IMCO

Power. Precision. Performance.

STREAKERS® M213

INTRODUCTION

M213 STREAKERS

The M213 STREAKERS end mills are designed specifically for extreme tool paths often used in the high-performance machining of aluminum alloys. Our special end face and flute grinds create a free cutting action that allows for aggressive plunging and ramping moves.

- Plunge at high feed rates up to 1 x diameter without using a peck cycle.
- Mill deep slots – even over 1 x diameter deep – with great chip evacuation.
- Run steep ramp angles for high feed rates on entry moves.

The M213 STREAKERS end mill does all this AND leaves a superior surface finish.
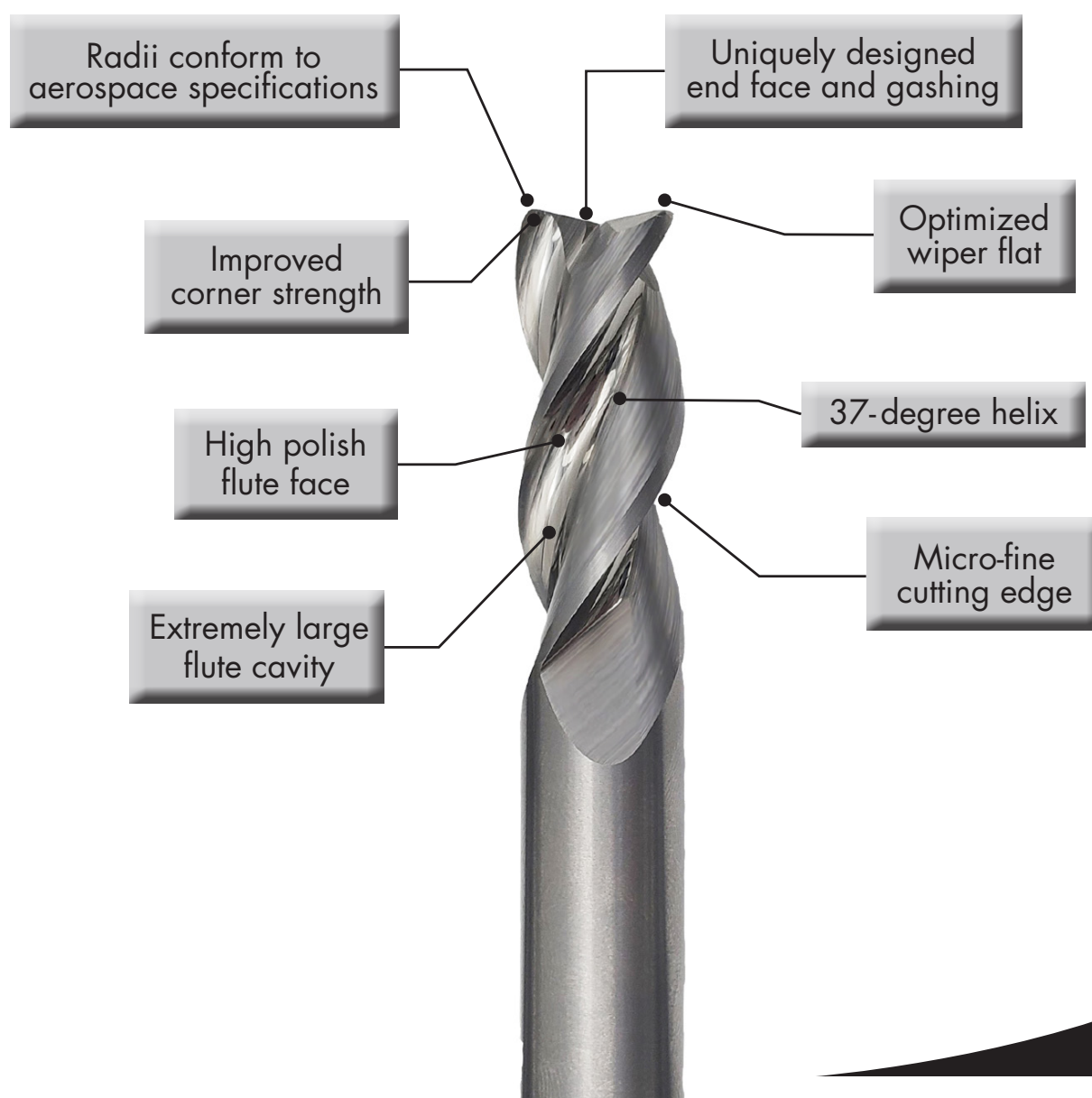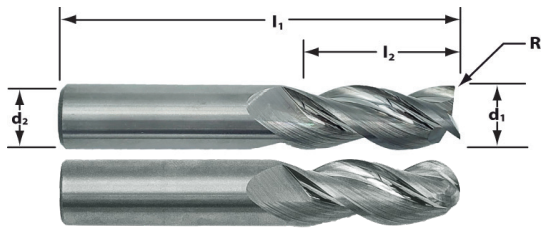
Radii conform to aerospace specifications

Uniquely designed end face and gashing

Improved corner strength

Optimized wiper flat

High polish flute face

37-degree helix

Extremely large flute cavity

Micro-fine cutting edge

d1: -0.0001 / -0.0004   d2: -0.0001 / -0.0004
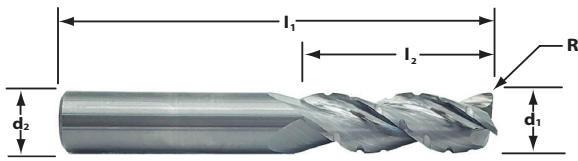cr/ball nose: +/- 0.0015

For high-performance machining in aluminum alloys.

› 37-degree helix
› High polish flute face
› Optimized wiper flat
› Improved corner strength

› Extremely large flute cavity
› Extremely fine cutting edge
› Uniquely designed end face and gashing

