 830RA

.0625" - .3125"
(1.588mm - 7.938mm)



TOLERANCES	
d1	+0.000" - .002" (+0.000 - .050mm)
d2	h6
r	+0.001" - .001" (+0.025 - .025mm)

Standard Length - Corner Radius

TiAlN Coating

Solid submicron grain carbide end mill - center cutting

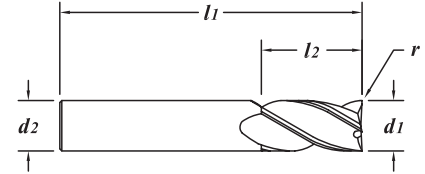
Dry or semi-dry machining

For stronger corners and part radius

Extremely versatile

Uncoated - page 190

Extended Length - page 218



MATERIAL HARDNESS (Rc) 70 35 0

(220RA) 2 Flute EDP#	(230RA/830RA) 4 Flute EDP#	Decimal	d1 † Diameter	Metric	d2 Shank Diameter	l1 Overall Length	l2 Flute Length	r Corner Radius	1-11	12-24	25-49	50-100
79587	80587	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	.010"	14.73	14.09	13.45	12.81
79597	80597	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	.015"	14.73	14.09	13.45	12.81
79607	80607	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	.010"	14.19	13.57	12.96	12.34
79617	80617	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	.015"	14.19	13.57	12.96	12.34
79627	80627	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	.020"	14.19	13.57	12.96	12.34
-	24077	.1181		3.000	3.0	38	12	0.20	13.13	12.56	11.99	11.42
-	24087	.1181		3.000	3.0	38	12	0.50	13.13	12.56	11.99	11.42
79007	80007	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	.010"	13.11	12.54	11.97	11.40
79017	80017	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	.015"	13.11	12.54	11.97	11.40
79027	80027	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	.020"	13.11	12.54	11.97	11.40
79037	80037	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	.030"	13.11	12.54	11.97	11.40
-	24097	.1575		4.000	4.0	50	14	0.30	17.19	16.45	15.70	14.95
-	24107	.1575		4.000	4.0	50	14	0.50	17.19	16.45	15.70	14.95
79047	80047	.1875	3/16"	4.763	3/16"	2"	5/8"	.010"	16.49	15.77	15.06	14.34
79057	80057	.1875	3/16"	4.763	3/16"	2"	5/8"	.015"	16.49	15.77	15.06	14.34
79067	80067	.1875	3/16"	4.763	3/16"	2"	5/8"	.020"	16.49	15.77	15.06	14.34
79077	80077	.1875	3/16"	4.763	3/16"	2"	5/8"	.030"	16.49	15.77	15.06	14.34
-	24117	.1969		5.000	5.0	50	16	0.30	22.94	21.95	20.95	19.95
-	24127	.1969		5.000	5.0	65	16	0.50	22.94	21.95	20.95	19.95
-	24177	.2362		6.000	6.0	65	19	0.50	23.39	22.37	21.36	20.34
-	24187	.2362		6.000	6.0	65	19	0.80	23.39	22.37	21.36	20.34
-	24197	.2362		6.000	6.0	65	19	1.00	23.39	22.37	21.36	20.34
-	24207	.2362		6.000	6.0	65	19	1.50	23.39	22.37	21.36	20.34
-	24217	.2362		6.000	6.0	65	19	2.00	23.39	22.37	21.36	20.34
-	80097	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.010"	22.49	21.52	20.54	19.56
79107	80107	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.015"	22.49	21.52	20.54	19.56
79117	80117	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.020"	22.49	21.52	20.54	19.56
79127	80127	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.030"	22.49	21.52	20.54	19.56
79137	80137	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.045"	22.49	21.52	20.54	19.56
79147	80147	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	.060"	22.49	21.52	20.54	19.56
79167	80167	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.015"	30.49	29.16	27.84	26.51
79177	80177	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.020"	30.49	29.16	27.84	26.51
79187	80187	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.030"	30.49	29.16	27.84	26.51
79197	80197	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.045"	30.49	29.16	27.84	26.51
79207	80207	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	.060"	30.49	29.16	27.84	26.51

Series 220RA, 230RA, 830RA (continued)

.3150" - .6299"
(8.000mm - 16.000mm)

END MILLS

(220RA) 2 Flute EDP#	(230RA/830RA) 4 Flute EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
		Decimal	Metric									
-	24227	.3150	8.000	8.0	65	22	0.50	31.63	30.25	28.88	27.50	
-	24237	.3150	8.000	8.0	65	22	0.80	31.63	30.25	28.88	27.50	
-	24247	.3150	8.000	8.0	65	22	1.00	31.63	30.25	28.88	27.50	
-	24257	.3150	8.000	8.0	65	22	1.50	31.63	30.25	28.88	27.50	
-	24267	.3150	8.000	8.0	65	22	2.00	31.63	30.25	28.88	27.50	
-	24277	.3150	8.000	8.0	65	22	2.50	31.63	30.25	28.88	27.50	
-	24287	.3150	8.000	8.0	65	22	3.00	31.63	30.25	28.88	27.50	
-	80227	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.010"	35.60	34.06	32.51	30.96
79237	80237	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.015"	35.60	34.06	32.51	30.96
79247	80247	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.020"	35.60	34.06	32.51	30.96
79257	80257	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.030"	35.60	34.06	32.51	30.96
79267	80267	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.045"	35.60	34.06	32.51	30.96
79277	80277	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	.060"	35.60	34.06	32.51	30.96
-	24297	.3937	10.000	10.0	70	25	0.50	42.99	41.12	39.25	37.38	
-	24307	.3937	10.000	10.0	70	25	0.80	42.99	41.12	39.25	37.38	
-	24317	.3937	10.000	10.0	70	25	1.00	42.99	41.12	39.25	37.38	
-	24327	.3937	10.000	10.0	70	25	1.50	42.99	41.12	39.25	37.38	
-	24337	.3937	10.000	10.0	70	25	2.00	42.99	41.12	39.25	37.38	
-	24347	.3937	10.000	10.0	70	25	2.50	42.99	41.12	39.25	37.38	
-	24357	.3937	10.000	10.0	70	25	3.00	42.99	41.12	39.25	37.38	
-	24367	.3937	10.000	10.0	70	25	3.20	42.99	41.12	39.25	37.38	
-	80279	.4375	7/16"	11.113	7/16"	2-3/4"	1"	.010"	43.06	41.19	39.32	37.44
-	80281	.4375	7/16"	11.113	7/16"	2-3/4"	1"	.015"	43.06	41.19	39.32	37.44
-	80283	.4375	7/16"	11.113	7/16"	2-3/4"	1"	.020"	43.06	41.19	39.32	37.44
-	80285	.4375	7/16"	11.113	7/16"	2-3/4"	1"	.030"	43.06	41.19	39.32	37.44
-	80287	.4375	7/16"	11.113	7/16"	2-3/4"	1"	.045"	43.06	41.19	39.32	37.44
-	80289	.4375	7/16"	11.113	7/16"	2-3/4"	1"	.060"	43.06	41.19	39.32	37.44
-	80291	.4375	7/16"	11.113	7/16"	2-3/4"	1"	.090"	43.06	41.19	39.32	37.44
-	80293	.4375	7/16"	11.113	7/16"	2-3/4"	1"	.125"	43.06	41.19	39.32	37.44
-	24377	.4724	12.000	12.0	75	25	0.50	63.31	60.56	57.80	55.05	
-	24387	.4724	12.000	12.0	75	25	0.80	63.31	60.56	57.80	55.05	
-	24397	.4724	12.000	12.0	75	25	1.00	63.31	60.56	57.80	55.05	
-	24407	.4724	12.000	12.0	75	25	1.50	63.31	60.56	57.80	55.05	
-	24417	.4724	12.000	12.0	75	25	2.00	63.31	60.56	57.80	55.05	
-	24427	.4724	12.000	12.0	75	25	2.50	63.31	60.56	57.80	55.05	
-	24437	.4724	12.000	12.0	75	25	3.00	63.31	60.56	57.80	55.05	
-	24447	.4724	12.000	12.0	75	25	3.20	63.31	60.56	57.80	55.05	
-	80297	.5000	1/2"	12.700	1/2"	3"	1"	.010"	60.73	58.09	55.45	52.81
79307	80307	.5000	1/2"	12.700	1/2"	3"	1"	.015"	60.73	58.09	55.45	52.81
79317	80317	.5000	1/2"	12.700	1/2"	3"	1"	.020"	60.73	58.09	55.45	52.81
79327	80327	.5000	1/2"	12.700	1/2"	3"	1"	.030"	60.73	58.09	55.45	52.81
79337	80337	.5000	1/2"	12.700	1/2"	3"	1"	.045"	60.73	58.09	55.45	52.81
79347	80347	.5000	1/2"	12.700	1/2"	3"	1"	.060"	60.73	58.09	55.45	52.81
79357	80357	.5000	1/2"	12.700	1/2"	3"	1"	.090"	60.73	58.09	55.45	52.81
79367	80367	.5000	1/2"	12.700	1/2"	3"	1"	.125"	60.73	58.09	55.45	52.81
79377	80377	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.015"	96.69	92.49	88.28	84.08
-	80387	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.020"	96.69	92.49	88.28	84.08
79397	80397	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.030"	96.69	92.49	88.28	84.08
79407	80407	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.045"	96.69	92.49	88.28	84.08
79417	80417	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.060"	96.69	92.49	88.28	84.08
79427	80427	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	.090"	96.69	92.49	88.28	84.08
-	24457	.6299	16.000	16.0	88	38	0.50	100.89	96.50	92.12	87.73	
-	24467	.6299	16.000	16.0	88	38	1.00	100.89	96.50	92.12	87.73	
-	24477	.6299	16.000	16.0	88	38	2.00	100.89	96.50	92.12	87.73	
-	24487	.6299	16.000	16.0	88	38	2.50	100.89	96.50	92.12	87.73	
-	24497	.6299	16.000	16.0	88	38	3.00	100.89	96.50	92.12	87.73	
-	24507	.6299	16.000	16.0	88	38	4.00	100.89	96.50	92.12	87.73	
-	24517	.6299	16.000	16.0	88	38	5.00	100.89	96.50	92.12	87.73	

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MATERIAL HARDNESS (Rc)

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continued →

Series 220RA, 230RA, 830RA (continued)

.7500" - 1.000"
(19.050mm - 25.400mm)

(220RA) 2 Flute EDP#	(230RA/830RA) 4 Flute EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
		Decimal	Metric									
79447	80447	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.015"	138.66	132.63	126.60	120.57
79457	80457	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.020"	138.66	132.63	126.60	120.57
79467	80467	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.030"	138.66	132.63	126.60	120.57
79477	80477	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.045"	138.66	132.63	126.60	120.57
79487	80487	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.060"	138.66	132.63	126.60	120.57
79497	80497	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.090"	138.66	132.63	126.60	120.57
79507	80507	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.125"	138.66	132.63	126.60	120.57
79637	80637	.7500	3/4"	19.050	3/4"	4"	1-1/2"	.250"	138.66	132.63	126.60	120.57
-	24527	.7874		20.000	20.0	100	38	0.50	196.24	187.70	179.17	170.64
-	24537	.7874		20.000	20.0	100	38	1.00	196.24	187.70	179.17	170.64
-	24547	.7874		20.000	20.0	100	38	2.00	196.24	187.70	179.17	170.64
-	24557	.7874		20.000	20.0	100	38	3.00	196.24	187.70	179.17	170.64
-	24567	.7874		20.000	20.0	100	38	5.00	196.24	187.70	179.17	170.64
-	80517	1.000	1"	25.400	1"	4"	1-1/2"	.015"	236.72	226.42	216.13	205.84
-	80527	1.000	1"	25.400	1"	4"	1-1/2"	.020"	236.72	226.42	216.13	205.84
79537	80537	1.000	1"	25.400	1"	4"	1-1/2"	.030"	236.72	226.42	216.13	205.84
-	80547	1.000	1"	25.400	1"	4"	1-1/2"	.045"	236.72	226.42	216.13	205.84
79557	80557	1.000	1"	25.400	1"	4"	1-1/2"	.060"	236.72	226.42	216.13	205.84
-	80567	1.000	1"	25.400	1"	4"	1-1/2"	.090"	236.72	226.42	216.13	205.84
79577	80577	1.000	1"	25.400	1"	4"	1-1/2"	.125"	236.72	226.42	216.13	205.84
79647	80647	1.000	1"	25.400	1"	4"	1-1/2"	.250"	236.72	226.42	216.13	205.84



End Mill Manufacturing

MATERIAL HARDNESS (Rc)

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TOLERANCES

d_1	$\leq .030"$	$+0.000" - .001" (+0.000 - .025mm)$
	$\geq 1/32"$	$+0.000" - .002" (+0.000 - .050mm)$
d_2	h6	
ball radius	$+0.000" - .001" (+0.000 - .025mm)$	

Series 320M, 323M, 330M, 920M, 923M, 930M



.0100" - .2656"
(0.254mm - 6.746mm)

END MILLS

Standard Length - Ball End

Solid submicron grain carbide end mill - center cutting

Extremely versatile

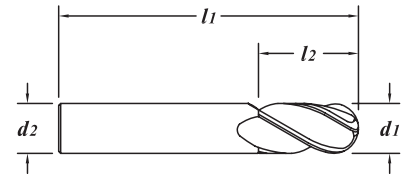
TiN Coating - page 197

TiCN Coating - page 198

TiAlN Coating - page 199

Stub Length - page 178

Extended length - page 221



(320M/920M) 2 Flute EDP#	(323M/923M) 3 Flute EDP#	(330M/930M) 4 Flute EDP#	d_1 †		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
16550	-	-	.0100	.0100"	0.254	1/8"	1-1/2"	.030"	21.71	20.77	19.82	18.88
16600	-	-	.0150	.0150"	0.381	1/8"	1-1/2"	.045"	21.62	20.68	19.74	18.80
16650	-	-	.0200	.0200"	0.508	1/8"	1-1/2"	.060"	21.05	20.13	19.22	18.30
16700	-	-	.0250	.0250"	0.635	1/8"	1-1/2"	.075"	20.34	19.46	18.57	17.69
16750	-	-	.0300	.0300"	0.762	1/8"	1-1/2"	.090"	17.53	16.76	16.00	15.24
16010	17010	18010	.0312	1/32"	0.792	1/8"	1-1/2"	3/32"	13.00	12.43	11.87	11.30
47010	38010	48010	.0394		1.000	3.0	38	4	13.65	13.06	12.46	11.87
16020	17020	18020	.0469	3/64"	1.191	1/8"	1-1/2"	1/8"	13.00	12.43	11.87	11.30
47020	38020	48020	.0591		1.500	3.0	38	6	13.65	13.06	12.46	11.87
16030	17030	18030	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	12.27	11.74	11.20	10.67
16040	17040	18040	.0781	5/64"	1.984	1/8"	1-1/2"	1/4"	12.27	11.74	11.20	10.67
47030	38030	48030	.0787		2.000	3.0	38	8	12.87	12.31	11.75	11.19
16050	17050	18050	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	11.73	11.22	10.71	10.20
47040	38040	48040	.0984		2.500	3.0	38	12	12.33	11.79	11.26	10.72
16060	17060	18060	.1094	7/64"	2.779	1/8"	1-1/2"	3/8"	11.73	11.22	10.71	10.20
47050	38050	48050	.1181		3.000	3.0	38	12	11.19	10.70	10.22	9.73
16070	17070	18070	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	10.65	10.19	9.72	9.26
47060	38060	48060	.1378		3.500	4.0	50	12	16.43	15.72	15.00	14.29
16080	17080	18080	.1406	9/64"	3.571	3/16"	2"	9/16"	15.62	14.94	14.26	13.58
16090	17090	18090	.1562	5/32"	3.967	3/16"	2"	9/16"	15.62	14.94	14.26	13.58
47070	38070	48070	.1575		4.000	4.0	50	14	14.73	14.09	13.45	12.81
16100	17100	18100	.1719	11/64"	4.366	3/16"	2"	9/16"	15.62	14.94	14.26	13.58
47080	38080	48080	.1772		4.500	5.0	50	14	18.54	17.73	16.93	16.12
16110	17110	18110	.1875	3/16"	4.763	3/16"	2"	5/8"	14.03	13.42	12.81	12.20
47090	38090	48090	.1969		5.000	5.0	65	16	17.86	17.08	16.31	15.53
16120	17120	18120	.2031	13/64"	5.159	1/4"	2-1/2"	5/8"	18.17	17.38	16.59	15.80
16130	17130	18130	.2188	7/32"	5.558	1/4"	2-1/2"	5/8"	18.17	17.38	16.59	15.80
16140	17140	18140	.2344	15/64"	5.954	1/4"	2-1/2"	3/4"	18.17	17.38	16.59	15.80
47100	38100	48100	.2362		6.000	6.0	65	19	18.31	17.51	16.72	15.92
16150	17150	18150	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	17.42	16.67	15.91	15.15
16160	17160	18160	.2656	17/64"	6.746	5/16"	2-1/2"	7/8"	27.27	26.08	24.90	23.71

continued →

MATERIAL HARDNESS (Rc)

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Series 320M, 323M, 330M, 920M, 923M, 930M (continued)

.2756" - 1.000"
(7.00mm - 25.40mm)

