Cutting Data

for M270 Ball Nose / Toroidal Cutters

ANSI ISO 513	Cutting Data for M270 Milling Cutters					COATED									UNCOATED		
	Cutter		Carbide Insert			TN2505			TN2510			TN7535			THM		
						feed per tooth *(inch)											
	M270 Ball Nose M270 Toroidal		.375			.0024	**.0031**	.0039	.0024	**.0031**	.0047	.0043	**.0065**	.0078	.0039	**.0055**	.0063
			.500			.0028	**.0039**	.0051	.0028	**.0039**	.0059	.0052	**.0069**	.0087	.0055	**.0079**	.0094
			.625			.0031	**.0047**	.0059	.0031	**.0047**	.0071	.0065	**.0087**	.0108	.0071	**.0098**	.0118
			.750			-	-	-	.0039	**.0055**	.0087	-	-	-	.0091	**.0126**	.0150
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
P	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	-	-	-	-	-	-	1180	**920**	790	-	-	-
		≥ 0.25% C	annealed	190	2	-	-	-	-	-	-	820	**620**	540	-	-	-
		< 0.55% C	heat-treated	250	3	-	-	-	-	-	-	690	**520**	460	-	-	-
		≥ 0.55% C	annealed	220	4	-	-	-	-	-	-	710	**540**	460	-	-	-
			heat-treated	300	5	-	-	-	-	-	-	590	**430**	360	-	-	-
	Low alloy steel and cast steel		annealed	200	6	-	-	-	-	-	-	790	**590**	490	-	-	-
			heat-treated	275	7	-	-	-	-	-	-	590	**460**	390	-	-	-
			heat-treated	300	8	-	-	-	-	-	-	520	**390**	330	-	-	-
			heat-treated	350	9	-	-	-	-	-	-	460	**330**	260	-	-	-
	High alloy steel, cast steel & tool steel		annealed	200	10	750	**590**	560	620	**490**	460	590	**480**	430	-	-	-
			heat-treated	325	11	520	**390**	330	430	**330**	260	390	**300**	230	-	-	-
	400 series stainless		FE / MA	200	12	950	**750**	590	790	**620**	490	750	**570**	490	-	-	-
			MA	240	13.1	820	**590**	520	690	**490**	430	660	**480**	390	-	-	-
			MA / PH	330	13.2	430	**330**	260	360	**260**	230	330	**250**	200	-	-	-
M	300 Series		AU	180	14.1	-	-	-	-	-	-	660	**390**	300	-	-	-
	Stainless		DU	230	14.2	-	-	-	-	-	-	520	**310**	230	-	-	-
	Duplex		S-AU	200	14.3	-	-	-	-	-	-	390	**230**	180	-	-	-
	Stainless		AU-PH	330	14.4	-	-	-	-	-	-	330	**200**	150	-	-	-
K	Grey cast iron		ferrit./pearl.	180	15	-	-	-	2260	**1640**	1100	-	-	-	-	-	-
			pearlitic	260	16	-	-	-	1740	**1310**	980	-	-	-	-	-	-
	Nodular cast iron		ferritic	160	17	2400	**1570**	1180	2000	**1310**	980	820	**620**	540	750	**560**	490
			pearlitic	250	18	1540	**1150**	850	1280	**950**	720	690	**520**	460	620	**460**	430
	Malleable cast iron		ferritic	130	19	-	-	-	1460	**1210**	950	-	-	-	-	-	-
			pearlitic	230	20	-	-	-	1310	**980**	710	-	-	-	-	-	-
N	Wrought		Non AG	60	21	-	-	-	-	-	-	-	-	-	3280	**2460**	1970
			AG	100	22	-	-	-	-	-	-	-	-	-	1640	**1180**	980
	Cast aluminum alloys		Non Ag	75	23	-	-	-	-	-	-	-	-	-	3280	**2460**	1970
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-	-	-	-	2620	**1970**	1640
		Si ≥ 12%		130	25	-	-	-	-	-	-	-	-	-	1640	**1150**	820
S	High Temp		G	200	31	-	-	-	-	-	-	-	-	-	120	**80**	-
	Alloy FE		AG	280	32	-	-	-	-	-	-	-	-	-	100	**70**	-
	High Temp		G	250	33	-	-	-	-	-	-	-	-	-	80	**50**	-
	Alloy		AG	350	34	-	-	-	-	-	-	-	-	-	70	**40**	-
	Ni / Co		GO	320	35	-	-	-	-	-	-	-	-	-	70	**40**	-
	Titanium alloys				36	-	-	-	-	-	-	-	-	-	260	**130**	-
	TiAL6V4		AG		37	-	-	-	-	-	-	-	-	-	230	**110**	-
H	Hardened steel		H	45	38.1	520	**390**	260	430	**340**	260	-	-	-	-	-	-
			H	55	38.2	520	**390**	260	430	**340**	260	-	-	-	-	-	-
			H	60	39.1	390	**330**	200	360	**280**	210	-	-	-	-	-	-
			H	> 62	39.2	390	**330**	200	360	**280**	210	-	-	-	-	-	-