Cutter Dia d1	Shank Dia d2	Length of Cut l2	Overall Length l1	Order Code SQ	Order Code by Corner Radius							Order Code BN
					.015 CR	.031 CR	.062 CR	.093 CR	.125 CR	.187 CR	.250 CR	
1/8	1/8	3/16	1-1/2	64550	-	-	-	-	-	-	-	-
		1/4	1-1/2	64551	64552	-	-	-	-	-	-	-
		1/4	2	64553	-	-	-	-	-	-	-	-
		3/8	1-1/2	64554	64555	-	-	-	-	-	-	64745
		3/8	2	64556	64557	-	-	-	-	-	-	64746
		1/2	2	64558	-	-	-	-	-	-	-	64747
		5/8	2	64559	-	-	-	-	-	-	-	-
		3/4	2	64560	-	-	-	-	-	-	-	-
		1	2	64561	-	-	-	-	-	-	-	-
3/16	3/16	1/4	2	64562	64763	64764	-	-	-	-	-	-
		3/8	2	64563	-	-	-	-	-	-	-	64748
		1/2	2	64564	64565	64566	-	-	-	-	-	-
		5/8	2-1/2	64567	64568	64569	-	-	-	-	-	64749
		3/4	2-1/2	64570	-	-	-	-	-	-	-	-
		1	2-1/2	64571	-	-	-	-	-	-	-	-
1/4	1/4	3/8	2	64572	64573	64574	-	-	-	-	-	-
		3/8	2-1/2	64575	64576	64577	-	-	-	-	-	-
		1/2	2-1/2	64578	-	-	-	-	-	-	-	64750
		5/8	2-1/2	64579	64580	64581	64582	-	-	-	-	-
		3/4	2-1/2	64583	64584	64585	64586	-	-	-	-	64751
		1	3	64587	64588	64589	-	-	-	-	-	-
		1-1/4	3	64590	-	64591	-	-	-	-	-	-
		1-1/2	3	64592	-	-	-	-	-	-	-	-
		1-3/4	4	64593	-	-	-	-	-	-	-	-
		2	4	64594	-	-	-	-	-	-	-	-
5/16	5/16	5/8	2-1/2	64595	-	-	-	-	-	-	-	-
		13/16	2-1/2	64596	64597	64598	-	-	-	-	-	64752
		15/16	2-1/2	64599	-	-	-	-	-	-	-	-
		1-1/4	3	64600	-	-	-	-	-	-	-	-
		1-1/2	4	64601	-	-	-	-	-	-	-	-

Z3 SQ CR BN

37° HIGH POLISH PLAIN

N

M213 STREAKERS

Cutter Dia d1	Shank Dia d2	Length of Cut l2	Overall Length l1	Order Code SQ	.015 CR	.031 CR	.062 CR	.093 CR	.125 CR	.187 CR	.250 CR	Order Code BN
3/8	3/8	1/2	2	64602	64603	64604	-	-	-	-	-	-
		1/2	2-1/2	64605	64606	64607	-	-	-	-	-	-
		5/8	2-1/2	64608	64609	64610	64765	64767	-	-	-	64753
		3/4	2-1/2	64611	-	-	-	-	-	-	-	-
		1	2-1/2	64612	64613	64614	64615	64768	-	-	-	64754
		1-1/4	3	64616	64617	64618	64619	64769	64620	-	-	64760
		1-1/2	3-1/2	64621	-	64622	64623	64770	-	-	-	64761
		2	4	64624	-	-	-	-	-	-	-	-
		2-1/2	4-1/2	64625	-	-	-	-	-	-	-	-
7/16	7/16	1	2-3/4	64626	-	-	-	-	-	-	-	-
1/2	1/2	5/8	2-1/2	64627	64628	64629	-	-	-	-	-	-
		5/8	3	64630	64631	64632	64633	64634	64635	-	-	64755
		3/4	3	64636	-	-	-	-	-	-	-	-
		1	3	64637	64638	64639	64640	64641	64642	-	-	64756
		1-1/4	3	64643	64644	64645	64646	64647	64648	-	-	64757
		1-5/8	4	64649	64650	64651	64652	64653	64654	-	-	-
		2	4	64655	64656	64657	64658	64659	64660	-	-	-
		2-1/4	4	64661	-	-	-	-	-	-	-	-
		2-1/2	5	64662	-	64663	64766	64771	64772	-	-	64762
		2-1/2	6	64664	-	-	-	-	-	-	-	-
		3-1/4	6	64665	-	-	-	-	-	-	-	-
		4	8	64666	-	-	-	-	-	-	-	-
5/8	5/8	3/4	3-1/2	64667	-	64668	-	-	64669	-	-	-
		1-1/4	3-1/2	64670	-	64671	-	-	64672	-	-	-
		1-5/8	4	64673	64674	64675	-	-	64676	-	-	64758
		1-7/8	4	64677	-	64678	-	-	64679	-	-	-
		2-1/8	5	64680	-	-	-	-	-	-	-	-
		2-1/2	5	64681	-	64682	-	-	-	-	-	-
		3-1/4	6	64683	-	-	-	-	-	-	-	-
3/4	3/4	1	4	64684	-	64685	64686	64687	64688	64689	64690	-
		1-5/8	4	64691	-	64692	64693	64694	64695	64696	64697	64759
		2	5	64698	-	-	-	-	64699	-	-	-
		2-1/4	5	64700	-	64701	64702	64703	64704	-	64705	-
		2-1/2	5	64706	-	64707	64708	-	64709	64710	64711	-
		3	6	64712	-	-	-	-	-	-	-	-
		3-1/4	6	64713	-	64714	-	-	64715	-	-	-
		3-1/2	6	64716	-	-	-	-	64717	-	-	-
		4	7	64718	-	-	-	-	-	-	-	-
		5	8	64719	-	-	-	-	-	-	-	-
1	1	1-1/4	4	64720	-	-	-	-	-	-	-	-
		1-1/2	4	64721	-	64722	64723	64724	64725	-	64726	-
		2	5	64727	-	-	-	-	-	-	-	-
		2-1/2	5	64728	-	64729	64730	64731	64732	-	64733	-
		3-1/2	6	64734	-	64735	64736	64737	64738	-	64739	-
		4-1/4	7	64740	-	64741	-	-	-	-	-	-
		5-1/2	8	64742	-	-	-	-	-	-	-	-

M213C STREAKERS

d1: -0.0001 / -0.0004   d2: -0.0001 / -0.0004
cr/ball nose: +/- 0.0015

Z3   SQ   CR   ROUGHER

37°   HIGH POLISH   PLAIN

N

For high-performance machining in aluminum alloys.

› 37-degree helix
› High polish flute face
› Optimized wiper flat
› Improved corner strength

› Extremely large flute cavity
› Extremely fine cutting edge
› Uniquely designed end face and gashing
› Advanced geometry to maximize chip control

Cutter Dia d1	Shank Dia d2	Length of Cut l2	Overall Length l1	Order Code by Corner Radius				
				.015 CR	.031 CR	.062 CR	.093 CR	.125 CR
1/4	1/4	1/2	2-1/2	64939	-	-	-	-
		3/4	2-1/2	64940	-	-	-	-
		1	3	64941	-	-	-	-
3/8	3/8	15/16	2-1/2	64942	-	-	-	-
		1-1/8	3	64943	-	-	-	-
		1-1/2	3-1/2	64944	-	-	-	-
1/2	1/2	1-1/4	3	-	64945	64961	64966	-
		1-1/2	3-1/2	-	64946	-	-	-
		2	4	-	64947	-	-	-
5/8	5/8	1-1/4	3-1/2	-	64950	64962	64967	64971
		1-7/8	4	-	64952	-	-	-
3/4	3/4	1-5/8	4	-	64955	64964	64969	64973
		2-1/4	5	-	64956	-	-	-
1	1	1-1/2	4	-	64958	64965	64970	64974
		2-1/4	5	-	64960	-	-	-

