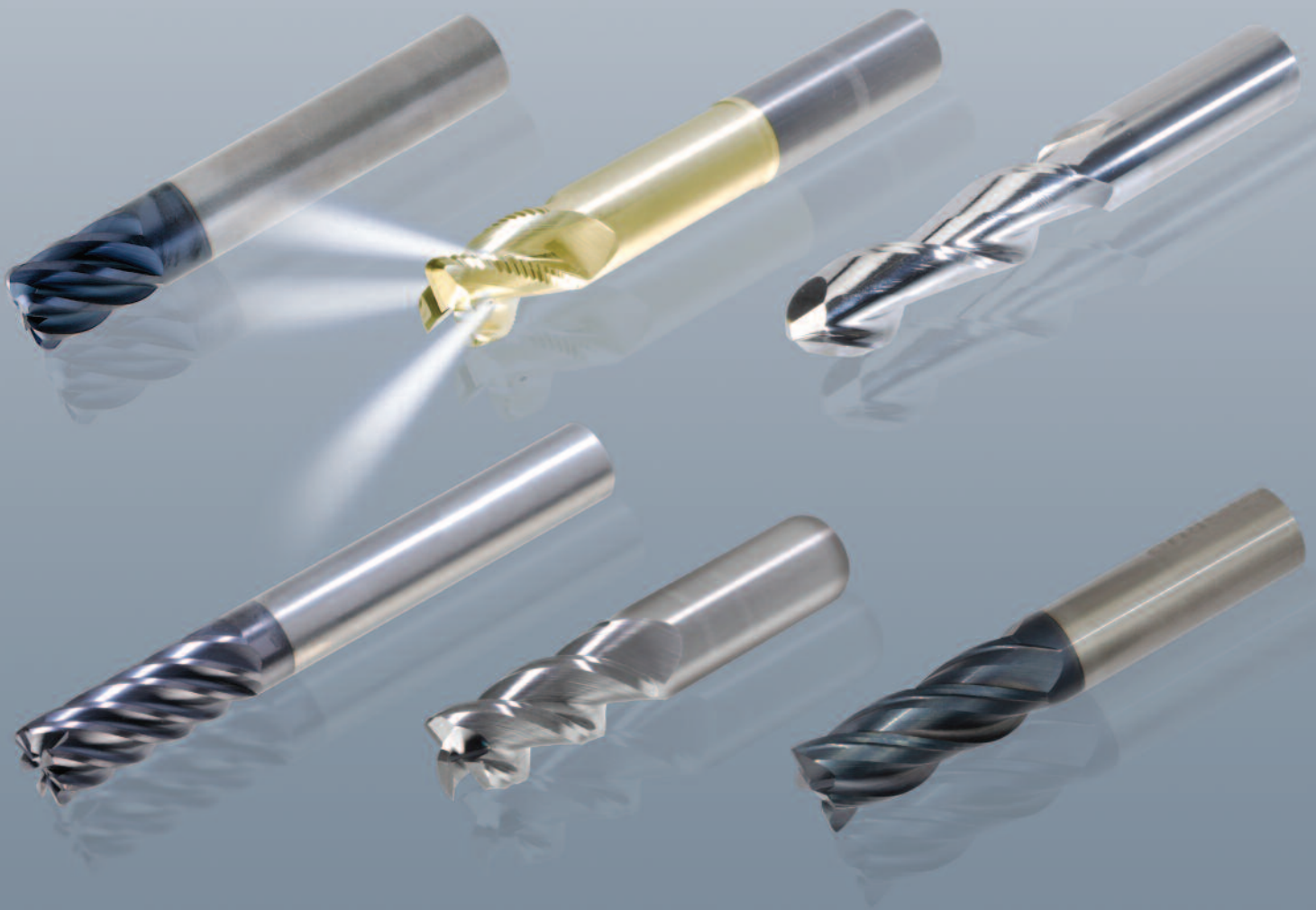


# High Performance Milling

Solid Carbide Metalworking Solutions



# TAKE IT ON

**YOUR CHALLENGES, OUR EXPERTISE.**

LMT Onsrud has been Taking ON challenging materials in the aerospace, medical and energy industries for over 70 years. As materials have changed so have LMT Onsrud's tool geometry and product diversification... high speed steel used in hand routing aluminum sheet to complex solid carbide and PCD tooling used in today's space age materials.

The manufacturing facility in Waukegan, IL, houses the latest CNC grinding machines and coating equipment. On the strength of our extensive engineering resources and technical service, LMT Onsrud has the deep, solution-based knowledge of how to solve complex problems that allows us to develop custom solutions as easily as we manufacture thousands of standard products.









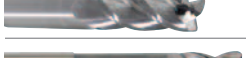









**YOUR CHALLENGES , OUR EXPERTISE.**







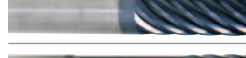







**Take IT On with LMT Onsrud.**

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## End Mills for Aluminum and other Non-Ferrous Applications (AF Series)

*2 AND 3 FLUTE DESIGNS FOR SLOTTING AND FINISHING OPERATIONS*

2 flute tools with open flute geometry optimized for slotting applications.

3 flute tools with large “sweet spot” for chatter free machining at high RPM and heavy cuts.

Chip former on flute face for optimal chip removal.

Reduced chatter will increase tool life, produce a higher quality part and optimize cutting efficiencies.

Polished flutes for better chip removal and low HP requirements.

Industry’s largest selection of corner radii and neck and flute lengths in a standard program.

Available uncoated with high polished flutes & specialty coatings for Aluminum





# AF-2 & AFN-2

2 Flute

Aluminum 2 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFS-20125	1/8	1/8	1/4	2	2	-	-	Square	• AMC400002	AMC400003
								0.010	AMC400004	AMC400005
								Ball	• AMC400006	AMC400007
AFM-20125	1/8	1/8	1/2	2	2	-	-	Square	• AMC400020	AMC400021
								0.010	AMC400022	AMC400023
								Ball	• AMC400024	AMC400025
AFS-20188	3/16	3/16	5/16	2	2	-	-	Square	• AMC400008	AMC400009
								0.010	AMC400010	AMC400011
								Ball	• AMC400012	AMC400013
AFM-20188	3/16	3/16	9/16	2 1/2	2	-	-	Square	• AMC400026	AMC400027
								0.010	AMC400028	AMC400029
								Ball	• AMC400030	AMC400031
AFS-20250	1/4	1/4	3/8	2	2	-	-	Square	• AMC700102	AMC700103
								0.015	• AMC700106	AMC700107
								0.030	• AMC700110	AMC700111
								0.060	AMC700114	AMC700115
								0.090	AMC700118	AMC700119
AFM-20250	1/4	1/4	3/4	2	2	-	-	Square	• AMC700752	• AMC700753
								0.015	• AMC700756	AMC700757
								0.030	• AMC700760	• AMC700761
								0.060	AMC700764	• AMC700765
								0.090	AMC700768	AMC700769
AFL-20250	1/4	1/4	1 1/4	2 1/2	2	-	-	Square	• AMC701402	AMC701403
								0.015	• AMC701406	AMC701407
								0.030	AMC701410	AMC701411
								0.060	AMC701414	AMC701415
								0.090	AMC701418	AMC701419
AFNS-20250	1/4	1/4	3/8	4	2	1 1/2	.235	Square	• AMC706102	AMC706103
								0.015	• AMC706106	AMC706107
								0.030	• AMC706110	AMC706111
								0.060	• AMC706114	AMC706115
								Ball	• AMC706138	AMC706139
AFNM-20250	1/4	1/4	3/8	4	2	1 3/4	.235	Square	• AMC706752	• AMC706753
								0.015	• AMC706756	AMC706757
								0.030	• AMC706760	AMC706761
								0.060	AMC706764	AMC706765
								Ball	• AMC706788	AMC706789
AFNL-20250	1/4	1/4	3/8	4	2	2 1/8	.235	Square	• AMC707402	AMC707403
								0.015	AMC707406	AMC707407
								0.030	AMC707410	AMC707411
								0.060	AMC707414	AMC707415
								Ball	• AMC707438	AMC707439
AFS-20313	5/16	5/16	9/16	2 1/2	2	-	-	Square	• AMC400014	AMC400015
								0.015	AMC400016	AMC400017
								Ball	• AMC400018	AMC400019
AFM-20313	5/16	5/16	13/16	2 1/2	2	-	-	Square	• AMC400032	AMC400033
								0.015	AMC400034	AMC400035
								Ball	• AMC400036	AMC400037
AFS-20375	3/8	3/8	1/2	2 1/2	2	-	-	Square	• AMC700202	AMC700203
								0.015	• AMC700206	AMC700207
								0.030	AMC700210	AMC700211
								0.060	AMC700214	AMC700215
								0.090	• AMC700218	AMC700219
								0.120	• AMC700222	AMC700223
Ball	AMC700238	AMC700239								

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Pages 56 & 57

# AF-2 & AFN-2

## 2 Flute



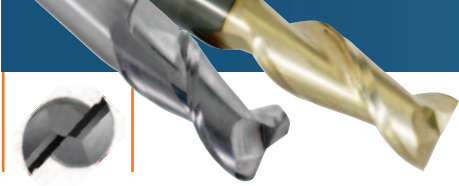
Aluminum 2 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFM-20375	3/8	3/8	1	2 1/2	2	-	-	Square	• AMC700852	AMC700853
								0.015	• AMC700856	AMC700857
								0.030	• AMC700860	AMC700861
								0.060	• AMC700864	AMC700865
								0.090	• AMC700868	AMC700869
								0.120	• AMC700872	AMC700873
								Ball	• AMC700888	AMC700889
AFL-20375	3/8	3/8	1 1/2	4	2	-	-	Square	• AMC701502	• AMC701503
								0.015	• AMC701506	AMC701507
								0.030	AMC701510	AMC701511
								0.060	AMC701514	AMC701515
								0.090	AMC701518	AMC701519
								0.120	AMC701522	AMC701523
								Ball	AMC701538	AMC701539
AFNS-20375	3/8	3/8	1/2	4	2	1 3/4	.353	Square	• AMC706202	AMC706203
								0.015	• AMC706206	AMC706207
								0.030	AMC706210	AMC706211
								0.060	AMC706214	AMC706215
								0.090	• AMC706218	AMC706219
								0.120	• AMC706222	AMC706223
								Ball	• AMC706238	AMC706239
AFNM-20375	3/8	3/8	1/2	4	2	2 1/4	.353	Square	• AMC706852	AMC706853
								0.015	• AMC706856	AMC706857
								0.030	• AMC706860	AMC706861
								0.060	• AMC706864	AMC706865
								0.090	• AMC706868	AMC706869
								0.120	• AMC706872	AMC706873
								Ball	• AMC706888	AMC706889
AFNL-20375	3/8	3/8	1/2	5	2	2 3/4	.353	Square	• AMC707502	AMC707503
								0.015	AMC707506	AMC707507
								0.030	• AMC707510	AMC707511
								0.060	• AMC707514	AMC707515
								0.090	AMC707518	AMC707519
								0.120	• AMC707522	AMC707523
								Ball	• AMC707538	AMC707539
AFS-20500	1/2	1/2	5/8	3	2	-	-	Square	• AMC700302	AMC700303
								0.015	• AMC700306	AMC700307
								0.030	• AMC700310	AMC700311
								0.060	• AMC700314	• AMC700315
								0.090	• AMC700318	AMC700319
								0.120	• AMC700322	AMC700323
								0.190	• AMC700330	AMC700331
Ball	• AMC700338	AMC700339								
AFM-20500	1/2	1/2	1 1/4	3	2	-	-	Square	• AMC700952	• AMC700953
								0.015	• AMC700956	AMC700957
								0.030	• AMC700960	• AMC700961
								0.060	• AMC700964	• AMC700965
								0.090	• AMC700968	• AMC700969
								0.120	• AMC700972	• AMC700973
								0.190	• AMC700980	AMC700981
Ball	• AMC700988	• AMC700989								
AFL-20500	1/2	1/2	2	4	2	-	-	Square	• AMC701602	AMC701603
								0.015	• AMC701606	AMC701607
								0.030	AMC701610	AMC701611
								0.060	• AMC701614	AMC701615
								0.090	• AMC701618	AMC701619
								0.120	AMC701622	AMC701623
								0.190	AMC701630	AMC701631
Ball	AMC701638	AMC701639								

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 14



# AF-2 & AFN-2

2 Flute

Aluminum 2 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC706302	AMC706303
								0.015	• AMC706306	AMC706307
								0.030	• AMC706310	AMC706311
								0.060	• AMC706314	AMC706315
								0.090	• AMC706318	AMC706319
								0.120	• AMC706322	AMC706323
								0.190	• AMC706330	AMC706331
AFNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC706952	AMC706953
								0.015	• AMC706956	AMC706957
								0.030	• AMC706960	AMC706961
								0.060	• AMC706964	AMC706965
								0.090	• AMC706968	AMC706969
								0.120	• AMC706972	AMC706973
								0.190	• AMC706980	AMC706981
AFNL-20500	1/2	1/2	5/8	6	2	4 1/8	.475	Square	• AMC707602	AMC707603
								0.015	• AMC707606	AMC707607
								0.030	• AMC707610	AMC707611
								0.060	• AMC707614	AMC707615
								0.090	AMC707618	AMC707619
								0.120	• AMC707622	AMC707623
								0.190	• AMC707630	AMC707631
AFS-20625	5/8	5/8	3/4	3	2	-	-	Square	• AMC700402	AMC700403
								0.030	• AMC700410	AMC700411
								0.060	AMC700414	AMC700415
								0.120	AMC700422	AMC700423
								0.250	AMC700434	AMC700435
								Ball	• AMC700438	AMC700439
								AFM-20625	5/8	5/8
0.030	• AMC701060	AMC701061								
0.060	AMC701064	AMC701065								
0.120	AMC701072	AMC701073								
0.250	AMC701084	AMC701085								
Ball	AMC701088	AMC701089								
AFL-20625	5/8	5/8	2 1/4	5	2	-	-			
								0.030	AMC701710	AMC701711
								0.060	AMC701714	AMC701715
								0.120	AMC701722	AMC701723
								0.250	AMC701734	AMC701735
								Ball	AMC701738	AMC701739
								AFNS-20625	5/8	5/8
0.030	• AMC706410	AMC706411								
0.060	• AMC706414	AMC706415								
0.120	AMC706422	AMC706423								
0.250	AMC706434	AMC706435								
Ball	• AMC706438	AMC706439								
AFNM-20625	5/8	5/8	3/4	5	2	3 1/8	.594			
								0.030	AMC707060	AMC707061
								0.060	AMC707064	AMC707065
								0.120	• AMC707072	AMC707073
								0.250	AMC707084	AMC707085
								Ball	• AMC707088	AMC707089

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 14



# AF-2 & AFN-2

## 2 Flute



Aluminum 2 Flute

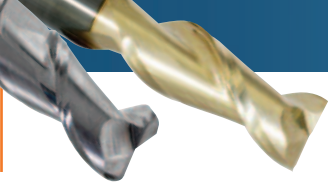
Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFNL-20625	5/8	5/8	3/4	6	2	4 1/8	.594	Square	AMC707702	AMC707703
								0.030	• AMC707710	AMC707711
								0.060	AMC707714	AMC707715
								0.120	AMC707722	AMC707723
								0.250	• AMC707734	AMC707735
AFS-20750	3/4	3/4	1	3	2	-	-	Ball	• AMC707738	AMC707739
								Square	• AMC700502	AMC700503
								0.030	• AMC700510	AMC700511
								0.060	• AMC700514	AMC700515
								0.090	AMC700518	AMC700519
AFM-20750	3/4	3/4	1 5/8	4	2	-	-	0.120	• AMC700522	AMC700523
								0.190	AMC700530	AMC700531
								0.250	• AMC700534	AMC700535
								Ball	• AMC700538	AMC700539
								Square	• AMC701152	AMC701153
AFL-20750	3/4	3/4	2 1/2	5	2	-	-	0.030	• AMC701160	AMC701161
								0.060	AMC701164	AMC701165
								0.090	AMC701168	AMC701169
								0.120	AMC701172	AMC701173
								0.190	• AMC701180	AMC701181
AFNS-20750	3/4	3/4	1	4	2	2 1/8	.713	0.250	• AMC701184	AMC701185
								Ball	• AMC701188	AMC701189
								Square	• AMC701802	AMC701803
								0.030	• AMC701810	AMC701811
								0.060	• AMC701814	AMC701815
AFNM-20750	3/4	3/4	1	5	2	3 1/8	.713	0.090	AMC701818	AMC701819
								0.120	AMC701822	AMC701823
								0.190	AMC701830	AMC701831
								0.250	AMC701834	AMC701835
								Ball	AMC701838	AMC701839
AFNL-20750	3/4	3/4	1	6	2	4 1/8	.713	Square	• AMC706502	AMC706503
								0.030	• AMC706510	AMC706511
								0.060	• AMC706514	AMC706515
								0.090	AMC706518	AMC706519
								0.120	• AMC706522	AMC706523
AFNL-20750	3/4	3/4	1	6	2	4 1/8	.713	0.190	• AMC706530	AMC706531
								0.250	• AMC706534	AMC706535
								Ball	• AMC706538	AMC706539
								Square	• AMC707152	AMC707153
								0.030	• AMC707160	AMC707161
AFNL-20750	3/4	3/4	1	6	2	4 1/8	.713	0.060	• AMC707164	AMC707165
								0.090	• AMC707168	AMC707169
								0.120	• AMC707172	AMC707173
								0.190	AMC707180	AMC707181
								0.250	• AMC707184	AMC707185
AFNL-20750	3/4	3/4	1	6	2	4 1/8	.713	Ball	• AMC707188	AMC707189
								Square	• AMC707802	AMC707803
								0.030	• AMC707810	AMC707811
								0.060	• AMC707814	AMC707815
								0.090	AMC707818	AMC707819
AFNL-20750	3/4	3/4	1	6	2	4 1/8	.713	0.120	• AMC707822	AMC707823
								0.190	AMC707830	AMC707831
								0.250	• AMC707834	AMC707835
								Ball	• AMC707838	AMC707839

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

[See Speed & Feed Chart Page 14](#)





# AF-2 & AFN-2

2 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFS-21000	1	1	1 1/4	4	2	-	-	Square	• AMC700602	AMC700603
								0.030	• AMC700610	AMC700611
								0.060	AMC700614	AMC700615
								0.120	AMC700622	AMC700623
								0.190	AMC700630	AMC700631
								0.250	AMC700634	AMC700635
AFM-21000	1	1	2 1/2	5	2	-	-	Square	• AMC701252	AMC701253
								0.030	• AMC701260	AMC701261
								0.060	AMC701264	AMC701265
								0.120	• AMC701272	AMC701273
								0.190	• AMC701280	AMC701281
								0.250	• AMC701284	AMC701285
AFL-21000	1	1	3 1/4	6	2	-	-	Square	AMC701902	AMC701903
								0.030	• AMC701910	AMC701911
								0.060	AMC701914	AMC701915
								0.120	AMC701922	AMC701923
								0.190	AMC701930	AMC701931
								0.250	AMC701934	AMC701935
AFNS-21000	1	1	1 1/4	5	2	2 1/8	.950	Square	• AMC706602	AMC706603
								0.030	• AMC706610	AMC706611
								0.060	• AMC706614	AMC706615
								0.120	• AMC706622	AMC706623
								0.190	• AMC706630	AMC706631
								0.250	• AMC706634	AMC706635
AFNM-21000	1	1	1 1/4	6	2	3 1/8	.950	Square	• AMC707252	AMC707253
								0.030	• AMC707260	AMC707261
								0.060	• AMC707264	AMC707265
								0.120	• AMC707272	AMC707273
								0.190	• AMC707280	AMC707281
								0.250	• AMC707284	AMC707285
AFNL-21000	1	1	1 1/4	7	2	4 1/8	.950	Square	AMC707902	AMC707903
								0.030	• AMC707910	AMC707911
								0.060	• AMC707914	AMC707915
								0.120	• AMC707922	AMC707923
								0.190	• AMC707930	AMC707931
								0.250	• AMC707934	AMC707935
								Ball	• AMC707288	AMC707289
								Ball	• AMC707938	AMC707939

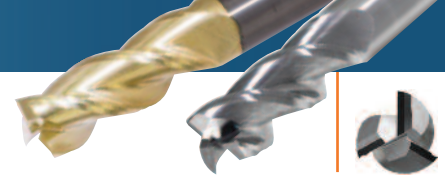
• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 14