END MILLS

(320M/920M) 2 Flute EDP#	(323M/923M) 3 Flute EDP#	(330M/930M) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
47110	38110	48110	.2756		7.000	7.0	65	22	23.51	22.48	21.46	20.44
16170	17170	18170	.2812	9/32"	7.142	5/16"	2-1/2"	7/8"	27.27	26.08	24.90	23.71
16180	-	18180	.2969	19/64"	7.541	5/16"	2-1/2"	7/8"	27.27	26.08	24.90	23.71
16190	17190	18190	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	22.85	21.86	20.86	19.87
47120	38120	48120	.3150		8.000	8.0	65	22	24.04	22.99	21.95	20.90
16200	17200	18200	.3281	21/64"	8.334	3/8"	2-1/2"	7/8"	32.65	31.23	29.81	28.39
16210	17210	18210	.3438	11/32"	8.733	3/8"	2-1/2"	7/8"	32.65	31.23	29.81	28.39
47130	38130	48130	.3543		9.000	9.0	65	22	29.37	28.09	26.82	25.54
16220	-	18220	.3594	23/64"	9.129	3/8"	2-1/2"	7/8"	32.65	31.23	29.81	28.39
16230	17230	18230	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	27.96	26.74	25.53	24.31
16240	17240	18240	.3906	25/64"	9.921	7/16"	2-3/4"	7/8"	40.17	38.42	36.68	34.93
47140	38140	48140	.3937		10.000	10.0	70	25	34.33	32.84	31.34	29.85
16250	17250	18250	.4062	13/32"	10.317	7/16"	2-3/4"	7/8"	40.17	38.42	36.68	34.93
16260	17260	18260	.4219	27/64"	10.716	7/16"	2-3/4"	7/8"	40.17	38.42	36.68	34.93
47150	38150	48150	.4331		11.000	11.0	75	25	36.13	34.56	32.99	31.42
16270	17270	18270	.4375	7/16"	11.113	7/16"	2-3/4"	1"	34.41	32.91	31.42	29.92
16280	17280	18280	.4531	29/64"	11.509	1/2"	3"	1"	57.55	55.04	52.54	50.04
16290	17290	18290	.4688	15/32"	11.908	1/2"	3"	1"	57.55	55.04	52.54	50.04
47160	38160	48160	.4724		12.000	12.0	75	25	54.66	52.28	49.91	47.53
16300	17300	18300	.4844	31/64"	12.304	1/2"	3"	1"	57.55	55.04	52.54	50.04
16310	17310	18310	.5000	1/2"	12.700	1/2"	3"	1"	52.05	49.79	47.52	45.26
47170	38170	48170	.5512		14.000	14.0	88	32	79.58	76.12	72.66	69.20
16320	17320	18320	.5625	9/16"	14.288	9/16"	3-1/2"	1-1/4"	75.80	72.50	69.21	65.91
16330	17330	18330	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	84.18	80.52	76.86	73.20
47180	38180	48180	.6299		16.000	16.0	88	38	88.37	84.52	80.68	76.84
16340	17340	18340	.6875	11/16"	17.463	3/4"	4"	1-1/2"	140.13	134.04	127.94	121.85
47190	38190	48190	.7087		18.000	18.0	100	38	130.05	124.40	118.74	113.09
16350	17350	18350	.7500	3/4"	19.050	3/4"	4"	1-1/2"	123.88	118.49	113.11	107.72
47200	38200	48200	.7874		20.000	20.0	100	38	174.40	166.82	159.23	151.65
47210	38210	48210	.8661		22.000	22.0	100	38	193.73	185.31	176.88	168.46
16360	17360	18360	.8750	7/8"	22.225	7/8"	4"	1-1/2"	198.46	189.83	181.20	172.57
47220	38220	48220	.9843		25.000	25.0	100	38	203.08	194.25	185.42	176.59
16370	17370	18370	1.000	1"	25.400	1"	4"	1-1/2"	214.88	205.54	196.19	186.85

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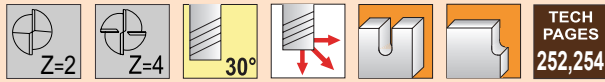
MATERIAL HARDNESS (Rc)

0

TOLERANCES

d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+.000 - .025mm)

Series 320MT, 330MT



END MILLS

Standard Length - Ball End

TiN Coating

Solid submicron grain carbide end mill - center cutting

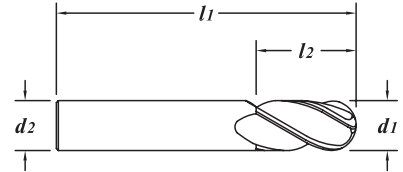
Improved lubricity

Extremely versatile

Uncoated - page 195

TiCN Coating - page 198

TiALN Coating - page 199



(320MT) 2 Flute EDP#	(330MT) 4 Flute EDP#	d_1 †		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
16073	18073	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	12.09	11.56	11.04	10.51
16113	18113	.1875	3/16"	4.763	3/16"	2"	5/8"	15.49	14.82	14.14	13.47
16153	18153	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	20.36	19.47	18.59	17.70
16193	18193	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	26.80	25.63	24.47	23.30
16233	18233	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	31.91	30.53	29.14	27.75
16273	18273	.4375	7/16"	11.113	7/16"	2-3/4"	1"	39.18	37.48	35.77	34.07
16313	18313	.5000	1/2"	12.700	1/2"	3"	1"	56.83	54.36	51.89	49.42
16333	18333	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	91.52	87.54	83.56	79.58
16353	18353	.7500	3/4"	19.050	3/4"	4"	1-1/2"	132.27	126.52	120.77	115.02
16373	18373	1.000	1"	25.400	1"	4"	1-1/2"	229.57	219.59	209.61	199.63

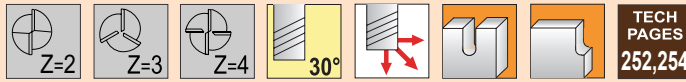
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MATERIAL HARDNESS (Rc)

0

Series 320MC, 323MC, 330MC



TOLERANCES	
d_1	+0.000" - .002" (+0.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+0.000 - .025mm)



Standard Length - Ball End

TiCN Coating

Solid submicron grain carbide end mill - center cutting

Improved abrasion resistance and lubricity

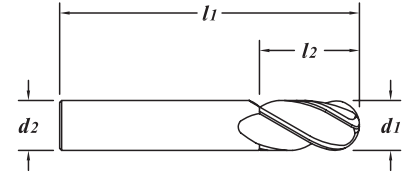
Extremely versatile

Uncoated - page 195

TiN Coating - page 197

TiALN Coating - page 199

Extended length - page 223



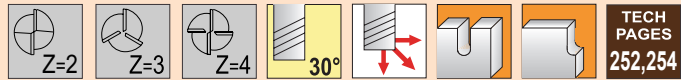
(320MC) 2 Flute EDP#	(323MC) 3 Flute EDP#	(330MC) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
16014	17014	18014	.0312	1/32"	0.792	1/8"	1-1/2"	3/32"	15.17	14.51	13.85	13.19
16024	17024	18024	.0469	3/64"	1.191	1/8"	1-1/2"	1/8"	15.17	14.51	13.85	13.19
16034	17034	18034	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	14.44	13.82	13.19	12.56
16044	17044	18044	.0781	5/64"	1.984	1/8"	1-1/2"	1/4"	14.44	13.82	13.19	12.56
16054	17054	18054	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	13.90	13.30	12.69	12.09
16064	17064	18064	.1094	7/64"	2.779	1/8"	1-1/2"	3/8"	13.90	13.30	12.69	12.09
16074	17074	18074	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	12.81	12.25	11.70	11.14
16084	17084	18084	.1406	9/64"	3.571	3/16"	2"	9/16"	17.81	17.04	16.26	15.49
16094	17094	18094	.1562	5/32"	3.967	3/16"	2"	9/16"	17.81	17.04	16.26	15.49
16104	-	18104	.1719	11/64"	4.366	3/16"	2"	9/16"	17.81	17.04	16.26	15.49
16114	17114	18114	.1875	3/16"	4.763	3/16"	2"	5/8"	16.20	15.50	14.79	14.09
16124	17124	18124	.2031	13/64"	5.159	1/4"	2-1/2"	5/8"	22.57	21.59	20.61	19.63
16134	17134	18134	.2188	7/32"	5.558	1/4"	2-1/2"	5/8"	22.57	21.59	20.61	19.63
16144	17144	18144	.2344	15/64"	5.954	1/4"	2-1/2"	3/4"	22.57	21.59	20.61	19.63
16154	17154	18154	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	21.83	20.88	19.93	18.98
-	17164	18164	.2656	17/64"	6.746	5/16"	2-1/2"	7/8"	33.17	31.72	30.28	28.84
16174	17174	18174	.2812	9/32"	7.142	5/16"	2-1/2"	7/8"	33.17	31.72	30.28	28.84
-	-	18184	.2969	19/64"	7.541	5/16"	2-1/2"	7/8"	33.17	31.72	30.28	28.84
16194	17194	18194	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	28.77	27.52	26.27	25.02
16204	-	-	.3281	21/64"	8.334	3/8"	2-1/2"	7/8"	38.55	36.87	35.20	33.52
-	17214	18214	.3438	11/32"	8.733	3/8"	2-1/2"	7/8"	38.55	36.87	35.20	33.52
16224	-	18224	.3594	23/64"	9.129	3/8"	2-1/2"	7/8"	38.55	36.87	35.20	33.52
16234	17234	18234	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	33.86	32.38	30.91	29.44
16244	-	18244	.3906	25/64"	9.921	7/16"	2-3/4"	7/8"	47.23	45.18	43.12	41.07
16254	17254	18254	.4062	13/32"	10.317	7/16"	2-3/4"	7/8"	47.23	45.18	43.12	41.07
-	-	18264	.4219	27/64"	10.716	7/16"	2-3/4"	7/8"	47.23	45.18	43.12	41.07
16274	17274	18274	.4375	7/16"	11.113	7/16"	2-3/4"	1"	41.49	39.69	37.88	36.08
-	17284	18284	.4531	29/64"	11.509	1/2"	3"	1"	64.63	61.82	59.01	56.20
-	17294	18294	.4688	15/32"	11.908	1/2"	3"	1"	64.63	61.82	59.01	56.20
16304	17304	18304	.4844	31/64"	12.304	1/2"	3"	1"	64.63	61.82	59.01	56.20
16314	17314	18314	.5000	1/2"	12.700	1/2"	3"	1"	59.14	56.57	54.00	51.43
16324	17324	18324	.5625	9/16"	14.288	9/16"	3-1/2"	1-1/4"	86.81	83.04	79.26	75.49
16334	17334	18334	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	95.21	91.07	86.93	82.79
-	17344	-	.6875	11/16"	17.463	3/4"	4"	1-1/2"	152.72	146.08	139.44	132.80
16354	17354	18354	.7500	3/4"	19.050	3/4"	4"	1-1/2"	136.48	130.55	124.61	118.68
16364	17364	18364	.8750	7/8"	22.225	7/8"	4"	1-1/2"	217.40	207.94	198.49	189.04
16374	17374	18374	1.000	1"	25.400	1"	4"	1-1/2"	233.82	223.65	213.49	203.32

MATERIAL HARDNESS (Rc) 70 35 0

TOLERANCES

d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+.000 - .025mm)

Series 320MA, 323MA, 330MA, 920MA, 923MA, 930MA



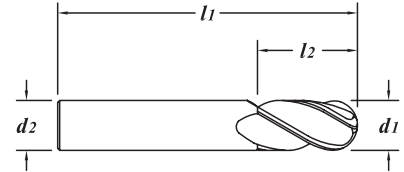
.0312" - .3150"
(0.792mm - 8.000mm)

END MILLS

Standard Length - Ball End

TiAlN Coating

- Solid submicron grain carbide end mill - center cutting
- Dry or semi-dry machining
- Extremely versatile
- Uncoated - page 195
- TiN Coating - page 197
- TiCN Coating - page 198
- Stub Length - page 179
- Extended length - page 224



(320MA/920MA) 2 Flute EDP#	(323MA/923MA) 3 Flute EDP#	(330MA/930MA) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
16017	17017	18017	.0312	1/32"	0.792	1/8"	1-1/2"	3/32"	15.46	14.78	14.11	13.44
47017	38017	48017	.0394		1.000	3.0	38	4	16.11	15.41	14.71	14.01
16027	17027	18027	.0469	3/64"	1.191	1/8"	1-1/2"	1/8"	15.46	14.78	14.11	13.44
47027	38027	48027	.0591		1.500	3.0	38	6	16.11	15.41	14.71	14.01
16037	17037	18037	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	14.73	14.09	13.45	12.81
16047	17047	18047	.0781	5/64"	1.984	1/8"	1-1/2"	1/4"	14.73	14.09	13.45	12.81
47037	38037	48037	.0787		2.000	3.0	38	8	15.34	14.67	14.01	13.34
16057	17057	18057	.0938	3/32"	2.383	1/8"	1-1/2"	3/8"	14.19	13.57	12.96	12.34
47047	38047	48047	.0984		2.500	3.0	38	12	14.79	14.15	13.50	12.86
16067	17067	18067	.1094	7/64"	2.779	1/8"	1-1/2"	3/8"	14.19	13.57	12.96	12.34
47057	38057	48057	.1181		3.000	3.0	38	12	13.65	13.06	12.46	11.87
16077	17077	18077	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	13.11	12.54	11.97	11.40
47067	38067	48067	.1378		3.500	4.0	50	12	18.88	18.06	17.24	16.42
16087	17087	18087	.1406	9/64"	3.571	3/16"	2"	9/16"	18.10	17.31	16.53	15.74
16097	17097	18097	.1562	5/32"	3.967	3/16"	2"	9/16"	18.10	17.31	16.53	15.74
47077	38077	48077	.1575		4.000	4.0	50	14	17.19	16.45	15.70	14.95
16107	17107	18107	.1719	11/64"	4.366	3/16"	2"	9/16"	18.10	17.31	16.53	15.74
47087	38087	48087	.1772		4.500	5.0	50	14	22.39	21.42	20.44	19.47
16117	17117	18117	.1875	3/16"	4.763	3/16"	2"	5/8"	16.49	15.77	15.06	14.34
47097	38097	48097	.1969		5.000	5.0	65	16	22.94	21.95	20.95	19.95
16127	17127	18127	.2031	13/64"	5.159	1/4"	2-1/2"	5/8"	23.26	22.25	21.24	20.23
16137	17137	18137	.2188	7/32"	5.558	1/4"	2-1/2"	5/8"	23.26	22.25	21.24	20.23
16147	17147	18147	.2344	15/64"	5.954	1/4"	2-1/2"	3/4"	23.26	22.25	21.24	20.23
47107	38107	48107	.2362		6.000	6.0	65	19	23.39	22.37	21.36	20.34
16157	17157	18157	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	22.49	21.52	20.54	19.56
16167	17167	18167	.2656	17/64"	6.746	5/16"	2-1/2"	7/8"	34.89	33.37	31.86	30.34
47117	38117	48117	.2756		7.000	7.0	65	22	31.10	29.74	28.39	27.04
16177	17177	18177	.2812	9/32"	7.142	5/16"	2-1/2"	7/8"	34.89	33.37	31.86	30.34
16187	17187	18187	.2969	19/64"	7.541	5/16"	2-1/2"	7/8"	34.89	33.37	31.86	30.34
16197	17197	18197	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	30.49	29.16	27.84	26.51
47127	38127	48127	.3150		8.000	8.0	65	22	31.63	30.25	28.88	27.50

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MATERIAL HARDNESS (Rc)

0

continued →

Series 320MA, 323MA, 330MA, 920MA, 923MA, 930MA (continued)

.3281" - 1.000"
(8.334mm - 25.400mm)