ISO Code	Work Material	Type of Cut	Tool LC/Dia.	Axial DOC	Radial DOC	Ramp Angle	Number of Flutes	Speed (SFM)	Feed (Inch per Tooth)								
									1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
N	Aluminum alloys 2024, 6061, 7075 Magnesium alloys O-T6	Slotting	≤ 2	1 x D	1 x D	-	3	800	.0015	.0023	.0030	.0038	.0045	.0060	.0075	.0090	.0120
		Peripheral - Rough	≤ 2	1 x D	.75 x D	-	3	1000	.0020	.0030	.0040	.0050	.0060	.0080	.0100	.0120	.0160
		Peripheral - Rough	> 2 - 3	1 x D	.75 x D	-	3	1000	.0019	.0028	.0038	.0047	.0056	.0075	.0094	.0113	.0150
		Peripheral - Rough	> 3 - 4	1 x D	.75 x D	-	3	900	.0016	.0024	.0032	.0041	.0049	.0065	.0081	.0097	.0130
		Peripheral - Rough	> 4 - 5	1 x D	.75 x D	-	3	800	.0014	.0022	.0029	.0036	.0043	.0058	.0072	.0086	.0115
		Finish	≤ 2.5	2 x D	.015 x D	-	3	1200	.0007	.0010	.0014	.0017	.0020	.0027	.0034	.0041	.0054
		Helical Ramp	≤ 2	2 x D	1 x D	15 deg	3	800	.0015	.0023	.0030	.0038	.0045	.0060	.0075	.0090	.0120
		Straight Line Ramp	≤ 2	1 x D	1 x D	45 deg	3	800	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
	Aluminum alloys 2024, 6061, 7075 Hardened or Anodized	Slotting	≤ 2	1 x D	1 x D	-	3	780	.0014	.0020	.0027	.0034	.0041	.0055	.0068	.0082	.0109
		Peripheral - Rough	≤ 2	1 x D	.75 x D	-	3	950	.0020	.0029	.0039	.0049	.0059	.0078	.0098	.0117	.0156
		Peripheral - Rough	> 2 - 3	1 x D	.75 x D	-	3	950	.0018	.0027	.0037	.0046	.0055	.0073	.0092	.0110	.0147
		Peripheral - Rough	> 3 - 4	1 x D	.625 x D	-	3	855	.0016	.0024	.0032	.0039	.0047	.0063	.0079	.0095	.0126
		Peripheral - Rough	> 4 - 5	1 x D	.625 x D	-	3	760	.0014	.0021	.0028	.0035	.0042	.0056	.0070	.0084	.0112
		Finish	≤ 2.5	2 x D	.010 x D	-	3	1170	.0006	.0009	.0012	.0015	.0018	.0024	.0030	.0037	.0049
		Helical Ramp	≤ 2	2 x D	1 x D	15 deg	3	800	.0015	.0023	.0030	.0038	.0045	.0060	.0075	.0090	.0120
		Straight Line Ramp	≤ 2	1 x D	1 x D	45 deg	3	800	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
	High Silicon Aluminum Alloys A380, A390 Bhn 30-150 500kg	Slotting	≤ 2	.75 x D	1 x D	-	3	500	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090
		Peripheral - Rough	≤ 2	1 x D	.5 x D	-	3	700	.0014	.0021	.0029	.0036	.0043	.0057	.0071	.0086	.0114
		Peripheral - Rough	> 2 - 3	1 x D	.5 x D	-	3	700	.0014	.0021	.0027	.0034	.0041	.0055	.0068	.0082	.0109
		Peripheral - Rough	> 3 - 4	1 x D	.4 x D	-	3	600	.0012	.0018	.0024	.0030	.0036	.0048	.0061	.0073	.0097
		Peripheral - Rough	> 4 - 5	1 x D	.4 x D	-	3	500	.0010	.0015	.0020	.0025	.0030	.0040	.0051	.0061	.0081
		Finish	≤ 2.5	2 x D	.015 x D	-	3	900	.0006	.0009	.0013	.0016	.0019	.0025	.0031	.0038	.0050
		Helical Ramp	≤ 2	2 x D	1 x D	15 deg	3	500	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090
		Straight Line Ramp	≤ 2	1 x D	1 x D	45 deg	3	500	.0008	.0011	.0015	.0019	.0023	.0030	.0038	.0045	.0061
	High Silicon Aluminum alloys A380, A390 Anodized	Slotting	≤ 2	.75 x D	1 x D	-	3	488	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
		Peripheral - Rough	≤ 2	1 x D	.45 x D	-	3	690	.0014	.0021	.0029	.0036	.0043	.0057	.0071	.0086	.0114
		Peripheral - Rough	> 2 - 3	1 x D	.45 x D	-	3	690	.0014	.0021	.0027	.0034	.0041	.0055	.0068	.0082	.0109
		Peripheral - Rough	> 3 - 4	1 x D	.375 x D	-	3	621	.0012	.0018	.0024	.0030	.0036	.0048	.0061	.0073	.0097
		Peripheral - Rough	> 4 - 5	1 x D	.375 x D	-	3	552	.0010	.0015	.0020	.0025	.0030	.0040	.0051	.0061	.0081
		Finish	≤ 2.5	2 x D	.010 x D	-	3	878	.0006	.0008	.0011	.0014	.0017	.0022	.0028	.0034	.0045
		Helical Ramp	≤ 2	2 x D	1 x D	15 deg	3	488	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	.0080
		Straight Line Ramp	≤ 2	1 x D	1 x D	45 deg	3	488	.0007	.0010	.0013	.0017	.0020	.0027	.0033	.0040	.0053
	Copper, Brass 10-80 HRb	Slotting	≤ 2	.75 x D	1 x D	-	3	500	.0009	.0014	.0019	.0023	.0028	.0037	.0046	.0056	.0074
		Peripheral - Rough	≤ 2	1 x D	.75 x D	-	3	600	.0012	.0017	.0023	.0029	.0035	.0046	.0058	.0069	.0092
		Peripheral - Rough	> 2 - 3	1 x D	.75 x D	-	3	600	.0011	.0017	.0022	.0028	.0033	.0045	.0056	.0067	.0089