# AF-3 & AFN-3

## 3 Flute

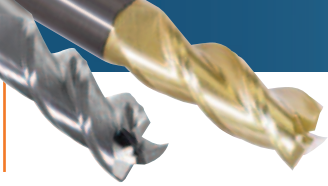


Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFS-30125	1/8	1/8	1/4	2	3	-	-	Square	• AMC400038	AMC400039
								0.010	AMC400040	AMC400041
								Ball	• AMC400042	AMC400043
AFM-30125	1/8	1/8	1/2	2	3	-	-	Square	• AMC400056	AMC400057
								0.010	AMC400058	AMC400059
								Ball	• AMC400060	AMC400061
AFS-30188	3/16	3/16	5/16	2	3	-	-	Square	• AMC400044	AMC400045
								0.010	AMC400046	AMC400047
								Ball	• AMC400048	AMC400049
AFM-30188	3/16	3/16	9/16	2 1/2	3	-	-	Square	• AMC400062	AMC400063
								0.010	AMC400064	AMC400065
								Ball	• AMC400066	AMC400067
AFL-30188	3/16	3/16	7/8	2 1/2	3	-	-	Square	• AMC400078	AMC400079
AFS-30250	1/4	1/4	3/8	2	3	-	-	Square	• AMC703102	AMC703103
								0.015	• AMC703106	AMC703107
								0.030	• AMC703110	AMC703111
								0.060	AMC703114	AMC703115
								0.090	AMC703118	AMC703119
								Ball	• AMC703138	AMC703139
AFM-30250	1/4	1/4	3/4	2	3	-	-	Square	• AMC703752	• AMC703753
								0.015	• AMC703756	AMC703757
								0.030	• AMC703760	AMC703761
								0.060	AMC703764	AMC703765
								0.090	AMC703768	AMC703769
								Ball	• AMC703788	AMC703789
AFL-30250	1/4	1/4	1 1/4	2 1/2	3	-	-	Square	• AMC704402	AMC704403
								0.015	• AMC704406	AMC704407
								0.030	AMC704410	AMC704411
								0.060	AMC704414	AMC704415
								0.090	AMC704418	AMC704419
								Ball	• AMC704438	AMC704439
AFNS-30250	1/4	1/4	3/8	4	3	1 1/2	.235	Square	• AMC709102	• AMC709103
								0.015	• AMC709106	AMC709107
								0.030	• AMC709110	AMC709111
								0.060	AMC709114	AMC709115
								0.090	AMC709118	AMC709119
								Ball	• AMC709138	AMC709139
AFNM-30250	1/4	1/4	3/8	4	3	1 3/4	.235	Square	• AMC709752	AMC709753
								0.015	• AMC709756	AMC709757
								0.030	• AMC709760	AMC709761
								0.060	AMC709764	AMC709765
								0.090	AMC709768	AMC709769
								Ball	• AMC709788	AMC709789
AFNL-30250	1/4	1/4	3/8	4	3	2 1/8	.235	Square	• AMC710402	AMC710403
								0.015	• AMC710406	AMC710407
								0.030	• AMC710410	• AMC710411
								0.060	AMC710414	AMC710415
								0.090	AMC710418	AMC710419
								Ball	• AMC710438	AMC710439
AFS-30313	5/16	5/16	9/16	2 1/2	3	-	-	Square	• AMC400050	AMC400051
								0.015	AMC400052	AMC400053
								Ball	• AMC400054	AMC400055
AFM-30313	5/16	5/16	13/16	2 1/2	3	-	-	Square	• AMC400068	AMC400069
								0.015	AMC400070	AMC400071
								Ball	• AMC400074	AMC400075
AFL-30313	5/16	5/16	1 1/4	3	3	-	-	Square	• AMC400080	AMC400081

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 14



# AF-3 & AFN-3

3 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFS-30375	3/8	3/8	1/2	2 1/2	3	-	-	Square	• AMC703202	AMC703203
								0.015	• AMC703206	AMC703207
								0.030	• AMC703210	AMC703211
								0.060	• AMC703214	AMC703215
								0.090	• AMC703218	AMC703219
								0.120	• AMC703222	AMC703223
								Ball	• AMC703238	AMC703239
AFM-30375	3/8	3/8	1	2 1/2	3	-	-	Square	• AMC703852	• AMC703853
								0.015	• AMC703856	AMC703857
								0.030	• AMC703860	AMC703861
								0.060	• AMC703864	AMC703865
								0.090	• AMC703868	AMC703869
								0.120	• AMC703872	AMC703873
								Ball	• AMC703888	AMC703889
AFL-30375	3/8	3/8	1 1/2	4	3	-	-	Square	• AMC704502	• AMC704503
								0.015	• AMC704506	AMC704507
								0.030	AMC704510	AMC704511
								0.060	AMC704514	AMC704515
								0.090	AMC704518	AMC704519
								0.120	• AMC704522	AMC704523
								Ball	• AMC704538	AMC704539
AFNS-30375	3/8	3/8	1/2	4	3	1 3/4	.353	Square	• AMC709202	AMC709203
								0.015	• AMC709206	AMC709207
								0.030	• AMC709210	AMC709211
								0.060	• AMC709214	AMC709215
								0.090	• AMC709218	AMC709219
								0.120	• AMC709222	AMC709223
								Ball	• AMC709238	AMC709239
AFNM-30375	3/8	3/8	1/2	4	3	2 1/4	.353	Square	• AMC709852	AMC709853
								0.015	• AMC709856	AMC709857
								0.030	• AMC709860	• AMC709861
								0.060	• AMC709864	AMC709865
								0.090	• AMC709868	AMC709869
								0.120	• AMC709872	AMC709873
								Ball	• AMC709888	AMC709889
AFNL-30375	3/8	3/8	1/2	5	3	2 3/4	.353	Square	• AMC710502	• AMC710503
								0.015	• AMC710506	AMC710507
								0.030	• AMC710510	AMC710511
								0.060	• AMC710514	AMC710515
								0.090	AMC710518	AMC710519
								0.120	• AMC710522	AMC710523
								Ball	• AMC710538	AMC710539
AFS-30500	1/2	1/2	5/8	3	3	-	-	Square	• AMC703302	AMC703303
								0.015	• AMC703306	AMC703307
								0.030	• AMC703310	AMC703311
								0.060	• AMC703314	AMC703315
								0.090	• AMC703318	AMC703319
								0.120	• AMC703322	AMC703323
								0.190	• AMC703330	AMC703331
Ball	• AMC703338	AMC703339								

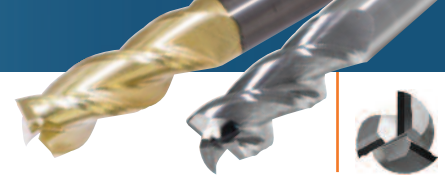
• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 14

# AF-3 & AFN-3

## 3 Flute



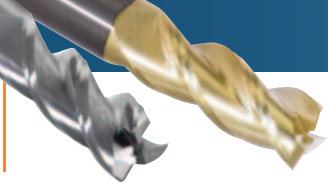
Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFM-30500	1/2	1/2	1 1/4	3	3	-	-	Square	• AMC703952	• AMC703953
								0.015	• AMC703956	AMC703957
								0.030	• AMC703960	AMC703961
								0.060	• AMC703964	AMC703965
								0.090	• AMC703968	AMC703969
								0.120	• AMC703972	AMC703973
								0.190	• AMC703980	AMC703981
								Ball	• AMC703988	AMC703989
AFL-30500	1/2	1/2	2	4	3	-	-	Square	• AMC704602	AMC704603
								0.015	• AMC704606	AMC704607
								0.030	• AMC704610	AMC704611
								0.060	• AMC704614	AMC704615
								0.090	AMC704618	AMC704619
								0.120	• AMC704622	AMC704623
								0.190	AMC704630	AMC704631
								Ball	AMC704638	AMC704639
AFX-30500	1/2	1/2	3 1/8	6	3	-	-	Square	AMC705252	AMC705253
								0.015	AMC705256	AMC705257
								0.030	AMC705260	AMC705261
								0.060	AMC705264	AMC705265
								0.090	AMC705268	AMC705269
								0.120	AMC705272	AMC705273
								0.190	AMC705280	AMC705281
								Ball	AMC705288	AMC705289
AFNS-30500	1/2	1/2	5/8	4	3	2 1/8	.475	Square	• AMC709302	• AMC709303
								0.015	• AMC709306	AMC709307
								0.030	• AMC709310	AMC709311
								0.060	• AMC709314	AMC709315
								0.090	• AMC709318	AMC709319
								0.120	• AMC709322	AMC709323
								0.190	• AMC709330	AMC709331
								Ball	• AMC709338	AMC709339
AFNM-30500	1/2	1/2	5/8	5	3	3 1/8	.475	Square	• AMC709952	• AMC709953
								0.015	• AMC709956	AMC709957
								0.030	• AMC709960	AMC709961
								0.060	• AMC709964	• AMC709965
								0.090	• AMC709968	AMC709969
								0.120	• AMC709972	AMC709973
								0.190	• AMC709980	AMC709981
								Ball	• AMC709988	AMC709989
AFNL-30500	1/2	1/2	5/8	6	3	4 1/8	.475	Square	• AMC710602	AMC710603
								0.015	• AMC710606	AMC710607
								0.030	• AMC710610	AMC710611
								0.060	• AMC710614	AMC710615
								0.090	AMC710618	AMC710619
								0.120	• AMC710622	AMC710623
								0.190	• AMC710630	AMC710631
								Ball	• AMC710638	AMC710639

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

[See Speed & Feed Chart Page 14](#)





# AF-3 & AFN-3

3 Flute

Aluminum 3 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFS-30625	5/8	5/8	3/4	3	3	-	-	Square	• AMC703402	AMC703403
								0.030	AMC703410	AMC703411
								0.060	AMC703414	AMC703415
								0.090	AMC703418	AMC703419
								0.120	AMC703422	AMC703423
								0.190	AMC703430	AMC703431
								0.250	AMC703434	AMC703435
AFM-30625	5/8	5/8	1 5/8	4	3	-	-	Square	• AMC704052	AMC704053
								0.030	• AMC704060	AMC704061
								0.060	AMC704064	AMC704065
								0.090	AMC704068	AMC704069
								0.120	AMC704072	AMC704073
								0.190	AMC704080	AMC704081
								0.250	AMC704084	AMC704085
AFL-30625	5/8	5/8	2 1/4	5	3	-	-	Square	• AMC704088	AMC704089
								0.030	• AMC704702	AMC704703
								0.060	• AMC704710	AMC704711
								0.090	AMC704714	AMC704715
								0.120	AMC704718	AMC704719
								0.190	AMC704722	AMC704723
								0.250	AMC704730	AMC704731
AFX-30625	5/8	5/8	3 1/4	6	3	-	-	Square	AMC704734	AMC704735
								0.030	AMC704738	AMC704739
								0.060	AMC705352	AMC705353
								0.090	AMC705360	AMC705361
								0.120	AMC709402	AMC709403
								0.190	• AMC709410	AMC709411
								0.250	AMC709414	AMC709415
AFNS-30625	5/8	5/8	3/4	4	3	2 1/8	.594	Square	• AMC709418	AMC709419
								0.030	• AMC709422	AMC709423
								0.060	AMC709430	AMC709431
								0.090	AMC709434	AMC709435
								0.120	• AMC709438	AMC709439
								0.190	• AMC710052	AMC710053
								0.250	• AMC710060	AMC710061
AFNM-30625	5/8	5/8	3/4	5	3	3 1/8	.594	Square	AMC710064	AMC710065
								0.030	AMC710068	AMC710069
								0.060	AMC710072	AMC710073
								0.090	• AMC710080	AMC710081
								0.120	• AMC710084	AMC710085
								0.190	• AMC710088	AMC710089
								0.250	• AMC710088	AMC710089
AFNL-30625	5/8	5/8	3/4	6	3	4 1/8	.594	Square	• AMC710702	AMC710703
								0.030	AMC710710	AMC710711
								0.060	• AMC710714	AMC710715
								0.090	AMC710718	AMC710719
								0.120	• AMC710722	AMC710723
								0.190	• AMC710730	AMC710731
								0.250	AMC710734	AMC710735
								Ball	• AMC710738	AMC710739

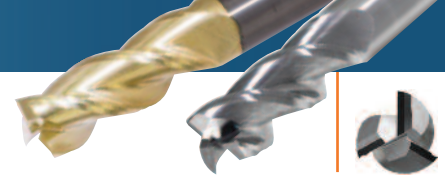
• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 14

# AF-3 & AFN-3

## 3 Flute

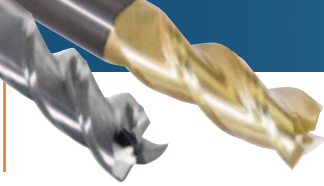


Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFS-30750	3/4	3/4	1	3	3	-	-	Square	• AMC703502	AMC703503
								0.030	• AMC703510	AMC703511
								0.060	• AMC703514	AMC703515
								0.090	AMC703518	AMC703519
								0.120	• AMC703522	AMC703523
								0.190	• AMC703530	AMC703531
								0.250	• AMC703534	AMC703535
								Ball	• AMC703538	AMC703539
AFM-30750	3/4	3/4	1 5/8	4	3	-	-	Square	• AMC704152	AMC704153
								0.030	• AMC704160	AMC704161
								0.060	• AMC704164	AMC704165
								0.090	• AMC704168	AMC704169
								0.120	• AMC704172	AMC704173
								0.190	AMC704180	AMC704181
								0.250	• AMC704184	AMC704185
								Ball	• AMC704188	AMC704189
AFL-30750	3/4	3/4	2 1/2	5	3	-	-	Square	• AMC704802	• AMC704803
								0.030	• AMC704810	AMC704811
								0.060	• AMC704814	AMC704815
								0.090	• AMC704818	AMC704819
								0.120	AMC704822	AMC704823
								0.190	AMC704830	AMC704831
								0.250	AMC704834	AMC704835
								Ball	AMC704838	AMC704839
AFX-30750	3/4	3/4	3 1/4	6	3	-	-	Square	• AMC705452	• AMC705453
								0.030	AMC705460	AMC705461
								0.060	AMC705464	AMC705465
								0.090	AMC705468	AMC705469
								0.120	AMC705472	AMC705473
								0.190	AMC705480	AMC705481
								0.250	AMC705484	AMC705485
								Ball	AMC705488	AMC705489
AFNS-30750	3/4	3/4	1	4	3	2 1/8	.713	Square	• AMC709502	AMC709503
								0.030	• AMC709510	AMC709511
								0.060	• AMC709514	AMC709515
								0.090	AMC709518	AMC709519
								0.120	• AMC709522	AMC709523
								0.190	• AMC709530	AMC709531
								0.250	• AMC709534	AMC709535
								Ball	AMC709538	AMC709539
AFNM-30750	3/4	3/4	1	5	3	3 1/8	.713	Square	• AMC710152	• AMC710153
								0.030	• AMC710160	AMC710161
								0.060	• AMC710164	AMC710165
								0.090	• AMC710168	AMC710169
								0.120	• AMC710172	AMC710173
								0.190	• AMC710180	AMC710181
								0.250	• AMC710184	AMC710185
								Ball	• AMC710188	AMC710189
AFNL-30750	3/4	3/4	1	6	3	4 1/8	.713	Square	• AMC710802	AMC710803
								0.030	• AMC710810	AMC710811
								0.060	• AMC710814	AMC710815
								0.090	• AMC710818	AMC710819
								0.120	• AMC710822	AMC710823
								0.190	• AMC710830	AMC710831
								0.250	• AMC710834	AMC710835
								Ball	• AMC710838	AMC710839

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 14



# AF-3 & AFN-3

3 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFS-31000	1	1	1 1/4	4	3	-	-	Square	• AMC703602	AMC703603
								0.030	• AMC703610	AMC703611
								0.060	• AMC703614	AMC703615
								0.120	• AMC703622	AMC703623
								0.190	• AMC703630	AMC703631
								0.250	• AMC703634	AMC703635
AFM-31000	1	1	2 1/2	5	3	-	-	Square	• AMC704252	• AMC704253
								0.030	• AMC704260	AMC704261
								0.060	• AMC704264	AMC704265
								0.120	• AMC704272	AMC704273
								0.190	• AMC704280	AMC704281
								0.250	• AMC704284	AMC704285
AFL-31000	1	1	3 1/4	6	3	-	-	Square	• AMC704902	AMC704903
								0.030	• AMC704910	AMC704911
								0.060	• AMC704914	AMC704915
								0.120	• AMC704922	AMC704923
								0.190	• AMC704930	AMC704931
								0.250	• AMC704934	AMC704935
AFX-31000	1	1	4 1/8	7	3	-	-	Square	• AMC705552	AMC705553
								0.030	• AMC705560	AMC705561
								0.060	• AMC705564	AMC705565
								0.120	• AMC705572	AMC705573
								0.190	• AMC705580	AMC705581
								0.250	• AMC705584	AMC705585
AFNS-31000	1	1	1 1/4	5	3	2 1/8	.950	Square	• AMC709602	AMC709603
								0.030	• AMC709610	AMC709611
								0.060	• AMC709614	AMC709615
								0.120	• AMC709622	AMC709623
								0.190	• AMC709630	AMC709631
								0.250	• AMC709634	AMC709635
AFNM-31000	1	1	1 1/4	6	3	3 1/8	.950	Square	• AMC710252	AMC710253
								0.030	• AMC710260	AMC710261
								0.060	• AMC710264	AMC710265
								0.120	• AMC710272	AMC710273
								0.190	• AMC710280	AMC710281
								0.250	• AMC710284	AMC710285
AFNL-31000	1	1	1 1/4	7	3	4 1/8	.950	Square	• AMC710902	AMC710903
								0.030	• AMC710910	AMC710911
								0.060	• AMC710914	AMC710915
								0.120	• AMC710922	AMC710923
								0.190	• AMC710930	AMC710931
								0.250	• AMC710934	AMC710935
AFNX-31000	1	1	1 1/4	7	3	4 5/8	.950	Square	• AMC710938	AMC710939
								0.030	• AMC710952	AMC710953
									• AMC710960	AMC710961

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 14

# AF Chart

ISO Grade	Material	Unit Power	SFM Range	Application	Recommended Starting Parameters									
					Rad DOC % of DIA	Axial DOC x DIA	SFM Starting	Chip Load Per Tooth						
								1/8	1/4	3/8	1/2	5/8	3/4	1
N	Aluminum	0.32	500 - 1500	Full Slotting	100%	1x	1000	.0015	.0027	.0043	.0056	.0070	.0085	.0112
				Heavy Profile	33%	1x	1200	.0019	.0035	.0055	.0071	.0089	.0108	.0143
				HEM* Profile	15%	2x	1200	.0027	.0049	.0077	.0100	.0125	.0152	.0200
				Finishing	5%	2x	1000	.0009	.0016	.0026	.0034	.0042	.0051	.0067
	Brass / Bronze	0.64	500 - 900	Full Slotting	100%	1x	600	.0013	.0023	.0034	.0046	.0057	.0069	.0091
				Heavy Profile	25%	1x	700	.0018	.0032	.0047	.0064	.0079	.0096	.0126
				HEM* Profile	15%	2x	700	.0025	.0045	.0066	.0089	.0111	.0134	.0177
				Finishing	5%	2x	600	.0007	.0012	.0017	.0023	.0029	.0035	.0046
	Copper Alloys	1	700 - 1000	Full Slotting	100%	1x	500	.0014	.0020	.0026	.0030	.0035	.0040	.0045
				Heavy Profile	25%	1x	600	.0019	.0028	.0036	.0042	.0048	.0055	.0062
				HEM* Profile	15%	2x	600	.0027	.0039	.0050	.0058	.0068	.0078	.0087
				Finishing	5%	2x	500	.0007	.0010	.0013	.0015	.0018	.0020	.0023
	Magnesium	0.16	500 - 900	Full Slotting	100%	1x	500	.0016	.0028	.0042	.0056	.0070	.0085	.0112
				Heavy Profile	33%	1x	700	.0020	.0036	.0054	.0071	.0089	.0108	.0143
				HEM* Profile	15%	2x	700	.0029	.0051	.0075	.0100	.0125	.0152	.0200
				Finishing	5%	2x	500	.0010	.0017	.0025	.0034	.0042	.0051	.0067

Remember to check horsepower requirements for your cut

Machine efficiency % ≈ 0.8

HEM\* = High Efficiency Machining

Radial Chip Thinning was applied to Chip Load Data

## MACHINING FORMULAS

**RPM** = (3.82 x SFM) / tool dia.

**SFM** = RPM x .262 x tool dia.

**FEED RATE (in/min)** = chipload x # flutes x RPM

**Material Removal Rate (in<sup>3</sup>/min)** = Feed Rate x ADoC x RDoC

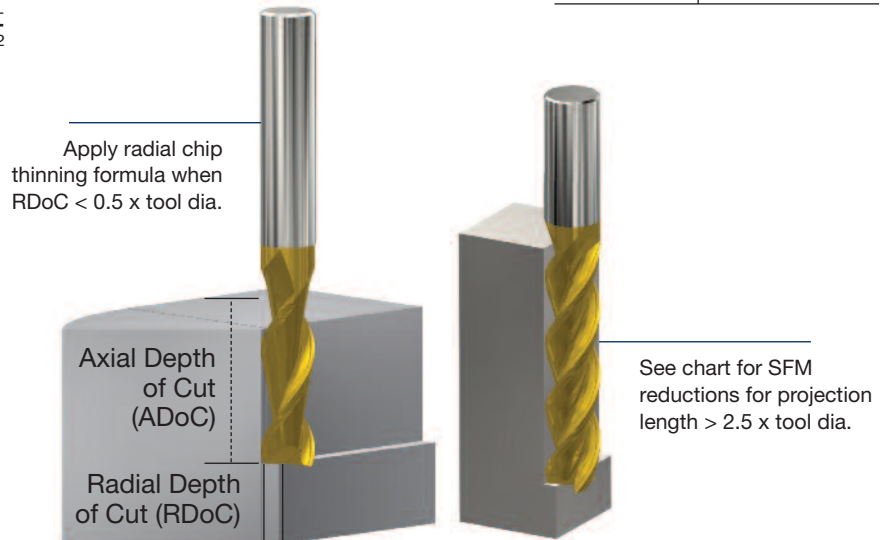
**Feed/Tooth (in)** = Feed Rate / (RPM x # Flutes)

**Required motor horsepower** = feed rate x axial doc x radial doc x unit power x machine efficiency %

$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

### REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER

PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%





## End Mills for Aluminum and other Non-Ferrous Applications (AFC Series)

*2 AND 3 FLUTE COOLANT THROUGH DESIGNS FOR SLOTTING AND FINISHING OPERATIONS*

2 flute tools with open flute geometry.

Slot over 15% faster with AFC series.

Unique coolant through design directs the coolant at the cutting edge. The coolant provides lubrication, dissipates heat and clears chips, which is especially important during deep cavity work.

Coolant at the cutting edge also contributes to superior finishes and prevents chips from adhering between the flutes.

Industry's largest selection of corner radii and neck and flute lengths in a standard program.

Available uncoated with high polished flutes & specialty coatings for Aluminum.