END MILLS

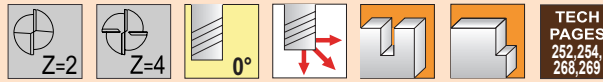
MATERIAL HARDNESS (Rc)
70
35
0

(320MA/920MA) 2 Flute EDP#	(323MA/923MA) 3 Flute EDP#	(330MA/930MA) 4 Flute EDP#	$d1$ †		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Diameter Metric								
16207	17207	18207	.3281	21/64"	8.334	3/8"	2-1/2"	7/8"	40.27	38.52	36.77	35.02
16217	17217	18217	.3438	11/32"	8.733	3/8"	2-1/2"	7/8"	40.27	38.52	36.77	35.02
47137	38137	48137	.3543		9.000	9.0	65	22	36.97	35.37	33.76	32.15
16227	17227	18227	.3594	23/64"	9.129	3/8"	2-1/2"	7/8"	40.27	38.52	36.77	35.02
16237	17237	18237	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	35.60	34.06	32.51	30.96
16247	17247	18247	.3906	25/64"	9.921	7/16"	2-3/4"	7/8"	48.82	46.70	44.57	42.45
47147	38147	48147	.3937		10.000	10.0	70	25	42.99	41.12	39.25	37.38
16257	17257	18257	.4062	13/32"	10.317	7/16"	2-3/4"	7/8"	48.82	46.70	44.57	42.45
16267	-	18267	.4219	27/64"	10.716	7/16"	2-3/4"	7/8"	48.82	46.70	44.57	42.45
47157	38157	48157	.4331		11.000	11.0	75	25	44.78	42.83	40.89	38.94
16277	17277	18277	.4375	7/16"	11.113	7/16"	2-3/4"	1"	43.06	41.18	39.31	37.44
16287	17287	18287	.4531	29/64"	11.509	1/2"	3"	1"	66.22	63.34	60.46	57.58
16297	17297	18297	.4688	15/32"	11.908	1/2"	3"	1"	66.22	63.34	60.46	57.58
47167	38167	48167	.4724		12.000	12.0	75	25	63.31	60.56	57.80	55.05
16307	17307	18307	.4844	31/64"	12.304	1/2"	3"	1"	66.22	63.34	60.46	57.58
16317	17317	18317	.5000	1/2"	12.700	1/2"	3"	1"	60.73	58.09	55.45	52.81
47177	38177	48177	.5512		14.000	14.0	88	32	92.10	88.10	84.09	80.09
16327	17327	18327	.5625	9/16"	14.288	9/16"	3-1/2"	1-1/4"	88.31	84.47	80.63	76.79
16337	17337	18337	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	96.69	92.49	88.28	84.08
47187	38187	48187	.6299		16.000	16.0	88	38	100.89	96.50	92.12	87.73
16347	17347	18347	.6875	11/16"	17.463	3/4"	4"	1-1/2"	154.89	148.16	141.42	134.69
47197	38197	48197	.7087		18.000	18.0	100	38	144.84	138.55	132.25	125.95
16357	17357	18357	.7500	3/4"	19.050	3/4"	4"	1-1/2"	138.66	132.63	126.60	120.57
47207	38207	48207	.7874		20.000	20.0	100	38	196.24	187.70	179.17	170.64
47217	38217	48217	.8661		22.000	22.0	100	38	215.57	206.20	196.82	187.45
-	17367	18367	.8750	7/8"	22.225	7/8"	4"	1-1/2"	220.29	210.72	201.14	191.56
47227	38227	48227	.9843		25.000	25.0	100	38	224.91	215.13	205.35	195.57
16377	17377	18377	1.000	1"	25.400	1"	4"	1-1/2"	236.72	226.42	216.13	205.84

TOLERANCES

d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+.000 - .025mm)

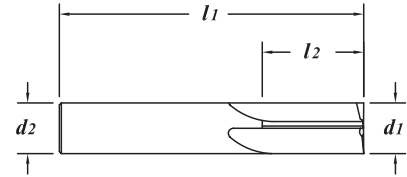
Series 222M, 234M, 322M, 334M



END MILLS

Standard Length - Straight Flute - Square End

Solid submicron grain carbide end mill - center cutting
 For cutting high Rc materials
 Helps to hold perpendicularity

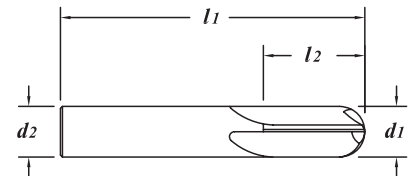


(222M) 2 Flute EDP#	(234M) 4 Flute EDP#	d_1 †		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Diameter Metric								
81070	82070	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	9.22	8.82	8.42	8.02
81110	82110	.1875	3/16"	4.763	3/16"	2"	5/8"	12.94	12.38	11.81	11.25
81150	82150	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	15.59	14.92	14.24	13.56
81190	82190	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	21.86	20.91	19.96	19.01
81230	82230	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	27.24	26.06	24.87	23.69
81270	82270	.4375	7/16"	11.113	7/16"	2-3/4"	1"	33.24	31.79	30.35	28.90
81310	82310	.5000	1/2"	12.700	1/2"	3"	1"	43.59	41.69	39.80	37.90
81330	82330	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	84.13	80.48	76.82	73.16
81350	82350	.7500	3/4"	19.050	3/4"	4"	1-1/2"	123.35	117.99	112.62	107.26
81370	82370	1.000	1"	25.400	1"	4"	1-1/2"	202.95	194.13	185.30	176.48

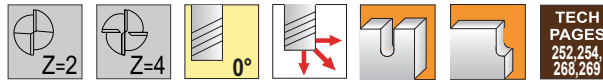
70

Standard Length - Straight Flute - Ball End

Solid submicron grain carbide end mill - center cutting
 For cutting high Rc materials
 Helps to hold perpendicularity



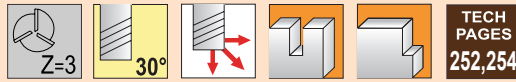
35



(322M) 2 Flute EDP#	(334M) 4 Flute EDP#	d_1 †		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Diameter Metric								
83070	84070	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	11.81	11.30	10.78	10.27
83110	84110	.1875	3/16"	4.763	3/16"	2"	5/8"	15.59	14.92	14.24	13.56
83150	84150	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	19.33	18.49	17.65	16.81
-	84230	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	31.06	29.71	28.36	27.01

MATERIAL HARDNESS (Rc)

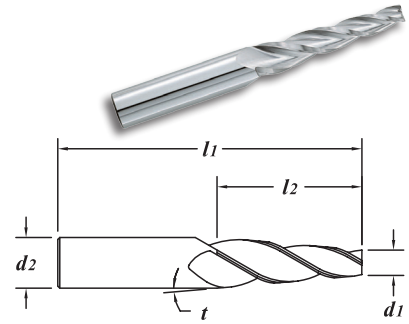
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TOLERANCES	
d_1	+0.003" - .000" (+.075 - .000mm)
d_2	h6

Standard Length - Tapered - Square End

Solid submicron grain carbide end mill - center cutting
Excellent for holding draft angles in mold and die applications

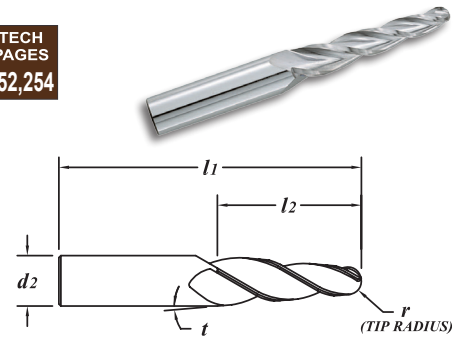


273M EDP#	d_2 Shank Diameter	t Taper Per Side	d_1 † Tip Diameter		l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric							
49010	1/4"	1°	.1250	1/8"	3.175	3"	1-1/2"	30.23	28.92	27.60	26.29
49020	1/4"	1° 30'	.1250	1/8"	3.175	3"	1-1/2"	30.23	28.92	27.60	26.29
49030	1/4"	2°	.1250	1/8"	3.175	3"	1"	30.23	28.92	27.60	26.29
49040	1/4"	3°	.1250	1/8"	3.175	3"	1-1/4"	30.23	28.92	27.60	26.29
49050	1/4"	5°	.1250	1/8"	3.175	3"	3/4"	30.23	28.92	27.60	26.29
49060	1/4"	7°	.1250	1/8"	3.175	3"	1/2"	30.23	28.92	27.60	26.29
49070	3/8"	1°	.1875	3/16"	4.763	3-1/2"	1-3/4"	45.40	43.43	41.45	39.48
49080	3/8"	1° 30'	.1875	3/16"	4.763	3-1/2"	1-3/4"	45.40	43.43	41.45	39.48
49090	3/8"	2°	.1875	3/16"	4.763	3-1/2"	1-3/4"	45.40	43.43	41.45	39.48
49100	3/8"	3°	.1562	5/32"	3.967	3-1/2"	1-3/4"	45.40	43.43	41.45	39.48
49110	3/8"	5°	.1250	1/8"	3.175	3-1/2"	1-1/2"	45.40	43.43	41.45	39.48
49120	3/8"	7°	.1562	5/32"	3.967	3-1/2"	1"	45.40	43.43	41.45	39.48
49130	1/2"	3°	.2500	1/4"	6.350	4"	2"	62.54	59.82	57.10	54.38
49140	1/2"	5°	.2500	1/4"	6.350	4"	1-1/2"	62.54	59.82	57.10	54.38
49150	1/2"	7°	.1875	3/16"	4.763	4"	1-5/16"	62.54	59.82	57.10	54.38



Standard Length - Tapered - Ball End

Solid submicron grain carbide end mill - center cutting
Excellent for holding draft angles in mold and die applications
Radius tolerance +.003" - .000" (+.075mm - .000mm)



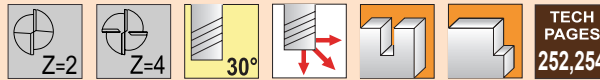
373M EDP#	d_2 Shank Diameter	t Taper Per Side	r † Tip Radius		l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric							
50010	1/4"	1°	.0620	.062"	1.575	3"	1-1/2"	33.53	32.08	30.62	29.16
50020	1/4"	1° 30'	.0620	.062"	1.575	3"	1-1/2"	33.53	32.08	30.62	29.16
50030	1/4"	2°	.0620	.062"	1.575	3"	1"	33.53	32.08	30.62	29.16
50040	1/4"	3°	.0620	.062"	1.575	3"	1-1/4"	33.53	32.08	30.62	29.16
50050	1/4"	5°	.0620	.062"	1.575	3"	3/4"	33.53	32.08	30.62	29.16
50060	1/4"	7°	.0620	.062"	1.575	3"	1/2"	33.53	32.08	30.62	29.16
50070	3/8"	1°	.0930	.093"	2.362	3-1/2"	1-3/4"	50.42	48.22	46.03	43.84
50080	3/8"	1° 30'	.0930	.093"	2.362	3-1/2"	1-3/4"	50.42	48.22	46.03	43.84
50090	3/8"	2°	.0930	.093"	2.362	3-1/2"	1-3/4"	50.42	48.22	46.03	43.84
50100	3/8"	3°	.0780	.078"	1.981	3-1/2"	1-3/4"	50.42	48.22	46.03	43.84
50110	3/8"	5°	.0620	.062"	1.575	3-1/2"	1-1/2"	50.42	48.22	46.03	43.84
50120	3/8"	7°	.0780	.078"	1.981	3-1/2"	1"	50.42	48.22	46.03	43.84
50130	1/2"	3°	.1250	.125"	3.175	4"	2"	71.88	68.75	65.63	62.50
50140	1/2"	5°	.1250	.125"	3.175	4"	1-1/2"	71.88	68.75	65.63	62.50
50150	1/2"	7°	.0930	.093"	2.362	4"	1-5/16"	71.88	68.75	65.63	62.50

MATERIAL HARDNESS (Rc) 70 35 0

TOLERANCES

d_1	+0.01" -0.000" (+0.025 -0.000mm)
d_2	h6

Series 280M, 290M, 380M, 390M



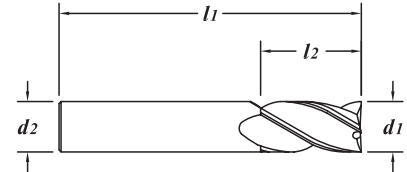
Standard Length - N/C Tolerance - Square End

Solid submicron grain carbide end mill - center cutting

Excellent for keyways

Tight tolerance for precision machining

For use when matching tools are necessary



(280M) 2 Flute EDP#	(290M) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
25010	26010	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	13.50	12.91	12.33	11.74
25020	26020	.0938	3/32"	2.383	1/8"	1-1/2"	5/16"	12.79	12.23	11.68	11.12
25030	26030	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	12.42	11.88	11.34	10.80
25040	26040	.1875	3/16"	4.763	3/16"	2"	9/16"	16.51	15.80	15.08	14.36
25050	26050	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	18.99	18.16	17.34	16.51
25060	26060	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	27.19	26.00	24.82	23.64
* 25070	* 26070	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	34.89	33.37	31.86	30.34
* 25080	* 26080	.4375	7/16"	11.113	7/16"	2-3/4"	1"	42.57	40.72	38.87	37.02
* 25090	* 26090	.5000	1/2"	12.700	1/2"	3"	1"	55.89	53.46	51.03	48.60
* 25100	* 26100	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	99.49	95.16	90.84	86.51
-	* 26110	.7500	3/4"	19.050	3/4"	4"	1-1/2"	148.79	142.32	135.85	129.38
* 25120	* 26120	1.000	1"	25.400	1"	4"	1-1/2"	252.68	241.69	230.71	219.72

70

Standard Length - N/C Tolerance - Ball End

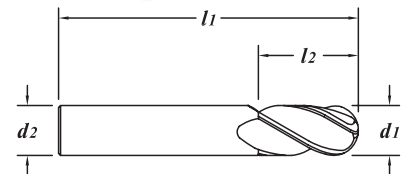
Solid submicron grain carbide end mill - center cutting

Excellent for keyways

Tight tolerance for precision machining

For use when matching tools are necessary

Ball radius tolerance +.0005" -0.0000" (+0.0127mm -0.0000mm)



35

(380M) 2 Flute EDP#	(390M) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
27010	28010	.0625	1/16"	1.588	1/8"	1-1/2"	1/4"	15.54	14.86	14.19	13.51
27020	28020	.0938	3/32"	2.383	1/8"	1-1/2"	5/16"	14.73	14.09	13.45	12.81
27030	28030	.1250	1/8"	3.175	1/8"	1-1/2"	1/2"	14.28	13.66	13.04	12.42
27040	28040	.1875	3/16"	4.763	3/16"	2"	9/16"	18.99	18.16	17.34	16.51
27050	28050	.2500	1/4"	6.350	1/4"	2-1/2"	3/4"	21.86	20.91	19.96	19.01
27060	28060	.3125	5/16"	7.938	5/16"	2-1/2"	7/8"	31.25	29.89	28.53	27.17
* 27070	* 28070	.3750	3/8"	9.525	3/8"	2-1/2"	7/8"	40.14	38.39	36.65	34.90
-	* 28080	.4375	7/16"	11.113	7/16"	2-3/4"	1"	48.93	46.81	44.68	42.55
* 27090	* 28090	.5000	1/2"	12.700	1/2"	3"	1"	64.29	61.49	58.70	55.90
-	* 28100	.6250	5/8"	15.875	5/8"	3-1/2"	1-1/4"	114.45	109.47	104.50	99.52
* 27110	* 28110	.7500	3/4"	19.050	3/4"	4"	1-1/2"	171.11	163.67	156.23	148.79
* 27120	* 28120	1.000	1"	25.400	1"	4"	1-1/2"	290.58	277.95	265.31	252.68

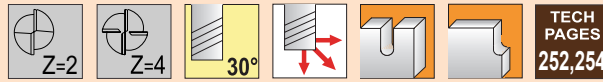
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* - Tools with weldon flats

TOLERANCES

d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+.000 - .025mm)

Series 525M, 535M, 525MA, 535MA

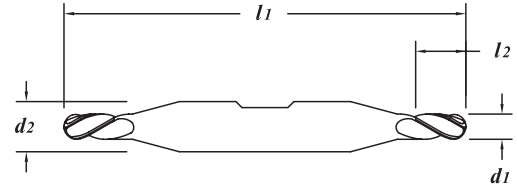


Standard Length - Double End - 3/8" Shank - Ball End

Solid submicron grain carbide end mill - center cutting

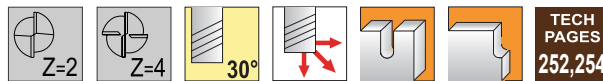
Common 3/8" diameter shank with weldon flat

For strength and adaptability when converting from high speed steel



(525M) 2 Flute EDP#	(535M) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
35010	36010	.1250	1/8"	3.175	3/8"	3"	3/8"	42.50	40.66	38.81	36.96
35020	36020	.1562	5/32"	3.967	3/8"	3"	7/16"	42.50	40.66	38.81	36.96
35030	36030	.1875	3/16"	4.763	3/8"	3"	1/2"	42.50	40.66	38.81	36.96
-	36040	.2188	7/32"	5.558	3/8"	3"	9/16"	42.50	40.66	38.81	36.96
35050	36050	.2500	1/4"	6.350	3/8"	3"	5/8"	42.50	40.66	38.81	36.96
-	36060	.2812	9/32"	7.142	3/8"	4"	11/16"	48.83	46.71	44.58	42.46
35070	36070	.3125	5/16"	7.938	3/8"	4"	3/4"	48.83	46.71	44.58	42.46
-	36080	.3438	11/32"	8.733	3/8"	4"	3/4"	48.83	46.71	44.58	42.46
35090	36090	.3750	3/8"	9.525	3/8"	4"	3/4"	48.83	46.71	44.58	42.46

70



Standard Length - Double End - 3/8" Shank - Ball End

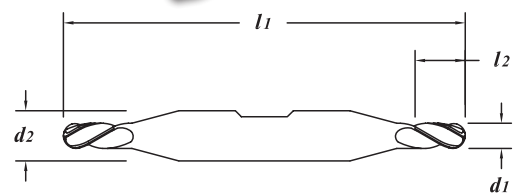
TiAlN Coated

Solid submicron grain carbide end mill - center cutting

Common 3/8" diameter shank with weldon flat

For strength and adaptability when converting from high speed steel

Dry or semi-dry machining



35

(525MA) 2 Flute EDP#	(535MA) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
35017	36017	.1250	1/8"	3.175	3/8"	3"	3/8"	53.92	51.58	49.23	46.89
35027	36027	.1562	5/32"	3.967	3/8"	3"	7/16"	53.92	51.58	49.23	46.89
35037	36037	.1875	3/16"	4.763	3/8"	3"	1/2"	53.92	51.58	49.23	46.89
35047	36047	.2188	7/32"	5.558	3/8"	3"	9/16"	53.92	51.58	49.23	46.89
35057	36057	.2500	1/4"	6.350	3/8"	3"	5/8"	53.92	51.58	49.23	46.89
-	36067	.2812	9/32"	7.142	3/8"	4"	11/16"	63.33	60.58	57.82	55.07
35077	36077	.3125	5/16"	7.938	3/8"	4"	3/4"	63.33	60.58	57.82	55.07
-	36087	.3438	11/32"	8.733	3/8"	4"	3/4"	63.33	60.58	57.82	55.07
35097	36097	.3750	3/8"	9.525	3/8"	4"	3/4"	63.33	60.58	57.82	55.07