		Peripheral - Rough	> 3 - 4	1 x D	.75 x D	-	3	500	.0010	.0014	.0019	.0024	.0029	.0039	.0048	.0058	.0077
		Peripheral - Rough	> 4 - 5	1 x D	.75 x D	-	3	450	.0008	.0012	.0017	.0021	.0025	.0033	.0041	.0050	.0066
		Finish	≤ 2.5	2 x D	.015 x D	-	3	650	.0005	.0008	.0011	.0013	.0016	.0021	.0026	.0032	.0042
		Helical Ramp	≤ 2	2 x D	1 x D	15 deg	3	500	.0009	.0014	.0019	.0023	.0028	.0037	.0046	.0056	.0074
		Straight Line Ramp	≤ 2	1 x D	1 x D	25 deg	3	500	.0006	.0009	.0012	.0016	.0019	.0025	.0031	.0037	.0050
	Copper alloys, Brass Alloys 81-100 HRb	Slotting	≤ 2	.75 x D	1 x D	-	3	488	.0009	.0014	.0018	.0023	.0027	.0036	.0045	.0054	.0072
		Peripheral - Rough	≤ 2	1 x D	.75 x D	-	3	590	.0012	.0017	.0023	.0029	.0035	.0046	.0058	.0069	.0092
		Peripheral - Rough	> 2 - 3	1 x D	.75 x D	-	3	590	.0011	.0017	.0022	.0028	.0033	.0044	.0055	.0066	.0088
		Peripheral - Rough	> 3 - 4	1 x D	.625 x D	-	3	492	.0009	.0014	.0019	.0024	.0028	.0038	.0047	.0057	.0075
		Peripheral - Rough	> 4 - 5	1 x D	.625 x D	-	3	443	.0008	.0012	.0016	.0020	.0024	.0032	.0040	.0048	.0064
		Finish	≤ 2.5	2 x D	.010 x D	-	3	634	.0005	.0007	.0010	.0012	.0015	.0020	.0024	.0029	.0039
		Helical Ramp	≤ 2	2 x D	1 x D	15 deg	3	488	.0009	.0014	.0018	.0023	.0027	.0036	.0045	.0054	.0072
		Straight Line Ramp	≤ 2	1 x D	1 x D	25 deg	3	488	.0006	.0009	.0012	.0015	.0018	.0024	.0030	.0036	.0048
	Bronze Bhn 166-186	Slotting	≤ 2	.75 x D	1 x D	-	3	500	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
		Peripheral - Rough	≤ 2	1 x D	.5 x D	-	3	600	.0011	.0017	.0022	.0028	.0033	.0044	.0055	.0066	.0088
		Peripheral - Rough	> 2 - 3	1 x D	.5 x D	-	3	600	.0010	.0016	.0021	.0026	.0031	.0042	.0052	.0063	.0084
		Peripheral - Rough	> 3 - 4	1 x D	.4 x D	-	3	500	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
		Peripheral - Rough	> 4 - 5	1 x D	.4 x D	-	3	450	.0007	.0011	.0015	.0019	.0022	.0030	.0037	.0045	.0059
		Finish	≤ 2.5	2 x D	.015 x D	-	3	650	.0005	.0007	.0010	.0012	.0014	.0019	.0024	.0029	.0038
		Helical Ramp	≤ 2	2 x D	1 x D	12 deg	3	500	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
		Straight Line Ramp	≤ 2	1 x D	1 x D	20 deg	3	500	.0006	.0009	.0012	.0015	.0018	.0023	.0029	.0035	.0047
	Bronze High Tin Bronze, Manganese Bronze Work Hardened Bronze Bhn 187-212	Slotting	≤ 2	.75 x D	1 x D	-	3	488	.0009	.0013	.0017	.0021	.0026	.0034	.0043	.0051	.0068
		Peripheral - Rough	≤ 2	1 x D	.45 x D	-	3	590	.0011	.0017	.0022	.0028	.0033	.0044	.0055	.0066	.0088
		Peripheral - Rough	> 2 - 3	1 x D	.45 x D	-	3	590	.0010	.0016	.0021	.0026	.0031	.0042	.0052	.0063	.0084
		Peripheral - Rough	> 3 - 4	1 x D	.375 x D	-	3	492	.0009	.0013	.0018	.0022	.0026	.0035	.0044	.0053	.0070
		Peripheral - Rough	> 4 - 5	1 x D	.375 x D	-	3	443	.0007	.0011	.0015	.0019	.0022	.0030	.0037	.0045	.0059
		Finish	≤ 2.5	2 x D	.010 x D	-	3	634	.0004	.0007	.0009	.0011	.0013	.0018	.0022	.0026	.0035
		Helical Ramp	≤ 2	2 x D	1 x D	12 deg	3	488	.0009	.0013	.0017	.0021	.0026	.0034	.0043	.0051	.0068
		Straight Line Ramp	≤ 2	1 x D	1 x D	20 deg	3	488	.0006	.0009	.0011	.0014	.0017	.0023	.0029	.0034	.0046
	Composites, Plastics, Fiberglass	Slotting	≤ 2	1 x D	1 x D	-	3	500	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090
		Peripheral - Rough	≤ 2	1 x D	.75 x D	-	3	700	.0014	.0021	.0029	.0036	.0043	.0057	.0071	.0086	.0114
		Peripheral - Rough	> 2 - 3	1 x D	.75 x D	-	3	700	.0014	.0021	.0027	.0034	.0041	.0055	.0068	.0082	.0109
		Peripheral - Rough	> 3 - 4	1 x D	.75 x D	-	3	600	.0012	.0018	.0024	.0030	.0036	.0048	.0061	.0073	.0097
		Peripheral - Rough	> 4 - 5	1 x D	.75 x D	-	3	500	.0010	.0015	.0020	.0025	.0030	.0040	.0051	.0061	.0081
		Finish	≤ 2.5	2 x D	.015 x D	-	3	900	.0006	.0009	.0013	.0016	.0019	.0025	.0031	.0038	.0050
		Helical Ramp	≤ 2	2 x D	1 x D	15 deg	3	500	.0011	.0017	.0023	.0028	.0034	.0045	.0056	.0068	.0090
		Straight Line Ramp	≤ 2	1 x D	1 x D	45 deg	3	500	.0008	.0011	.0015	.0019	.0023	.0030	.0038	.0045	.0061