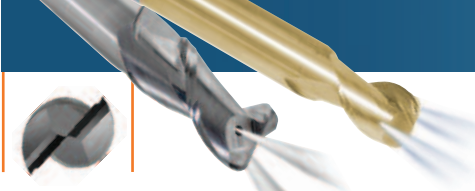


# AFC-2 & AFCN-2

## 2 Flute



Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZrN EDP #
AFCNS-20250	1/4	1/4	3/8	4	2	1 1/2	.235	Square	• AMC712102	AMC712103
								0.015	• AMC712106	AMC712107
								0.030	AMC712110	AMC712111
								0.060	AMC712114	AMC712115
								Ball	• AMC712138	AMC712139
AFCNM-20250	1/4	1/4	3/8	4	2	1 3/4	.235	Square	• AMC712752	AMC712753
								0.015	• AMC712756	AMC712757
								0.030	AMC712760	AMC712761
								0.060	AMC712764	AMC712765
								Ball	• AMC712788	AMC712789
AFCNL-20250	1/4	1/4	3/8	4	2	2 1/8	.235	Square	• AMC713402	AMC713403
								0.015	• AMC713406	AMC713407
								0.030	AMC713410	AMC713411
								0.060	AMC713414	AMC713415
								Ball	AMC713438	AMC713439
AFCM-20375	3/8	3/8	1	3	2	-	-	Square	• AMC717002	AMC717003
AFCNS-20375	3/8	3/8	1/2	4	2	1 3/4	.353	Square	• AMC712202	AMC712203
								0.015	• AMC712206	AMC712207
								0.030	AMC712210	AMC712211
								0.060	AMC712214	AMC712215
								0.090	AMC712218	AMC712219
AFCNM-20375	3/8	3/8	1/2	4	2	2 1/4	.353	Square	• AMC712238	AMC712239
								0.015	• AMC712238	AMC712239
								0.030	AMC712238	AMC712239
								0.060	AMC712238	AMC712239
								0.090	AMC712238	AMC712239
AFCNL-20375	3/8	3/8	1/2	5	2	2 3/4	.353	Square	• AMC712852	AMC712853
								0.015	• AMC712856	AMC712857
								0.030	AMC712860	AMC712861
								0.060	AMC712864	AMC712865
								0.090	AMC712868	AMC712869
AFCM-20500	1/2	1/2	1 1/4	3	2	-	-	Square	• AMC712872	AMC712873
								0.015	• AMC712888	AMC712889
								0.030	AMC712888	AMC712889
								0.060	AMC712888	AMC712889
								0.120	AMC712888	AMC712889
AFCNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC713502	AMC713503
								0.015	• AMC713506	AMC713507
								0.030	AMC713510	AMC713511
								0.060	AMC713514	AMC713515
								0.090	AMC713518	AMC713519
AFCNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC713522	AMC713523
								0.015	• AMC713522	AMC713523
								0.030	AMC713522	AMC713523
								0.060	AMC713522	AMC713523
								0.090	AMC713522	AMC713523
AFCNL-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC713538	AMC713539
								0.015	• AMC713538	AMC713539
								0.030	AMC713538	AMC713539
								0.060	AMC713538	AMC713539
								0.090	AMC713538	AMC713539
AFCM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC717006	AMC717007
								0.015	• AMC717008	AMC717009
								0.030	AMC717006	AMC717007
								0.060	AMC717006	AMC717007
								0.090	AMC717006	AMC717007
AFCNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC712302	AMC712303
								0.015	• AMC712306	AMC712307
								0.030	AMC712310	AMC712311
								0.060	AMC712314	AMC712315
								0.090	AMC712318	AMC712319
AFCNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712322	AMC712323
								0.015	• AMC712322	AMC712323
								0.030	AMC712322	AMC712323
								0.060	AMC712322	AMC712323
								0.090	AMC712322	AMC712323
AFCNL-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712332	AMC712333
								0.015	• AMC712332	AMC712333
								0.030	AMC712332	AMC712333
								0.060	AMC712332	AMC712333
								0.090	AMC712332	AMC712333
AFCM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712338	AMC712339
								0.015	• AMC712338	AMC712339
								0.030	AMC712338	AMC712339
								0.060	AMC712338	AMC712339
								0.090	AMC712338	AMC712339
AFCNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC712952	AMC712953
								0.015	• AMC712956	AMC712957
								0.030	• AMC712960	AMC712961
								0.060	AMC712964	AMC712965
								0.090	AMC712968	AMC712969
AFCNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712972	AMC712973
								0.015	• AMC712972	AMC712973
								0.030	• AMC712972	AMC712973
								0.060	• AMC712972	AMC712973
								0.090	• AMC712972	AMC712973
AFCNL-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712980	AMC712981
								0.015	• AMC712980	AMC712981
								0.030	• AMC712980	AMC712981
								0.060	• AMC712980	AMC712981
								0.090	• AMC712980	AMC712981
AFCM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNL-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNL-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNL-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNL-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNS-20500	1/2	1/2	5/8	4	2	2 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC712988	AMC712989
								0.030	• AMC712988	AMC712989
								0.060	• AMC712988	AMC712989
								0.090	• AMC712988	AMC712989
AFCNM-20500	1/2	1/2	5/8	5	2	3 1/8	.475	Square	• AMC712988	AMC712989
								0.015	• AMC71	



# AFC-2 & AFCN-2

2 Flute

Aluminum 2 Flute Coolant Through

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFCNL-20500	1/2	1/2	5/8	6	2	4 1/8	.475	Square	• AMC713602	AMC713603
								0.015	• AMC713606	AMC713607
								0.030	AMC713610	AMC713611
								0.060	AMC713614	AMC713615
								0.090	AMC713618	AMC713619
								0.120	AMC713622	AMC713623
								0.190	AMC713630	AMC713631
								Ball	• AMC713638	AMC713639
AFCNS-20625	5/8	5/8	3/4	4	2	2 1/8	.594	Square	• AMC712402	AMC712403
								0.030	• AMC712410	AMC712411
AFCNM-20625	5/8	5/8	3/4	6	2	3 1/8	.594	Square	• AMC713052	AMC713053
								0.030	• AMC713060	AMC713061
AFCNL-20625	5/8	5/8	3/4	6	2	4 1/8	.594	Square	• AMC713702	AMC713703
								0.030	• AMC713710	AMC713711
AFCM-20750	3/4	3/4	1 5/8	4	2	-	-	Square	• AMC717010	AMC717011
								0.030	• AMC717012	AMC717013
AFCNS-20750	3/4	3/4	1	4	2	2 1/8	.713	Square	• AMC712502	AMC712503
								0.030	• AMC712510	AMC712511
								0.060	AMC712514	AMC712515
								0.090	AMC712518	AMC712519
								0.120	AMC712522	AMC712523
								0.190	AMC712530	AMC712531
								0.250	AMC712534	AMC712535
								Ball	• AMC712538	AMC712539
AFCNM-20750	3/4	3/4	1	6	2	3 1/8	.713	Square	• AMC713152	AMC713153
								0.030	• AMC713160	AMC713161
								0.060	AMC713164	AMC713165
								0.090	AMC713168	AMC713169
								0.120	AMC713172	AMC713173
								0.190	AMC713180	AMC713181
								0.250	AMC713184	AMC713185
								Ball	AMC713188	AMC713189
AFCNL-20750	3/4	3/4	1	6	2	4 1/8	.713	Square	• AMC713802	AMC713803
								0.030	• AMC713810	AMC713811
								0.060	AMC713814	AMC713815
								0.090	AMC713818	AMC713819
								0.120	AMC713822	AMC713823
								0.190	AMC713830	AMC713831
								0.250	AMC713834	AMC713835
								Ball	AMC713838	AMC713839
AFCM-21000	1	1	2 1/2	5	2	-	-	Square	• AMC717014	AMC717015
								0.030	• AMC717016	AMC717017

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 21

# AFC-2 & AFCN-2

## 2 Flute



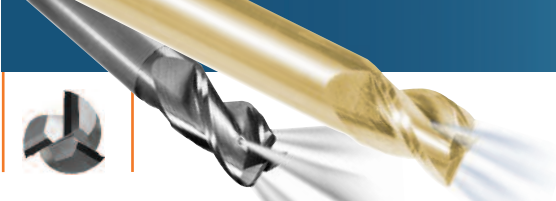
Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #
AFCNS-21000	1	1	1 1/4	5	2	2 1/8	.950	Square	• AMC712602	AMC712603
								0.030	• AMC712610	AMC712611
								0.060	AMC712614	AMC712615
								0.120	AMC712622	AMC712623
								0.190	AMC712630	AMC712631
								0.250	AMC712634	AMC712635
								Ball	AMC712638	AMC712639
AFCNM-21000	1	1	1 1/4	6	2	3 1/8	.950	Square	• AMC713252	AMC713253
								0.030	• AMC713260	AMC713261
								0.060	AMC713264	AMC713265
								0.120	AMC713272	AMC713273
								0.190	AMC713280	AMC713281
								0.250	AMC713284	AMC713285
								Ball	AMC713288	AMC713289
AFCNL-21000	1	1	1 1/4	7	2	4 1/8	.950	Square	• AMC713902	AMC713903
								0.030	• AMC713910	AMC713911
								0.060	AMC713914	AMC713915
								0.120	• AMC713922	AMC713923
								0.190	AMC713930	AMC713931
								0.250	AMC713934	AMC713935
								Ball	AMC713938	AMC713939

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

[See Speed & Feed Chart Page 21](#)





# AFC-3 & AFCN-3

3 Flute

Aluminum 3 Flute Coolant Through

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #	
AFCNS-30250	1/4	1/4	3/8	4	3	1 1/2	.235	Square	• AMC715102	AMC715103	
								0.015	• AMC715106	AMC715107	
								0.030	AMC715110	AMC715111	
								0.060	AMC715114	AMC715115	
								Ball	• AMC715138	AMC715139	
AFCNM-30250	1/4	1/4	3/8	4	3	1 3/4	.235	Square	• AMC715752	AMC715753	
								0.015	• AMC715756	AMC715757	
								0.030	AMC715760	AMC715761	
								0.060	AMC715764	AMC715765	
								Ball	• AMC715788	AMC715789	
AFCNL-30250	1/4	1/4	3/8	4	3	2 1/8	.235	Square	• AMC716402	AMC716403	
								0.015	• AMC716406	• AMC716407	
								0.030	AMC716410	AMC716411	
								0.060	AMC716414	AMC716415	
								Ball	• AMC716438	AMC716439	
AFCM-30375	3/8	3/8	1	3	3	-	-	Square	• AMC717018	AMC717019	
								0.015	• AMC717020	AMC717021	
AFCNS-30375	3/8	3/8	1/2	4	3	1 3/4	.353	Square	• AMC715202	AMC715203	
								0.015	• AMC715206	AMC715207	
								0.030	AMC715210	AMC715211	
								0.060	AMC715214	AMC715215	
								0.090	AMC715218	AMC715219	
								0.120	AMC715222	AMC715223	
AFCNM-30375	3/8	3/8	1/2	4	3	2 1/4	.353	Square	• AMC715238	AMC715239	
								0.015	• AMC715238	AMC715239	
								0.030	AMC715852	AMC715853	
								0.060	AMC715856	AMC715857	
								0.090	AMC715860	AMC715861	
								0.120	AMC715864	AMC715865	
AFCNL-30375	3/8	3/8	1/2	5	3	2 3/4	.353	Square	• AMC715868	AMC715869	
								0.015	AMC715872	AMC715873	
								0.030	Ball	AMC715888	AMC715889
								0.060	• AMC716502	AMC716503	
								0.090	• AMC716506	AMC716507	
								0.120	AMC716510	AMC716511	
AFCM-30500	1/2	1/2	1 1/4	3	3	-	-	Square	AMC716514	AMC716515	
								0.030	AMC716518	AMC716519	
								0.060	AMC716522	AMC716523	
								0.090	Ball	• AMC716538	AMC716539
								0.120	• AMC717022	AMC717023	
								0.190	• AMC717024	AMC717025	
AFCNS-30500	1/2	1/2	5/8	4	3	2 1/8	.475	Square	• AMC715302	AMC715303	
								0.015	• AMC715306	AMC715307	
								0.030	• AMC715310	AMC715311	
								0.060	• AMC715314	AMC715315	
								0.090	• AMC715318	AMC715319	
								0.120	AMC715322	AMC715323	
AFCNM-30500	1/2	1/2	5/8	5	3	3 1/8	.475	Square	• AMC715330	AMC715331	
								0.015	• AMC715334	AMC715335	
								0.030	• AMC715338	AMC715339	
								0.060	• AMC715952	AMC715953	
								0.090	• AMC715956	AMC715957	
								0.120	AMC715960	AMC715961	
								Square	AMC715964	AMC715965	
								0.030	AMC715968	AMC715969	
								0.060	AMC715972	AMC715973	
								0.090	AMC715976	AMC715977	
								0.120	AMC715980	AMC715981	
								0.190	Ball	• AMC715988	AMC715989

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 21

# AFC-3 & AFCN-3

## 3 Flute



Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	Uncoated EDP #	ZRN EDP #								
AFCNL-30500	1/2	1/2	5/8	6	3	4 1/8	.475	Square	• AMC716602	AMC716603								
								0.015	• AMC716606	AMC716607								
								0.030	AMC716610	AMC716611								
								0.060	AMC716614	AMC716615								
								0.090	AMC716618	AMC716619								
								0.120	AMC716622	AMC716623								
								0.190	AMC716630	AMC716631								
								Ball	• AMC716638	AMC716639								
								AFCNS-30625	5/8	5/8	3/4	4	3	2 1/8	.594	Square	• AMC715402	AMC715403
																0.030	• AMC715410	AMC715411
AFCNM-30625	5/8	5/8	3/4	6	3	3 1/8	.594									Square	• AMC716052	AMC716053
								0.030	• AMC716060	AMC716061								
								AFCNL-30625	5/8	5/8	3/4	6	3	4 1/8	.594	Square	• AMC713702	AMC716703
0.030	• AMC716710	AMC716711																
AFCM-30750	3/4	3/4	1 5/8	4	3	-	-									Square	• AMC717026	AMC717027
								0.030	• AMC717028	AMC717029								
								AFCNS-30750	3/4	3/4	1	4	3	2 1/8	.713	Square	• AMC715502	AMC715503
0.030	• AMC715510	AMC715511																
0.060	• AMC715514	AMC715515																
0.090	AMC715518	AMC715519																
0.120	AMC715522	AMC715523																
0.190	AMC715530	AMC715531																
0.250	AMC715534	AMC715535																
Ball	AMC715538	AMC715539																
AFCNM-30750	3/4	3/4	1	6	3	3 1/8	.713									Square	• AMC716152	AMC716153
																0.030	• AMC716160	AMC716161
								0.060	• AMC716164	AMC716165								
								0.090	AMC716168	AMC716169								
								0.120	• AMC716172	AMC716173								
								0.190	AMC716180	AMC716181								
								0.250	AMC716184	AMC716185								
								Ball	• AMC716188	AMC716189								
								AFCNL-30750	3/4	3/4	1	6	3	4 1/8	.713	Square	• AMC716802	AMC716803
																0.030	• AMC716810	AMC716811
0.060	AMC716814	AMC716815																
0.090	AMC716818	AMC716819																
0.120	• AMC716822	AMC716823																
0.190	AMC716830	AMC716831																
0.250	AMC716834	AMC716835																
Ball	• AMC716838	AMC716839																
AFCM-31000	1	1	2 1/2	5	3	-	-									Square	• AMC717030	AMC717031
																0.030	• AMC717032	AMC717033
AFCNS-31000	1	1	1 1/4	5	3	2 1/8	.950	Square	• AMC715602	AMC715603								
								0.030	• AMC715610	• AMC715611								
								0.060	AMC715614	AMC715615								
								0.120	AMC715622	AMC715623								
								0.190	AMC715630	AMC715631								
								0.250	• AMC715634	AMC715635								
AFCNM-31000	1	1	1 1/4	6	3	3 1/8	.950	Square	• AMC715638	AMC715639								
								0.030	• AMC716252	AMC716253								
								0.060	• AMC716260	AMC716261								
								0.120	AMC716264	AMC716265								
								0.190	• AMC716272	AMC716273								
								0.250	AMC716280	AMC716281								
AFCNL-31000	1	1	1 1/4	7	3	4 1/8	.950	Square	• AMC716284	AMC716285								
								0.030	• AMC716288	AMC716289								
								0.060	• AMC716902	AMC716903								
								0.120	• AMC716910	AMC716911								
								0.190	• AMC716914	AMC716915								
								0.250	AMC716922	AMC716923								
								0.190	AMC716930	AMC716931								
								0.250	AMC716934	AMC716935								
								Ball	AMC716938	AMC716939								

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 21

ISO Grade	Material	Unit Power	SFM Range	Application	Recommended Starting Parameters									
					Rad DOC % of DIA	Axial DOC x DIA	SFM Starting	Chip Load Per Tooth						
								1/4	3/8	1/2	5/8	3/4	1	
N	Aluminum	0.32	500 - 1500	Full Slotting	100%	1x	1000	.0032	.0051	.0067	.0084	.0100	.0130	
				Heavy Profile	33%	1x	1200	.0041	.0065	.0085	.0107	.0128	.0166	
				HEM* Profile	15%	2x	1200	.0057	.0091	.0120	.0150	.0179	.0232	
				Finishing	5%	2x	1000	.0019	.0031	.0040	.0050	.0060	.0078	
	Brass / Bronze	0.64	500 - 900	Full Slotting	100%	1x	600	.0026	.0039	.0053	.0065	.0079	.0105	
				Heavy Profile	25%	1x	700	.0036	.0054	.0073	.0090	.0109	.0145	
				HEM* Profile	15%	2x	700	.0050	.0076	.0103	.0126	.0153	.0204	
				Finishing	5%	2x	600	.0016	.0023	.0032	.0039	.0047	.0063	
	Copper Alloys	1	300-800	Full Slotting	100%	1x	400	.0024	.0031	.0036	.0042	.0048	.0054	
				Heavy Profile	25%	1x	600	.0033	.0043	.0050	.0058	.0067	.0075	
				HEM* Profile	15%	2x	600	.0047	.0060	.0070	.0081	.0093	.0105	
				Finishing	5%	2x	400	.0014	.0019	.0022	.0025	.0029	.0032	
	Magnesium	0.16	500 - 900	Full Slotting	100%	1x	500	.0032	.0043	.0067	.0084	.0100	.0130	
				Heavy Profile	25%	1x	700	.0041	.0055	.0085	.0107	.0128	.0166	
				HEM* Profile	15%	2x	700	.0057	.0077	.0120	.0150	.0179	.0232	
				Finishing	5%	2x	500	.0019	.0026	.0040	.0050	.0060	.0078	

Remember to check horsepower requirements for your cut  
Machine efficiency % ≈ 0.8

HEM\* = High Efficiency Machining  
Radial Chip Thinning was applied to Chip Load Data

### MACHINING FORMULAS

$$\text{RPM} = (3.82 \times \text{SFM}) / \text{tool dia.}$$

$$\text{SFM} = \text{RPM} \times .262 \times \text{tool dia.}$$

$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times \text{RPM}$$

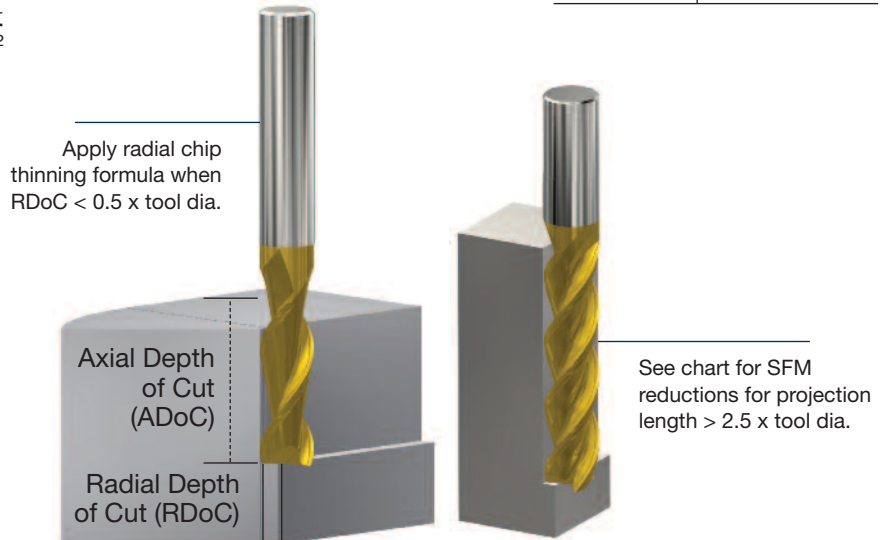
$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (\text{RPM} \times \# \text{ Flutes})$$

$$\text{Required motor horsepower} = \text{feed rate} \times \text{axial doc} \times \text{radial doc} \times \text{unit power} \times \text{machine efficiency} \%$$

$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER	
PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%



## Roughing End Mills for Aluminum and other Non-Ferrous Applications (AR Series)

*2 AND 3 FLUTE, NON – COOLANT THROUGH AND COOLANT THROUGH DESIGNS*

Designed for heavy material removal rates.

The sinusoidal chipbreaker pattern and open flute geometry are optimized to slot 30% faster than our standard AF series.

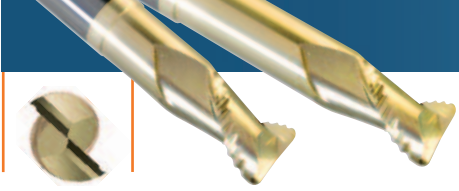
Unique coolant through design directs the coolant at the cutting edge. The coolant provides lubrication, dissipates heat and clears chips, which is especially important during deep cavity work.

Stock standard common aircraft corner radii.