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$d1$	+0.000" -0.002" (+0.000 -0.050mm)
$d2$	h6



TECH PAGES
252, 254

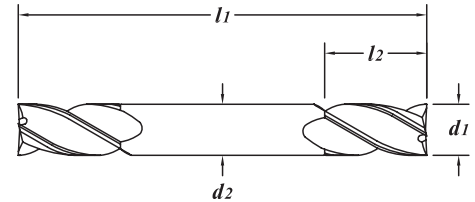
Standard Length - Double End

Solid submicron grain carbide end mill - center cutting

Extremely versatile

TiAlN Coating - page 207

Stub Length - page 180



MATERIAL HARDNESS (Rc)

70

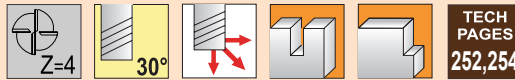
35

0

(430M/450M) EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
	Decimal	Metric								
30010	.0312	1/32"	0.792	1/8"	2"	3/32"	21.87	20.92	19.97	19.02
30510	.0394		1.000	3.0	50	4	23.02	22.02	21.02	20.02
30020	.0469	3/64"	1.191	1/8"	2"	1/8"	21.87	20.92	19.97	19.02
30520	.0591		1.500	3.0	50	5	23.02	22.02	21.02	20.02
30030	.0625	1/16"	1.588	1/8"	2"	3/16"	21.87	20.92	19.97	19.02
30530	.0787		2.000	3.0	50	6	23.02	22.02	21.02	20.02
30040	.0938	3/32"	2.383	1/8"	2"	1/4"	21.87	20.92	19.97	19.02
30540	.0984		2.500	3.0	50	7	23.02	22.02	21.02	20.02
30550	.1181		3.000	3.0	50	8	16.63	15.91	15.18	14.46
30050	.1250	1/8"	3.175	1/8"	2"	3/8"	15.80	15.11	14.43	13.74
30560	.1378		3.500	4.0	65	9.5	23.77	22.74	21.70	20.67
30060	.1562	5/32"	3.967	3/16"	2-1/2"	7/16"	22.59	21.60	20.62	19.64
30570	.1575		4.000	4.0	65	10	19.90	19.03	18.17	17.30
30580	.1772		4.500	5.0	65	12	26.47	25.32	24.17	23.02
30070	.1875	3/16"	4.763	3/16"	2-1/2"	1/2"	18.89	18.07	17.25	16.43
30590	.1969		5.000	5.0	65	12	23.08	22.08	21.07	20.07
30080	.2188	7/32"	5.558	1/4"	2-1/2"	9/16"	25.15	24.06	22.96	21.87
30600	.2362		6.000	6.0	65	16	24.10	23.06	22.01	20.96
30090	.2500	1/4"	6.350	1/4"	2-1/2"	5/8"	22.91	21.91	20.92	19.92
30610	.2756		7.000	7.0	88	19	30.30	28.99	27.67	26.35
30100	.3125	5/16"	7.938	5/16"	3-1/2"	3/4"	29.91	28.61	27.31	26.01
30620	.3150		8.000	8.0	88	19	31.49	30.12	28.75	27.38
30630	.3543		9.000	9.0	88	19	40.66	38.90	37.13	35.36
30110	.3750	3/8"	9.525	3/8"	3-1/2"	3/4"	38.63	36.95	35.27	33.59
30640	.3937		10.000	10.0	88	19	54.05	51.70	49.35	47.00
30650	.4331		11.000	11.0	100	22	57.78	55.26	52.75	50.24
30120	.4375	7/16"	11.113	7/16"	4"	7/8"	54.90	52.51	50.13	47.74
30660	.4724		12.000	12.0	100	25	64.95	62.13	59.30	56.48
30130	.5000	1/2"	12.700	1/2"	4"	1"	61.69	59.00	56.32	53.64

TOLERANCES

d_1	+0.000° -0.002° (+.000 -0.050mm)
d_2	h6



Standard Length - Double End

TiAlN Coating

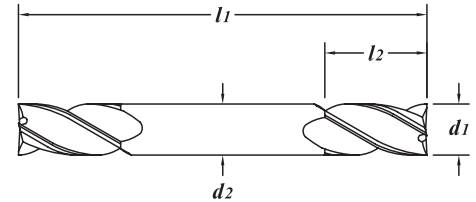
Solid submicron grain carbide end mill - center cutting

Dry or semi-dry machining

Extremely versatile

Uncoated - page 206

Stub Length - page 181



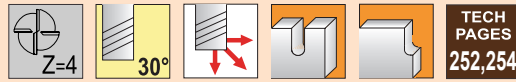
(430MA/450MA) EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
	Decimal	Metric								
30017	.0312	1/32"	0.792	1/8"	2"	3/32"	25.58	24.46	23.35	22.24
30517	.0394		1.000	3.0	50	4	26.74	25.58	24.41	23.25
30027	.0469	3/64"	1.191	1/8"	2"	1/8"	25.58	24.46	23.35	22.24
30527	.0591		1.500	3.0	50	5	26.74	25.58	24.41	23.25
30037	.0625	1/16"	1.588	1/8"	2"	3/16"	25.58	24.46	23.35	22.24
30537	.0787		2.000	3.0	50	6	26.74	25.58	24.41	23.25
30047	.0938	3/32"	2.383	1/8"	2"	1/4"	25.58	24.46	23.35	22.24
30547	.0984		2.500	3.0	50	7	26.74	25.58	24.41	23.25
30557	.1181		3.000	3.0	50	8	20.33	19.45	18.56	17.68
30057	.1250	1/8"	3.175	1/8"	2"	3/8"	19.50	18.66	17.81	16.96
30567	.1378		3.500	4.0	65	9.5	29.53	28.25	26.96	25.68
30067	.1562	5/32"	3.967	3/16"	2-1/2"	7/16"	28.34	27.10	25.87	24.64
30577	.1575		4.000	4.0	65	10	25.65	24.53	23.42	22.30
30587	.1772		4.500	5.0	65	12	34.10	32.62	31.13	29.65
30077	.1875	3/16"	4.763	3/16"	2-1/2"	1/2"	24.67	23.60	22.52	21.45
30597	.1969		5.000	5.0	65	12	30.69	29.36	28.02	26.69
30087	.2188	7/32"	5.558	1/4"	2-1/2"	9/16"	32.78	31.35	29.93	28.50
30607	.2362		6.000	6.0	65	16	31.73	30.35	28.97	27.59
30097	.2500	1/4"	6.350	1/4"	2-1/2"	5/8"	30.56	29.23	27.90	26.57
30107	.3125	5/16"	7.938	5/16"	3-1/2"	3/4"	44.41	42.48	40.55	38.62
30627	.3150		8.000	8.0	88	19	45.99	43.99	41.99	39.99
30637	.3543		9.000	9.0	88	19	55.17	52.77	50.37	47.97
30117	.3750	3/8"	9.525	3/8"	3-1/2"	3/4"	53.15	50.84	48.53	46.22
30647	.3937		10.000	10.0	88	19	70.86	67.78	64.70	61.62
30657	.4331		11.000	11.0	100	22	74.59	71.35	68.10	64.86
30127	.4375	7/16"	11.113	7/16"	4"	7/8"	71.70	68.59	65.47	62.35
30667	.4724		12.000	12.0	100	25	81.75	78.20	74.64	71.09
30137	.5000	1/2"	12.700	1/2"	4"	1"	78.49	75.08	71.66	68.25

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MATERIAL HARDNESS (Rc)

0



TOLERANCES

d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+.000 - .025mm)

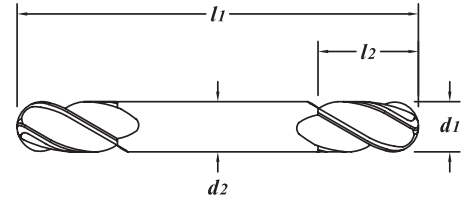
Standard Length - Double End - Ball End

Solid submicron grain carbide end mill - center cutting

Extremely versatile

TiAlN Coating - page 209

Stub Length - page 182



EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
	Decimal	Metric								
32010	.0312	1/32"	0.792	1/8"	2"	3/32"	25.16	24.07	22.97	21.88
32020	.0469	3/64"	1.191	1/8"	2"	1/8"	25.16	24.07	22.97	21.88
32030	.0625	1/16"	1.588	1/8"	2"	3/16"	25.16	24.07	22.97	21.88
32040	.0938	3/32"	2.383	1/8"	2"	1/4"	25.16	24.07	22.97	21.88
32050	.1250	1/8"	3.175	1/8"	2"	3/8"	18.16	17.37	16.58	15.79
32060	.1562	5/32"	3.967	3/16"	2-1/2"	7/16"	25.98	24.85	23.72	22.59
32070	.1875	3/16"	4.763	3/16"	2-1/2"	1/2"	22.24	21.27	20.31	19.34
32080	.2188	7/32"	5.558	1/4"	2-1/2"	9/16"	28.92	27.67	26.41	25.15
32090	.2500	1/4"	6.350	1/4"	2-1/2"	5/8"	26.39	25.25	24.10	22.95
32100	.3125	5/16"	7.938	5/16"	3-1/2"	3/4"	34.40	32.90	31.41	29.91
32110	.3750	3/8"	9.525	3/8"	3-1/2"	3/4"	44.46	42.53	40.59	38.66
32120	.4375	7/16"	11.113	7/16"	4"	7/8"	63.14	60.39	57.65	54.90
32130	.5000	1/2"	12.700	1/2"	4"	1"	70.94	67.86	64.77	61.69

TOLERANCES

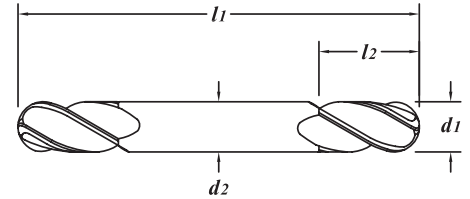
d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+.000 - .025mm)



TECH
PAGES
252, 254

Standard Length - Double End - Ball End
TiAlN Coating

- Solid submicron grain carbide end mill - center cutting
- Dry or semi-dry machining
- Extremely versatile
- Uncoated - page 208
- Stub Length - page 183



EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
	Decimal	Metric								
32017	.0312	1/32"	0.792	1/8"	2"	3/32"	28.87	27.61	26.36	25.10
32027	.0469	3/64"	1.191	1/8"	2"	1/8"	28.87	27.61	26.36	25.10
32037	.0625	1/16"	1.588	1/8"	2"	3/16"	28.87	27.61	26.36	25.10
32047	.0938	3/32"	2.383	1/8"	2"	1/4"	28.87	27.61	26.36	25.10
32057	.1250	1/8"	3.175	1/8"	2"	3/8"	21.86	20.91	19.96	19.01
32067	.1562	5/32"	3.967	3/16"	2-1/2"	7/16"	31.73	30.35	28.97	27.59
32077	.1875	3/16"	4.763	3/16"	2-1/2"	1/2"	28.00	26.79	25.57	24.35
32087	.2188	7/32"	5.558	1/4"	2-1/2"	9/16"	36.56	34.97	33.38	31.79
32097	.2500	1/4"	6.350	1/4"	2-1/2"	5/8"	34.03	32.55	31.07	29.59
32107	.3125	5/16"	7.938	5/16"	3-1/2"	3/4"	48.91	46.78	44.66	42.53
32117	.3750	3/8"	9.525	3/8"	3-1/2"	3/4"	58.96	56.40	53.83	51.27
32127	.4375	7/16"	11.113	7/16"	4"	7/8"	79.94	76.46	72.99	69.51
32137	.5000	1/2"	12.700	1/2"	4"	1"	87.75	83.93	80.12	76.30

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MATERIAL HARDNESS (Rc)

0

Series 620M, 623M, 630M, 640M, 643M, 650M

.1181" - .3150"
(3.000mm - 8.000mm)



TECH
PAGES
252,254

TOLERANCES	
d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6

Extra Length

Solid submicron grain carbide end mill - center cutting

Extended reach

Can be modified with a neck within 48 hours

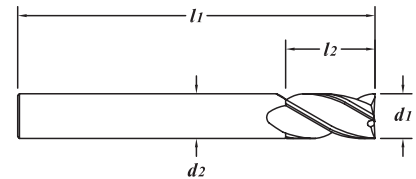
Extremely versatile

TiCN Coating - page 212

TiALN Coating - page 213

Stub Length - page 175

Standard length - page 184



(620M/640M) 2 Flute EDP#	(623M/643M) 3 Flute EDP#	(630M/650M) 4 Flute EDP#	d_1 †		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
92010	93010	94010	.1181	3.000	3.0	50	16	11.64	11.13	10.63	10.12	
92020	93020	94020	.1181	3.000	3.0	75	20	19.78	18.92	18.06	17.20	
92030	93030	94030	.1181	3.000	3.0	75	25	19.78	18.92	18.06	17.20	
41010	54510	42010	.1250	1/8"	3.175	1/8"	2"	5/8"	12.18	11.65	11.12	10.59
41020	54520	42020	.1250	1/8"	3.175	1/8"	3"	3/4"	18.79	17.97	17.16	16.34
41030	54530	42030	.1250	1/8"	3.175	1/8"	3"	1"	18.79	17.97	17.16	16.34
92040	93040	94040	.1575	4.000	4.0	50	16	12.24	11.70	11.17	10.64	
92050	93050	94050	.1575	4.000	4.0	75	20	20.24	19.36	18.48	17.60	
92060	93060	94060	.1575	4.000	4.0	75	25	20.24	19.36	18.48	17.60	
41040	54540	42040	.1875	3/16"	4.763	3/16"	3"	1"	20.73	19.83	18.93	18.03
41050	54550	42050	.1875	3/16"	4.763	3/16"	3"	1-1/8"	20.73	19.83	18.93	18.03
41060	54560	42060	.1875	3/16"	4.763	3/16"	4"	1"	22.90	21.90	20.91	19.91
92070	93070	94070	.1969	5.000	5.0	50	16	14.38	13.75	13.13	12.50	
92080	93080	94080	.1969	5.000	5.0	75	20	21.83	20.88	19.93	18.98	
92090	93090	94090	.1969	5.000	5.0	75	25	21.83	20.88	19.93	18.98	
92100	93100	94100	.2362	6.000	6.0	75	25	25.30	24.20	23.10	22.00	
92110	93110	94110	.2362	6.000	6.0	100	25	26.69	25.53	24.37	23.21	
92120	93120	94120	.2362	6.000	6.0	100	32	26.69	25.53	24.37	23.21	
92130	93130	94130	.2362	6.000	6.0	150	38	36.11	34.54	32.97	31.40	
41070	54570	42070	.2500	1/4"	6.350	1/4"	3"	1"	24.01	22.97	21.92	20.88
41080	54580	42080	.2500	1/4"	6.350	1/4"	4"	1"	25.36	24.26	23.15	22.05
41090	54590	42090	.2500	1/4"	6.350	1/4"	4"	1-1/2"	25.36	24.26	23.15	22.05
41100	54600	42100	.2500	1/4"	6.350	1/4"	6"	1-1/2"	34.29	32.80	31.31	29.82
41110	54610	42110	.3125	5/16"	7.938	5/16"	3"	1"	29.64	28.35	27.06	25.77
41120	54620	42120	.3125	5/16"	7.938	5/16"	4"	1"	33.09	31.65	30.21	28.77
41130	54630	42130	.3125	5/16"	7.938	5/16"	4"	1-5/8"	33.09	31.65	30.21	28.77
41140	54640	42140	.3125	5/16"	7.938	5/16"	6"	1-1/2"	49.07	46.94	44.80	42.67
92140	93140	94140	.3150	8.000	8.0	75	25	31.21	29.85	28.50	27.14	
92150	93150	94150	.3150	8.000	8.0	100	25	34.81	33.30	31.78	30.27	
92160	93160	94160	.3150	8.000	8.0	100	41	34.81	33.30	31.78	30.27	
92170	93170	94170	.3150	8.000	8.0	150	50	50.31	48.13	45.94	43.75	

MATERIAL HARDNESS (Rc)

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Series 620M, 623M, 630M, 640M, 643M, 650M (continued)

.3750" - 1.250"
(9.525mm - 31.750mm)