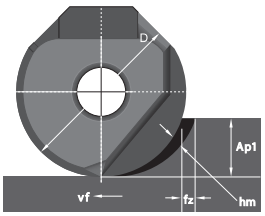
*See page 115 for M270 Application Advice

Cutting Data

for M270 High Feed Cutters

ANSI ISO 513	Cutting Data for M270 Milling Cutters					COATED					
	Cutter		Carbide Insert			TN2505			TN6540		
						feed per tooth *(inch)					
	M270 High Feed		.375			.0059	**.0098**	.0110	.0059	**.0118**	.0197
			.500			.0059	**.0118**	.0138	.0059	**.0157**	.0197
			.625			.0059	**.0157**	.0177	.0059	**.0197**	.0236
			.750			.0059	**.0197**	.0217	.0059	**.0236**	.0276
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)					
P	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	-	-	-	950	**740**	620
		≥ 0.25% C	annealed	190	2	-	-	-	660	**490**	430
		< 0.55% C	heat-treated	250	3	-	-	-	560	**430**	360
		≥ 0.55% C	annealed	220	4	-	-	-	560	**430**	360
			heat-treated	300	5	-	-	-	480	**340**	300
	Low alloy steel and cast steel		annealed	200	6	-	-	-	620	**480**	390
			heat-treated	275	7	-	-	-	480	**360**	310
			heat-treated	300	8	-	-	-	430	**310**	260
			heat-treated	350	9	-	-	-	360	**260**	210
	High alloy steel, cast steel & tool steel		annealed	200	10	560	**460**	430	480	**380**	340
			heat-treated	325	11	360	**260**	230	310	**230**	180
	400 series stainless		FE / MA	200	12	720	**560**	460	610	**460**	390
			MA	240	13.1	620	**460**	360	520	**380**	310
			MA / PH	330	13.2	330	**230**	200	260	**200**	160
M	300 Series		AU	180	14.1	-	-	-	520	**310**	230
	Stainless		DU	230	14.2	-	-	-	430	**250**	180
	Duplex		S-AU	200	14.3	-	-	-	310	**180**	150
	Stainless		AU-PH	330	14.4	-	-	-	260	**160**	110
K	Grey cast iron		ferrit./pearl.	180	15	-	-	-	-	-	-
			pearlitic	260	16	-	-	-	-	-	-
	Nodular cast iron		ferritic	160	17	790	**590**	520	660	**490**	430
			pearlitic	250	18	660	**520**	430	560	**430**	360
	Malleable cast iron		ferritic	130	19	-	-	-	-	-	-
			pearlitic	230	20	-	-	-	-	-	-
N	Wrought		Non AG	60	21	-	-	-	-	-	-
			AG	100	22	-	-	-	-	-	-
	Cast aluminum alloys		Non Ag	75	23	-	-	-	-	-	-
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-
		Si ≥ 12%		130	25	-	-	-	-	-	-
S	High Temp		G	200	31	-	-	-	200	**160**	150
	Alloy FE		AG	280	32	-	-	-	160	**130**	110
	High Temp		G	250	33	-	-	-	110	**80**	70
	Alloy		AG	350	34	-	-	-	100	**70**	50
	Ni / Co		GO	320	35	-	-	-	100	**70**	50
	Titanium alloys				36	-	-	-	260	**160**	130
	TiAL6V4		AG		37	-	-	-	230	**150**	110
H	Hardened steel		H	45	38.1	520	**390**	260	-	-	-
			H	55	38.2	520	**390**	260	-	-	-
			H	60	39.1	390	**330**	200	-	-	-
			H	> 62	39.2	390	**330**	200	-	-	-

Factors for M270 Ball Nose & Toroidal Milling Cutters:



First choice starting speed (vc) are in bold type. Use corresponding feed (fz).

Given fz is valid for face milling with width of cut (ae) ≥ 0.4 D1 and Ap1 max.

For smaller ae and ap, use the given correction factors (D = dia. of insert, D1 = cutter dia.).