** D = Tool Diameter   The M213 excels at plunge milling, please refer to page 11 for speed, feed and peck info.   Tool LC/Dia equals amount of tool projection from the holder.**

M213N STREAKERS
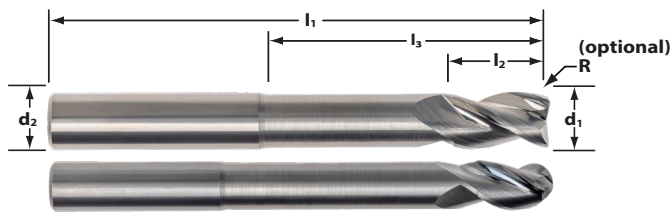
d1: -0.0001 / -0.0004   d2: -0.0001 / -0.0004
cr/ball nose: + / - 0.0015

For high-performance machining in aluminum alloys.

› 37- degree helix
› High polish flute face
› Optimized wiper flat
› Improved corner strength
› Extremely large flute cavity
› Extremely fine cutting edge
› Uniquely designed end face and gashing

Cutter Dia d1	Shank Dia d2	Length of Cut l2	Reach LBS l3	Overall Length l1	Order Code SQ	.015 CR	.031 CR	.062 CR	.093 CR	.125 CR	.187 CR	.250 CR	Order Code BN
1/8	1/8	3/16	3/4	2-1/2	64773	64806	-	-	-	-	-	-	64905
			5/8	3	64774	64807	-	-	-	-	-	-	64906
			1	3	64775	64808	-	-	-	-	-	-	64907
3/16	3/16	1/4	3/4	2-1/2	64777	64810	64826	-	-	-	-	-	64909
			1	3	64778	64811	64827	-	-	-	-	-	64910
1/4	1/4	3/8	7/8	2-1/2	64779	64812	64828	64855	-	-	-	-	64911
			1-3/8	3	64780	64813	64829	-	-	-	-	-	64912
			1-5/8	3	64781	64814	64830	64856	-	-	-	-	64913
			2-1/4	4	64782	64815	64831	-	-	-	-	-	64914
3/8	3/8	5/8	1-1/8	2-1/2	64783	64816	64832	64857	64874	-	-	-	64915
			1-1/4	3	64784	64817	64833	64858	-	-	-	-	64916
			1-5/8	3	64785	64818	64834	64859	-	-	-	-	64917
			2-1/4	4	64786	64819	64835	-	-	-	-	-	64918
			2-1/2	5	64787	-	64836	64860	-	-	-	-	64919
			3-1/8	6	64788	64820	64837	-	-	-	-	-	64920
1/2	1/2	5/8	1-3/8	3	64789	64821	64838	64861	64875	64881	-	-	64921
			1-3/4	3-1/2	64790	-	64839	64862	-	64882	-	-	64922
		3/4	2-1/4	4	64791	64822	64840	64863	64876	64883	-	-	64923
			2-3/4	4-1/2	64792	-	64841	64864	-	64884	-	-	64924
			3-1/4	5	64793	64823	64842	64865	-	64885	-	-	64925
			3-3/4	5	64794	-	64843	-	-	-	-	-	64926
			4-1/4	6	64795	64824	64844	64866	64877	64886	-	-	64927
5/8	5/8	3/4	1-3/4	4	64796	-	64845	-	-	64887	-	-	64928
			2-3/8	5	64797	-	64846	64867	64878	64888	-	-	64929
			3-3/8	6	64798	-	64847	-	-	64889	-	-	64930
3/4	3/4	1	1-3/4	4	64799	-	64848	64868	64879	64890	64897	64899	64931
			2-3/8	5	64800	-	64849	64869	-	64891	-	-	64932
			3-3/8	6	64801	-	64850	64870	64880	64892	64898	64900	64933
			5	7	64802	-	64851	64871	-	64893	-	64901	64934
1	1	1-1/4	2-5/8	5	64803	-	64852	64872	-	64894	-	64902	64935
			3-3/8	6	64804	-	64853	-	-	64895	-	64903	64936
			4-3/8	7	64805	-	64854	64873	-	64896	-	64904	64937