END MILLS

(620M/640M) 2 Flute EDP#	(623M/643M) 3 Flute EDP#	(630M/650M) 4 Flute EDP#	$d1$ †		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Diameter Metric								
41150	54650	42150	.3750	3/8"	9.525	3/8"	3"	1"	33.34	31.89	30.44	28.99
41160	54660	42160	.3750	3/8"	9.525	3/8"	4"	1"	36.60	35.01	33.42	31.83
41170	54670	42170	.3750	3/8"	9.525	3/8"	4"	2"	36.60	35.01	33.42	31.83
41180	54680	42180	.3750	3/8"	9.525	3/8"	6"	1-1/2"	53.35	51.03	48.71	46.39
41190	54690	42190	.3750	3/8"	9.525	3/8"	6"	3"	53.35	51.03	48.71	46.39
92180	93180	94180	.3937		10.000	10.0	75	25	36.20	34.63	33.05	31.48
92190	93190	94190	.3937		10.000	10.0	100	25	46.67	44.64	42.61	40.58
92200	93200	94200	.3937		10.000	10.0	100	50	46.67	44.64	42.61	40.58
92210	93210	94210	.3937		10.000	10.0	150	38	61.39	58.72	56.05	53.38
92220	93220	94220	.3937		10.000	10.0	150	75	61.39	58.72	56.05	53.38
41200	54700	42200	.4375	7/16"	11.113	7/16"	4"	1"	50.39	48.20	46.01	43.82
41210	54710	42210	.4375	7/16"	11.113	7/16"	4"	2"	50.39	48.20	46.01	43.82
41220	54720	42220	.4375	7/16"	11.113	7/16"	6"	1-1/2"	66.99	64.08	61.16	58.25
41230	54730	42230	.4375	7/16"	11.113	7/16"	6"	3"	66.99	64.08	61.16	58.25
92230	93230	94230	.4724		12.000	12.0	100	25	56.83	54.36	51.89	49.42
92240	93240	94240	.4724		12.000	12.0	100	50	56.83	54.36	51.89	49.42
92250	93250	94250	.4724		12.000	12.0	150	50	77.50	74.13	70.76	67.39
92260	93260	94260	.4724		12.000	12.0	150	75	77.50	74.13	70.76	67.39
41240	54740	42240	.5000	1/2"	12.700	1/2"	4"	1"	53.60	51.27	48.94	46.61
41250	54750	42250	.5000	1/2"	12.700	1/2"	4"	2"	53.60	51.27	48.94	46.61
41260	54760	42260	.5000	1/2"	12.700	1/2"	6"	1-1/2"	77.50	74.13	70.76	67.39
41270	54770	42270	.5000	1/2"	12.700	1/2"	6"	3"	77.50	74.13	70.76	67.39
92270	93270	94270	.5512		14.000	14.0	100	25	78.03	74.64	71.24	67.85
92280	93280	94280	.5512		14.000	14.0	100	50	78.03	74.64	71.24	67.85
92290	93290	94290	.5512		14.000	14.0	150	50	101.73	97.31	92.88	88.46
92300	93300	94300	.5512		14.000	14.0	150	75	101.73	97.31	92.88	88.46
41280	54780	42280	.5625	9/16"	14.288	9/16"	6"	2"	101.74	97.32	92.89	88.47
41290	54790	42290	.5625	9/16"	14.288	9/16"	6"	3"	101.74	97.32	92.89	88.47
41300	54800	42300	.6250	5/8"	15.875	5/8"	6"	2"	110.47	105.67	100.86	96.06
41310	54810	42310	.6250	5/8"	15.875	5/8"	6"	3"	110.47	105.67	100.86	96.06
92310	93310	94310	.6299		16.000	16.0	150	50	110.47	105.67	100.86	96.06
92320	93320	94320	.6299		16.000	16.0	150	75	110.47	105.67	100.86	96.06
92330	93330	94330	.7087		18.000	18.0	150	50	166.08	158.86	151.64	144.42
92340	93340	94340	.7087		18.000	18.0	150	75	166.08	158.86	151.64	144.42
41320	54820	42320	.7500	3/4"	19.050	3/4"	6"	2"	175.97	168.32	160.67	153.02
41330	54830	42330	.7500	3/4"	19.050	3/4"	6"	3"	175.97	168.32	160.67	153.02
92350	93350	94350	.7874		20.000	20.0	150	50	185.38	177.32	169.26	161.20
92360	93360	94360	.7874		20.000	20.0	150	75	185.38	177.32	169.26	161.20
92370	93370	94370	.9843		25.000	25.0	150	50	285.66	273.24	260.82	248.40
92380	93380	94380	.9843		25.000	25.0	150	75	285.66	273.24	260.82	248.40
41340	54840	42340	1.000	1"	25.400	1"	6"	2"	299.16	286.15	273.15	260.14
41350	54850	42350	1.000	1"	25.400	1"	6"	3"	299.16	286.15	273.15	260.14
-	-	42360	1.000	1"	25.400	1"	6"	4"	314.90	301.21	287.52	273.83
-	-	42390	1.250	1-1/4"	31.750	1-1/4"	6"	3"	634.71	607.11	579.52	551.92

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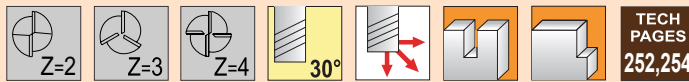
MATERIAL HARDNESS (Rc)

0

Series 620MC, 623MC, 630MC

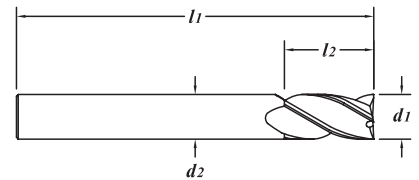
TOLERANCES

$d1$	+0.000" -0.002" (+0.000 -0.050mm)
$d2$	h6



Extra Length TiCN Coating

- Solid submicron grain carbide end mill - center cutting
- Extended reach
- Improved abrasion resistance and lubricity
- Can be modified with a neck within 48 hours
- Extremely versatile
- Uncoated - page 210
- TiALN Coating - page 213
- Standard length - page 184



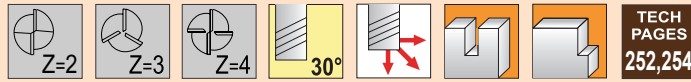
(620MC) 2 Flute EDP#	(623MC) 3 Flute EDP#	(630MC) 4 Flute EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
41014	54514	42014	.1250	1/8"	3.175	1/8"	2"	5/8"	14.35	13.73	13.10	12.48
41024	54524	42024	.1250	1/8"	3.175	1/8"	3"	3/4"	21.44	20.50	19.57	18.64
41034	54534	42034	.1250	1/8"	3.175	1/8"	3"	1"	21.44	20.50	19.57	18.64
41044	54544	42044	.1875	3/16"	4.763	3/16"	3"	1"	23.79	22.76	21.72	20.69
41054	54554	42054	.1875	3/16"	4.763	3/16"	3"	1-1/8"	23.79	22.76	21.72	20.69
41064	54564	42064	.1875	3/16"	4.763	3/16"	4"	1"	26.43	25.28	24.13	22.98
41074	54574	42074	.2500	1/4"	6.350	1/4"	3"	1"	28.44	27.20	25.97	24.73
41084	54584	42084	.2500	1/4"	6.350	1/4"	4"	1"	30.13	28.82	27.51	26.20
41094	54594	42094	.2500	1/4"	6.350	1/4"	4"	1-1/2"	30.13	28.82	27.51	26.20
41104	54604	42104	.2500	1/4"	6.350	1/4"	6"	1-1/2"	42.56	40.71	38.86	37.01
41114	54614	42114	.3125	5/16"	7.938	5/16"	3"	1"	35.54	33.99	32.45	30.90
41124	54624	42124	.3125	5/16"	7.938	5/16"	4"	1"	40.39	38.63	36.88	35.12
41134	54634	42134	.3125	5/16"	7.938	5/16"	4"	1-5/8"	40.39	38.63	36.88	35.12
41144	54644	42144	.3125	5/16"	7.938	5/16"	6"	1-1/2"	58.95	56.39	53.82	51.26
41154	54654	42154	.3750	3/8"	9.525	3/8"	3"	1"	39.24	37.53	35.83	34.12
41164	54664	42164	.3750	3/8"	9.525	3/8"	4"	1"	43.96	42.05	40.14	38.23
41174	54674	42174	.3750	3/8"	9.525	3/8"	4"	2"	43.96	42.05	40.14	38.23
41184	54684	42184	.3750	3/8"	9.525	3/8"	6"	1-1/2"	63.25	60.50	57.75	55.00
41194	54694	42194	.3750	3/8"	9.523	3/8"	6"	3"	63.25	60.50	57.75	55.00
41204	54704	42204	.4375	7/16"	11.113	7/16"	4"	1"	59.23	56.65	54.08	51.50
41214	54714	42214	.4375	7/16"	11.113	7/16"	4"	2"	59.23	56.65	54.08	51.50
41224	54724	42224	.4375	7/16"	11.113	7/16"	6"	1-1/2"	79.51	76.05	72.60	69.14
-	54734	42234	.4375	7/16"	11.113	7/16"	6"	3"	79.51	76.05	72.60	69.14
41244	54744	42244	.5000	1/2"	12.700	1/2"	4"	1"	62.43	59.72	57.00	54.29
41254	54754	42254	.5000	1/2"	12.700	1/2"	4"	2"	62.43	59.72	57.00	54.29
41264	54764	42264	.5000	1/2"	12.700	1/2"	6"	1-1/2"	90.02	86.11	82.19	78.28
41274	54774	42274	.5000	1/2"	12.700	1/2"	6"	3"	90.02	86.11	82.19	78.28
41284	54784	42284	.5625	9/16"	14.288	9/16"	6"	2"	117.19	112.09	107.00	101.90
41294	-	42294	.5625	9/16"	14.288	9/16"	6"	3"	117.19	112.09	107.00	101.90
41304	54804	42304	.6250	5/8"	15.875	5/8"	6"	2"	125.91	120.44	114.96	109.49
41314	54814	42314	.6250	5/8"	15.875	5/8"	6"	3"	125.91	120.44	114.96	109.49
41324	54824	42324	.7500	3/4"	19.050	3/4"	6"	2"	193.61	185.20	176.78	168.36
41334	54834	42334	.7500	3/4"	19.050	3/4"	6"	3"	193.61	185.20	176.78	168.36
41344	54844	42344	1.000	1"	25.400	1"	6"	2"	324.15	310.06	295.96	281.87
41354	54854	42354	1.000	1"	25.400	1"	6"	3"	324.15	310.06	295.96	281.87
-	-	42364	1.000	1"	25.400	1"	6"	4"	339.87	325.09	310.32	295.54
-	-	42394	1.250	1-1/4"	31.750	1-1/4"	6"	3"	669.32	640.22	611.12	582.02

MATERIAL HARDNESS (Rc) 70 35 0

TOLERANCES

d_1	+0.000° -0.002° (+.000 -0.050mm)
d_2	h6

Series 620MA, 623MA, 630MA, 640MA, 643MA, 650MA

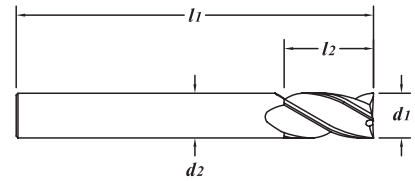


.1181" - .3150"
(3.000mm - 8.000mm)

END MILLS

**Extra Length
TiAlN Coating**

- Solid submicron grain carbide end mill - center cutting
- Extended reach
- Dry or semi-dry machining
- Can be modified with a neck within 48 hours
- Extremely versatile
- Uncoated - page 210
- TiCN Coating - page 212
- Stub Length - page 175
- Standard length - page 184



(620MA/640MA) 2 Flute EDP#	(623MA/643MA) 3 Flute EDP#	(630MA/650MA) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
92017	93017	94017	.1181	3.000	3.0	50	16	13.59	13.00	12.41	11.82	
92027	93027	94027	.1181	3.000	3.0	75	20	22.24	21.27	20.31	19.34	
92037	93037	94037	.1181	3.000	3.0	75	25	22.24	21.27	20.31	19.34	
41017	54517	42017	.1250	1/8"	3.175	1/8"	2"	5/8"	14.65	14.01	13.38	12.74
41027	54527	42027	.1250	1/8"	3.175	1/8"	3"	3/4"	21.80	20.86	19.91	18.96
41037	54537	42037	.1250	1/8"	3.175	1/8"	3"	1"	21.80	20.86	19.91	18.96
92047	93047	94047	.1575	4.000	4.0	50	16	14.70	14.06	13.42	12.78	
92057	93057	94057	.1575	4.000	4.0	75	20	24.06	23.01	21.97	20.92	
92067	93067	94067	.1575	4.000	4.0	75	25	24.06	23.01	21.97	20.92	
41047	54547	42047	.1875	3/16"	4.763	3/16"	3"	1"	24.58	23.51	22.44	21.37
41057	54557	42057	.1875	3/16"	4.763	3/16"	3"	1-1/8"	24.58	23.51	22.44	21.37
41067	54567	42067	.1875	3/16"	4.763	3/16"	4"	1"	27.38	26.19	25.00	23.81
92077	93077	94077	.1969	5.000	5.0	50	16	18.22	17.42	16.63	15.84	
92087	93087	94087	.1969	5.000	5.0	75	20	26.90	25.73	24.56	23.39	
92097	93097	94097	.1969	5.000	5.0	75	25	26.90	25.73	24.56	23.39	
92107	93107	94107	.2362	6.000	6.0	75	25	30.36	29.04	27.72	26.40	
92117	93117	94117	.2362	6.000	6.0	100	25	32.65	31.23	29.81	28.39	
92127	93127	94127	.2362	6.000	6.0	100	32	32.65	31.23	29.81	28.39	
92137	93137	94137	.2362	6.000	6.0	150	38	44.51	42.57	40.64	38.70	
41077	54577	42077	.2500	1/4"	6.350	1/4"	3"	1"	29.11	27.84	26.58	25.31
41087	54587	42087	.2500	1/4"	6.350	1/4"	4"	1"	31.31	29.95	28.59	27.23
41097	54597	42097	.2500	1/4"	6.350	1/4"	4"	1-1/2"	31.31	29.95	28.59	27.23
41107	54607	42107	.2500	1/4"	6.350	1/4"	6"	1-1/2"	42.70	40.84	38.99	37.13
41117	54617	42117	.3125	5/16"	7.938	5/16"	3"	1"	37.26	35.64	34.02	32.40
41127	54627	42127	.3125	5/16"	7.938	5/16"	4"	1"	42.75	40.89	39.03	37.17
41137	54637	42137	.3125	5/16"	7.938	5/16"	4"	1-5/8"	42.75	40.89	39.03	37.17
41147	54647	42147	.3125	5/16"	7.938	5/16"	6"	1-1/2"	62.31	59.60	56.89	54.18
92147	93147	94147	.3150	8.000	8.0	75	25	38.80	37.11	35.43	33.74	
92157	93157	94157	.3150	8.000	8.0	100	25	44.49	42.56	40.62	38.69	
92167	93167	94167	.3150	8.000	8.0	100	41	44.49	42.56	40.62	38.69	
92177	93177	94177	.3150	8.000	8.0	150	50	63.57	60.81	58.04	55.28	

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MATERIAL HARDNESS (Rc)

0

continued →

Series 620MA, 623MA, 630MA, 640MA, 643MA, 650MA (continued)

.3750" - 1.250"
(9.525mm - 31.750mm)