Available with ZrN coating for Aluminum







# AR-2 & ARN-2

2 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ZRN EDP #
ARS-20375	3/8	3/8	1/2	3	2	-	-	0.030	• AMC800003
ARNS-20375	3/8	3/8	1/2	4	2	1 5/8	0.353	0.030	AMC800011
ARS-20500	1/2	1/2	5/8	3	2	-	-	0.030	• AMC800005
ARNS-20500	1/2	1/2	5/8	4	2	2 1/8	0.475	0.030	• AMC800013
								0.060	AMC800015
ARNM-20500	1/2	1/2	5/8	5	2	3 1/8	0.475	0.030	• AMC800025
								0.060	AMC800027
ARNL-20500	1/2	1/2	5/8	6	2	4 1/8	0.475	0.030	AMC800035
								0.060	AMC800037
ARS-20750	3/4	3/4	1	4	2	-	-	0.030	AMC800185
								0.060	• AMC800007
ARNS-20750	3/4	3/4	1	4	2	2 1/8	0.713	0.030	AMC800187
								0.060	• AMC800017
								0.120	AMC800019
ARNM-20750	3/4	3/4	1	6	2	3 1/8	0.713	0.030	AMC800189
								0.060	• AMC800029
								0.120	AMC800031
ARNL-20750	3/4	3/4	1	6	2	4 1/8	0.713	0.030	AMC800191
								0.060	AMC800039
								0.120	AMC800041
ARS-21000	1	1	1 1/4	4	2	-	-	0.030	AMC800193
								0.060	• AMC800009
ARNS-21000	1	1	1 1/4	5	2	2 1/8	0.950	0.030	AMC800195
								0.060	AMC800021
								0.120	AMC800023
ARNM-21000	1	1	1 1/4	6	2	3 1/8	0.950	0.030	AMC800197
								0.120	AMC800033
ARNL-21000	1	1	1 1/4	7	2	4 1/8	0.950	0.030	AMC800199
								0.120	AMC800043

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 27

## AR-3 &amp; ARN-3

## 3 Flute



Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ZRN EDP #
ARS-30375	3/8	3/8	1/2	3	3	-	-	0.030	• AMC800103
ARNS-30375	3/8	3/8	1/2	4	3	1 5/8	0.353	0.030	• AMC800111
ARS-30500	1/2	1/2	5/8	3	3	-	-	0.030	• AMC800105
ARNS-30500	1/2	1/2	5/8	4	3	2 1/8	0.475	0.030	• AMC800113
								0.060	AMC800115
ARNM-30500	1/2	1/2	5/8	5	3	3 1/8	0.475	0.030	• AMC800125
								0.060	AMC800127
ARNL-30500	1/2	1/2	5/8	6	3	4 1/8	0.475	0.030	AMC800135
								0.060	AMC800137
ARS-30750	3/4	3/4	1	4	3	-	-	0.030	• AMC800217
								0.060	• AMC800107
ARNS-30750	3/4	3/4	1	4	3	2 1/8	0.713	0.030	• AMC800219
								0.060	• AMC800117
								0.120	• AMC800119
ARNM-30750	3/4	3/4	1	6	3	3 1/8	0.713	0.030	• AMC800221
								0.060	• AMC800129
								0.120	AMC800131
ARNL-30750	3/4	3/4	1	6	3	4 1/8	0.713	0.030	• AMC800223
								0.060	• AMC800139
								0.120	AMC800141
ARS-31000	1	1	1 1/4	4	3	-	-	0.030	• AMC800225
								0.060	• AMC800109
ARNS-31000	1	1	1 1/4	5	3	2 1/8	0.950	0.030	• AMC800227
								0.060	• AMC800121
								0.120	AMC800123
ARNM-31000	1	1	1 1/4	6	3	3 1/8	0.950	0.030	AMC800229
								0.120	• AMC800133
ARNL-31000	1	1	1 1/4	7	3	4 1/8	0.950	0.030	AMC800231
								0.120	AMC800143

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed &amp; Feed Chart Page 27



# ARC-2 & ARCN-2

2 Flute

Aluminum 2 Flute Rougher Coolant Through

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ZRN EDP #
ARCS-20375	3/8	3/8	1/2	3	2	-	-	0.030	• AMC800045
ARCS-20500	1/2	1/2	5/8	3	2	-	-	0.030	• AMC800047
ARCNS-20500	1/2	1/2	5/8	4	2	2 1/8	0.475	0.030 0.060	AMC800053 AMC800055
ARCNM-20500	1/2	1/2	5/8	5	2	3 1/8	0.475	0.030 0.060	• AMC800065 AMC800067
ARCNL-20500	1/2	1/2	5/8	6	2	4 1/8	0.475	0.030 0.060	AMC800075 AMC800077
ARCS-20750	3/4	3/4	1	4	2	-	-	0.030 0.060	AMC800201 AMC800049
ARCNS-20750	3/4	3/4	1	4	2	2 1/8	0.713	0.030 0.060 0.120	AMC800203 • AMC800057 AMC800059
ARCNM-20750	3/4	3/4	1	6	2	3 1/8	0.713	0.030 0.060 0.120	AMC800205 • AMC800069 AMC800071
ARCNL-20750	3/4	3/4	1	6	2	4 1/8	0.713	0.030 0.060 0.120	AMC800207 AMC800079 AMC800081
ARCS-21000	1	1	1 1/4	4	2	-	-	0.030 0.060	AMC800209 AMC800051
ARCNS-21000	1	1	1 1/4	5	2	2 1/8	0.950	0.030 0.060 0.120	AMC800211 • AMC800061 AMC800063
ARCNM-21000	1	1	1 1/4	6	2	3 1/8	0.950	0.030 0.120	AMC800213 AMC800073
ARCNL-21000	1	1	1 1/4	7	2	4 1/8	0.950	0.030 0.120	AMC800215 AMC800083

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 27

# ARC-3 & ARCN-3

## 3 Flute



Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ZRN EDP #
ARCS-30375	3/8	3/8	1/2	3	3	-	-	0.030	• AMC800145
ARCS-30500	1/2	1/2	5/8	3	3	-	-	0.030	• AMC800147
ARCNS-30500	1/2	1/2	5/8	4	3	2 1/8	0.475	0.030 0.060	• AMC800153 AMC800155
ARCNM-30500	1/2	1/2	5/8	5	3	3 1/8	0.475	0.030 0.060	• AMC800165 AMC800167
ARCNL-30500	1/2	1/2	5/8	6	3	4 1/8	0.475	0.030 0.060	AMC800175 AMC800177
ARCS-30750	3/4	3/4	1	4	3	-	-	0.030 0.060	AMC800233 • AMC800149
ARCNS-30750	3/4	3/4	1	4	3	2 1/8	0.713	0.030 0.060 0.120	AMC800235 • AMC800157 AMC800159
ARCNM-30750	3/4	3/4	1	6	3	3 1/8	0.713	0.030 0.060 0.120	AMC800237 • AMC800169 AMC800171
ARCNL-30750	3/4	3/4	1	6	3	4 1/8	0.713	0.030 0.060 0.120	AMC800239 AMC800179 AMC800181
ARCS-31000	1	1	1 1/4	4	3	-	-	0.030 0.060	AMC800241 AMC800151
ARCNS-31000	1	1	1 1/4	5	3	2 1/8	0.950	0.030 0.060 0.120	AMC800243 • AMC800161 AMC800163
ARCNM-31000	1	1	1 1/4	6	3	3 1/8	0.950	0.030 0.120	AMC800245 • AMC800173
ARCNL-31000	1	1	1 1/4	7	3	4 1/8	0.950	0.030 0.120	AMC800247 • AMC800183

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 27

ISO Grade	Material	Unit Power	SFM Range	Application	Recommended Starting Parameters						
					Rad DOC % of DIA	Axial DOC x DIA	SFM Starting	Chip Load Per Tooth			
								3/8	1/2	3/4	1
N	Aluminum	0.32	500 - 1500	Full Slotting	100%	1x	1000	.0060	.0080	.0120	.0156
				Heavy Profile	33%	1x	1200	.0077	.0102	.0153	.0199
				Profile	15%	1x	1200	.0107	.0143	.0214	.0279
	Brass / Bronze	0.64	500 - 900	Full Slotting	100%	1x	500	.0046	.0063	.0094	.0126
				Heavy Profile	33%	1x	700	.0059	.0080	.0120	.0161
				Profile	15%	1x	700	.0082	.0113	.0168	.0225
	Copper Alloys	1	700 - 1000	Full Slotting	100%	1x	400	.0038	.0043	.0058	.0065
				Heavy Profile	33%	1x	600	.0048	.0055	.0074	.0083
				Profile	15%	1x	600	.0068	.0077	.0104	.0116
	Magnesium	0.16	500 - 900	Full Slotting	100%	1x	500	.0051	.0080	.0120	.0155
				Heavy Profile	33%	1x	700	.0065	.0102	.0153	.0198
				Profile	15%	1x	700	.0091	.0143	.0214	.0277

# ARC Chart

ISO Grade	Material	Unit Power	SFM Range	Application	Recommended Starting Parameters						
					Rad DOC % of DIA	Axial DOC x DIA	SFM Starting	Chip Load Per Tooth			
								3/8	1/2	3/4	1
N	Aluminum		500 - 1500	Full Slotting	100%	1x	1000	.0066	.0088	.0132	.0170
				Heavy Profile	33%	1x	1200	.0084	.0112	.0168	.0217
				Profile	15%	1x	1200	.0118	.0157	.0236	.0304
	Brass / Bronze		500 - 900	Full Slotting	100%	1x	500	.0050	.0069	.0103	.0138
				Heavy Profile	33%	1x	700	.0064	.0088	.0131	.0176
				Profile	15%	1x	700	.0089	.0123	.0184	.0247
	Copper Alloys		700 - 1000	Full Slotting	100%	1x	400	.0041	.0047	.0063	.0071
				Heavy Profile	33%	1x	600	.0052	.0060	.0080	.0091
				Profile	15%	1x	600	.0073	.0084	.0113	.0127
	Magnesium		500 - 900	Full Slotting	100%	1x	500	.0056	.0088	.0132	.0170
				Heavy Profile	33%	1x	700	.0071	.0112	.0168	.0217
				Profile	15%	1x	700	.0100	.0157	.0236	.0304

Remember to check horsepower requirements for your cut  
Machine efficiency % ≈ 0.8

HEM\* = High Efficiency Machining  
Radial Chip Thinning was applied to Chip Load Data

### MACHINING FORMULAS

$$RPM = (3.82 \times SFM) / \text{tool dia.}$$

$$SFM = RPM \times .262 \times \text{tool dia.}$$

$$FEED RATE (\text{in}/\text{min}) = \text{chipload} \times \# \text{ flutes} \times RPM$$

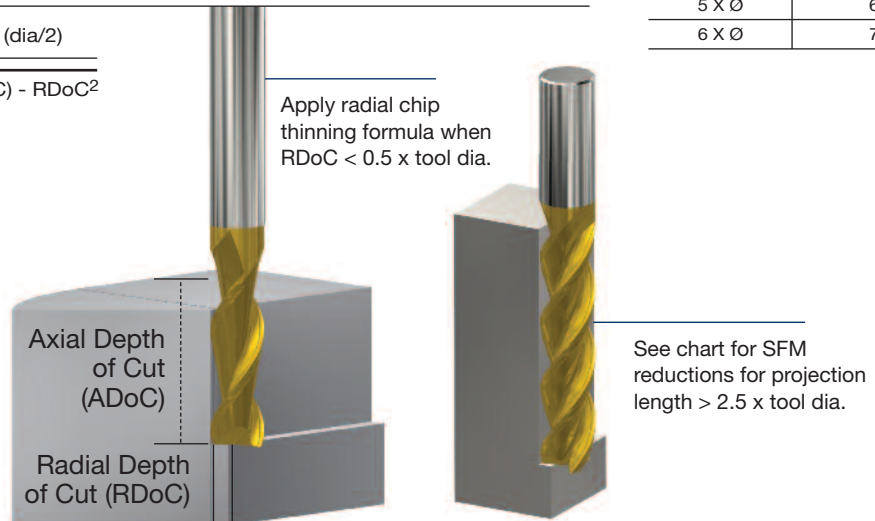
$$\text{Material Removal Rate } (\text{in}^3/\text{min}) = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (RPM \times \# \text{ Flutes})$$

$$\text{Required motor horsepower} = \text{feed rate} \times \text{axial doc} \times \text{radial doc} \times \text{unit power} \times \text{machine efficiency \%}$$

$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER	
PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%





## End Mills for Exotic Metal & Stainless Steel Applications (TV-4 Series)

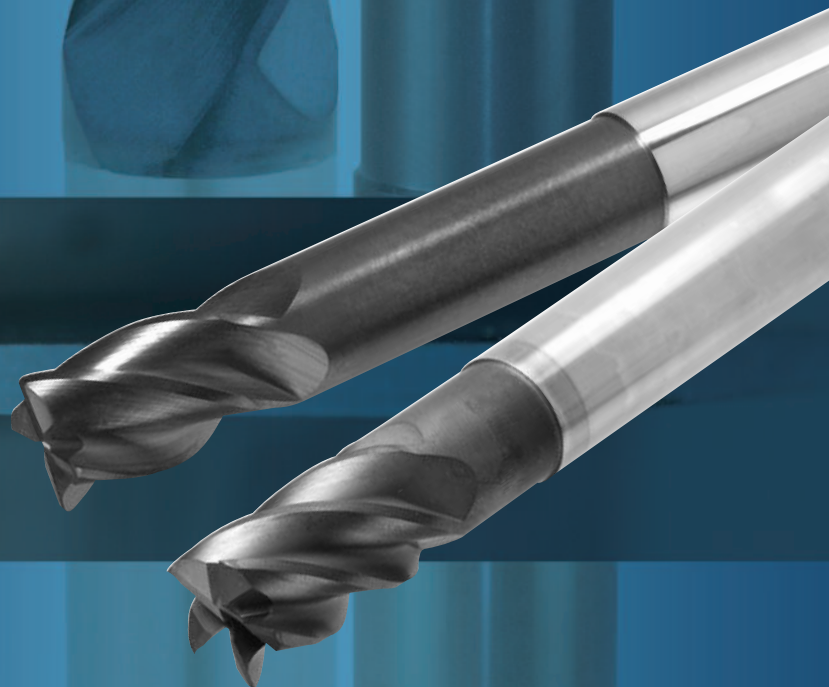
*4 FLUTE DESIGNS FOR SLOTTING, ROUGHING, AND SEMI-FINISHING*

High metal removal rates due to variable flute indexing that reduce cutting forces and chatter.

Longer length tools incorporate a large core diameter that further prevents chatter from deflection.

Industry's largest selection of corner radii and neck and flute lengths in a standard program.

Coated with ENDURASpeed.





# TV-4 & TVN-4

4 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TVS-40125	1/8	1/8	1/4	2	4	-	-	Square	• EMC400002
								0.010	EMC400004
TVM-40125	1/8	1/8	1/2	2 1/2	4	-	-	Square	• EMC400020
								0.010	EMC400022
TVS-40188	3/16	3/16	5/16	2	4	-	-	Square	• EMC400008
								0.010	EMC400010
TVM-40188	3/16	3/16	5/8	2 1/2	4	-	-	Square	• EMC400026
								0.010	EMC400028
TVS-40250	1/4	1/4	3/8	2	4	-	-	Square	• EMC601604
								0.015	• EMC601734
								0.030	• EMC601624
								0.060	EMC601640
TVM-40250	1/4	1/4	3/4	2 1/2	4	-	-	Square	• EMC601904
								0.015	• EMC602034
								0.030	• EMC601924
								0.060	EMC601940
TVNS-40250	1/4	1/4	3/8	4	4	2 1/8	.235	Square	• EMC602504
								0.015	• EMC602616
								0.030	• EMC602522
								0.060	EMC602536
TVNM-40250	1/4	1/4	3/8	4	4	2 1/2	.235	Square	EMC602804
								0.015	EMC602916
								0.030	• EMC602822
								0.060	EMC602836
TVNL-40250	1/4	1/4	3/8	4	4	3 1/8	.235	Square	EMC603204
								0.015	EMC603316
								0.030	• EMC603222
								0.060	EMC603236
TVS-40313	5/16	5/16	9/16	2 1/2	4	-	-	Square	• EMC400014
								0.015	EMC400016
TVM-40313	5/16	5/16	13/16	2 1/2	4	-	-	Square	• EMC400032
								0.015	EMC400034
TVS-40375	3/8	3/8	1/2	2	4	-	-	Square	• EMC601608
								0.015	• EMC601738
								0.030	• EMC601628
								0.060	• EMC601644
								0.090	• EMC601660
								0.120	• EMC601672

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 34

# TV-4 & TVN-4

## 4 Flute



Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TVM-40375	3/8	3/8	1 1/8	2 1/2	4	-	-	Square	• EMC601908
								0.015	• EMC602038
								0.030	• EMC601928
								0.060	• EMC601944
								0.090	• EMC601960
								0.120	• EMC601972
TVNS-40375	3/8	3/8	1/2	4	4	2 1/4	.353	Square	• EMC602508
								0.015	• EMC602620
								0.030	• EMC602526
								0.060	• EMC602540
								0.090	• EMC602554
								0.120	• EMC602564
TVNM-40375	3/8	3/8	1/2	4	4	2 5/8	.353	Square	• EMC602808
								0.015	EMC602920
								0.030	• EMC602826
								0.060	• EMC602840
								0.090	EMC602854
								0.120	EMC602864
TVNL-40375	3/8	3/8	1/2	6	4	3 1/4	.353	Square	EMC603208
								0.015	EMC603320
								0.030	• EMC603226
								0.060	EMC603240
								0.090	EMC603254
								0.120	EMC603264
TVS-40500	1/2	1/2	5/8	2 1/2	4	-	-	Square	• EMC601612
								0.015	• EMC601742
								0.030	• EMC601632
								0.060	• EMC601648
								0.090	• EMC601664
								0.120	• EMC601676
TVM-40500	1/2	1/2	1 1/4	3	4	-	-	Square	• EMC601912
								0.015	• EMC602042
								0.030	• EMC601932
								0.060	• EMC601948
								0.090	• EMC601964
								0.120	• EMC601976
								0.190	• EMC601996

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 34



# TV-4 & TVN-4

4 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TVNS-40500	1/2	1/2	5/8	4	4	2 3/8	.475	Square	• EMC602512
								0.015	• EMC602624
								0.030	• EMC602530
								0.060	• EMC602544
								0.090	• EMC602558
								0.120	EMC602568
TVNM-40500	1/2	1/2	5/8	6	4	3 1/8	.475	Square	EMC602812
								0.015	• EMC602924
								0.030	• EMC602830
								0.060	• EMC602844
								0.090	• EMC602858
								0.120	• EMC602868
TVNL-40500	1/2	1/2	5/8	6	4	4 1/8	.475	Square	EMC603212
								0.015	EMC603324
								0.030	EMC603230
								0.060	EMC603244
								0.090	EMC603258
								0.120	EMC603268
TVS-40625	5/8	5/8	3/4	3	4	-	-	Square	• EMC601614
								0.030	• EMC601634
								0.060	EMC601650
								0.120	EMC601678
								0.190	EMC601698
								0.250	EMC601704
TVM-40625	5/8	5/8	1 5/8	3 1/2	4	-	-	Square	EMC601914
								0.030	• EMC601934
								0.060	• EMC601950
								0.120	• EMC601978
								0.190	EMC601998
								0.250	EMC602004
TVNS-40625	5/8	5/8	3/4	4	4	2 3/8	0.594	Square	• EMC602632
								0.030	• EMC602634
								0.060	• EMC602636
								0.120	EMC602640
								0.190	EMC602644
								0.250	EMC602646

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 34

# TV-4 & TVN-4

## 4 Flute



Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TVNM-40625	5/8	5/8	3/4	6	4	3 1/8	0.594	Square	EMC602932
								0.030	• EMC602934
								0.060	• EMC602936
								0.120	EMC602940
								0.190	EMC602944
								0.250	EMC602946
TVS-40750	3/4	3/4	1 1/8	3	4	-	-	Square	• EMC601616
								0.030	• EMC601636
								0.060	• EMC601652
								0.090	• EMC601668
								0.120	• EMC601680
								0.190	EMC601700
TVM-40750	3/4	3/4	1 5/8	4	4	-	-	Square	• EMC601916
								0.030	• EMC601936
								0.060	• EMC601952
								0.090	• EMC601968
								0.120	• EMC601980
								0.190	• EMC602000
TVNS-40750	3/4	3/4	1 1/8	4	4	2 1/2	.713	Square	• EMC602514
								0.030	• EMC602532
								0.060	• EMC602546
								0.090	• EMC602560
								0.120	• EMC602570
								0.190	EMC602592
TVNM-40750	3/4	3/4	1 1/8	6	4	3 1/8	.713	Square	• EMC602814
								0.030	• EMC602832
								0.060	• EMC602846
								0.090	• EMC602860
								0.120	• EMC602870
								0.190	EMC602886
TVNL-40750	3/4	3/4	1 1/8	6	4	4 1/8	.713	Square	EMC603214
								0.030	EMC603232
								0.060	• EMC603246
								0.090	EMC603260
								0.120	EMC603270
								0.190	EMC603286
								0.250	• EMC603290

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 34





# TV-4 & TVN-4

4 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TVS-41000	1	1	1 1/4	3	4	-	-	Square	EMC601618
								0.030	EMC601638
								0.060	EMC601654
								0.120	• EMC601682
								0.190	EMC601702
TVM-41000	1	1	2	4	4	-	-	Square	EMC601918
								0.030	• EMC601938
								0.060	• EMC601954
								0.120	• EMC601982
								0.190	EMC602002
TVNS-41000	1	1	1 1/4	5	4	2 1/2	.950	Square	EMC602516
								0.030	• EMC602534
								0.060	EMC602548
								0.120	• EMC602572
								0.190	EMC602594
TVNM-41000	1	1	1 1/4	6	4	3 1/8	.950	Square	EMC602816
								0.030	EMC602834
								0.060	• EMC602848
								0.120	• EMC602872
								0.190	EMC602888
TVNL-41000	1	1	1 1/4	7	4	4 1/8	.950	Square	EMC603216
								0.030	EMC603234
								0.060	EMC603248
								0.120	• EMC603272
								0.190	EMC603288
								0.250	• EMC603292

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 34

### MACHINING FORMULAS

$$RPM = (3.82 \times SFM) / \text{tool dia.}$$

$$SFM = RPM \times .262 \times \text{tool dia.}$$

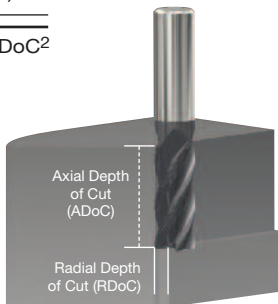
$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times RPM$$

$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

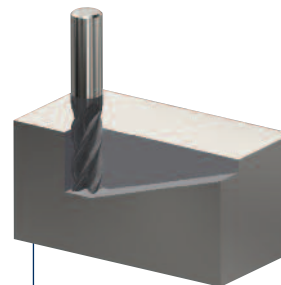
$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (RPM \times \# \text{ Flutes})$$

$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER	
PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%



Apply radial chip thinning formula when RDoC < 0.5 x tool dia.



Ramp Angle = 1° - 3°  
Reduce chipload by 20% of slotting rates.



See chart for SFM reductions for projection length > 2.5 x tool dia.