Application Guide – Speed & Feed

ISO Code	Work Material	Type of Cut	Tool LBS/Dia.	Axial DOC	Radial DOC	Ramp Angle	Number of Flutes	Speed (SFM)	Feed (Inch per Tooth)							
									1/8	3/16	1/4	3/8	1/2	5/8	3/4	1
N	Aluminum alloys 2024, 6061, 7075 Magnesium alloys O-T6	Slotting	>2-3	1 x D	1 x D	-	3	800	.0015	.0023	.0030	.0045	.0060	.0075	.0090	.0120
		Peripheral -Rough	>2-3	1 x D	.75 x D	-	3	1000	.0020	.0030	.0040	.0060	.0080	.0100	.0120	.0160
		Peripheral -Rough	>3-4	1 x D	.75 x D	-	3	1000	.0019	.0028	.0038	.0056	.0075	.0094	.0113	.0150
		Peripheral -Rough	>4-5	1 x D	.75 x D	-	3	900	.0016	.0024	.0032	.0049	.0065	.0081	.0097	.0130
		Peripheral -Rough	>5-6	1 x D	.625 x D	-	3	800	.0014	.0022	.0029	.0043	.0058	.0072	.0086	.0115
		Finish	>2-3	3 x D	.015 x D	-	3	1200	.0007	.0010	.0014	.0020	.0027	.0034	.0041	.0054
		Helical Ramp	>2-3	3 x D	1 x D	15 deg	3	800	.0015	.0023	.0030	.0045	.0060	.0075	.0090	.0120
		Straight Line Ramp	>2-3	1 x D	1 x D	45 deg	3	800	.0010	.0015	.0020	.0030	.0040	.0050	.0060	.0080
	Aluminum alloys 2024, 6061, 7075 Hardened or Anodized	Slotting	>2-3	1 x D	1 x D	-	3	780	.0014	.0020	.0027	.0041	.0055	.0068	.0082	.0109
		Peripheral -Rough	>2-3	1 x D	.75 x D	-	3	950	.0020	.0029	.0039	.0059	.0078	.0098	.0117	.0156
		Peripheral -Rough	>3-4	1 x D	.625 x D	-	3	950	.0018	.0027	.0037	.0055	.0073	.0092	.0110	.0147
		Peripheral -Rough	>4-5	1 x D	.625 x D	-	3	855	.0016	.0024	.0032	.0047	.0063	.0079	.0095	.0126
		Peripheral -Rough	>5-6	.75 x D	.5 x D	-	3	760	.0014	.0021	.0028	.0042	.0056	.0070	.0084	.0112
		Finish	>2-3	3 x D	.010 x D	-	3	1170	.0006	.0009	.0012	.0018	.0024	.0030	.0037	.0049
		Helical Ramp	>2-3	3 x D	1 x D	15 deg	3	780	.0014	.0020	.0027	.0041	.0055	.0068	.0082	.0109
		Straight Line Ramp	>2-3	1 x D	1 x D	45 deg	3	780	.0009	.0014	.0018	.0027	.0037	.0046	.0055	.0073
	High Silicon Aluminum Alloys A380, A390 Bhn 30-150 500kg	Slotting	>2-3	.75 x D	1 x D	-	3	500	.0011	.0017	.0023	.0034	.0045	.0056	.0068	.0090
		Peripheral -Rough	>2-3	1 x D	.5 x D	-	3	700	.0014	.0021	.0029	.0043	.0057	.0071	.0086	.0114
		Peripheral -Rough	>3-4	1 x D	.4 x D	-	3	700	.0014	.0021	.0027	.0041	.0055	.0068	.0082	.0109
		Peripheral -Rough	>4-5	1 x D	.4 x D	-	3	600	.0012	.0018	.0024	.0036	.0048	.0061	.0073	.0097
		Peripheral -Rough	>5-6	1 x D	.3 x D	-	3	500	.0010	.0015	.0020	.0030	.0040	.0051	.0061	.0081
		Finish	>2-3	3 x D	.015 x D	-	3	900	.0006	.0009	.0013	.0019	.0025	.0031	.0038	.0050
		Helical Ramp	>2-3	3 x D	1 x D	15 deg	3	500	.0011	.0017	.0023	.0034	.0045	.0056	.0068	.0090
		Straight Line Ramp	>2-3	1 x D	1 x D	45 deg	3	500	.0008	.0011	.0015	.0023	.0030	.0038	.0045	.0061
	High Silicon Aluminum alloys A380, A390 Anodized	Slotting	>2-3	.75 x D	1 x D	-	3	488	.0010	.0015	.0020	.0030	.0040	.0050	.0060	.0080
		Peripheral -Rough	>2-3	1 x D	.45 x D	-	3	690	.0014	.0021	.0029	.0043	.0057	.0071	.0086	.0114
		Peripheral -Rough	>3-4	1 x D	.375 x D	-	3	690	.0014	.0021	.0027	.0041	.0055	.0068	.0082	.0109
		Peripheral -Rough	>4-5	1 x D	.375 x D	-	3	621	.0012	.0018	.0024	.0036	.0048	.0061	.0073	.0097
		Peripheral -Rough	>5-6	.75 x D	.3 x D	-	3	552	.0010	.0015	.0020	.0030	.0040	.0051	.0061	.0081
		Finish	>2-3	3 x D	.010 x D	-	3	878	.0006	.0008	.0011	.0017	.0022	.0028	.0034	.0045
		Helical Ramp	>2-3	3 x D	1 x D	15 deg	3	488	.0010	.0015	.0020	.0030	.0040	.0050	.0060	.0080
		Straight Line Ramp	>2-3	1 x D	1 x D	45 deg	3	488	.0007	.0010	.0013	.0020	.0027	.0033	.0040	.0053
	Copper, Brass	Slotting	>2-3	.75 x D	1 x D	-	3	500	.0009	.0014	.0019	.0028	.0037	.0046	.0056	.0074
		Peripheral -Rough	>2-3	1 x D	.75 x D	-	3	600	.0012	.0017	.0023	.0035	.0046	.0058	.0069	.0092
		Peripheral -Rough	>3-4	1 x D	.75 x D	-	3	600	.0011	.0017	.0022	.0033	.0045	.0056	.0067	.0089
		Peripheral -Rough	>4-5	1 x D	.75 x D	-	3	500	.0010	.0014	.0019	.0029	.0039	.0048	.0058	.0077
		Peripheral -Rough	>5-6	1 x D	.625 x D	-	3	450	.0008	.0012	.0017	.0025	.0033	.0041	.0050	.0066
		Finish	>2-3	3 x D	.015 x D	-	3	650	.0005	.0008	.0011	.0016	.0021	.0026	.0032	.0042
		Helical Ramp	>2-3	3 x D	1 x D	15 deg	3	500	.0009	.0014	.0019	.0028	.0037	.0046	.0056	.0074
		Straight Line Ramp	>2-3	1 x D	1 x D	25 deg	3	500	.0006	.0009	.0012	.0019	.0025	.0031	.0037	.0050
	Copper alloys, Brass Alloys	Slotting	>2-3	.75 x D	1 x D	-	3	488	.0009	.0014	.0018	.0027	.0036	.0045	.0054	.0072
		Peripheral -Rough	>2-3	1 x D	.75 x D	-	3	590	.0012	.0017	.0023	.0035	.0046	.0058	.0069	.0092
		Peripheral -Rough	>3-4	1 x D	.625 x D	-	3	590	.0011	.0017	.0022	.0033	.0044	.0055	.0066	.0088
		Peripheral -Rough	>4-5	1 x D	.625 x D	-	3	492	.0009	.0014	.0019	.0028	.0038	.0047	.0057	.0075
		Peripheral -Rough	>5-6	.75 x D	.5 x D	-	3	443	.0008	.0012	.0016	.0024	.0032	.0040	.0048	.0064
		Finish	>2-3	3 x D	.010 x D	-	3	634	.0005	.0007	.0010	.0015	.0020	.0024	.0029	.0039
		Helical Ramp	>2-3	3 x D	1 x D	15 deg	3	488	.0009	.0014	.0018	.0027	.0036	.0045	.0054	.0072
		Straight Line Ramp	>2-3	1 x D	1 x D	25 deg	3	488	.0006	.0009	.0012	.0018	.0024	.0030	.0036	.0048
	Bronze	Slotting	>2-3	.75 x D	1 x D	-	3	500	.0009	.0013	.0018	.0026	.0035	.0044	.0053	.0070
		Peripheral -Rough	>2-3	1 x D	.5 x D	-	3	600	.0011	.0017	.0022	.0033	.0044	.0055	.0066	.0088
		Peripheral -Rough	>3-4	1 x D	.4 x D	-	3	600	.0010	.0016	.0021	.0031	.0042	.0052	.0063	.0084
		Peripheral -Rough	>4-5	1 x D	.4 x D	-	3	500	.0009	.0013	.0018	.0026	.0035	.0044	.0053	.0070
		Peripheral -Rough	>5-6	1 x D	.3 x D	-	3	450	.0007	.0011	.0015	.0022	.0030	.0037	.0045	.0059
		Finish	>2-3	3 x D	.015 x D	-	3	650	.0005	.0007	.0010	.0014	.0019	.0024	.0029	.0038
		Helical Ramp	>2-3	3 x D	1 x D	12 deg	3	500	.0009	.0013	.0018	.0026	.0035	.0044	.0053	.0070
		Straight Line Ramp	>2-3	1 x D	1 x D	20 deg	3	500	.0006	.0009	.0012	.0018	.0023	.0029	.0035	.0047
	Bronze High Tin Bronze, Manganese Bronze Work Hardened Bronze	Slotting	>2-3	.75 x D	1 x D	-	3	488	.0009	.0013	.0017	.0026	.0034	.0043	.0051	.0068
		Peripheral -Rough	>2-3	1 x D	.45 x D	-	3	590	.0011	.0017	.0022	.0033	.0044	.0055	.0066	.0088
		Peripheral -Rough	>3-4	1 x D	.375 x D	-	3	590	.0010	.0016	.0021	.0031	.0042	.0052	.0063	.0084
		Peripheral -Rough	>4-5	1 x D	.375 x D	-	3	492	.0009	.0013	.0018	.0026	.0035	.0044	.0053	.0070
		Peripheral -Rough	>5-6	.75 x D	.3 x D	-	3	443	.0007	.0011	.0015	.0022	.0030	.0037	.0045	.0059
		Finish	>2-3	3 x D	.010 x D	-	3	634	.0004	.0007	.0009	.0013	.0018	.0022	.0026	.0035
		Helical Ramp	>2-3	3 x D	1 x D	12 deg	3	488	.0009	.0013	.0017	.0026	.0034	.0043	.0051	.0068
		Straight Line Ramp	>2-3	1 x D	1 x D	20 deg	3	488	.0006	.0009	.0011	.0017	.0023	.0029	.0034	.0046
	Composites, Plastics, Fiberglass	Slotting	>2-3	1 x D	1 x D	-	3	500	.0011	.0017	.0023	.0034	.0045	.0056	.0068	.0090
		Peripheral - Rough	>2-3	1 x D	.75 x D	-	3	700	.0014	.0021	.0029	.0043	.0057	.0071	.0086	.0114
		Peripheral - Rough	>3-4	1 x D	.75 x D	-	3	700	.0014	.0021	.0027	.0041	.0055	.0068	.0082	.0109
		Peripheral - Rough	>4-5	1 x D	.75 x D	-	3	600	.0012	.0018	.0024	.0036	.0048	.0061	.0073	.0097
		Peripheral -Rough	>5-6	1 x D	.625 x D	-	3	500	.0010	.0015	.0020	.0030	.0040	.0051	.0061	.0081
		Finish	>2-3	3 x D	.015 x D	-	3	900	.0006	.0009	.0013	.0019	.0025	.0031	.0038	.0050
		Helical Entry	>2-3	3 x D	1 x D	15 deg	3	500	.0011	.0017	.0023	.0034	.0045	.0056	.0068	.0090
		Straight Line Ramp	>2-3	1 x D	1 x D	45 deg	3	500	.0008	.0011	.0015	.0023	.0030	.0038	.0045	.0061