END MILLS

(620MA/640MA) 2 Flute EDP#	(623MA/643MA) 3 Flute EDP#	(630MA/650MA) 4 Flute EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
41157	54657	42157	.3750	3/8"	9.525	3/8"	3"	1"	40.97	39.19	37.41	35.63
41167	54667	42167	.3750	3/8"	9.525	3/8"	4"	1"	46.30	44.29	42.27	40.26
41177	54677	42177	.3750	3/8"	9.525	3/8"	4"	2"	46.30	44.29	42.27	40.26
41187	54687	42187	.3750	3/8"	9.525	3/8"	6"	1-1/2"	66.60	63.70	60.81	57.91
41197	54697	42197	.3750	3/8"	9.525	3/8"	6"	3"	66.60	63.70	60.81	57.91
92187	93187	94187	.3937		10.000	10.0	75	25	44.85	42.90	40.95	39.00
92197	93197	94197	.3937		10.000	10.0	100	25	57.87	55.35	52.84	50.32
92207	93207	94207	.3937		10.000	10.0	100	50	57.87	55.35	52.84	50.32
92217	93217	94217	.3937		10.000	10.0	150	38	77.14	73.79	70.43	67.08
92227	93227	94227	.3937		10.000	10.0	150	75	77.14	73.79	70.43	67.08
41207	54707	42207	.4375	7/16"	11.113	7/16"	4"	1"	61.59	58.92	56.24	53.56
41217	54717	42217	.4375	7/16"	11.113	7/16"	4"	2"	61.59	58.92	56.24	53.56
41227	54727	42227	.4375	7/16"	11.113	7/16"	6"	1-1/2"	82.75	79.16	75.56	71.96
41237	54737	42237	.4375	7/16"	11.113	7/16"	6"	3"	82.75	79.16	75.56	71.96
92237	93237	94237	.4724		12.000	12.0	100	25	68.03	65.08	62.12	59.16
92247	93247	94247	.4724		12.000	12.0	100	50	68.03	65.08	62.12	59.16
92257	93257	94257	.4724		12.000	12.0	150	50	93.25	89.20	85.14	81.09
92267	93267	94267	.4724		12.000	12.0	150	75	93.25	89.20	85.14	81.09
41247	54747	42247	.5000	1/2"	12.700	1/2"	4"	1"	64.80	61.99	59.17	56.35
41257	54757	42257	.5000	1/2"	12.700	1/2"	4"	2"	64.80	61.99	59.17	56.35
41267	54767	42267	.5000	1/2"	12.700	1/2"	6"	1-1/2"	93.25	89.20	85.14	81.09
41277	54777	42277	.5000	1/2"	12.700	1/2"	6"	3"	93.25	89.20	85.14	81.09
92277	93277	94277	.5512		14.000	14.0	100	25	90.54	86.60	82.67	78.73
92287	93287	94287	.5512		14.000	14.0	100	50	90.54	86.60	82.67	78.73
-	93297	94297	.5512		14.000	14.0	150	50	120.32	115.09	109.86	104.63
92307	93307	94307	.5512		14.000	14.0	150	75	120.32	115.09	109.86	104.63
41287	54787	42287	.5625	9/16"	14.288	9/16"	6"	2"	120.32	115.09	109.86	104.63
-	54797	42297	.5625	9/16"	14.288	9/16"	6"	3"	120.32	115.09	109.86	104.63
41307	54807	42307	.6250	5/8"	15.875	5/8"	6"	2"	129.06	123.45	117.84	112.23
41317	54817	42317	.6250	5/8"	15.875	5/8"	6"	3"	129.06	123.45	117.84	112.23
92317	93317	94317	.6299		16.000	16.0	150	50	129.06	123.45	117.84	112.23
92327	93327	94327	.6299		16.000	16.0	150	75	129.06	123.45	117.84	112.23
92337	-	94337	.7087		18.000	18.0	150	50	187.61	179.45	171.30	163.14
-	93347	94347	.7087		18.000	18.0	150	75	187.61	179.45	171.30	163.14
41327	54827	42327	.7500	3/4"	19.050	3/4"	6"	2"	197.50	188.91	180.33	171.74
41337	54837	42337	.7500	3/4"	19.050	3/4"	6"	3"	197.50	188.91	180.33	171.74
92357	93357	94357	.7874		20.000	20.0	150	50	213.34	204.06	194.79	185.51
92367	93367	94367	.7874		20.000	20.0	150	75	213.34	204.06	194.79	185.51
-	93377	94377	.9843		25.000	25.0	150	50	313.61	299.97	286.34	272.70
92387	93387	94387	.9843		25.000	25.0	150	75	313.61	299.97	286.34	272.70
41347	54847	42347	1.000	1"	25.400	1"	6"	2"	327.11	312.88	298.66	284.44
41357	54857	42357	1.000	1"	25.400	1"	6"	3"	327.11	312.88	298.66	284.44
-	-	42367	1.000	1"	25.400	1"	6"	4"	342.85	327.94	313.04	298.13
-	-	42397	1.250	1-1/4"	31.750	1-1/4"	6"	3"	670.53	641.38	612.22	583.07

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MATERIAL HARDNESS (Rc)

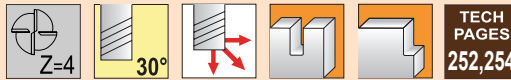
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TOLERANCES

$d1$	+0.00" - .002" (+.000 - .050mm)
$d2$	h6
r	+0.01" - .001" (+.025 - .025mm)

Series 630R

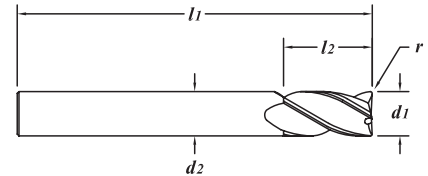
.1250" - .3125"
(3.175mm - 7.938mm)



END MILLS

Extra Length - Corner Radius

- Solid submicron grain carbide end mill - center cutting
- Extended reach
- For stronger corners and part radius
- Can be modified with a neck within 48 hours
- Extremely versatile
- TiALN Coating - page 218
- Standard length - page 190



EDP#	$d1$ †		$d2$	$l1$	$l2$	r	1-11	12-24	25-49	50-100	
	Decimal	Diameter									Metric
20100	.1250	1/8"	3.175	1/8"	3"	1"	.010"	22.11	21.15	20.19	19.23
20110	.1250	1/8"	3.175	1/8"	3"	1"	.015"	22.11	21.15	20.19	19.23
20120	.1250	1/8"	3.175	1/8"	3"	1"	.020"	22.11	21.15	20.19	19.23
20130	.1250	1/8"	3.175	1/8"	3"	1"	.030"	22.11	21.15	20.19	19.23
20140	.1250	1/8"	3.175	1/8"	3"	1"	.045"	22.11	21.15	20.19	19.23
20150	.1875	3/16"	4.763	3/16"	3"	1"	.010"	24.39	23.33	22.27	21.21
20160	.1875	3/16"	4.763	3/16"	3"	1"	.015"	24.39	23.33	22.27	21.21
20170	.1875	3/16"	4.763	3/16"	3"	1"	.020"	24.39	23.33	22.27	21.21
20180	.1875	3/16"	4.763	3/16"	3"	1"	.030"	24.39	23.33	22.27	21.21
20190	.1875	3/16"	4.763	3/16"	3"	1"	.045"	24.39	23.33	22.27	21.21
20200	.1875	3/16"	4.763	3/16"	3"	1"	.060"	24.39	23.33	22.27	21.21
20210	.1875	3/16"	4.763	3/16"	4"	1"	.010"	26.25	25.11	23.97	22.83
20220	.1875	3/16"	4.763	3/16"	4"	1"	.015"	26.25	25.11	23.97	22.83
20230	.1875	3/16"	4.763	3/16"	4"	1"	.020"	26.25	25.11	23.97	22.83
20240	.1875	3/16"	4.763	3/16"	4"	1"	.030"	26.25	25.11	23.97	22.83
20250	.1875	3/16"	4.763	3/16"	4"	1"	.045"	26.25	25.11	23.97	22.83
20260	.1875	3/16"	4.763	3/16"	4"	1"	.060"	26.25	25.11	23.97	22.83
20270	.2500	1/4"	6.350	1/4"	3"	1"	.010"	28.23	27.01	25.78	24.55
20280	.2500	1/4"	6.350	1/4"	3"	1"	.020"	28.23	27.01	25.78	24.55
20290	.2500	1/4"	6.350	1/4"	3"	1"	.030"	28.23	27.01	25.78	24.55
20300	.2500	1/4"	6.350	1/4"	3"	1"	.045"	28.23	27.01	25.78	24.55
20310	.2500	1/4"	6.350	1/4"	3"	1"	.060"	28.23	27.01	25.78	24.55
20320	.2500	1/4"	6.350	1/4"	4"	1"	.010"	29.70	28.41	27.12	25.83
20330	.2500	1/4"	6.350	1/4"	4"	1"	.020"	29.70	28.41	27.12	25.83
20340	.2500	1/4"	6.350	1/4"	4"	1"	.030"	29.70	28.41	27.12	25.83
20350	.2500	1/4"	6.350	1/4"	4"	1"	.045"	29.70	28.41	27.12	25.83
20360	.2500	1/4"	6.350	1/4"	4"	1"	.060"	29.70	28.41	27.12	25.83
20370	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.010"	38.62	36.94	35.26	33.58
20380	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.020"	38.62	36.94	35.26	33.58
20390	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.030"	38.62	36.94	35.26	33.58
20400	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.045"	38.62	36.94	35.26	33.58
20410	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.060"	38.62	36.94	35.26	33.58
20420	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.010"	38.92	37.22	35.53	33.84
20430	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.020"	38.92	37.22	35.53	33.84
20440	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.030"	38.92	37.22	35.53	33.84
20450	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.045"	38.92	37.22	35.53	33.84
20460	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.060"	38.92	37.22	35.53	33.84
20470	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.090"	38.92	37.22	35.53	33.84
20480	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.125"	38.92	37.22	35.53	33.84

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MATERIAL HARDNESS (Rc)

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continued →

Series 630R (continued)

.3750" - .6250"
(9.525mm - 15.875mm)

END MILLS

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0
MATERIAL HARDNESS (Rc)

EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
	Decimal	Metric									
20490	.3750	3/8"	9.525	3/8"	4"	1"	.010"	43.06	41.18	39.31	37.44
20500	.3750	3/8"	9.525	3/8"	4"	1"	.020"	43.06	41.18	39.31	37.44
20510	.3750	3/8"	9.525	3/8"	4"	1"	.030"	43.06	41.18	39.31	37.44
20520	.3750	3/8"	9.525	3/8"	4"	1"	.045"	43.06	41.18	39.31	37.44
20530	.3750	3/8"	9.525	3/8"	4"	1"	.060"	43.06	41.18	39.31	37.44
20540	.3750	3/8"	9.525	3/8"	4"	1"	.090"	43.06	41.18	39.31	37.44
20550	.3750	3/8"	9.525	3/8"	4"	1"	.125"	43.06	41.18	39.31	37.44
20560	.3750	3/8"	9.525	3/8"	4"	2"	.010"	43.06	41.18	39.31	37.44
20570	.3750	3/8"	9.525	3/8"	4"	2"	.020"	43.06	41.18	39.31	37.44
20580	.3750	3/8"	9.525	3/8"	4"	2"	.030"	43.06	41.18	39.31	37.44
20590	.3750	3/8"	9.525	3/8"	4"	2"	.045"	43.06	41.18	39.31	37.44
20600	.3750	3/8"	9.525	3/8"	4"	2"	.060"	43.06	41.18	39.31	37.44
20610	.3750	3/8"	9.525	3/8"	4"	2"	.090"	43.06	41.18	39.31	37.44
20620	.3750	3/8"	9.525	3/8"	4"	2"	.125"	43.06	41.18	39.31	37.44
20630	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.010"	59.13	56.56	53.99	51.42
20640	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.020"	59.13	56.56	53.99	51.42
20650	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.030"	59.13	56.56	53.99	51.42
20660	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.045"	59.13	56.56	53.99	51.42
20670	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.060"	59.13	56.56	53.99	51.42
20680	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.090"	59.13	56.56	53.99	51.42
20690	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.125"	59.13	56.56	53.99	51.42
20700	.5000	1/2"	12.700	1/2"	4"	1"	.015"	60.55	57.92	55.28	52.65
20710	.5000	1/2"	12.700	1/2"	4"	1"	.020"	60.55	57.92	55.28	52.65
20720	.5000	1/2"	12.700	1/2"	4"	1"	.030"	60.55	57.92	55.28	52.65
20730	.5000	1/2"	12.700	1/2"	4"	1"	.045"	60.55	57.92	55.28	52.65
20740	.5000	1/2"	12.700	1/2"	4"	1"	.060"	60.55	57.92	55.28	52.65
20750	.5000	1/2"	12.700	1/2"	4"	1"	.090"	60.55	57.92	55.28	52.65
20760	.5000	1/2"	12.700	1/2"	4"	1"	.125"	60.55	57.92	55.28	52.65
20770	.5000	1/2"	12.700	1/2"	4"	2"	.015"	60.55	57.92	55.28	52.65
20780	.5000	1/2"	12.700	1/2"	4"	2"	.020"	60.55	57.92	55.28	52.65
20790	.5000	1/2"	12.700	1/2"	4"	2"	.030"	60.55	57.92	55.28	52.65
20800	.5000	1/2"	12.700	1/2"	4"	2"	.045"	60.55	57.92	55.28	52.65
20810	.5000	1/2"	12.700	1/2"	4"	2"	.060"	60.55	57.92	55.28	52.65
20820	.5000	1/2"	12.700	1/2"	4"	2"	.090"	60.55	57.92	55.28	52.65
20830	.5000	1/2"	12.700	1/2"	4"	2"	.125"	60.55	57.92	55.28	52.65
20840	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.015"	85.76	82.03	78.30	74.57
20850	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.020"	85.76	82.03	78.30	74.57
20860	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.030"	85.76	82.03	78.30	74.57
20870	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.045"	85.76	82.03	78.30	74.57
20880	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.060"	85.76	82.03	78.30	74.57
20890	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.090"	85.76	82.03	78.30	74.57
20900	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.125"	85.76	82.03	78.30	74.57
20910	.6250	5/8"	15.875	5/8"	6"	2"	.010"	126.10	120.62	115.13	109.65
20920	.6250	5/8"	15.875	5/8"	6"	2"	.015"	126.10	120.62	115.13	109.65
20930	.6250	5/8"	15.875	5/8"	6"	2"	.020"	126.10	120.62	115.13	109.65
20940	.6250	5/8"	15.875	5/8"	6"	2"	.030"	126.10	120.62	115.13	109.65
20950	.6250	5/8"	15.875	5/8"	6"	2"	.045"	126.10	120.62	115.13	109.65
20960	.6250	5/8"	15.875	5/8"	6"	2"	.060"	126.10	120.62	115.13	109.65
20970	.6250	5/8"	15.875	5/8"	6"	2"	.090"	126.10	120.62	115.13	109.65
20980	.6250	5/8"	15.875	5/8"	6"	2"	.125"	126.10	120.62	115.13	109.65

EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
	Decimal	Metric									
20990	.7500	3/4"	19.050	3/4"	6"	3"	.015"	206.93	197.93	188.94	179.94
21000	.7500	3/4"	19.050	3/4"	6"	3"	.020"	206.93	197.93	188.94	179.94
21010	.7500	3/4"	19.050	3/4"	6"	3"	.030"	206.93	197.93	188.94	179.94
21020	.7500	3/4"	19.050	3/4"	6"	3"	.045"	206.93	197.93	188.94	179.94
21030	.7500	3/4"	19.050	3/4"	6"	3"	.060"	206.93	197.93	188.94	179.94
21040	.7500	3/4"	19.050	3/4"	6"	3"	.090"	206.93	197.93	188.94	179.94
21050	.7500	3/4"	19.050	3/4"	6"	3"	.125"	206.93	197.93	188.94	179.94
21140	.7500	3/4"	19.050	3/4"	6"	3"	.250"	206.93	197.93	188.94	179.94
21060	1.000	1"	25.400	1"	6"	3"	.015"	351.89	336.59	321.29	305.99
21070	1.000	1"	25.400	1"	6"	3"	.020"	351.89	336.59	321.29	305.99
21080	1.000	1"	25.400	1"	6"	3"	.030"	351.89	336.59	321.29	305.99
21090	1.000	1"	25.400	1"	6"	3"	.045"	351.89	336.59	321.29	305.99
21100	1.000	1"	25.400	1"	6"	3"	.060"	351.89	336.59	321.29	305.99
21110	1.000	1"	25.400	1"	6"	3"	.090"	351.89	336.59	321.29	305.99
21120	1.000	1"	25.400	1"	6"	3"	.125"	351.89	336.59	321.29	305.99
21130	1.000	1"	25.400	1"	6"	3"	.250"	351.89	336.59	321.29	305.99



End Mill Reconditioning

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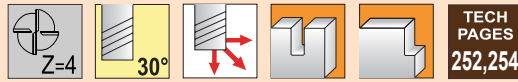
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MATERIAL HARDNESS (Rc)

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Series 630RA

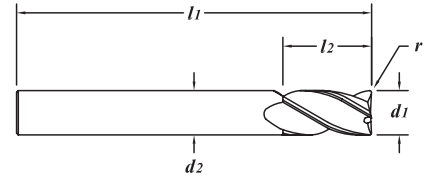
.1250" - .3125"
(3.175mm - 7.938mm)



TOLERANCES	
d_1	+0.000" - .002" (+0.000 - .050mm)
d_2	h6
r	+0.001" - .001" (+0.025 - .025mm)

Extra Length - Corner Radius TiAlN Coating

- Solid submicron grain carbide end mill - center cutting
- Extended reach
- For stronger corners and part radius
- Dry or semi-dry machining
- Can be modified with a neck within 48 hours
- Extremely versatile
- Uncoated - page 215
- Standard length - page 192



MATERIAL HARDNESS (Rc)