# TV-4 Chart

ISO Grade	Material / Grade	SFM Hardness		Application	Recommended Starting Parameters (< 32Rc)									
		< 32Rc	> 32Rc		Rad DOC % of DIA	Axial DOC x DIA	SFM Starting (<32Rc)	Chip Load Per Tooth						
								1/8	1/4	3/8	1/2	5/8	3/4	1
P	<b>Carbon Steel</b> 10XX, 11XX 12XX, 15XX	340 - 480	120 - 200	Full Slotting	100%	.5x	400	.0006	.0012	.0018	.0022	.0027	.0032	.0037
		280 - 520	120 - 200	Heavy Profile	33%	1.25x	450	.0008	.0015	.0022	.0027	.0033	.0039	.0047
		500 - 850	225 - 325	HEM* Profile	15%	2x	550	.0011	.0021	.0031	.0038	.0046	.0054	.0066
		280 - 360	160 - 240	Finishing	2-5%	2x	325	.0006	.0012	.0018	.0022	.0027	.0032	.0037
	<b>Alloy Steel</b> 13XX, 40XX, 41XX, 43XX 44XX, 46XX, 47XX, 48XX	220 - 320	80 - 160	Full Slotting	100%	.5x	300	.0006	.0012	.0018	.0022	.0027	.0032	.0037
		240 - 360	120 - 180	Heavy Profile	33%	1.25x	325	.0008	.0015	.0022	.0027	.0033	.0039	.0047
		450 - 750	175 - 300	HEM* Profile	15%	2x	500	.0011	.0021	.0031	.0038	.0046	.0054	.0066
		300 - 360	160 - 200	Finishing	2-5%	2x	325	.0006	.0012	.0018	.0022	.0027	.0032	.0037
	<b>Mold &amp; Die Steel</b> 300M, 4340, 52100, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	180 - 260	60 - 120	Full Slotting	100%	.5x	225	.0003	.0009	.0013	.0017	.0021	.0025	.0029
		180 - 300	60 - 120	Heavy Profile	33%	1.25x	275	.0004	.0011	.0016	.0021	.0026	.0030	.0037
		350 - 500	150 - 275	HEM* Profile	10%	2x	400	.0006	.0019	.0026	.0035	.0043	.0051	.0062
		240 - 320	100 - 180	Finishing	2-5%	2x	300	.0003	.0009	.0013	.0017	.0021	.0025	.0029
<b>Tool Steel</b> PM STEELS	100 - 220		Full Slotting	100%	.5x	200	.0004	.0008	.0016	.0020	.0024	.0028	.0032	
	140 - 260		Heavy Profile	25%	1.25x	230	.0006	.0011	.0021	.0027	.0032	.0037	.0044	
	275 - 475		HEM* Profile	10%	2x	350	.0009	.0018	.0035	.0044	.0053	.0061	.0074	
	200 - 280		Finishing	2-5%	2x	250	.0004	.0008	.0016	.0020	.0024	.0028	.0032	
M	<b>Austenitic Stainless</b> 301, 302, 303, 304/304L/304H, 316/316L, 317L, 321/321H, 347/347H, Nitronic, 309/309S, 310/310S/310H, 330	130 - 210	60 - 130	Full Slotting	100%	.75x	175	.0005	.0010	.0018	.0022	.0026	.0030	.0035
		160 - 220	60 - 130	Heavy Profile	33%	1.25x	200	.0006	.0013	.0022	.0026	.0032	.0036	.0045
		300 - 500	150 - 275	HEM* Profile	15%	2x	400	.0009	.0018	.0031	.0037	.0045	.0051	.0063
		160 - 220	115 - 180	Finishing	2-5%	2x	200	.0005	.0010	.0018	.0022	.0026	.0030	.0035
	<b>Martensitic Stainless</b> 403, 405, 409, 410/410S/410HT, 416/416HT, 420, 422, 430, 440C	160 - 260	80 - 200	Full Slotting	100%	.5x	225	.0003	.0008	.0014	.0018	.0022	.0026	.0030
		180 - 280	80 - 200	Heavy Profile	25%	1.25x	250	.0004	.0010	.0019	.0024	.0029	.0035	.0042
		275 - 450	125 - 250	HEM* Profile	10%	2x	400	.0007	.0017	.0031	.0040	.0049	.0058	.0069
		200 - 280	120 - 220	Finishing	2-5%	2x	250	.0003	.0008	.0014	.0018	.0022	.0026	.0030
	<b>Precipitation Stainless</b> 13-8 PH, 15-5 PH, 15-7 PH 17-4 PH, 17-7 PH S143	130 - 180	80 - 160	Full Slotting	100%	.5x	150	.0003	.0008	.0015	.0019	.0022	.0026	.0030
		145 - 200	80 - 100	Heavy Profile	25%	1.25x	175	.0004	.0011	.0020	.0025	.0029	.0034	.0042
		225 - 450	125 - 250	HEM* Profile	10%	2x	400	.0007	.0018	.0034	.0042	.0049	.0057	.0069
		200 - 260	120 - 220	Finishing	2-5%	2x	225	.0003	.0008	.0015	.0019	.0022	.0026	.0030
K	<b>Cast Iron Grey</b> 20A, 25A, 30A, 35A, 40A, 45A, 50A	200 - 320	110 - 240	Full Slotting	100%	.5x	300	.0004	.0011	.0019	.0023	.0028	.0032	.0036
		200 - 360	140 - 240	Heavy Profile	33%	1.25x	325	.0005	.0014	.0023	.0028	.0034	.0038	.0046
		300 - 550	350 - 500	HEM* Profile	10%	2x	500	.0009	.0023	.0039	.0047	.0056	.0064	.0077
		240 - 320	240 - 320	Finishing	2-5%	2x	300	.0004	.0011	.0019	.0023	.0028	.0032	.0036
	<b>Cast Ductile / Nodular</b> 40010, 60-40-18, 65-45-12 32510, 32518	100 - 240	80 - 140	Full Slotting	100%	.5x	225	.0004	.0008	.0016	.0020	.0024	.0028	.0032
		200 - 280	100 - 150	Heavy Profile	33%	1.25x	250	.0005	.0009	.0019	.0024	.0028	.0033	.0038
		300 - 500	170 - 270	HEM* Profile	10%	2x	450	.0018	.0035	.0057	.0059	.0068	.0092	.0101
		220 - 320	140 - 200	Finishing	2-5%	2x	300	.0005	.0009	.0019	.0022	.0026	.0030	.0035
S	<b>Cobalt Base</b> Haynes 21, 25, L-605, Mar-M302, NASA Co-W-Re Stellite, Ultimet	60 - 100	30 - 80	Full Slotting	100%	.3x	80	.0002	.0005	.0010	.0013	.0016	.0019	.0022
		60 - 100	30 - 80	Heavy Profile	20%	.75x	80	.0003	.0008	.0014	.0019	.0023	.0027	.0033
		150 - 210	80 - 100	HEM* Profile	8%	1.25x	170	.0006	.0014	.0026	.0034	.0042	.0050	.0061
		70 - 100	70 - 90	Finishing	2-5%	1.5x	80	.0002	.0005	.0010	.0013	.0016	.0019	.0022
	<b>Iron Base</b> A-286, Discaloy Incoloy 800-802, Multimet 16-25-6	50 - 80	30 - 60	Full Slotting	100%	.2x	70	.0003	.0008	.0015	.0019	.0022	.0026	.0030
		70 - 120	30 - 60	Heavy Profile	20%	.75x	100	.0005	.0012	.0022	.0027	.0032	.0037	.0045
		100 - 160	60 - 80	HEM* Profile	80%	1.25x	140	.0008	.0022	.0040	.0050	.0058	.0068	.0083
		70 - 100	50 - 70	Finishing	2-5%	1.5x	80	.0003	.0008	.0015	.0019	.0022	.0026	.0030
	<b>Nickel Base</b> Hastelloy, Haynes 242, Inconel 600, 625, 718, Invar, Kovar, Monel, Nimonic, Rene 41, 77, 95, Udimet, Waspaloy	60 - 80	30 - 70	Full Slotting	100%	.2x	70	.0002	.0005	.0010	.0013	.0016	.0019	.0022
		60 - 100	30 - 80	Heavy Profile	20%	.75x	90	.0003	.0008	.0014	.0019	.0023	.0027	.0033
		100 - 150	70 - 120	HEM* Profile	8%	1.5x	125	.0006	.0014	.0026	.0034	.0042	.0050	.0061
		80 - 120	60 - 80	Finishing	2-5%	1.5x	100	.0002	.0005	.0010	.0013	.0016	.0019	.0022
	<b>Titanium</b> 6Al-4V, Commercially Pure Titanium Aluminide	100 - 140	70 - 110	Full Slotting	100%	.5x	140	.0003	.0008	.0016	.0020	.0023	.0027	.0031
		100 - 160	80 - 120	Heavy Profile	30%	1x	160	.0004	.0010	.0020	.0025	.0029	.0034	.0041
		200 - 450	100 - 140	HEM* Profile	10%	1.5x	300	.0007	.0017	.0033	.0042	.0048	.0056	.0068
		160 - 360	80 - 120	Finishing	2-5%	1.5x	250	.0003	.0008	.0016	.0020	.0023	.0027	.0031
<b>Titanium</b> Ti 10-2-3 Beta 21S Ti 5553	70 - 110	50 - 80	Full Slotting	100%	.2x	70	.0002	.0005	.0010	.0013	.0016	.0019	.0022	
	80 - 110	70 - 100	Heavy Profile	20%	1x	80	.0003	.0008	.0014	.0019	.0023	.0027	.0033	
	100 - 150	80 - 120	HEM* Profile	8%	1.5x	100	.0006	.0014	.0026	.0034	.0042	.0050	.0061	
	80 - 130	80 - 100	Finishing	2-5%	1.5x	110	.0002	.0005	.0010	.0013	.0016	.0019	.0022	

HEM\* = High Efficiency Machining

Radial Chip Thinning was applied to Chip Load Data

## End Mills for Exotic Metal & Stainless Steel Applications (TV-5 Series)

*5 FLUTE DESIGNS FOR SLOTTING,  
ROUGHING, AND SEMI-FINISHING*

Increase feed rates 20% over 4 flute tools.

Variable flute indexed to break  
up machining harmonics

Full Eccentric grind technology  
to reduce chatter

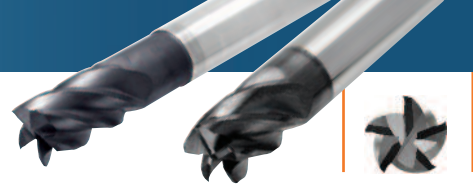
Industry's largest selection of corner  
radii and neck and flute lengths  
in a standard program.

Coated with ENDURASpeed coating.



# TV-5 & TVN-5

## 5 Flute



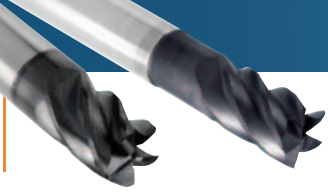
Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP#
TVS-50125	1/8	1/8	1/4	2	5	-	-	Square	• EMC400038
								.010	EMC400040
								Ball	• EMC400042
TVM-50125	1/8	1/8	1/2	2 1/2	5	-	-	Square	• EMC400056
								.010	EMC400058
TVS-50188	3/16	3/16	5/16	2	5	-	-	Square	• EMC400044
								.010	EMC400046
TVM-50188	3/16	3/16	5/8	2 1/2	5	-	-	Square	• EMC400062
								.010	EMC400064
TVS-50250	1/4	1/4	3/8	2	5	-	-	Square	• EMC604000
								.015	• EMC604002
								.030	• EMC604004
								.060	EMC604006
TVM-50250	1/4	1/4	3/4	2 1/2	5	-	-	Square	• EMC604100
								.015	• EMC604102
								.030	• EMC604104
								.060	• EMC604106
TVNS-50250	1/4	1/4	3/8	3	5	1 3/8	.235	Square	• EMC604200
								.015	• EMC604202
								.030	• EMC604204
								.060	EMC604206
TVNM-50250	1/4	1/4	3/8	4	5	1 3/4	.235	Square	• EMC604300
								.015	• EMC604302
								.030	EMC604304
								.060	EMC604306
TVNL-50250	1/4	1/4	3/8	4	5	2 1/8	.235	Square	EMC604400
								.015	EMC604402
								.030	EMC604404
								.060	EMC604406
TVS-50313	5/16	5/16	9/16	2 1/2	5	-	-	Square	• EMC400050
								.015	EMC400052
TVM-50313	5/16	5/16	13/16	2 1/2	5	-	-	Square	• EMC400068
								.015	EMC400070
TVS-50375	3/8	3/8	1/2	2	5	-	-	Square	• EMC604012
								.015	• EMC604014
								.030	• EMC604016
								.060	• EMC604018
								.090	• EMC604020
								.120	• EMC604022

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 41





# TV-5 & TVN-5

5 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP#
TVM-50375	3/8	3/8	1 1/8	2 1/2	5	-	-	Square	• EMC604112
								.015	• EMC604114
								.030	• EMC604116
								.060	• EMC604118
								.090	• EMC604120
								.120	• EMC604122
TVNS-50375	3/8	3/8	1/2	3	5	1 5/8	.353	Square	• EMC604212
								.015	• EMC604214
								.030	• EMC604216
								.060	• EMC604218
								.090	• EMC604220
								.120	• EMC604222
TVNM-50375	3/8	3/8	1/2	4	5	2 1/8	.353	Square	• EMC604312
								.015	• EMC604314
								.030	• EMC604316
								.060	• EMC604318
								.090	• EMC604320
								.120	• EMC604322
TVNL-50375	3/8	3/8	1/2	4	5	2 5/8	.353	Square	• EMC604412
								.015	• EMC604414
								.030	• EMC604416
								.060	• EMC604418
								.090	• EMC604420
								.120	• EMC604422
TVS-50500	1/2	1/2	5/8	2 1/2	5	-	-	Square	• EMC604026
								.015	• EMC604028
								.030	• EMC604030
								.060	• EMC604032
								.090	• EMC604034
								.120	• EMC604036
								.190	• EMC604040
TVM-50500	1/2	1/2	1 1/4	3	5	-	-	Square	• EMC604126
								.015	• EMC604128
								.030	• EMC604130
								.060	• EMC604132
								.090	• EMC604134
								.120	• EMC604136
								.190	• EMC604140

• = In-Stock

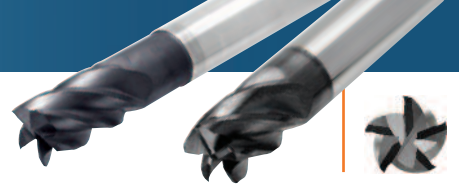
Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 41

Exotic Metals 5 Flute

# TV-5 & TVN-5

## 5 Flute



Exotic Metals 5 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP#
TVNS-50500	1/2	1/2	5/8	4	5	2 1/8	.475	Square	• EMC604226
								.015	• EMC604228
								.030	• EMC604230
								.060	• EMC604232
								.090	• EMC604234
								.120	• EMC604236
								.190	• EMC604240
TVNM-50500	1/2	1/2	5/8	5	5	2 3/4	.475	Square	• EMC604326
								.015	• EMC604328
								.030	EMC604330
								.060	• EMC604332
								.090	• EMC604334
								.120	• EMC604336
								.190	• EMC604340
TVNL-50500	1/2	1/2	5/8	5	5	3 3/8	.475	Square	EMC604426
								.015	EMC604428
								.030	EMC604430
								.060	EMC604432
								.090	EMC604434
								.120	• EMC604436
								.190	EMC604440
TVS-50625	5/8	5/8	3/4	3	5	-	-	Square	• EMC604044
								.030	• EMC604046
								.060	• EMC604048
								.120	EMC604052
								.190	EMC604056
								.250	EMC604058
TVM-50625	5/8	5/8	1 5/8	3 1/2	5	-	-	Square	• EMC604144
								.030	• EMC604146
								.060	• EMC604148
								.120	• EMC604152
								.190	EMC604156
								.250	EMC604158
TVNS-50625	5/8	5/8	3/4	5	5	2 3/8	0.594	Square	EMC604244
								.030	• EMC604246
								.060	EMC604248
								.120	EMC604252
								.190	EMC604256
								.250	EMC604258

• = In-Stock

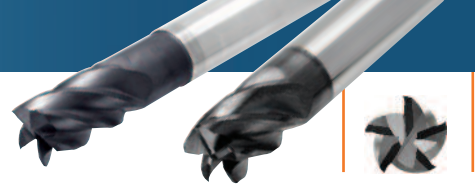
Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 41



# TV-5 & TVN-5

## 5 Flute



Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP#
TVS-51000	1	1	1 1/4	4	5	-	-	Square	EMC604080
								.030	• EMC604082
								.060	• EMC604084
								.090	• EMC604086
								.120	• EMC604088
								.190	EMC604092
								.250	• EMC604094
TVM-51000	1	1	2	5	5	-	-	Square	EMC604180
								.030	• EMC604182
								.060	• EMC604184
								.090	• EMC604186
								.120	• EMC604188
								.190	EMC604192
								.250	EMC604194
TVNS-51000	1	1	1 1/4	5	5	2 5/8	.950	Square	EMC604280
								.030	• EMC604282
								.060	EMC604284
								.090	• EMC604286
								.120	• EMC604288
								.190	EMC604292
								.250	EMC604294
TVNM-51000	1	1	1 1/4	6	5	3 1/8	.950	Square	EMC604380
								.030	EMC604382
								.060	• EMC604384
								.090	EMC604386
								.120	• EMC604388
								.190	EMC604392
								.250	• EMC604394
TVNL-51000	1	1	1 1/4	7	5	4 1/8	.950	Square	EMC604480
								.030	EMC604482
								.060	EMC604484
								.090	EMC604486
								.120	• EMC604488
								.190	• EMC604492
								.250	• EMC604494

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

[See Speed & Feed Chart Page 41](#)

### MACHINING FORMULAS

$$\text{RPM} = (3.82 \times \text{SFM}) / \text{tool dia.}$$

$$\text{SFM} = \text{RPM} \times .262 \times \text{tool dia.}$$

$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times \text{RPM}$$

$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (\text{RPM} \times \# \text{ Flutes})$$

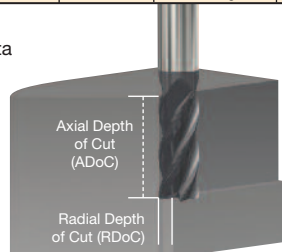
$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$