** D = Tool Diameter   The M213 excels at plunge milling, please refer to page 11 for speed, feed and peck info.   Tool LC/Dia equals amount of tool projection from the holder.**

Tool*bot*

Check it before you wreck it.

The brand new, easy to use online tool for dynamic speeds and feed from IMCO.

Simply input your part number or describe your tool, input select details about your application, confirm your machine details, and get ready to rock and roll with highly technical and in-depth speed and feed recommendations.

It's as easy as 1, 2, 3, 4!

---

① Your End Mill

Provide the part number for your IMCO end mill, or describe your part.

Part Number

🔍 Enter part number

Alternatives: Don't know the number? Use our Tool Filter to find your part.

---

② Choose a Material

Select your material group. You may filter by ISO or select a specific material.

ISO Filter

| H | K | M | P | S |

Material Group *

⌄

Material

optional ⌄

---

③ Operation Details

Select your operation and add details about the feature.

Operation *

⌄

Feature Depth * ⓘ

in

Options based on IMCO recommendations for your material and your part's model and specifications.

---

④ Machine Limits

Provide the capability of your machine so we can calculate accurate recommendations.

Max Spindle Power *

250 hp

Max Feed Rate *

3000 ipm

Max RPM *

75000 rpm

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www.imcousa.com/resources/toolbot

TECHNICAL RESOURCES

IMPROVED ENTRIES

Method 1	Method 2	Method 3
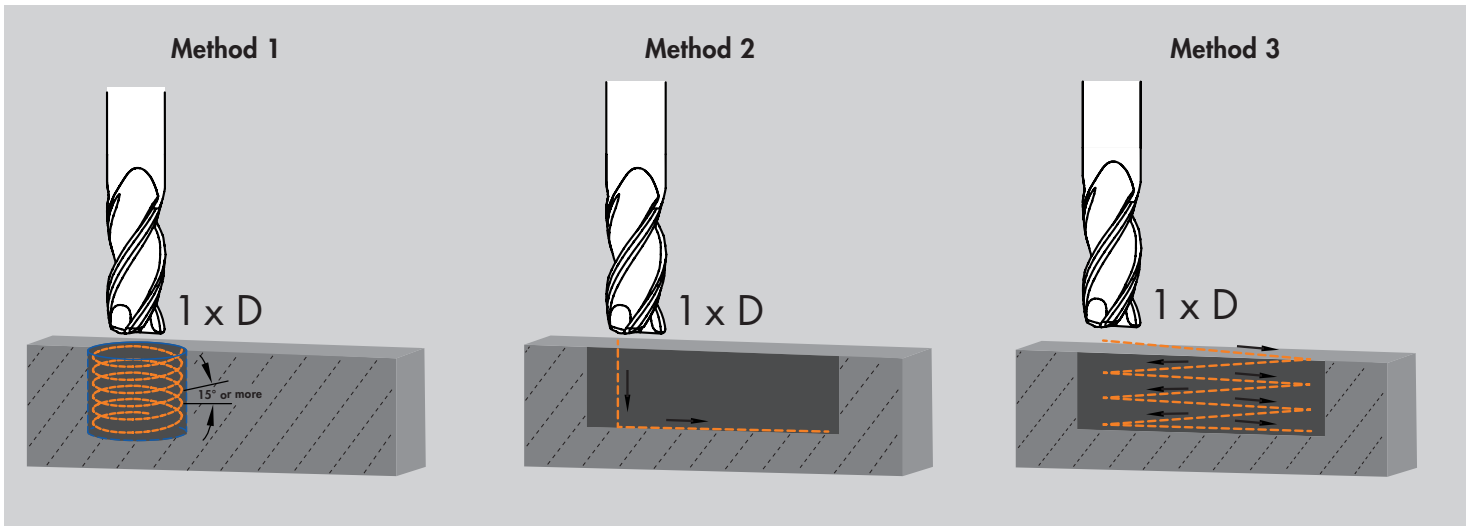
The M213 STREAKERS series is designed to excel when using a variety of entry moves – helical ramping, plunging, and straight-line ramping. The M213 efficiently creates and evacuates the chips in all entry moves, allowing you to choose your tool path based on the part requirements and your programming needs.

METHOD 1: Helical Entry

Helical ramping is a preferred entry method due to the lower impact and stress placed on the end mill, which increases tool life. Helical ramping also creates the entry pocket without increasing cycle time to the process and allows for milling to deeper Z depths. The M213 can helical ramp to the depth of the tool's length of cut.
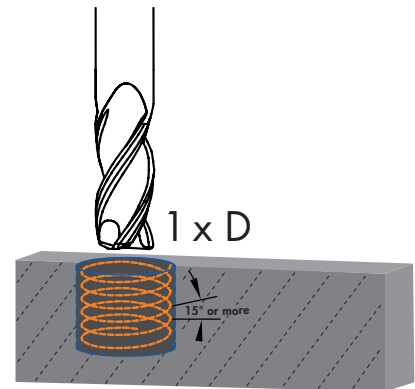
Tool	Max Ramp Angle	SFM and Feed Rate	Max Ramp Depth	Max Hole Diameter
M213	15°	Please reference data in chart on page 7.	Equal to LOC	(D x 2) - (corner radius x 2)

METHOD 2: Plunging

A pre-drilled starter hole is no longer needed when milling with the M213 series. The end face geometry allows for a plunge move in the Z-axis up to 1 x diameter at feed rates that compare to a drill. Plunging to depth and milling that level at high feed rates keeps the metal removal rates high and saves the time of a tool change.