M270 Ball Nose

fz-factor for ratio ae:d[1]				
ap1	0.05	0.1	0.2	0.4
5% of d	9	6.3	4.3	3.2
10% of d	6.3	4.3	3.2	2.2
20% of d	4.3	3.2	2.2	1.6
40% of d	3.2	4.2	1.6	1.1

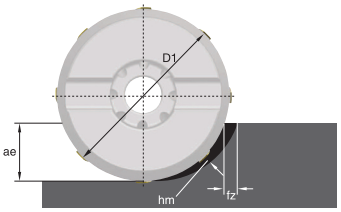
vc-factor at fz-factor							
fz - Factor	9	6.3	4.3	3.2	2.2	1.6	1.1
fc - Factor	1.6	1.5	1.4	1.3	1.2	1.1	1

Example: ae : D1 = 0.1 = 0.2 x D
fznom = .0080" fz eff=.0080" x 3.2 = .0256"
vcnom = 525 vc eff = 525 x 1.3 = 683 sfm

M270 Toroidal

ae / D1	0.02	0.05	0.1	0.2	0.4
fz - Factor	3.5	3	2	1.5	1
fc - Factor	1.6	1.5	1.4	1.3	1.1

Factors for M270 High Feed Milling Cutters:



$$hm = fz \cdot \sqrt{\frac{ae}{D1}} \qquad fz = hm \cdot \sqrt{\frac{D1}{ae}}$$

First choice starting speed (vc) are in bold type. Use corresponding feed (fz).

fz and vc are valid for ae ≥ 0.4 D1.

For smaller ae, fz and vc should be multiplied by the factor given below.

ae / D1	0.1	0.2	0.3	0.4
fz - Factor	2	1.5	1.3	1
fc - Factor	1.4	1.3	1.2	1.1

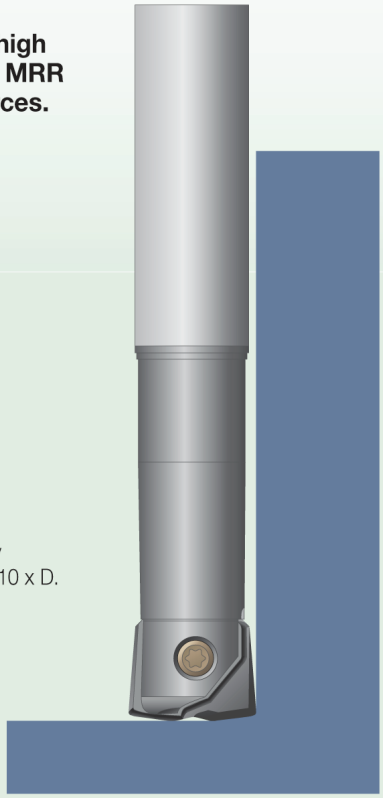
***See page 116 for further M270 High Feed Application Advice**

Cutting Data

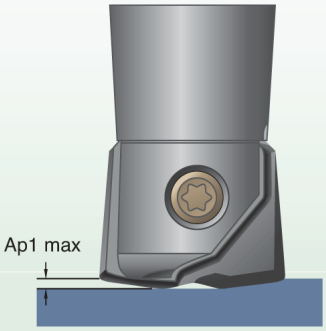
for M270 High Feed Application Advice

Applying High-Feed Tools

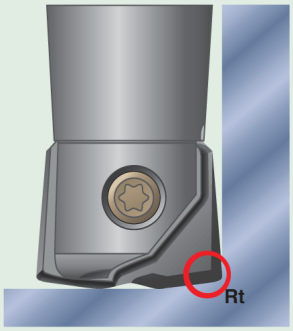
The High-Feed concept bases its strategy in small depth of cut and high fz values, which results in a higher MRR and productivity with low radial forces.



Recommended when long overhang is necessary due to lower radial forces. Maximum L/D ratio of 10 x D.



Small Ap1 values and higher feed rate generate lower cutting forces versus traditional milling strategies.



For CAM programming, the tools can be programmed as a toroidal tool type by using the Rt value as the insert radius.

Rt represents theoretical programming radius

L/D ratio	% of Ap1 max to reduce	% of vc to reduce
<4	0%	0%
4<L/D<7	55–65%	10–15%
>8	65–75%	20–30%

General Programming Information for Applying M270 High-Feed

tool diameter	.375"	.500"	.625"	.750"
recommended starting Ap1 (inch)	.016	.016	.023	.030
Rt CAM programming	.044	.057	.070	.090
fz recommended for general purpose	.020	.022	.024	.030
fz recommended for 45 HRC (approx.)	.015	.018	.022	.026
fz recommended for 55 HRC (approx.)	.012	.014	.018	.020

Use two effective teeth for feed calculations.
For materials above 45 HRC, we recommend adjusting the ae max to 55% of cutting diameter and using no more than 50% of Ap1 max.
While center cutting is possible, we recommend using a ramp angle of 0.5°–1.0° to ensure smooth operation.