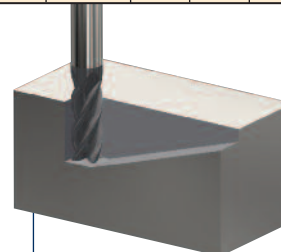
ISO Grade	Material / Grade	SFM Hardness		Application	Recommended Starting Parameters (< 32Rc)									
		< 32Rc	> 32Rc		Rad DOC % of DIA	Axial DOC x DIA	SFM Starting (<32Re)	Chip Load Per Tooth						
								1/8	1/4	3/8	1/2	5/8	3/4	1
P	<b>Carbon Steel</b> 10XX, 11XX 12XX, 15XX	340 - 480	120 - 200	Full Slotting	100%	.3x	400	.0004	.0008	.0014	.0018	.0023	.0027	.0031
		280 - 520	120 - 200	Heavy Profile	33%	1.25x	450	.0008	.0015	.0022	.0027	.0033	.0039	.0047
		500 - 850	225 - 325	HEM* Profile	15%	2x	550	.0011	.0021	.0031	.0038	.0046	.0054	.0066
		280 - 360	160 - 240	Finishing	2-5%	2x	325	.0004	.0008	.0014	.0018	.0023	.0027	.0031
	<b>Alloy Steel</b> 13XX, 40XX, 41XX, 43XX 44XX, 46XX, 47XX, 48XX	220 - 320	80 - 160	Full Slotting	100%	.3x	300	.0004	.0008	.0012	.0018	.0022	.0027	.0031
		240 - 360	120 - 180	Heavy Profile	33%	1.25x	325	.0008	.0015	.0022	.0027	.0033	.0039	.0047
		450 - 750	175 - 300	HEM* Profile	15%	2x	500	.0011	.0021	.0031	.0038	.0046	.0054	.0066
		300 - 360	160 - 200	Finishing	2-5%	2x	325	.0004	.0008	.0012	.0018	.0022	.0027	.0031
	<b>Mold &amp; Die Steel</b> 300M, 4340, 52100, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2 240 - 320	180 - 260	60 - 120	Full Slotting	100%	.3x	225	.0002	.0006	.0010	.0014	.0017	.0021	.0024
		180 - 300	60 - 120	Heavy Profile	33%	1.25x	275	.0004	.0011	.0016	.0021	.0026	.0030	.0037
		350 - 500	150 - 275	HEM* Profile	10%	2x	400	.0006	.0019	.0026	.0035	.0043	.0051	.0062
		240 - 320	100 - 180	Finishing	2-5%	2x	300	.0002	.0006	.0010	.0014	.0017	.0021	.0024
<b>Tool Steel</b> PM STEELS	100 - 220		Full Slotting	100%	.3x	200	.0003	.0006	.0013	.0017	.0020	.0024	.0028	
	140 - 260		Heavy Profile	25%	1.25x	230	.0006	.0011	.0021	.0027	.0032	.0037	.0044	
	275 - 475		HEM* Profile	10%	2x	350	.0009	.0018	.0035	.0044	.0053	.0061	.0074	
	200 - 280		Finishing	2-5%	2x	250	.0003	.0006	.0013	.0017	.0020	.0024	.0028	
M	<b>Austenitic Stainless</b> 301, 302, 303, 304/304L/304H, 316/316L, 317L, 321/321H, 347/347H, Nitronic, 309/309S, 310/310S/310H, 330	130 - 210	60 - 130	Full Slotting	100%	.3x	175	.0003	.0007	.0014	.0018	.0022	.0026	.0031
		160 - 220	60 - 130	Heavy Profile	33%	1.25x	200	.0006	.0013	.0022	.0026	.0032	.0036	.0045
		300 - 500	150 - 275	HEM* Profile	15%	2x	325	.0009	.0018	.0031	.0037	.0045	.0051	.0063
		160 - 220	115 - 180	Finishing	2-5%	2x	200	.0003	.0007	.0014	.0018	.0022	.0026	.0031
	<b>Martensitic Stainless</b> 403, 405, 409, 410/410S/410HT, 416/416HT, 420, 422, 430, 440C	160 - 260	80 - 200	Full Slotting	100%	.3x	225	.0002	.0005	.0011	.0014	.0018	.0022	.0026
		180 - 280	80 - 200	Heavy Profile	25%	1.25x	250	.0004	.0010	.0019	.0024	.0029	.0035	.0042
		275 - 450	125 - 250	HEM* Profile	10%	2x	350	.0007	.0017	.0031	.0040	.0049	.0058	.0069
		200 - 280	120 - 220	Finishing	2-5%	2x	250	.0002	.0005	.0011	.0014	.0018	.0022	.0026
	<b>Precipitation Stainless</b> 13-8 PH, 15-5 PH, 15-7 PH 17-4 PH, 17-7 PH S143	130 - 180	80 - 160	Full Slotting	100%	.3x	150	.0002	.0005	.0011	.0015	.0018	.0022	.0026
		145 - 200	80 - 100	Heavy Profile	25%	1.25x	175	.0004	.0011	.0020	.0025	.0029	.0034	.0042
		225 - 450	125 - 250	HEM* Profile	10%	2x	350	.0007	.0018	.0034	.0042	.0049	.0057	.0069
		200 - 260	120 - 220	Finishing	2-5%	2x	225	.0002	.0005	.0011	.0015	.0018	.0022	.0026
K	<b>Cast Iron Grey</b> 20A, 25A, 30A, 35A, 40A, 45A, 50A	200 - 320	110 - 240	Full Slotting	100%	.3x	300	.0003	.0008	.0015	.0020	.0025	.0028	.0032
		200 - 360	140 - 240	Heavy Profile	33%	1.25x	325	.0005	.0014	.0023	.0028	.0034	.0038	.0046
		300 - 550	350 - 500	HEM* Profile	10%	2x	450	.0009	.0023	.0039	.0047	.0056	.0064	.0077
		240 - 320	240 - 320	Finishing	2-5%	2x	300	.0003	.0008	.0015	.0020	.0025	.0028	.0032
	<b>Cast Ductile / Nodular</b> 40010, 60-40-18, 65-45-12 32510, 32518	100 - 240	80 - 140	Full Slotting	100%	.3x	225	.0003	.0006	.0012	.0016	.0020	.0024	.0028
		200 - 280	100 - 150	Heavy Profile	33%	1.25x	250	.0005	.0010	.0020	.0024	.0029	.0034	.0041
S	<b>Cobalt Base</b> Haynes 21, 25, L-605, Mar-M302, NASA Co-W-Re Stellite, Ultimet	60 - 100	30 - 80	Full Slotting	100%	.15x	80	.0002	.0005	.0010	.0012	.0015	.0018	.0021
		60 - 100	30 - 80	Heavy Profile	20%	.75x	80	.0003	.0008	.0014	.0019	.0023	.0027	.0033
		100 - 160	60 - 80	HEM* Profile	8%	1.25x	140	.0006	.0014	.0026	.0034	.0042	.0050	.0061
		70 - 100	70 - 90	Finishing	2-5%	1.5x	80	.0002	.0005	.0010	.0012	.0015	.0018	.0021
	<b>Iron Base</b> A-286, Discaloy Incoloy 800-802, Multimet 16-25-6	50 - 80	30 - 60	Full Slotting	100%	.15x	70	.0002	.0005	.0012	.0015	.0015	.0018	.0021
		70 - 120	30 - 60	Heavy Profile	20%	.75x	100	.0005	.0012	.0022	.0027	.0032	.0037	.0045
		150 - 200	60 - 80	HEM* Profile	8%	1.25x	170	.0008	.0022	.0040	.0050	.0058	.0068	.0083
		70 - 100	50 - 70	Finishing	2-5%	1.5x	80	.0002	.0005	.0012	.0015	.0015	.0018	.0021
	<b>Nickel Base</b> Hastelloy, Haynes 242, Inconel 600, 625, 718, Invar, Kovar, Monel, Nimonic, Rene 41, 77, 95, Udimet, Waspaloy	60 - 80	30 - 70	Full Slotting	100%	.15x	70	.0002	.0005	.0010	.0012	.0015	.0018	.0021
		60 - 100	30 - 80	Heavy Profile	20%	.75x	90	.0003	.0008	.0014	.0019	.0023	.0027	.0033
		100 - 150	70 - 120	HEM* Profile	8%	1.5x	125	.0006	.0014	.0026	.0034	.0042	.0050	.0061
		80 - 120	60 - 80	Finishing	2-5%	1.5x	100	.0002	.0005	.0010	.0012	.0015	.0018	.0021
<b>Titanium</b> 6Al-4V, Commercially Pure Titanium Aluminide	100 - 140	70 - 110	Full Slotting	100%	.25x	140	.0002	.0005	.0012	.0015	.0018	.0022	.0026	
	100 - 160	80 - 120	Heavy Profile	30%	1x	160	.0004	.0010	.0020	.0025	.0029	.0034	.0041	
	200 - 450	100 - 140	HEM* Profile	10%	1.5x	300	.0007	.0017	.0033	.0042	.0048	.0056	.0068	
	160 - 360	80 - 120	Finishing	2-5%	1.5x	250	.0002	.0005	.0012	.0015	.0018	.0022	.0026	
<b>Titanium</b> Ti 10-2-3 Beta 21S Ti 5553	70 - 110	50 - 80	Full Slotting	100%	.15x	70	.0002	.0005	.0010	.0012	.0015	.0018	.0021	
	80 - 110	70 - 100	Heavy Profile	15%	1x	80	.0003	.0008	.0014	.0019	.0023	.0027	.0033	
	100 - 150	80 - 120	HEM* Profile	8%	1.25x	100	.0006	.0014	.0026	.0034	.0042	.0050	.0061	
	80 - 130	80 - 100	Finishing	2-5%	1.5	110	.0002	.0005	.0010	.0012	.0015	.0018	.0021	

Radial Chip Thinning was applied to Chip Load Data  
HEM\* = High Efficiency Machining

REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER	
PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%



Apply radial chip thinning when RDoC < 0.5 x tool dia.



Ramp Angle = 1° - 3°  
Reduce chipload by 20% of slotting rates.



See chart for SFM reductions for projection length > 2.5 x tool dia.

## End Mills for Exotic Metal & Stainless Steel Applications (TV-7 Series)

*7 FLUTE DESIGNS FOR HIGH EFFICIENCY MACHINING*

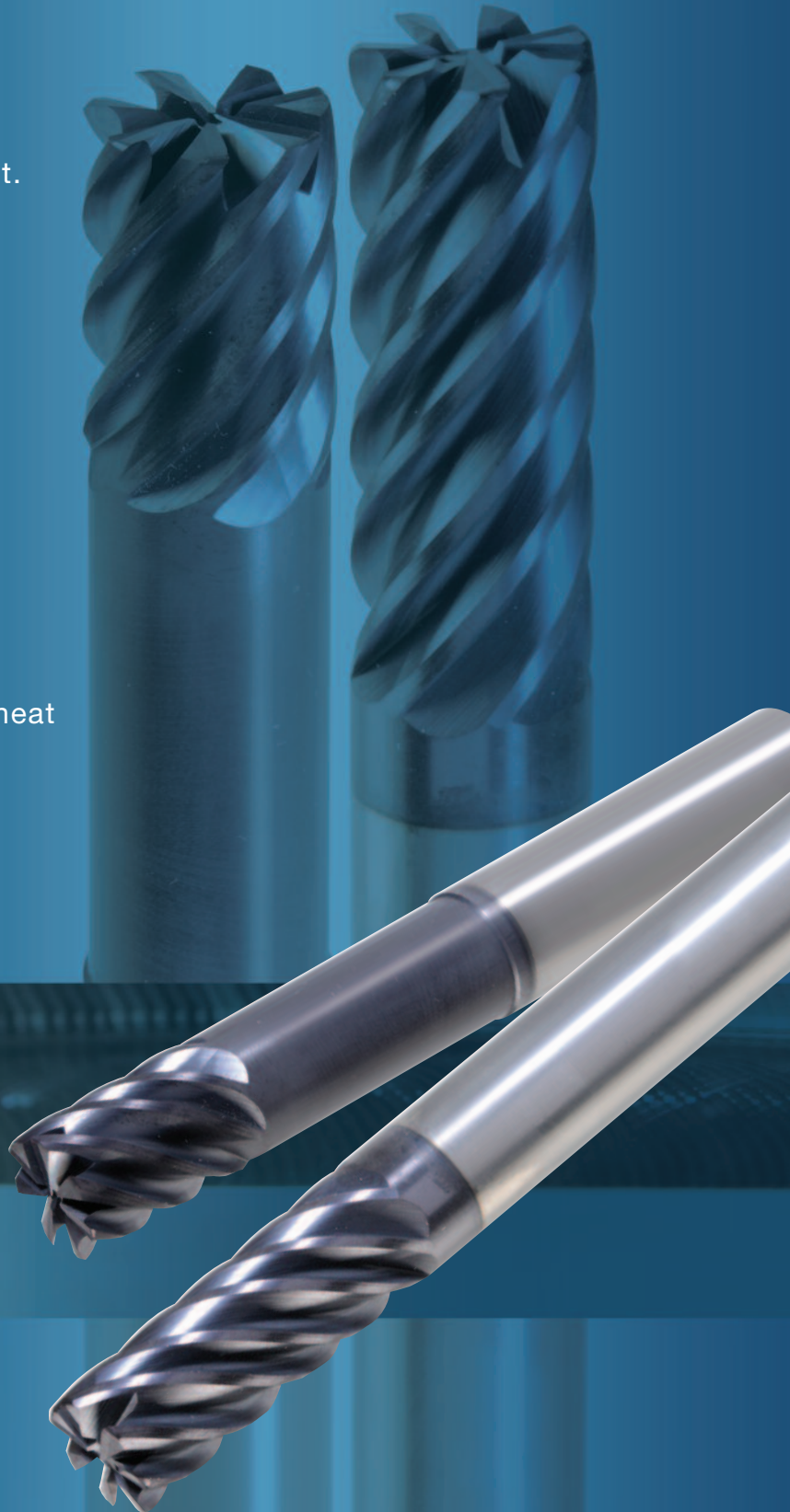
Optimized for High Speed Machining techniques with low radial engagement.

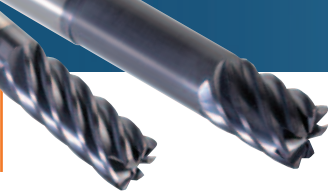
Produce accurate and superior workpiece finishes.

The unique geometry and large core diameter prevents deflection.

Industry's largest selection of corner radii and neck and flute lengths in a standard program.

ENDURASpeed coating features high heat resistance which leads to increased wear resistance and tool life.





# TV-7 & TVN-7

7 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP#
TVS-70500	1/2	1/2	5/8	2 1/2	7	-	-	Square	• EMC700051
								0.015	• EMC700053
								0.030	• EMC700055
								0.060	EMC700057
								0.090	EMC700059
								0.120	EMC700061
TVM-70500	1/2	1/2	1 1/4	3	7	-	-	Square	• EMC700107
								0.015	• EMC700109
								0.030	• EMC700111
								0.060	EMC700113
								0.090	• EMC700115
								0.120	• EMC700117
TVL-70500	1/2	1/2	2	4	7	-	-	Square	• EMC700163
								0.015	• EMC700165
								0.030	• EMC700167
								0.060	• EMC700169
								0.090	EMC700171
								0.120	• EMC700173
TVNS-70500	1/2	1/2	5/8	5	7	2 1/8	0.475	Square	EMC700219
								0.015	EMC700221
								0.030	• EMC700223
								0.060	• EMC700225
								0.090	EMC700227
								0.120	EMC700229
TVNM-70500	1/2	1/2	5/8	5	7	3 1/8	0.475	Square	EMC700275
								0.015	EMC700277
								0.030	• EMC700279
								0.060	EMC700281
								0.120	EMC700285
								TVNL-70500	1/2
0.015	EMC700333								
0.030	• EMC700335								
0.060	EMC700337								
0.090	EMC700339								
0.120	EMC700341								
TVS-70625	5/8	5/8	3/4	3	7	-	-	Square	EMC700065
								0.030	• EMC700067
								0.060	• EMC700069
								0.120	EMC700073
								0.190	EMC700075
								TVM-70625	5/8
0.030	• EMC700123								
0.060	• EMC700125								
0.120	EMC700129								
0.190	• EMC700131								
TVL-70625	5/8	5/8	2 1/8	4	7	-	-		
								0.030	• EMC700179
								0.060	EMC700181
								0.120	EMC700185
								0.190	EMC700187

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 46

# TV-7 & TVN-7

## 7 Flute

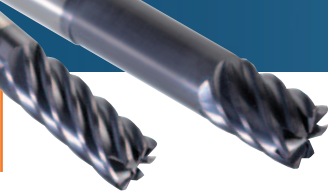


Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP#
TVNS-70625	5/8	5/8	3/4	5	7	2 3/8	0.594	Square	EMC700233
								0.030	EMC700235
								0.060	EMC700237
								0.120	EMC700241
								0.190	• EMC700243
TVNM-70625	5/8	5/8	3/4	5	7	3 1/8	0.594	Square	EMC700289
								0.030	EMC700291
								0.060	EMC700293
								0.090	EMC700295
								0.120	EMC700297
TVS-70750	3/4	3/4	1 1/8	3	7	-	-	Square	EMC700079
								0.030	• EMC700081
								0.060	EMC700083
								0.090	• EMC700085
								0.120	• EMC700087
TVM-70750	3/4	3/4	1 5/8	4	7	-	-	Square	EMC700089
								0.190	EMC700091
								0.250	• EMC700093
								0.030	• EMC700135
								0.060	• EMC700137
TVL-70750	3/4	3/4	2 5/8	5	7	-	-	Square	• EMC700139
								0.060	• EMC700141
								0.090	• EMC700143
								0.120	• EMC700145
								0.190	• EMC700147
TVNS-70750	3/4	3/4	1 1/8	5	7	2 5/8	0.713	Square	EMC700191
								0.030	• EMC700193
								0.060	• EMC700195
								0.090	EMC700197
								0.120	• EMC700199
TVNM-70750	3/4	3/4	1 1/8	5	7	3 1/8	0.713	Square	• EMC700201
								0.190	• EMC700203
								0.250	• EMC700205
								0.030	• EMC700249
								0.060	• EMC700251
TVNL-70750	3/4	3/4	1 1/8	6	7	4 1/8	0.713	Square	EMC700253
								0.060	• EMC700255
								0.090	• EMC700257
								0.120	• EMC700259
								0.190	• EMC700303
TVNS-70750	3/4	3/4	1 1/8	5	7	2 5/8	0.713	Square	• EMC700305
								0.030	• EMC700307
								0.060	EMC700309
								0.090	• EMC700311
								0.120	EMC700313
TVNM-70750	3/4	3/4	1 1/8	5	7	3 1/8	0.713	Square	• EMC700315
								0.190	EMC700317
								0.250	• EMC700319
								0.030	EMC700359
								0.060	EMC700361
TVNS-70750	3/4	3/4	1 1/8	5	7	2 5/8	0.713	Square	EMC700363
								0.060	• EMC700365
								0.090	• EMC700367
								0.120	EMC700369
								0.190	• EMC700371

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 46



# TV-7 & TVN-7

7 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP#
TVS-71000	1	1	1 1/4	4	7	-	-	Square	• EMC700093
								0.030	• EMC700095
								0.060	• EMC700097
								0.120	• EMC700101
								0.190	EMC700103
								0.250	EMC700105
TVM-71000	1	1	2	5	7	-	-	Square	• EMC700149
								0.030	• EMC700151
								0.060	• EMC700153
								0.120	• EMC700157
								0.190	EMC700159
								0.250	EMC700161
TVL-71000	1	1	3	6	7	-	-	Square	EMC700205
								0.030	EMC700207
								0.060	EMC700209
								0.120	EMC700213
								0.190	EMC700215
								0.250	EMC700217
TVNS-71000	1	1	1 1/4	5	7	2 5/8	0.950	Square	EMC700261
								0.030	• EMC700263
								0.060	EMC700265
								0.120	EMC700269
								0.190	EMC700271
								0.250	EMC700273
TVNM-71000	1	1	1 1/4	5	7	3 1/8	0.950	Square	EMC700317
								0.030	• EMC700319
								0.060	• EMC700321
								0.120	• EMC700325
								0.190	EMC700327
								0.250	• EMC700329
TVNL-71000	1	1	1 1/4	7	7	4 1/8	0.950	Square	EMC700373
								0.030	• EMC700375
								0.060	EMC700377
								0.120	EMC700381
								0.190	EMC700383
								0.250	EMC700385

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 46

### MACHINING FORMULAS

$$\text{RPM} = (3.82 \times \text{SFM}) / \text{tool dia.}$$

$$\text{SFM} = \text{RPM} \times .262 \times \text{tool dia.}$$

$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times \text{RPM}$$

$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (\text{RPM} \times \# \text{ Flutes})$$

$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

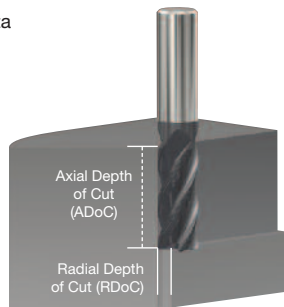


# TV-7 Chart

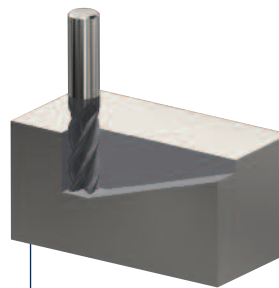
ISO Grade	Material / Grade	SFM Hardness		Application	Recommended Starting Parameters (< 32Rc)							
		< 32Rc	> 32Rc		Rad DOC % of DIA	Axial DOC x DIA	SFM Starting (<32Rc)	Chip Load Per Tooth				
								1/2	5/8	3/4	1	1-1/4
P	<b>Carbon Steel</b> 10XX, 11XX, 12XX, 15XX	450 - 800	150 - 250	HEM* Profile	10%	2x	650	.0050	.0058	.0067	.0075	.0083
		450 - 800	150 - 250	HEM* Profile	7%	2x	650	.0059	.0069	.0078	.0088	.0098
		300 - 600	150 - 250	Finishing	2-3%	2x	450	.0030	.0035	.0040	.0045	.0050
	<b>Alloy Steel</b> 13XX, 40XX, 41XX, 43XX, 44XX, 46XX, 47XX, 48XX	400 - 750	100 - 200	HEM* Profile	10%	2x	600	.0042	.0050	.0058	.0067	.0075
		400 - 750	100 - 200	HEM* Profile	7%	2x	600	.0049	.0059	.0069	.0078	.0088
		200 - 450	100 - 200	Finishing	2-3%	2x	400	.0025	.0030	.0035	.0040	.0045
	<b>Mold &amp; Die Steel</b> M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	300 - 550	70 - 150	HEM* Profile	10%	2x	400	.0037	.0043	.0050	.0058	.0067
		300 - 550	70 - 150	HEM* Profile	7%	2x	400	.0043	.0051	.0059	.0069	.0078
		150 - 250	70 - 150	Finishing	2-3%	2x	200	.0022	.0026	.0030	.0035	.0040
<b>Tool Steel</b> PM STEELS	250 - 500		HEM* Profile	10%	2x	350	.0042	.0050	.0058	.0067	.0075	
	250 - 500		HEM* Profile	7%	2x	350	.0049	.0059	.0069	.0078	.0088	
	100 - 200		Finishing	2-3%	2x	150	.0025	.0030	.0035	.0040	.0045	
M	<b>Austenitic Stainless</b> 301, 302, 303, 304/304L/304H, 316/316L, 317L, 321/321H, 347/347H, Nitronic, 309/309S, 310/310S/310H, 330	250 - 400	80 - 200	HEM* Profile	10%	2x	375	.0040	.0047	.0053	.0060	.0067
		250 - 400	80 - 200	HEM* Profile	7%	2x	375	.0047	.0055	.0063	.0071	.0078
		200 - 350	80 - 200	Finishing	2-3%	2x	250	.0020	.0024	.0028	.0031	.0036
	<b>Martensitic Stainless</b> 403, 405, 409, 410/410S/410HT, 416/416HT, 420, 422, 430, 440C	300 - 500	100 - 250	HEM* Profile	0.1	2x	400	.0042	.0050	.0058	.0067	.0075
		300 - 500	100 - 250	HEM* Profile	0.07	2x	400	0.0049	0.0059	0.0069	0.0078	0.0088
		300 - 450	100 - 250	Finishing	2-3%	2x	350	.0025	.0030	.0035	.0040	.0045
	<b>Precipitation Stainless</b> 13-8 PH, 15-5 PH, 15-7 PH, 17-4 PH, 17-7 PH, S143	250 - 500	90 - 125	HEM* Profile	10%	2x	325	.0040	.0047	.0053	.0060	.0067
		250 - 500	90 - 125	HEM* Profile	7%	2x	325	.0047	.0055	.0063	.0071	.0078
		120 - 225	90 - 125	Finishing	2-3%	2x	225	.0024	.0028	.0032	.0036	.0040
K	<b>Cast Iron Grey</b> 20A, 25A, 30A, 35A, 40A, 45A, 50A	400 - 750	130 - 300	HEM* Profile	10%	2x	550	0.0050	0.0058	0.0067	0.0075	0.0083
		400 - 750	130 - 300	HEM* Profile	7%	2x	550	0.0059	0.0069	0.0078	0.0088	0.0098
		375 - 500	130 - 300	Finishing	2-3%	2x	450	0.0030	0.0035	0.0040	0.0045	0.0050
	<b>Cast Ductile / Nodular</b> 40010, 60-40-18, 65-45-12, 32510, 32518	270 - 650	80 - 140	HEM* Profile	10%	2x	400	.0033	.0040	.0047	.0053	.0060
		270 - 650	80 - 140	HEM* Profile	7%	2x	400	.0039	.0047	.0055	.0063	.0071
		180 - 350	80 - 140	Finishing	2-3%	2x	275	.0020	.0024	.0028	.0032	.0036
S	<b>Cobalt Base</b> Haynes 21, 25, L-605, Mar-M302, NASA Co-W-Re, Stellite, Ultimet	90-160	40 - 90	HEM* Profile	10%	1.25x	125	.0027	.0030	.0035	.0040	.0045
		90-160	40 - 90	HEM* Profile	7%	1.25x	125	.0031	.0035	.0041	.0047	.0053
		70 - 140	40 - 90	Finishing	2-3%	1.5x	100	.0016	.0018	.0021	.0024	.0027
	<b>Iron Base</b> A-286, Discaloy, Incoloy 800-802, Multimet, 16-25-6	100 - 160	40 - 70	HEM* Profile	10%	1.25x	140	.0030	.0035	.0040	.0045	.0050
		100 - 160	40 - 70	HEM* Profile	7%	1.25x	140	.0035	.0041	.0047	.0053	.0059
		90 - 135	40 - 70	Finishing	2-3%	1.5x	110	.0018	.0021	.0024	.0027	.0030
	<b>Nickel Base</b> Hastelloy, Haynes 242, Inconel 600, 625, 718, Invar, Kovar, Monel, Nimonic, Rene 41, 77, 95, Udimet, Waspaloy	100 - 150	40 - 90	HEM* Profile	10%	1.5x	130	.0033	.0040	.0047	.0053	.0060
		100 - 150	40 - 90	HEM* Profile	7%	1.5x	130	.0039	.0047	.0055	.0063	.0071
		105 - 180	40 - 90	Finishing	3%	1.5x	110	.0020	.0024	.0028	.0032	.0036
	<b>Titanium</b> 6Al-4V, Commercially Pure, Titanium Aluminide	180 - 350	100 - 160	HEM* Profile	10%	1.5x	325	.0033	.0040	.0047	.0053	.0060
		180 - 350	100 - 160	HEM* Profile	7%	1.5x	325	.0038	.0045	.0053	.0063	.0071
		160 - 300	100 - 220	Finishing	3%	1.5x	250	.0020	.0024	.0028	.0032	.0036
120 - 180		80 - 140	HEM* Profile	10%	1.5x	150	.0023	.0028	.0033	.0038	.0043	
<b>Titanium</b> Ti 10-2-3, Beta 21S, Ti 5553	120 - 180	80 - 140	HEM* Profile	7%	1.5x	150	.0027	.0033	.0039	.0045	.0051	
	80 - 140	100 - 120	Finishing	3%	1.5x	115	.0014	.0017	.0020	.0023	.0026	

Radial Chip Thinning was applied to Chip Load Data  
HEM\* = High Efficiency Machining

REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER	
PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%



Apply radial chip thinning formula when RDoC < 0.5 x tool dia.