1 x D
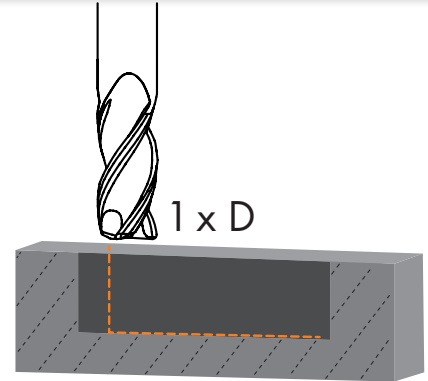
Tool	Max Ramp Angle	SFM	Feed	Max Ramp Depth	Max Peck Depth
M213	90°	Use slotting speed	Use slotting IPT x .9	1 x D	Up to 1 x D per peck

D = Tool Diameter

METHOD 3: Straight Line Ramping

The M213 end mill can straight-line ramp at an entry angle up to 45° which saves time using the traditional zig-zag entry tool path. Caution: machine horsepower requirements increase as the ramp angle increases. Once reaching the final Z depth, the M213 can slot up to 1 x D depth with no clogging.

1 x D
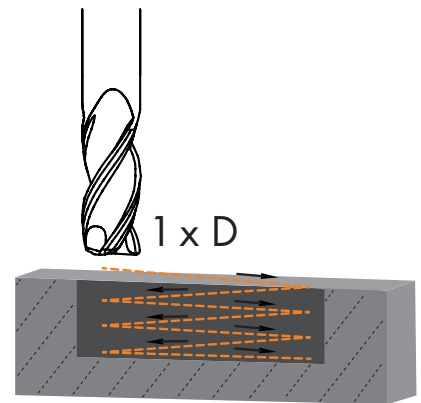
Tool	Max Ramp Angle	SFM and Feed Rate	Max Ramp Depth	Max Ramp Length
M213	45°	Please reference data in chart on page 7.	1 x D	(1 x D) / drop per inch

D = Tool Diameter

Use this guide as an aid in determining maximum ramp length. ▶

Ramp Angle	Drop (per inch)
1°	0.0175
2°	0.035
2.5°	0.04375
3°	0.0525
3.5°	0.06125
5°	0.0875
10°	0.175

Ramp Angle	Drop (per inch)
15°	0.2625
20°	0.35
25°	0.4375
30°	0.525
35°	0.6125
40°	0.7
45°	0.7875

ADJUSTMENTS FOR BALL NOSE END MILLS

The speeds and feeds of ball nose end mills must be adjusted to ensure proper tool life. Adjustments are based on the amount of tool engagement.

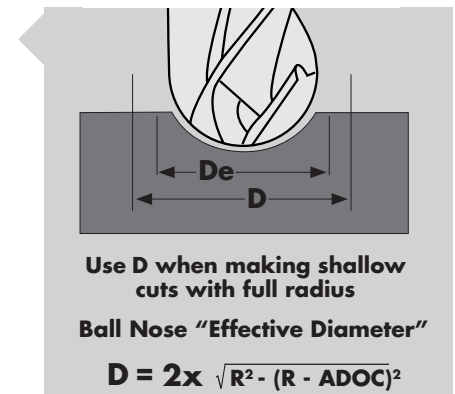### If the depth of cut (ADOC) is <50% of the tool diameter:

Adjustments must be made to determine the effective cutting diameter and to adjust for axial chip thinning. Follow these steps:

STEP 1: Use speed and feed values for slot cuts from the speed and feed charts for the appropriate material and tool diameter.

Note: Make an additional adjustment using the chart to the right if the tool projection exceeds 2.5 x the tool diameter.

Projection	Speed Adj	Feed Adj
> 2.5 to 3 x D	SFM x .95	IPT x .95
> 3 to 4 x D	SFM x .90	IPT x .90
> 4 to 5 x D	SFM x .80	IPT x .80
> 5 to 6 x D	SFM x .70	IPT x .70

STEP 2: Determine the effective cutting diameter (De) of the end mill based on the axial depth of cut. The effective cutting diameter will be used to make both speed and feed adjustments.

Use D when making shallow cuts with full radius

Ball Nose "Effective Diameter"

$$D = 2x \sqrt{R^2 - (R - ADOC)^2}$$

For easy reference, use the chart below.

Depth of Cut (ADOC)	1/8		1/4		3/8		1/2		3/4		1	
	Depth	De	Depth	De	Depth	De	Depth	De	Depth	De	Depth	De
10% of tool diameter	.013	.075	.025	.150	.038	.225	.050	.300	.075	.450	.100	.600
20% of tool diameter	.025	.100	.050	.200	.075	.300	.100	.400	.150	.600	.200	.800
30% of tool diameter	.038	.115	.075	.229	.113	.344	.150	.458	.225	.687	.300	.917
40% of tool diameter	.050	.123	.100	.245	.150	.367	.200	.490	.300	.73	.400	.980
50% of tool diameter	.063	.125	.125	.250	.186	.375	.250	.500	.375	.75	.500	1.00

STEP 3: Calculate speed based on using the effective cutting diameter. Use the standard to RPM conversion formula. Substitute the effective cutting diameter (De) for the actual tool diameter (D).

STEP 4: Calculate the adjusted feed rate based on the effective cutting diameter and the axial chip thinning formula.

$$RPM = (SFM \times 3.82) / De$$

D = Actual tool diameter
IPT = Feed rate from chart for slot milling
De = Effective cutting diameter

$$IPTadj = (D \times IPT) / De$$

The new feed rate is calculated:

$$IPM = RPM \times (Z \times IPT\,adj)$$

IPM = Inches per minute
Z = # of flutes
IPT adj = Adjusted chip load per tooth fractional

If the axial depth of cut (ADOC) is ≥50% of the tool diameter:

- Use the speed and feed values shown for the slotting operation in the speed and feed charts for the series of end mill being used.
- If the tool projection exceeds 2.5 x the tool diameter, adjust the slotting speeds and feeds by the chart for long reach tool adjustments.

SURFACE FINISH

Radial depth of cut (RDOC), or step-over, is based on the desired finish. The lighter the step-over, the lower the scallop height (material left uncut by the radius of the tool), and the better the finish. These charts calculate approximate scallop height using the following formula:

$$h \sim (ae^2) / (8R)$$

h = Scallop height
ae = Radial step-over
R = Radius of end mill
     (tool diameter x .5)

Radial stepover
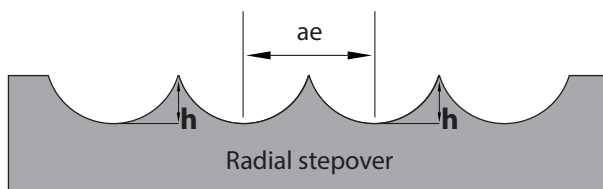
Tool Diameter	Step-over % of OD	Step-over Actual	Approx Scallop Height
1/8	10%	.013	.0003
	20%	.025	.0013
	30%	.038	.0028
1/4	10%	.025	.0006
	20%	.050	.0025
	30%	.075	.0056
3/8	10%	.038	.0009
	20%	.075	.0038
	.30%	.113	.0084
1/2	10%	.050	.0013
	20%	.100	.0050
	30%	.150	.0113
3/4	10%	.075	.0019
	20%	.150	.0075
	30%	.225	.0169
1	10%	.100	.0025
	20%	.200	.0100
	30%	.300	.0225