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EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
	Decimal	Metric									
20107	.1250	1/8"	3.175	1/8"	3"	1"	.010"	25.13	24.04	22.94	21.85
20117	.1250	1/8"	3.175	1/8"	3"	1"	.015"	25.13	24.04	22.94	21.85
20127	.1250	1/8"	3.175	1/8"	3"	1"	.020"	25.13	24.04	22.94	21.85
20137	.1250	1/8"	3.175	1/8"	3"	1"	.030"	25.13	24.04	22.94	21.85
20147	.1250	1/8"	3.175	1/8"	3"	1"	.045"	25.13	24.04	22.94	21.85
20157	.1875	3/16"	4.763	3/16"	3"	1"	.010"	28.22	26.99	25.77	24.54
20167	.1875	3/16"	4.763	3/16"	3"	1"	.015"	28.22	26.99	25.77	24.54
20177	.1875	3/16"	4.763	3/16"	3"	1"	.020"	28.22	26.99	25.77	24.54
20187	.1875	3/16"	4.763	3/16"	3"	1"	.030"	28.22	26.99	25.77	24.54
20197	.1875	3/16"	4.763	3/16"	3"	1"	.045"	28.22	26.99	25.77	24.54
20207	.1875	3/16"	4.763	3/16"	3"	1"	.060"	28.22	26.99	25.77	24.54
20217	.1875	3/16"	4.763	3/16"	4"	1"	.010"	30.72	29.38	28.05	26.71
20227	.1875	3/16"	4.763	3/16"	4"	1"	.015"	30.72	29.38	28.05	26.71
20237	.1875	3/16"	4.763	3/16"	4"	1"	.020"	30.72	29.38	28.05	26.71
20247	.1875	3/16"	4.763	3/16"	4"	1"	.030"	30.72	29.38	28.05	26.71
20257	.1875	3/16"	4.763	3/16"	4"	1"	.045"	30.72	29.38	28.05	26.71
20267	.1875	3/16"	4.763	3/16"	4"	1"	.060"	30.72	29.38	28.05	26.71
20277	.2500	1/4"	6.350	1/4"	3"	1"	.010"	33.33	31.88	30.43	28.98
20287	.2500	1/4"	6.350	1/4"	3"	1"	.020"	33.33	31.88	30.43	28.98
20297	.2500	1/4"	6.350	1/4"	3"	1"	.030"	33.33	31.88	30.43	28.98
20307	.2500	1/4"	6.350	1/4"	3"	1"	.045"	33.33	31.88	30.43	28.98
20317	.2500	1/4"	6.350	1/4"	3"	1"	.060"	33.33	31.88	30.43	28.98
20327	.2500	1/4"	6.350	1/4"	4"	1"	.010"	35.68	34.13	32.58	31.03
20337	.2500	1/4"	6.350	1/4"	4"	1"	.020"	35.68	34.13	32.58	31.03
20347	.2500	1/4"	6.350	1/4"	4"	1"	.030"	35.68	34.13	32.58	31.03
20357	.2500	1/4"	6.350	1/4"	4"	1"	.045"	35.68	34.13	32.58	31.03
20367	.2500	1/4"	6.350	1/4"	4"	1"	.060"	35.68	34.13	32.58	31.03
20377	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.010"	47.02	44.98	42.93	40.89
20387	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.020"	47.02	44.98	42.93	40.89
20397	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.030"	47.02	44.98	42.93	40.89
20407	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.045"	47.02	44.98	42.93	40.89
20417	.2500	1/4"	6.350	1/4"	6"	1-1/2"	.060"	47.02	44.98	42.93	40.89
20427	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.010"	48.60	46.49	44.37	42.26
20437	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.020"	48.60	46.49	44.37	42.26
20447	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.030"	48.60	46.49	44.37	42.26
20457	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.045"	48.60	46.49	44.37	42.26
20467	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.060"	48.60	46.49	44.37	42.26
20477	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.090"	48.60	46.49	44.37	42.26
20487	.3125	5/16"	7.938	5/16"	4"	1-5/8"	.125"	48.60	46.49	44.37	42.26

EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
	Decimal	Metric									
20497	.3750	3/8"	9.525	3/8"	4"	1"	.010"	52.73	50.44	48.14	45.85
20507	.3750	3/8"	9.525	3/8"	4"	1"	.020"	52.73	50.44	48.14	45.85
20517	.3750	3/8"	9.525	3/8"	4"	1"	.030"	52.73	50.44	48.14	45.85
20527	.3750	3/8"	9.525	3/8"	4"	1"	.045"	52.73	50.44	48.14	45.85
20537	.3750	3/8"	9.525	3/8"	4"	1"	.060"	52.73	50.44	48.14	45.85
20547	.3750	3/8"	9.525	3/8"	4"	1"	.090"	52.73	50.44	48.14	45.85
20557	.3750	3/8"	9.525	3/8"	4"	1"	.125"	52.73	50.44	48.14	45.85
20567	.3750	3/8"	9.525	3/8"	4"	2"	.010"	52.73	50.44	48.14	45.85
20577	.3750	3/8"	9.525	3/8"	4"	2"	.020"	52.73	50.44	48.14	45.85
20587	.3750	3/8"	9.525	3/8"	4"	2"	.030"	52.73	50.44	48.14	45.85
20597	.3750	3/8"	9.525	3/8"	4"	2"	.045"	52.73	50.44	48.14	45.85
20607	.3750	3/8"	9.525	3/8"	4"	2"	.060"	52.73	50.44	48.14	45.85
20617	.3750	3/8"	9.525	3/8"	4"	2"	.090"	52.73	50.44	48.14	45.85
20627	.3750	3/8"	9.525	3/8"	4"	2"	.125"	52.73	50.44	48.14	45.85
20637	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.010"	73.00	69.83	66.65	63.48
20647	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.020"	73.00	69.83	66.65	63.48
20657	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.030"	73.00	69.83	66.65	63.48
20667	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.045"	73.00	69.83	66.65	63.48
20677	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.060"	73.00	69.83	66.65	63.48
20687	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.090"	73.00	69.83	66.65	63.48
20697	.3750	3/8"	9.525	3/8"	6"	1-1/2"	.125"	73.00	69.83	66.65	63.48
21157	.4375	7/16"	11.113	7/16"	4"	1"	.010"	70.51	67.44	64.38	61.31
21167	.4375	7/16"	11.113	7/16"	4"	1"	.015"	70.51	67.44	64.38	61.31
21177	.4375	7/16"	11.113	7/16"	4"	1"	.020"	70.51	67.44	64.38	61.31
21187	.4375	7/16"	11.113	7/16"	4"	1"	.030"	70.51	67.44	64.38	61.31
21197	.4375	7/16"	11.113	7/16"	4"	1"	.045"	70.51	67.44	64.38	61.31
21207	.4375	7/16"	11.113	7/16"	4"	1"	.060"	70.51	67.44	64.38	61.31
21217	.4375	7/16"	11.113	7/16"	4"	1"	.090"	70.51	67.44	64.38	61.31
21227	.4375	7/16"	11.113	7/16"	4"	1"	.125"	70.51	67.44	64.38	61.31
20707	.5000	1/2"	12.700	1/2"	4"	1"	.015"	71.77	68.65	65.53	62.41
20717	.5000	1/2"	12.700	1/2"	4"	1"	.020"	71.77	68.65	65.53	62.41
20727	.5000	1/2"	12.700	1/2"	4"	1"	.030"	71.77	68.65	65.53	62.41
20737	.5000	1/2"	12.700	1/2"	4"	1"	.045"	71.77	68.65	65.53	62.41
20747	.5000	1/2"	12.700	1/2"	4"	1"	.060"	71.77	68.65	65.53	62.41
20757	.5000	1/2"	12.700	1/2"	4"	1"	.090"	71.77	68.65	65.53	62.41
20767	.5000	1/2"	12.700	1/2"	4"	1"	.125"	71.77	68.65	65.53	62.41
20777	.5000	1/2"	12.700	1/2"	4"	2"	.015"	71.77	68.65	65.53	62.41
20787	.5000	1/2"	12.700	1/2"	4"	2"	.020"	71.77	68.65	65.53	62.41
20797	.5000	1/2"	12.700	1/2"	4"	2"	.030"	71.77	68.65	65.53	62.41
20807	.5000	1/2"	12.700	1/2"	4"	2"	.045"	71.77	68.65	65.53	62.41
20817	.5000	1/2"	12.700	1/2"	4"	2"	.060"	71.77	68.65	65.53	62.41
20827	.5000	1/2"	12.700	1/2"	4"	2"	.090"	71.77	68.65	65.53	62.41
20837	.5000	1/2"	12.700	1/2"	4"	2"	.125"	71.77	68.65	65.53	62.41
20847	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.015"	101.50	97.09	92.67	88.26
20857	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.020"	101.50	97.09	92.67	88.26
20867	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.030"	101.50	97.09	92.67	88.26
20877	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.045"	101.50	97.09	92.67	88.26
20887	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.060"	101.50	97.09	92.67	88.26
20897	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.090"	101.50	97.09	92.67	88.26
20907	.5000	1/2"	12.700	1/2"	6"	1-1/2"	.125"	101.50	97.09	92.67	88.26
20917	.6250	5/8"	15.875	5/8"	6"	2"	.010"	144.68	138.39	132.10	125.81
20927	.6250	5/8"	15.875	5/8"	6"	2"	.015"	144.68	138.39	132.10	125.81
20937	.6250	5/8"	15.875	5/8"	6"	2"	.020"	144.68	138.39	132.10	125.81
20947	.6250	5/8"	15.875	5/8"	6"	2"	.030"	144.68	138.39	132.10	125.81
20957	.6250	5/8"	15.875	5/8"	6"	2"	.045"	144.68	138.39	132.10	125.81
20967	.6250	5/8"	15.875	5/8"	6"	2"	.060"	144.68	138.39	132.10	125.81
20977	.6250	5/8"	15.875	5/8"	6"	2"	.090"	144.68	138.39	132.10	125.81
20987	.6250	5/8"	15.875	5/8"	6"	2"	.125"	144.68	138.39	132.10	125.81

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MATERIAL HARDNESS (Rc)

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continued →

Series 630RA (continued)

.7500" - 1.000"
(19.050mm - 25.400mm)

EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	r Corner Radius	1-11	12-24	25-49	50-100	
	Decimal	Metric									
20997	.7500	3/4"	19.050	3/4"	6"	3"	.015"	228.46	218.53	208.59	198.66
21007	.7500	3/4"	19.050	3/4"	6"	3"	.020"	228.46	218.53	208.59	198.66
21017	.7500	3/4"	19.050	3/4"	6"	3"	.030"	228.46	218.53	208.59	198.66
21027	.7500	3/4"	19.050	3/4"	6"	3"	.045"	228.46	218.53	208.59	198.66
21037	.7500	3/4"	19.050	3/4"	6"	3"	.060"	228.46	218.53	208.59	198.66
21047	.7500	3/4"	19.050	3/4"	6"	3"	.090"	228.46	218.53	208.59	198.66
21057	.7500	3/4"	19.050	3/4"	6"	3"	.125"	228.46	218.53	208.59	198.66
21147	.7500	3/4"	19.050	3/4"	6"	3"	.250"	228.46	218.53	208.59	198.66
21067	1.000	1"	25.400	1"	6"	3"	.015"	379.86	363.34	346.83	330.31
21077	1.000	1"	25.400	1"	6"	3"	.020"	379.86	363.34	346.83	330.31
21087	1.000	1"	25.400	1"	6"	3"	.030"	379.86	363.34	346.83	330.31
21097	1.000	1"	25.400	1"	6"	3"	.045"	379.86	363.34	346.83	330.31
21107	1.000	1"	25.400	1"	6"	3"	.060"	379.86	363.34	346.83	330.31
21117	1.000	1"	25.400	1"	6"	3"	.090"	379.86	363.34	346.83	330.31
21127	1.000	1"	25.400	1"	6"	3"	.125"	379.86	363.34	346.83	330.31
21137	1.000	1"	25.400	1"	6"	3"	.250"	379.86	363.34	346.83	330.31

MATERIAL HARDNESS (Rc)

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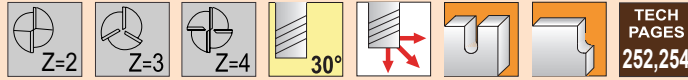
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TOLERANCES

d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+.000 - .025mm)

Series 720M, 723M, 730M, 740M, 743M, 750M

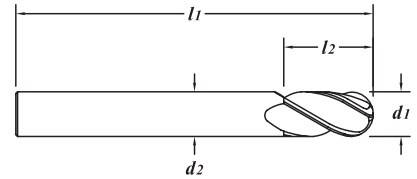


.1181" - .3150"
(3.000mm - 8.000mm)

END MILLS

Extra Length - Ball End

- Solid submicron grain carbide end mill - center cutting
- Extended reach
- Can be modified with a neck within 48 hours
- Extremely versatile
- TiCN Coating - page 223
- TiAlN Coating - page 224
- Stub Length - page 178
- Standard length - page 195



(720M/740M) 2 Flute EDP#	(723M/743M) 3 Flute EDP#	(730M/750M) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100
			Decimal	Metric							
97010	98010	99010	.1181	3.000	3.0	50	16	14.13	13.52	12.90	12.29
97020	98020	99020	.1181	3.000	3.0	75	20	23.28	22.26	21.25	20.24
97030	98030	99030	.1181	3.000	3.0	75	25	23.28	22.26	21.25	20.24
43010	55510	44010	.1250	1/8"	3.175	1/8"	2"	14.34	13.72	13.09	12.47
43020	55520	44020	.1250	1/8"	3.175	1/8"	3"	22.11	21.15	20.19	19.23
43030	55530	44030	.1250	1/8"	3.175	1/8"	3"	22.11	21.15	20.19	19.23
97040	98040	99040	.1575	4.000	4.0	50	16	14.73	14.09	13.45	12.81
97050	98050	99050	.1575	4.000	4.0	75	20	23.77	22.74	21.70	20.67
97060	98060	99060	.1575	4.000	4.0	75	25	23.77	22.74	21.70	20.67
43040	55540	44040	.1875	3/16"	4.763	3/16"	3"	24.39	23.33	22.27	21.21
43050	55550	44050	.1875	3/16"	4.763	3/16"	3"	24.39	23.33	22.27	21.21
43060	55560	44060	.1875	3/16"	4.763	3/16"	4"	26.25	25.11	23.97	22.83
97070	98070	99070	.1969	5.000	5.0	50	16	17.04	16.30	15.56	14.82
97080	98080	99080	.1969	5.000	5.0	75	20	25.67	24.55	23.44	22.32
97090	98090	99090	.1969	5.000	5.0	75	25	25.67	24.55	23.44	22.32
97100	98100	99100	.2362	6.000	6.0	75	25	29.72	28.42	27.13	25.84
97110	98110	99110	.2362	6.000	6.0	100	25	31.28	29.92	28.56	27.20
97120	98120	99120	.2362	6.000	6.0	100	32	31.28	29.92	28.56	27.20
97130	98130	99130	.2362	6.000	6.0	150	38	40.65	38.89	37.12	35.35
43070	55570	44070	.2500	1/4"	6.350	1/4"	3"	28.23	27.01	25.78	24.55
43080	55580	44080	.2500	1/4"	6.350	1/4"	4"	29.70	28.41	27.12	25.83
43090	55590	44090	.2500	1/4"	6.350	1/4"	4"	29.70	28.41	27.12	25.83
43100	55600	44100	.2500	1/4"	6.350	1/4"	6"	38.62	36.94	35.26	33.58
43110	55610	44110	.3125	5/16"	7.938	5/16"	3"	34.88	33.36	31.85	30.33
43120	55620	44120	.3125	5/16"	7.938	5/16"	4"	38.92	37.22	35.53	33.84
43130	55630	44130	.3125	5/16"	7.938	5/16"	4"	38.92	37.22	35.53	33.84
43140	55640	44140	.3125	5/16"	7.938	5/16"	6"	57.74	55.23	52.72	50.21
97140	98140	99140	.3150	8.000	8.0	75	25	36.71	35.11	33.52	31.92
97150	98150	99150	.3150	8.000	8.0	100	25	40.97	39.19	37.41	35.63
97160	98160	99160	.3150	8.000	8.0	100	41	40.97	39.19	37.41	35.63
97170	98170	99170	.3150	8.000	8.0	150	50	59.25	56.67	54.10	51.52

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MATERIAL HARDNESS (Rc)

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continued →

Series 720M, 723M, 730M, 740M, 743M, 750M (continued)

.3750" - 1.000"
(9.525mm - 25.400mm)

END MILLS

(720M/740M) 2 Flute EDP#	(723M/743M) 3 Flute EDP#	(730M/750M) 4 Flute EDP#	$d1$ † Diameter		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
43150	55650	44150	.3750	3/8"	9.525	3/8"	3"	1"	39.24	37.53	35.83	34.12
43160	55660	44160	.3750	3/8"	9.525	3/8"	4"	1"	43.06	41.18	39.31	37.44
43170	55670	44170	.3750	3/8"	9.525	3/8"	4"	2"	43.06	41.18	39.31	37.44
43180	55680	44180	.3750	3/8"	9.525	3/8"	6"	1-1/2"	59.77	57.17	54.57	51.97
43190	55690	44190	.3750	3/8"	9.525	3/8"	6"	3"	59.77	57.17	54.57	51.97
97180	98180	99180	.3937		10.000	10.0	75	25	42.40	40.56	38.71	36.87
97190	98190	99190	.3937		10.000	10.0	100	25	55.57	53.15	50.74	48.32
97200	98200	99200	.3937		10.000	10.0	100	50	55.57	53.15	50.74	48.32
97210	98210	99210	.3937		10.000	10.0	150	38	71.48	68.38	65.27	62.16
97220	98220	99220	.3937		10.000	10.0	150	75	71.48	68.38	65.27	62.16
43200	55700	44200	.4375	7/16"	11.113	7/16"	4"	1"	59.27	56.69	54.12	51.54
43210	55710	44210	.4375	7/16"	11.113	7/16"	4"	2"	59.27	56.69	54.12	51.54
43220	55720	44220	.4375	7/16"	11.113	7/16"	6"	1-1/2"	77.05	73.70	70.35	67.00
43230	-	44230	.4375	7/16"	11.113	7/16"	6"	3"	77.05	73.70	70.35	67.00
97230	98230	99230	.4724		12.000	12.0	100	25	63.80	61.03	58.25	55.48
97240	98240	99240	.4724		12.000	12.0	100	50	63.80	61.03	58.25	55.48
97250	98250	99250	.4724		12.000	12.0	150	50	85.73	82.01	78.28	74.55
97260	98260	99260	.4724		12.000	12.0	150	75	85.73	82.01	78.28	74.55
43240	55740	44240	.5000	1/2"	12.700	1/2"	4"	1"	60.55	57.92	55.28	52.65
43250	55750	44250	.5000	1/2"	12.700	1/2"	4"	2"	60.55	57.92	55.28	52.65
43260	55760	44260	.5000	1/2"	12.700	1/2"	6"	1-1/2"	85.76	82.03	78.30	74.57
43270	55770	44270	.5000	1/2"	12.700	1/2"	6"	3"	85.76	82.03	78.30	74.57
97270	98270	99270	.5512		14.000	14.0	100	25	88.16	84.33	80.49	76.66
97280	98280	99280	.5512		14.000	14.0	100	50	88.16	84.33	80.49	76.66
97290	98290	99290	.5512		14.000	14.0	150	50	119.67	114.47	109.26	104.06
97300	98300	99300	.5512		14.000	14.0	150	75	119.67	114.47	109.26	104.06
43280	55780	44280	.5625	9/16"	14.288	9/16"	6"	2"	119.66	114.46	109.25	104.05
-	55790	44290	.5625	9/16"	14.288	9/16"	6"	3"	119.66	114.46	109.25	104.05
43300	55800	44300	.6250	5/8"	15.875	5/8"	6"	2"	126.10	120.62	115.13	109.65
43310	55810	44310	.6250	5/8"	15.875	5/8"	6"	3"	126.10	120.62	115.13	109.65
97310	98310	99310	.6299		16.000	16.0	150	50	126.09	120.60	115.12	109.64
97320	98320	99320	.6299		16.000	16.0	150	75	126.09	120.60	115.12	109.64
97330	98330	99330	.7087		18.000	18.0	150	50	193.96	185.53	177.09	168.66
97340	98340	99340	.7087		18.000	18.0	150	75	193.96	185.53	177.09	168.66
43320	55820	44320	.7500	3/4"	19.050	3/4"	6"	2"	206.93	197.93	188.94	179.94
43330	55830	44330	.7500	3/4"	19.050	3/4"	6"	3"	206.93	197.93	188.94	179.94
97350	98350	99350	.7874		20.000	20.0	150	50	213.26	203.98	194.71	185.44
97360	98360	99360	.7874		20.000	20.0	150	75	213.26	203.98	194.71	185.44
97370	98370	99370	.9843		25.000	25.0	150	50	338.39	323.68	308.96	294.25
97380	98380	99380	.9843		25.000	25.0	150	75	338.39	323.68	308.96	294.25
43340	55840	44340	1.000	1"	25.400	1"	6"	2"	351.89	336.59	321.29	305.99
43350	55850	44350	1.000	1"	25.400	1"	6"	3"	351.89	336.59	321.29	305.99