## End Mills for Exotic Metal & Stainless Steel Applications (TF Series)

*6, 8 AND 10 FLUTE DESIGNS FOR FINISHING*

Optimized to produce accurate parts with superior finishes that meet, or exceed demanding aerospace specifications.

Shallow flute design combined with a large core prevents deflection on even the longest length tools.

Eccentric relief creates dampening effect to reduce chatter on both thin wall parts and floors.

In-house coating features high heat resistance which leads to increased wear resistance and tool life.



# TF & TFN

6 Flute, 8 Flute, 10 Flute



Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TFS-60250	1/4	1/4	3/8	2	6	-	-	Square	• EMC600900
								0.015	EMC601104
								0.030	• EMC600916
								0.060	EMC600932
TFM-60250	1/4	1/4	3/4	2 1/2	6	-	-	Square	• EMC601002
								0.015	• EMC601120
								0.030	EMC601018
								0.060	EMC601034
TFNS-60250	1/4	1/4	3/8	4	6	2 1/8	.235	Square	• EMC600002
								0.015	EMC600104
								0.030	EMC600018
								0.060	EMC600034
TFNM-60250	1/4	1/4	3/8	4	6	2 1/2	.235	Square	EMC600302
								0.015	EMC600402
								0.030	EMC600318
								0.060	EMC600334
TFNL-60250	1/4	1/4	3/8	4	6	3 1/8	.235	Square	EMC600600
								0.015	EMC600700
								0.030	• EMC600616
								0.060	EMC600632
TFS-60375	3/8	3/8	1/2	2	6	-	-	Square	• EMC600904
								0.015	• EMC601108
								0.030	• EMC600920
								0.060	• EMC600936
								0.090	EMC600952
								0.120	EMC600964
TFM-60375	3/8	3/8	1 1/8	2 1/2	6	-	-	Square	• EMC601006
								0.015	• EMC601124
								0.030	• EMC601022
								0.060	• EMC601038
								0.090	EMC601054
								0.120	EMC601066
TFNS-60375	3/8	3/8	1/2	4	6	2 1/4	.353	Square	• EMC600006
								0.015	EMC600108
								0.030	EMC600022
								0.060	EMC600038
								0.090	• EMC600054
								0.120	• EMC600066
TFNM-60375	3/8	3/8	1/2	4	6	2 5/8	.353	Square	EMC600306
								0.015	EMC600406
								0.030	EMC600322
								0.060	EMC600338
								0.090	• EMC600354
								0.120	EMC600366
TFNL-60375	3/8	3/8	1/2	6	6	3 1/4	.353	Square	EMC600604
								0.015	EMC600704
								0.030	• EMC600620
								0.060	EMC600636
								0.090	• EMC600652
								0.120	• EMC600664

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 52



## TF & TFN

6 Flute, 8 Flute, 10 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TFS-60500	1/2	1/2	5/8	2 1/2	6	-	-	Square	• EMC600908
								0.015	• EMC601112
								0.030	• EMC600924
								0.060	• EMC600940
								0.090	EMC600956
								0.120	EMC600968
								0.190	• EMC600988
TFM-60500	1/2	1/2	1 1/4	3	6	-	-	Square	• EMC601010
								0.015	• EMC601128
								0.030	• EMC601026
								0.060	EMC601042
								0.090	EMC601058
								0.120	EMC601070
								0.190	EMC601090
TFNS-60500	1/2	1/2	5/8	4	6	2 3/8	.475	Square	EMC600010
								0.015	EMC600112
								0.030	EMC600026
								0.060	EMC600042
								0.090	• EMC600058
								0.120	• EMC600070
								0.190	• EMC600090
TFNM-60500	1/2	1/2	5/8	6	6	3 1/8	.475	Square	EMC600310
								0.015	• EMC600410
								0.030	• EMC600326
								0.060	EMC600342
								0.090	• EMC600358
								0.120	• EMC600370
								0.190	• EMC600390
TFNL-60500	1/2	1/2	5/8	6	6	4 1/8	.475	Square	EMC600608
								0.015	EMC600708
								0.030	EMC600624
								0.060	EMC600640
								0.090	• EMC600656
								0.120	EMC600668
								0.190	EMC600688
TFS-60625	5/8	5/8	3/4	3	6	-	-	Square	EMC600910
								0.030	EMC600926
								0.060	EMC600942
								0.120	EMC600970
								0.190	EMC600990
TFM-60625	5/8	5/8	1 5/8	3 1/2	6	-	-	Square	• EMC600996
								0.030	EMC601012
								0.060	• EMC601028
								0.120	EMC601044
								0.190	EMC601072
								0.120	EMC601092
								0.190	EMC601092
								0.250	EMC601098

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 52

# TF & TFN

6 Flute, 8 Flute, 10 Flute



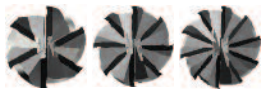
Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TFNS-60625	5/8	5/8	3/4	4	6	2 3/8	0.594	Square	EMC600012
								0.030	EMC600028
								0.060	EMC600044
								0.120	EMC600072
								0.190	EMC600092
								0.250	EMC600098
TFNM-60625	5/8	5/8	3/4	6	6	3 1/8	0.594	Square	EMC600312
								0.030	EMC600328
								0.060	EMC600344
								0.120	• EMC600372
								0.190	EMC600392
								0.250	EMC600420
TFS-80750	3/4	3/4	1 1/8	3	8	-	-	Square	EMC600912
								0.030	• EMC600928
								0.060	• EMC600944
								0.090	EMC600960
								0.120	EMC600972
								0.190	EMC600992
TFM-80750	3/4	3/4	1 5/8	4	8	-	-	Square	EMC601014
								0.030	• EMC601030
								0.060	EMC601046
								0.090	EMC601062
								0.120	• EMC601074
								0.190	EMC601094
TFNS-80750	3/4	3/4	1 1/8	4	8	2 1/2	.713	Square	EMC600014
								0.030	EMC600030
								0.060	EMC600046
								0.090	EMC600062
								0.120	• EMC600074
								0.190	EMC600094
TFNM-80750	3/4	3/4	1 1/8	6	8	3 1/8	.713	Square	EMC600314
								0.030	• EMC600330
								0.060	• EMC600346
								0.090	EMC600362
								0.120	• EMC600374
								0.190	EMC600394
TFNL-80750	3/4	3/4	1 1/8	6	8	4 1/8	.713	Square	EMC600612
								0.030	• EMC600628
								0.060	EMC600644
								0.090	EMC600660
								0.120	• EMC600672
								0.190	EMC600692
								0.250	EMC600696

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 52





## TF & TFN

6 Flute, 8 Flute, 10 Flute

Description	Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #
TFS-101000	1	1	1 1/4	3	10	-	-	Square	EMC600914
								0.030	EMC600930
								0.060	EMC600946
								0.090	EMC600962
								0.120	EMC600974
								0.190	EMC600994
TFM-101000	1	1	2	4	10	-	-	Square	• EMC601016
								0.030	• EMC601032
								0.060	• EMC601048
								0.090	EMC601064
								0.120	• EMC601076
								0.190	EMC601096
TFNS-101000	1	1	1 1/4	5	10	2 1/2	.950	Square	EMC600016
								0.030	EMC600032
								0.060	• EMC600048
								0.090	EMC600064
								0.120	EMC600076
								0.190	EMC600096
TFNM-101000	1	1	1 1/4	6	10	3 1/8	.950	Square	EMC600316
								0.030	EMC600332
								0.060	EMC600348
								0.090	EMC600364
								0.120	EMC600376
								0.190	• EMC600396
TFNL-101000	1	1	1 1/4	7	10	4 1/8	.950	Square	EMC600614
								0.030	• EMC600630
								0.060	EMC600646
								0.090	EMC600662
								0.120	• EMC600674
								0.190	EMC600694
								0.250	• EMC600698

• = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 52

### MACHINING FORMULAS

$$\text{RPM} = (3.82 \times \text{SFM}) / \text{tool dia.}$$

$$\text{SFM} = \text{RPM} \times .262 \times \text{tool dia.}$$

$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times \text{RPM}$$

$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

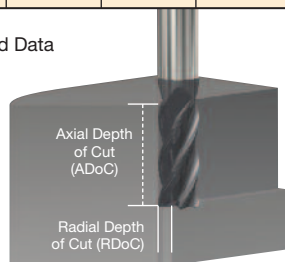
$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (\text{RPM} \times \# \text{ Flutes})$$

$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

# TF Chart

ISO Grade	Material / Grade	SFM Hardness		Application	Recommended Starting Parameters (< 32Rc)								
		< 32Rc	> 32Rc		Rad DOC % of DIA	Axial DOC x DIA	SFM Starting (<32Rc)	Chip Load Per Tooth					
								1/4	3/8	1/2	5/8	3/4	1
P	<b>Carbon Steel</b> 10XX, 11XX 12XX, 15XX	600 - 900	150 - 250	Finishing	2-3%	2x	650	.0020	.0026	.0030	.0036	.0042	.0048
	<b>Alloy Steel</b> 13XX, 40XX, 41XX, 43XX 44XX, 46XX, 47XX, 48XX	375 - 675	100 - 200	Finishing	2-3%	2x	500	.0018	.0023	.0027	.0032	.0038	.0043
	<b>Mold &amp; Die Steel</b> 300M, 4340, 52100, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	225 - 375	70 - 150	Finishing	2-3%	2x	350	.0016	.0019	.0028	.0034	.0042	.0056
	<b>Tool Steel</b> PM STEELS	150 - 300		Finishing	2-3%	2x	250	.0018	.0022	.0032	.0038	.0047	.0063
M	<b>Austenitic Stainless</b> 301, 302, 303, 304/304L/304H, 316/316L, 317L, 321/321H, 347/347H, Nitronic, 309/309S, 310/310S/310H, 330	225 - 525	80 - 200	Finishing	2-3%	2x	350	.0016	.0021	.0024	.0029	.0034	.0038
	<b>Martensitic Stainless</b> 403, 405, 409, 410/410S/410HT, 416/416HT, 420, 422, 430, 440C	300 - 625	100 - 250	Finishing	2-3%	2x	400	.0015	.0020	.0023	.0027	.0032	.0036
	<b>Precipitation Stainless</b> 13-8 PH, 15-5 PH, 15-7 PH 17-4 PH, 17-7 PH, S143	120 - 375	90 - 125	Finishing	2-3%	2x	350	.0012	.0016	.0018	.0022	.0025	.0029
K	<b>Cast Iron Grey</b> 20A, 25A, 30A, 35A, 40A, 45A, 50A	375 - 675	130 - 300	Finishing	2-3%	2x	650	.0019	.0025	.0029	.0034	.0040	.0046
	<b>Cast Ductile / Nodular</b> 40010, 60-40-18, 65-45-12 32510, 32518	180 - 525	80 - 140	Finishing	2-3%	2x	500	.0017	.0022	.0026	.0031	.0036	.0041
S	<b>Cobalt Base</b> Haynes 21, 25, L-605, Mar-M302, NASA Co-W-Re, Stellite, Ultimet	105 - 180	40 - 90	Finishing	2-3%	1.5x	150	.0011	.0014	.0017	.0020	.0023	.0026
	<b>Iron Base</b> A-286, Discaloy Incoloy 800-802, Multimet, 16-25-6	90 - 135	40 - 70	Finishing	2-3%	1.5x	120	.0015	.0020	.0023	.0027	.0032	.0036
	<b>Nickel Base</b> Hastelloy, Haynes 242, Inconel 600, 625, 718, Invar, Kovar, Monel, Nimonic, Rene 41, 77, 95, Udimet, Waspaloy	105 - 180	40 - 90	Finishing	2-3%	1.5x	75	.0015	.0020	.0023	.0027	.0032	.0036
	<b>Titanium</b> 6Al-4V, Commercially Pure Titanium Aluminide	200 - 400	100 - 220	Finishing	2-3%	1.5x	300	.0013	.0017	.0020	.0023	.0027	.0031
	<b>Titanium</b> Ti 10-2-3 Beta 21S, Ti 5553	100 - 160	100 - 120	Finishing	2-3%	1.5x	125	.0013	.0017	.0020	.0023	.0027	.0031

Radial Chip Thinning was applied to Chip Load Data  
HEM\* = High Efficiency Machining



Apply radial chip thinning formula when RDoC < 0.5 x tool dia.



See chart for SFM reductions for projection length > 2.5 x tool dia.

**REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER**

PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%



# MAXQ

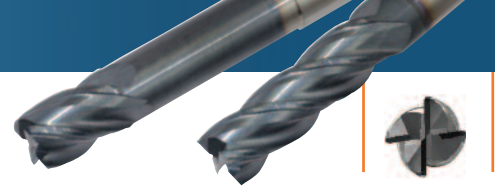
FOR MAXIMUM SPEEDS & FEED RATES

## Variable Index, Dual Helix Geometry for Exotic Metals, Stainless Steel, Steel & Cast Iron

- Unmatched material removal rates
- Broad technique range from slotting to profiling
- Full radial engagement up to 1/2 time diameter deep
- ENDURASpeed coating for maximum heat resistance



**LMT•ONSRUD**

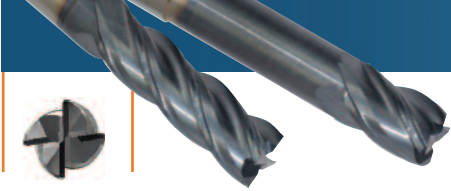


Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #	ENDURASpeed EDP # w/ Weldon Flat
1/8	1/8	1/4	2	4	-	-	Square	● MXQ2650000	MXQ2650000W
							0.015	● MXQ2650001	MXQ2650001W
1/8	1/8	1/2	2	4	-	-	Square	● MXQ2650002	MXQ2650002W
							0.015	● MXQ2650003	MXQ2650003W
3/16	3/16	5/16	2	4	-	-	Square	● MXQ2650004	MXQ2650004W
							0.015	● MXQ2650005	MXQ2650005W
3/16	3/16	9/16	2 1/2	4	-	-	Square	● MXQ2650006	MXQ2650006W
							0.015	● MXQ2650007	MXQ2650007W
1/4	1/4	3/8	2 1/2	4	-	-	Square	● MXQ2650008	MXQ2650008W
							0.015	● MXQ2650009	MXQ2650009W
							0.030	● MXQ2650010	MXQ2650010W
1/4	1/4	3/4	2 1/2	4	-	-	Square	● MXQ2650011	MXQ2650011W
							0.015	● MXQ2650012	MXQ2650012W
							0.030	● MXQ2650013	MXQ2650013W
1/4	1/4	3/8	3	4	1 1/8	0.235	0.015	● MXQ2650014	MXQ2650014W
							0.030	● MXQ2650015	MXQ2650015W
5/16	5/16	7/16	2	4	-	-	Square	● MXQ2650016	MXQ2650016W
							0.015	● MXQ2650017	MXQ2650017W
5/16	5/16	1	3	4	-	-	Square	● MXQ2650018	MXQ2650018W
							0.015	● MXQ2650019	MXQ2650019W
							0.030	● MXQ2650020	MXQ2650020W
3/8	3/8	1/2	2 1/2	4	-	-	0.015	● MXQ2650021	MXQ2650021W
							0.030	● MXQ2650022	MXQ2650022W
							0.060	MXQ2650104	MXQ2650104W
							0.090	● MXQ2650105	MXQ2650105W
							0.120	MXQ2650106	MXQ2650106W
3/8	3/8	1 1/8	3	4	-	-	Square	● MXQ2650023	MXQ2650023W
							0.015	● MXQ2650024	MXQ2650024W
							0.030	● MXQ2650025	MXQ2650025W
							0.060	● MXQ2650107	MXQ2650107W
							0.090	MXQ2650108	MXQ2650108W
3/8	3/8	1/2	3 1/2	4	1 5/8	0.353	Square	MXQ2650110	MXQ2650110W
							0.015	● MXQ2650026	MXQ2650026W
							0.030	● MXQ2650027	MXQ2650027W
							0.060	● MXQ2650111	MXQ2650111W
							0.090	MXQ2650112	MXQ2650112W
1/2	1/2	5/8	2 1/2	4	-	-	Square	● MXQ2650113	MXQ2650113W
							0.120	MXQ2650109	MXQ2650109W
							0.015	● MXQ2650028	MXQ2650028W
							0.030	● MXQ2650029	MXQ2650029W
							0.060	● MXQ2650030	MXQ2650030W
1/2	1/2	1 1/4	3	4	-	-	0.060	● MXQ2650114	MXQ2650114W
							0.090	MXQ2650115	MXQ2650115W
							0.120	MXQ2650116	MXQ2650116W
							0.190	MXQ2650117	MXQ2650117W
							Square	● MXQ2650034	MXQ2650034W
1/2	1/2	5/8	4	4	1 3/4	0.475	0.015	● MXQ2650035	MXQ2650035W
							0.030	● MXQ2650036	MXQ2650036W
							0.060	● MXQ2650122	MXQ2650122W
							0.090	MXQ2650123	MXQ2650123W
							0.120	MXQ2650124	MXQ2650124W
1/2	1/2	5/8	4	4	1 3/4	0.475	0.190	MXQ2650125	MXQ2650125W
							Square	● MXQ2650040	MXQ2650040W
							0.030	● MXQ2650041	MXQ2650041W
							0.060	● MXQ2650042	MXQ2650042W
							0.090	MXQ2650130	MXQ2650130W
1/2	1/2	5/8	4	4	1 3/4	0.475	0.120	MXQ2650131	MXQ2650131W
							0.190	MXQ2650132	MXQ2650132W

● = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 60

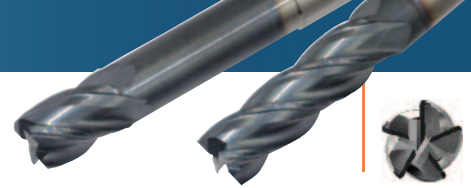


Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #	ENDURASpeed EDP # w/ Weldon Flat
5/8	5/8	3/4	3	4	-	-	Square	● MXQ2650046	MXQ2650046W
							0.030	● MXQ2650047	MXQ2650047W
							0.060	● MXQ2650136	MXQ2650136W
							0.120	● MXQ2650137	MXQ2650137W
							0.190	● MXQ2650138	MXQ2650138W
							0.250	● MXQ2650139	MXQ2650139W
5/8	5/8	1 3/8	3 1/2	4	-	-	Square	● MXQ2650048	MXQ2650048W
							0.030	● MXQ2650049	MXQ2650049W
							0.060	● MXQ2650140	MXQ2650140W
							0.120	● MXQ2650141	MXQ2650141W
							0.190	● MXQ2650142	MXQ2650142W
							0.250	● MXQ2650143	MXQ2650143W
3/4	3/4	1 1/8	3	4	-	-	Square	● MXQ2650050	MXQ2650050W
							0.030	● MXQ2650051	MXQ2650051W
							0.060	● MXQ2650052	MXQ2650052W
							0.090	● MXQ2650144	MXQ2650144W
							0.120	● MXQ2650053	MXQ2650053W
							0.190	● MXQ2650145	MXQ2650145W
3/4	3/4	1 5/8	4	4	-	-	Square	● MXQ2650059	MXQ2650059W
							0.030	● MXQ2650060	MXQ2650060W
							0.060	● MXQ2650061	MXQ2650061W
							0.090	● MXQ2650156	MXQ2650156W
							0.120	● MXQ2650062	MXQ2650062W
							0.190	● MXQ2650157	MXQ2650157W
3/4	3/4	2 1/4	5	4	-	-	Square	● MXQ2650100	MXQ2650100W
							0.030	● MXQ2650101	MXQ2650101W
							0.060	● MXQ2650162	MXQ2650162W
							0.090	● MXQ2650163	MXQ2650163W
							0.120	● MXQ2650164	MXQ2650164W
							0.190	● MXQ2650165	MXQ2650165W
3/4	3/4	1 1/8	5	4	2 3/8	0.713	Square	● MXQ2650172	MXQ2650172W
							0.030	● MXQ2650067	MXQ2650067W
							0.060	● MXQ2650068	MXQ2650068W
							0.090	● MXQ2650173	MXQ2650173W
							0.120	● MXQ2650069	MXQ2650069W
							0.190	● MXQ2650174	MXQ2650174W
3/4	3/4	1 1/8	6	4	3 1/8	0.713	Square	● MXQ2650180	MXQ2650180W
							0.030	● MXQ2650073	MXQ2650073W
							0.060	● MXQ2650074	MXQ2650074W
							0.090	● MXQ2650181	MXQ2650181W
							0.120	● MXQ2650075	MXQ2650075W
							0.190	● MXQ2650182	MXQ2650182W
1	1	1 1/4	4	4	-	-	Square	● MXQ2650188	MXQ2650188W
							0.030	● MXQ2650079	MXQ2650079W
							0.060	● MXQ2650189	MXQ2650189W
							0.090	● MXQ2650190	MXQ2650190W
							0.120	● MXQ2650080	MXQ2650080W
							0.190	● MXQ2650191	MXQ2650191W
1	1	2	5	4	-	-	Square	● MXQ2650202	MXQ2650202W
							0.030	● MXQ2650086	MXQ2650086W
							0.060	● MXQ2650203	MXQ2650203W
							0.090	● MXQ2650204	MXQ2650204W
							0.120	● MXQ2650087	MXQ2650087W
							0.190	● MXQ2650088	MXQ2650088W
							0.250	● MXQ2650089	MXQ2650089W