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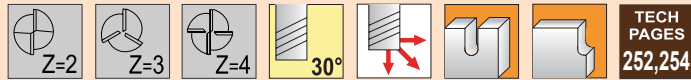
MATERIAL HARDNESS (Rc)

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TOLERANCES

d_1	+0.000" - .002" (+.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+.000 - .025mm)

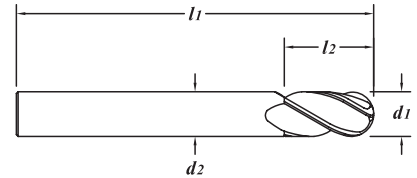
Series 720MC, 723MC, 730MC



Extra Length - Ball End

TiCN Coating

- Solid submicron grain carbide end mill - center cutting
- Extended reach
- Improved abrasion resistance and lubricity
- Can be modified with a neck within 48 hours
- Extremely versatile
- Uncoated - page 221
- TiALN Coating - page 224
- Standard length - page 195



END MILLS

(720MC) 2 Flute EDP#	(723MC) 3 Flute EDP#	(730MC) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Metric								
43014	55514	44014	.1250	1/8"	3.175	1/8"	2"	5/8"	16.49	15.77	15.06	14.34
43024	55524	44024	.1250	1/8"	3.175	1/8"	3"	3/4"	24.77	23.69	22.62	21.54
43034	55534	44034	.1250	1/8"	3.175	1/8"	3"	1"	24.77	23.69	22.62	21.54
43044	55544	44044	.1875	3/16"	4.763	3/16"	3"	1"	27.43	26.24	25.04	23.85
43054	55554	44054	.1875	3/16"	4.763	3/16"	3"	1-1/8"	27.43	26.24	25.04	23.85
43064	55564	44064	.1875	3/16"	4.763	3/16"	4"	1"	29.79	28.49	27.20	25.90
43074	55574	44074	.2500	1/4"	6.350	1/4"	3"	1"	32.65	31.23	29.81	28.39
43084	55584	44084	.2500	1/4"	6.350	1/4"	4"	1"	34.48	32.98	31.48	29.98
43094	55594	44094	.2500	1/4"	6.350	1/4"	4"	1-1/2"	34.48	32.98	31.48	29.98
43104	55604	44104	.2500	1/4"	6.350	1/4"	6"	1-1/2"	46.85	44.81	42.78	40.74
43114	55614	44114	.3125	5/16"	7.938	5/16"	3"	1"	40.80	39.03	37.25	35.48
43124	55624	44124	.3125	5/16"	7.938	5/16"	4"	1"	46.26	44.25	42.24	40.23
43134	-	44134	.3125	5/16"	7.938	5/16"	4"	1-5/8"	46.26	44.25	42.24	40.23
43144	55644	44144	.3125	5/16"	7.938	5/16"	6"	1-1/2"	67.63	64.69	61.75	58.81
43154	55654	44154	.3750	3/8"	9.525	3/8"	3"	1"	45.14	43.18	41.21	39.25
43164	55664	44164	.3750	3/8"	9.525	3/8"	4"	1"	50.40	48.21	46.02	43.83
43174	55674	44174	.3750	3/8"	9.525	3/8"	4"	2"	50.40	48.21	46.02	43.83
43184	55684	44184	.3750	3/8"	9.525	3/8"	6"	1-1/2"	69.67	66.64	63.61	60.58
-	55694	44194	.3750	3/8"	9.525	3/8"	6"	3"	69.67	66.64	63.61	60.58
-	55704	44204	.4375	7/16"	11.113	7/16"	4"	1"	68.13	65.16	62.20	59.24
-	55714	44214	.4375	7/16"	11.113	7/16"	4"	2"	68.13	65.16	62.20	59.24
43224	55724	44224	.4375	7/16"	11.113	7/16"	6"	1-1/2"	89.56	85.67	81.77	77.88
-	-	44234	.4375	7/16"	11.113	7/16"	6"	3"	89.56	85.67	81.77	77.88
43244	55744	44244	.5000	1/2"	12.700	1/2"	4"	1"	69.39	66.37	63.36	60.34
43254	55754	44254	.5000	1/2"	12.700	1/2"	4"	2"	69.39	66.37	63.36	60.34
43264	55764	44264	.5000	1/2"	12.700	1/2"	6"	1-1/2"	98.28	94.01	89.73	85.46
43274	55774	44274	.5000	1/2"	12.700	1/2"	6"	3"	98.28	94.01	89.73	85.46
-	55784	44284	.5625	9/16"	14.288	9/16"	6"	2"	135.13	129.25	123.38	117.50
-	-	44294	.5625	9/16"	14.288	9/16"	6"	3"	135.13	129.25	123.38	117.50
43304	55804	44304	.6250	5/8"	15.875	5/8"	6"	2"	141.54	135.39	129.23	123.08
-	-	44314	.6250	5/8"	15.875	5/8"	6"	3"	141.54	135.39	129.23	123.08
43324	55824	44324	.7500	3/4"	19.050	3/4"	6"	2"	224.58	214.82	205.05	195.29
43334	55834	44334	.7500	3/4"	19.050	3/4"	6"	3"	224.58	214.82	205.05	195.29
-	55844	44344	1.000	1"	25.400	1"	6"	2"	376.88	360.49	344.11	327.72
43354	55854	44354	1.000	1"	25.400	1"	6"	3"	376.88	360.49	344.11	327.72

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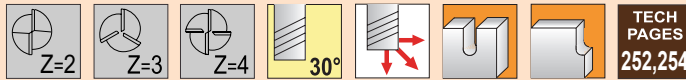
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MATERIAL HARDNESS (Rc)

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Series 720MA, 723MA, 730MA, 740MA, 743MA, 750MA

.1181" - .3150"
(3.000mm - 8.000mm)

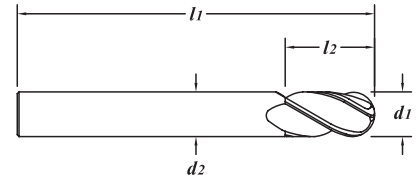


TOLERANCES	
d_1	+0.000" - .002" (+0.000 - .050mm)
d_2	h6
ball radius	+0.000" - .001" (+0.000 - .025mm)

TECH PAGES
252,254

Extra Length - Ball End TiAlN Coating

- Solid submicron grain carbide end mill - center cutting
- Extended reach
- Dry or semi-dry machining
- Can be modified with a neck within 48 hours
- Extremely versatile
- Uncoated - page 221
- TiCN Coating - page 223
- Stub Length - page 178
- Standard length - page 195



MATERIAL HARDNESS (Rc)

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(720MA/740MA)	(723MA/743MA)	(730MA/750MA)	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100
2 Flute EDP#	3 Flute EDP#	4 Flute EDP#	Decimal	Metric							
97017	98017	99017	.1181	3.000	3.0	50	16	16.10	15.40	14.70	14.00
97027	98027	99027	.1181	3.000	3.0	75	20	25.74	24.62	23.50	22.38
97037	98037	99037	.1181	3.000	3.0	75	25	25.74	24.62	23.50	22.38
43017	55517	44017	.1250	3.175	1/8"	2"	5/8"	16.78	16.05	15.32	14.59
43027	55527	44027	.1250	3.175	1/8"	3"	3/4"	25.13	24.04	22.94	21.85
43037	55537	44037	.1250	3.175	1/8"	3"	1"	25.13	24.04	22.94	21.85
97047	98047	99047	.1575	4.000	4.0	50	16	17.19	16.45	15.70	14.95
97057	98057	99057	.1575	4.000	4.0	75	20	27.61	26.41	25.21	24.01
97067	98067	99067	.1575	4.000	4.0	75	25	27.61	26.41	25.21	24.01
43047	55547	44047	.1875	4.763	3/16"	3"	1"	28.22	26.99	25.77	24.54
43057	55557	44057	.1875	4.763	3/16"	3"	1-1/8"	28.22	26.99	25.77	24.54
43067	55567	44067	.1875	4.763	3/16"	4"	1"	30.72	29.38	28.05	26.71
97077	98077	99077	.1969	5.000	5.0	50	16	20.88	19.98	19.07	18.16
97087	98087	99087	.1969	5.000	5.0	75	20	30.75	29.41	28.08	26.74
97097	98097	99097	.1969	5.000	5.0	75	25	30.75	29.41	28.08	26.74
97107	98107	99107	.2362	6.000	6.0	75	25	34.80	33.29	31.77	30.26
97117	98117	99117	.2362	6.000	6.0	100	25	37.23	35.61	33.99	32.37
97127	98127	99127	.2362	6.000	6.0	100	32	37.23	35.61	33.99	32.37
97137	98137	99137	.2362	6.000	6.0	150	38	49.05	46.92	44.78	42.65
43077	55577	44077	.2500	6.350	1/4"	3"	1"	33.33	31.88	30.43	28.98
43087	55587	44087	.2500	6.350	1/4"	4"	1"	35.68	34.13	32.58	31.03
43097	55597	44097	.2500	6.350	1/4"	4"	1-1/2"	35.68	34.13	32.58	31.03
43107	55607	44107	.2500	6.350	1/4"	6"	1-1/2"	47.02	44.98	42.93	40.89
43117	-	44117	.3125	7.938	5/16"	3"	1"	42.50	40.66	38.81	36.96
43127	55627	44127	.3125	7.938	5/16"	4"	1"	48.60	46.49	44.37	42.26
43137	55637	44137	.3125	7.938	5/16"	4"	1-5/8"	48.60	46.49	44.37	42.26
43147	55647	44147	.3125	7.938	5/16"	6"	1-1/2"	70.97	67.88	64.80	61.71
97147	98147	99147	.3150	8.000	8.0	75	25	44.31	42.38	40.46	38.53
97157	98157	99157	.3150	8.000	8.0	100	25	50.62	48.42	46.22	44.02
97167	98167	99167	.3150	8.000	8.0	100	41	50.62	48.42	46.22	44.02
97177	98177	99177	.3150	8.000	8.0	150	50	72.48	69.33	66.18	63.03

Series 720MA, 723MA, 730MA, 740MA, 743MA, 750MA (continued)

.3750" - 1.000"
(9.525mm - 25.400mm)

END MILLS

(720MA/740MA) 2 Flute EDP#	(723MA/743MA) 3 Flute EDP#	(730MA/750MA) 4 Flute EDP#	$d1$ †		$d2$ Shank Diameter	$l1$ Overall Length	$l2$ Flute Length	1-11	12-24	25-49	50-100	
			Decimal	Diameter								Metric
43157	55657	44157	.3750	3/8"	9.525	3/8"	3"	1"	46.85	44.81	42.78	40.74
43167	55667	44167	.3750	3/8"	9.525	3/8"	4"	1"	52.73	50.44	48.14	45.85
43177	55677	44177	.3750	3/8"	9.525	3/8"	4"	2"	52.73	50.44	48.14	45.85
43187	55687	44187	.3750	3/8"	9.525	3/8"	6"	1-1/2"	73.00	69.83	66.65	63.48
43197	55697	44197	.3750	3/8"	9.525	3/8"	6"	3"	73.00	69.83	66.65	63.48
97187	98187	99187	.3937		10.000	10.0	76	25	51.07	48.85	46.63	44.41
97197	98197	99197	.3937		10.000	10.0	100	25	66.76	63.86	60.95	58.05
97207	98207	99207	.3937		10.000	10.0	100	50	66.76	63.86	60.95	58.05
97217	98217	99217	.3937		10.000	10.0	150	38	87.22	83.42	79.63	75.84
97227	98227	99227	.3937		10.000	10.0	150	75	87.22	83.42	79.63	75.84
43207	-	44207	.4375	7/16"	11.113	7/16"	4"	1"	70.51	67.44	64.38	61.31
-	55717	44217	.4375	7/16"	11.113	7/16"	4"	2"	70.51	67.44	64.38	61.31
43227	55727	44227	.4375	7/16"	11.113	7/16"	6"	1-1/2"	92.81	88.77	84.74	80.70
43237	55737	44237	.4375	7/16"	11.113	7/16"	6"	3"	92.81	88.77	84.74	80.70
97237	98237	99237	.4724		12.000	12.0	100	25	74.99	71.73	68.47	65.21
97247	98247	99247	.4724		12.000	12.0	100	50	74.99	71.73	68.47	65.21
97257	98257	99257	.4724		12.000	12.0	150	50	101.50	97.09	92.67	88.26
97267	98267	99267	.4724		12.000	12.0	150	75	101.50	97.09	92.67	88.26
43247	55747	44247	.5000	1/2"	12.700	1/2"	4"	1"	71.77	68.65	65.53	62.41
43257	55757	44257	.5000	1/2"	12.700	1/2"	4"	2"	71.77	68.65	65.53	62.41
43267	55767	44267	.5000	1/2"	12.700	1/2"	6"	1-1/2"	101.50	97.09	92.67	88.26
43277	55777	44277	.5000	1/2"	12.700	1/2"	6"	3"	101.50	97.09	92.67	88.26
97277	98277	99277	.5512		14.000	14.0	100	25	100.69	96.32	91.94	87.56
97287	98287	99287	.5512		14.000	14.0	100	50	100.69	96.32	91.94	87.56
97297	98297	99297	.5512		14.000	14.0	150	50	138.25	132.24	126.23	120.22
97307	98307	99307	.5512		14.000	14.0	150	75	138.25	132.24	126.23	120.22
43287	-	44287	.5625	9/16"	14.288	9/16"	6"	2"	138.25	132.24	126.23	120.22
43297	-	44297	.5625	9/16"	14.288	9/16"	6"	3"	138.25	132.24	126.23	120.22
43307	55807	44307	.6250	5/8"	15.875	5/8"	6"	2"	144.68	138.39	132.10	125.81
43317	55817	44317	.6250	5/8"	15.875	5/8"	6"	3"	144.68	138.39	132.10	125.81
97317	98317	99317	.6299		16.000	16.0	150	50	144.68	138.39	132.10	125.81
97327	98327	99327	.6299		16.000	16.0	150	75	144.68	138.39	132.10	125.81
97337	98337	99337	.7087		18.000	18.0	150	50	215.50	206.13	196.76	187.39
97347	98347	99347	.7087		18.000	18.0	150	75	215.50	206.13	196.76	187.39
43327	55827	44327	.7500	3/4"	19.050	3/4"	6"	2"	228.46	218.53	208.59	198.66
43337	55837	44337	.7500	3/4"	19.050	3/4"	6"	3"	228.46	218.53	208.59	198.66
97357	98357	99357	.7874		20.000	20.0	150	50	241.24	230.75	220.26	209.77
97367	98367	99367	.7874		20.000	20.0	150	75	241.24	230.75	220.26	209.77
97377	98377	99377	.9843		25.000	25.0	150	50	366.33	350.41	334.48	318.55
97387	98387	99387	.9843		25.000	25.0	150	75	366.33	350.41	334.48	318.55
-	55847	44347	1.000	1"	25.400	1"	6"	2"	379.86	363.34	346.83	330.31
43357	55857	44357	1.000	1"	25.400	1"	6"	3"	379.86	363.34	346.83	330.31

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MATERIAL HARDNESS (Rc)

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