● = In-Stock  
 Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.  
 See Speed & Feed Chart Page 60

MaxQ 4 Flute



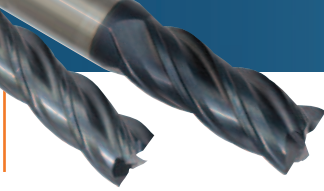


Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #	ENDURASpeed EDP # w/ Weldon Flat
1/2	1/2	5/8	2 1/2	5			Square	● MXQ2650031	MXQ2650031W
							0.015	● MXQ2650032	MXQ2650032W
							0.030	● MXQ2650033	MXQ2650033W
							0.060	● MXQ2650118	MXQ2650118W
							0.090	● MXQ2650119	MXQ2650119W
							0.120	● MXQ2650120	MXQ2650120W
							0.190	● MXQ2650121	MXQ2650121W
1/2	1/2	1 1/4	3	5			Square	● MXQ2650037	MXQ2650037W
							0.015	● MXQ2650038	MXQ2650038W
							0.030	● MXQ2650039	MXQ2650039W
							0.060	● MXQ2650126	MXQ2650126W
							0.090	● MXQ2650127	MXQ2650127W
							0.120	● MXQ2650128	MXQ2650128W
							0.190	● MXQ2650129	MXQ2650129W
1/2	1/2	5/8	4	5	1 3/4	0.475	Square	● MXQ2650043	MXQ2650043W
							0.030	● MXQ2650044	MXQ2650044W
							0.060	● MXQ2650045	MXQ2650045W
							0.090	● MXQ2650133	MXQ2650133W
							0.120	● MXQ2650134	MXQ2650134W
							0.190	● MXQ2650135	MXQ2650135W
							3/4	3/4	1 1/8
0.030	● MXQ2650055	MXQ2650055W							
0.060	● MXQ2650056	MXQ2650056W							
0.090	● MXQ2650147	MXQ2650147W							
0.120	● MXQ2650057	MXQ2650057W							
0.190	● MXQ2650148	MXQ2650148W							
0.250	● MXQ2650149	MXQ2650149W							
3/4	3/4	1 1/2	4	5			Square	● MXQ2650150	MXQ2650150W
							0.030	● MXQ2650151	MXQ2650151W
							0.060	● MXQ2650152	MXQ2650152W
							0.090	MXQ2650153	MXQ2650153W
							0.120	● MXQ2650058	MXQ2650058W
							0.190	MXQ2650154	MXQ2650154W
							0.250	MXQ2650155	MXQ2650155W
3/4	3/4	1 5/8	4	5			Square	● MXQ2650063	MXQ2650063W
							0.030	● MXQ2650064	MXQ2650064W
							0.060	● MXQ2650065	MXQ2650065W
							0.090	● MXQ2650159	MXQ2650159W
							0.120	● MXQ2650066	MXQ2650066W
							0.190	● MXQ2650160	MXQ2650160W
							0.250	● MXQ2650161	MXQ2650161W
3/4	3/4	2 1/4	5	5			Square	● MXQ2650102	MXQ2650102W
							0.030	● MXQ2650103	MXQ2650103W
							0.060	● MXQ2650167	MXQ2650167W
							0.090	MXQ2650168	MXQ2650168W
							0.120	MXQ2650169	MXQ2650169W
							0.190	MXQ2650170	MXQ2650170W
							0.250	MXQ2650171	MXQ2650171W
3/4	3/4	1 1/8	5	5	2 3/8	0.713	Square	MXQ2650176	MXQ2650176W
							0.030	● MXQ2650070	MXQ2650070W
							0.060	● MXQ2650071	MXQ2650071W
							0.090	● MXQ2650177	MXQ2650177W
							0.120	● MXQ2650072	MXQ2650072W
							0.190	MXQ2650178	MXQ2650178W
							0.250	● MXQ2650179	MXQ2650179W

● = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

[See Speed & Feed Chart Page 61](#)



Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #	ENDURASpeed EDP # w/ Weldon Flat
3/4	3/4	1 1/8	6	5	3 1/8	0.713	Square	● MXQ2650184	MXQ2650184W
							0.030	● MXQ2650076	MXQ2650076W
							0.060	MXQ2650077	MXQ2650077W
							0.090	● MXQ2650185	MXQ2650185W
							0.120	MXQ2650078	MXQ2650078W
							0.190	MXQ2650186	MXQ2650186W
							0.250	MXQ2650187	MXQ2650187W
1	1	1 1/4	4	5			Square	● MXQ2650193	MXQ2650193W
							0.030	● MXQ2650081	MXQ2650081W
							0.060	● MXQ2650194	MXQ2650194W
							0.090	● MXQ2650195	MXQ2650195W
							0.120	● MXQ2650082	MXQ2650082W
							0.190	● MXQ2650083	MXQ2650083W
							0.250	● MXQ2650084	MXQ2650084W
1	1	1 1/2	4	5			Square	● MXQ2650196	MXQ2650196W
							0.030	● MXQ2650197	MXQ2650197W
							0.060	● MXQ2650198	MXQ2650198W
							0.090	● MXQ2650199	MXQ2650199W
							0.120	● MXQ2650085	MXQ2650085W
							0.190	MXQ2650200	MXQ2650200W
							0.250	MXQ2650201	MXQ2650201W
1	1	2	5	5			Square	● MXQ2650205	MXQ2650205W
							0.030	● MXQ2650090	MXQ2650090W
							0.060	● MXQ2650206	MXQ2650206W
							0.090	● MXQ2650207	MXQ2650207W
							0.120	● MXQ2650091	MXQ2650091W
							0.190	● MXQ2650092	MXQ2650092W
							0.250	● MXQ2650093	MXQ2650093W
1	1	1 1/4	6	5	3 1/8	0.960	Square	● MXQ2650208	MXQ2650208W
							0.030	● MXQ2650209	MXQ2650209W
							0.060	● MXQ2650094	MXQ2650094W
							0.090	● MXQ2650210	MXQ2650210W
							0.120	● MXQ2650095	MXQ2650095W
							0.190	MXQ2650211	MXQ2650211W
							0.250	● MXQ2650096	MXQ2650096W
1	1	1 1/4	7	5	4 1/8	0.960	Square	● MXQ2650212	MXQ2650212W
							0.030	● MXQ2650213	MXQ2650213W
							0.060	● MXQ2650097	MXQ2650097W
							0.090	● MXQ2650214	MXQ2650214W
							0.120	● MXQ2650098	MXQ2650098W
							0.190	MXQ2650215	MXQ2650215W
							0.250	● MXQ2650099	MXQ2650099W

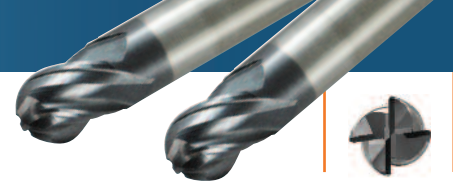
● = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 61



4 Flute

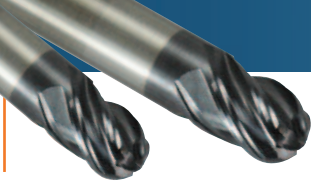


Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #	ENDURASpeed EDP # w/ Weldon Flat
1/8	1/8	1/4	2	4	-	-	Ball	● MXB2650500	MXB2650500W
1/8	1/8	1/2	2 1/2	4	-	-	Ball	● MXB2650501	MXB2650501W
1/8	1/8	3/4	2 1/2	4	-	-	Ball	● MXB2650502	MXB2650502W
1/8	1/8	3/16	3	4	1/2	0.118	Ball	● MXB2650503	MXB2650503W
3/16	3/16	5/16	2	4	-	-	Ball	● MXB2650504	MXB2650504W
3/16	3/16	5/8	2 1/2	4	-	-	Ball	● MXB2650505	MXB2650505W
3/16	3/16	3/4	2 1/2	4	-	-	Ball	● MXB2650506	MXB2650506W
3/16	3/16	1/4	3	4	3/4	0.177	Ball	● MXB2650507	MXB2650507W
1/4	1/4	3/8	2	4	-	-	Ball	● MXB2650508	MXB2650508W
1/4	1/4	3/4	2 1/2	4	-	-	Ball	● MXB2650509	MXB2650509W
1/4	1/4	1 1/8	3	4	-	-	Ball	● MXB2650510	MXB2650510W
1/4	1/4	3/8	3	4	5/8	0.235	Ball	● MXB2650511	MXB2650511W
1/4	1/4	3/8	4	4	1 1/8	0.235	Ball	● MXB2650512	MXB2650512W
1/4	1/4	3/8	4	4	1 5/8	0.235	Ball	● MXB2650513	MXB2650513W
5/16	5/16	1/2	2 1/2	4	-	-	Ball	● MXB2650514	MXB2650514W
5/16	5/16	3/4	2 1/2	4	-	-	Ball	● MXB2650515	MXB2650515W
5/16	5/16	1 1/4	3	4	-	-	Ball	● MXB2650516	MXB2650516W
5/16	5/16	1/2	4	4	1 1/8	0.294	Ball	● MXB2650517	MXB2650517W
3/8	3/8	1/2	2	4	-	-	Ball	● MXB2650518	MXB2650518W
3/8	3/8	7/8	3	4	-	-	Ball	● MXB2650519	MXB2650519W
3/8	3/8	1 1/4	3	4	-	-	Ball	● MXB2650520	MXB2650520W
3/8	3/8	1/2	4	4	1 1/8	0.353	Ball	● MXB2650521	MXB2650521W
3/8	3/8	1/2	4	4	2 1/8	0.353	Ball	● MXB2650522	MXB2650522W
3/8	3/8	1/2	6	4	3 1/8	0.353	Ball	● MXB2650523	MXB2650523W
1/2	1/2	5/8	2 1/2	4	-	-	Ball	● MXB2650524	MXB2650524W
1/2	1/2	1 1/8	3	4	-	-	Ball	● MXB2650525	MXB2650525W
1/2	1/2	1 5/8	4	4	-	-	Ball	● MXB2650526	MXB2650526W
1/2	1/2	5/8	4	4	2 1/8	0.475	Ball	● MXB2650527	MXB2650527W
1/2	1/2	5/8	6	4	3 1/8	0.475	Ball	● MXB2650528	MXB2650528W
1/2	1/2	5/8	6	4	4 1/8	0.475	Ball	● MXB2650529	MXB2650529W
5/8	5/8	3/4	3	4	-	-	Ball	● MXB2650530	MXB2650530W
5/8	5/8	1 5/8	3 1/2	4	-	-	Ball	● MXB2650531	MXB2650531W
5/8	5/8	2 1/8	4	4	-	-	Ball	● MXB2650532	MXB2650532W
5/8	5/8	3/4	4	4	2 3/8	0.594	Ball	● MXB2650533	MXB2650533W
5/8	5/8	3/4	6	4	3 3/8	0.594	Ball	● MXB2650534	MXB2650534W
5/8	5/8	3/4	6	4	4 1/8	0.594	Ball	● MXB2650535	MXB2650535W
3/4	3/4	1 1/8	4	4	-	-	Ball	● MXB2650536	MXB2650536W
3/4	3/4	1 5/8	4	4	-	-	Ball	● MXB2650537	MXB2650537W
3/4	3/4	2 1/4	5	4	-	-	Ball	● MXB2650538	MXB2650538W
3/4	3/4	1 1/8	4	4	2 1/2	0.713	Ball	● MXB2650539	MXB2650539W
3/4	3/4	1 1/8	6	4	3 1/2	0.713	Ball	● MXB2650540	MXB2650540W
3/4	3/4	1 1/8	6	4	4 1/8	0.713	Ball	● MXB2650541	MXB2650541W
1	1	1 1/4	4	4	-	-	Ball	● MXB2650542	MXB2650542W
1	1	2 1/4	5	4	-	-	Ball	● MXB2650543	MXB2650543W
1	1	3 1/4	6	4	-	-	Ball	● MXB2650544	MXB2650544W
1	1	1 1/4	5	4	2 1/2	0.95	Ball	● MXB2650545	MXB2650545W
1	1	1 1/4	7	4	3 5/8	0.95	Ball	● MXB2650546	MXB2650546W

● = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 60



5 Flute



**MAXQ**  
BALL NOSE

Cutting DIA	SHK DIA	LOC	OAL	No of Flutes	Ext Reach LGTH	Neck DIA	Corner Radius	ENDURASpeed EDP #	ENDURASpeed EDP # w/ Weldon Flat
3/8	3/8	7/8	3	5	–	–	Ball	● MXB2650548	MXB2650548W
3/8	3/8	1 1/4	3	5	–	–	Ball	● MXB2650549	MXB2650549W
3/8	3/8	1/2	4	5	2 1/8	0.353	Ball	● MXB2650550	MXB2650550W
3/8	3/8	1/2	6	5	3 1/8	0.353	Ball	● MXB2650551	MXB2650551W
1/2	1/2	1 1/8	3	5	–	–	Ball	● MXB2650552	MXB2650552W
1/2	1/2	1 5/8	4	5	–	–	Ball	● MXB2650553	MXB2650553W
1/2	1/2	5/8	6	5	3 1/8	0.475	Ball	● MXB2650554	MXB2650554W
1/2	1/2	5/8	6	5	4 1/8	0.475	Ball	● MXB2650555	MXB2650555W
5/8	5/8	1 5/8	3 1/2	5	–	–	Ball	● MXB2650556	MXB2650556W
5/8	5/8	2 1/8	4	5	–	–	Ball	● MXB2650557	MXB2650557W
5/8	5/8	3/4	6	5	3 3/8	0.594	Ball	● MXB2650558	MXB2650558W
5/8	5/8	3/4	6	5	4 1/8	0.594	Ball	● MXB2650559	MXB2650559W
3/4	3/4	1 5/8	4	5	–	–	Ball	● MXB2650560	MXB2650560W
3/4	3/4	2 1/4	5	5	–	–	Ball	● MXB2650561	MXB2650561W
3/4	3/4	1 1/8	6	5	3 1/2	0.713	Ball	● MXB2650562	MXB2650562W
3/4	3/4	1 1/8	6	5	4 1/8	0.713	Ball	● MXB2650563	MXB2650563W
1	1	2 1/4	5	5	–	–	Ball	● MXB2650564	MXB2650564W
1	1	3 1/4	6	5	–	–	Ball	● MXB2650565	MXB2650565W
1	1	1 1/4	7	5	3 5/8	0.95	Ball	● MXB2650566	MXB2650566W

● = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 61

### MACHINING FORMULAS

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$$\text{RPM} = (3.82 \times \text{SFM}) / \text{tool dia.}$$

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$$\text{SFM} = \text{RPM} \times .262 \times \text{tool dia.}$$

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$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times \text{RPM}$$

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$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

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$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (\text{RPM} \times \# \text{ Flutes})$$

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$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

# MAXQ-4 Speed & Feed Chart

ISO Grade	Material / Grade	SFM Hardness		Application	Recommended Starting Parameters (< 32Rc)									
		< 32Rc	> 32Rc		Rad DOC % of DIA	Axial DOC x DIA	SFM Starting (<32Rc)	Chip Load Per Tooth						
								1/8	1/4	3/8	1/2	5/8	3/4	1
P	<b>Carbon Steel</b> 10XX, 11XX 12XX, 15XX	400 - 600	150 - 250	Full Slotting	100%	.5x	350	.0008	.0016	.0024	.0028	.0036	.0044	.0050
		350 - 650	150 - 250	Heavy Profile	33%	1.25x	400	.0010	.0020	.0029	.0034	.0044	.0053	.0064
		500 - 850	225 - 325	HEM* Profile	15%	2x	550	.0014	.0029	.0041	.0048	.0062	.0075	.0089
	<b>Alloy Steel</b> 13XX, 40XX, 41XX, 43XX 44XX, 46XX, 47XX, 48XX	350 - 450	200 - 300	Finishing	3-5%	2x	450	.0008	.0016	.0024	.0028	.0036	.0044	.0050
		275 - 400	100 - 200	Full Slotting	100%	.5x	325	.0008	.0016	.0024	.0028	.0036	.0044	.0050
		300 - 450	150 - 225	Heavy Profile	33%	1.25x	350	.0010	.0020	.0029	.0034	.0044	.0053	.0064
		450 - 750	175 - 300	HEM* Profile	15%	2x	500	.0014	.0029	.0041	.0048	.0062	.0075	.0089
	<b>Mold &amp; Die Steel</b> 300M, 4340, 52100, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	375 - 450	200 - 250	Finishing	3-5%	2x	450	.0008	.0016	.0024	.0028	.0036	.0044	.0050
		225 - 325	70 - 150	Full Slotting	100%	.5x	275	.0004	.0012	.0019	.0024	.0028	.0033	.0038
		225 - 375	70 - 150	Heavy Profile	33%	1.25x	275	.0005	.0015	.0023	.0029	.0034	.0040	.0048
		350 - 500	150 - 275	HEM* Profile	10%	2x	400	.0009	.0026	.0039	.0049	.0057	.0067	.0081
	<b>Tool Steel</b> PM STEELS	300 - 400	125 - 225	Finishing	3-5%	2x	350	.0004	.0012	.0019	.0024	.0028	.0033	.0038
125 - 275			Full Slotting	100%	.5x	200	.0005	.0010	.0020	.0025	.0030	.0035	.0040	
175 - 325			Heavy Profile	25%	1.25x	250	.0007	.0014	.0027	.0033	.0040	.0046	.0055	
275 - 475			HEM* Profile	10%	2x	350	.0012	.0023	.0044	.0055	.0066	.0077	.0092	
M	<b>Austenitic Stainless</b> 301, 302, 303, 304/304L/304H, 316/316L, 317L, 321/321H, 347/347H, Nitronic, 309/309S, 310/310S/310H, 330	200 - 325	80 - 200	Full Slotting	100%	.75x	275	.0006	.0013	.0022	.0026	.0032	.0039	.0045
		250 - 350	80 - 200	Heavy Profile	33%	1.25x	325	.0008	.0017	.0027	.0032	.0039	.0047	.0057
		300 - 500	150 - 275	HEM* Profile	15%	2x	400	.0011	.0023	.0038	.0045	.0055	.0066	.0080
		250 - 350	175 - 275	Finishing	3-5%	2x	350	.0006	.0013	.0022	.0026	.0032	.0039	.0045
	<b>Martensitic Stainless</b> 403, 405, 409, 410/410S/410HT, 416/416HT, 420, 422, 430, 440C	200 - 325	100 - 250	Full Slotting	100%	.5x	275	.0004	.0010	.0020	.0023	.0030	.0035	.0040
		225 - 350	100 - 250	Heavy Profile	25%	1.25x	300	.0006	.0014	.0027	.0031	.0040	.0046	.0055
		275 - 450	125 - 250	HEM* Profile	10%	2x	400	.0009	.0023	.0044	.0051	.0066	.0077	.0092
		250 - 350	150 - 275	Finishing	3-5%	2x	350	.0004	.0010	.0020	.0023	.0030	.0035	.0040
	<b>Precipitation Stainless</b> 13-8 PH, 15-5 PH, 15-7 PH 17-4 PH, 17-7 PH S143	160 - 225	90 - 180	Full Slotting	100%	.5x	200	.0004	.0010	.0020	.0025	.0030	.0035	.0040
		180 - 250	90 - 125	Heavy Profile	25%	1.25x	225	.0006	.0014	.0027	.0033	.0040	.0046	.0055
		225 - 450	125 - 250	HEM* Profile	10%	2x	400	.0009	.0023	.0044	.0055	.0066	.0077	.0092
		225 - 325	150 - 275	Finishing	3-5%	2x	325	.0004	.0010	.0020	.0025	.0030	.0035	.0040
K	<b>Cast Iron Grey</b> 20A, 25A, 30A, 35A, 40A, 45A, 50A	250 - 400	130 - 300	Full Slotting	100%	.5x	375	.0005	.0015	.0025	.0030	.0035	.0040	.0046
		250 - 450	170 - 300	Heavy Profile	33%	1.25x	425	.0006	.0019	.0031	.0037	.0043	.0048	.0059
		300 - 550	350 - 500	HEM* Profile	10%	2x	500	.0011	.0032	.0051	.0061	.0071	.0081	.0098
	<b>Cast Ductile / Nodular</b> 40010, 60-40-18, 65-45-12 32510, 32518	300 - 400	300 - 400	Finishing	3-5%	2x	400	.0005	.0015	.0025	.0030	.0035	.0040	.0046
		120 - 300	80 - 140	Full Slotting	100%	.5x	275	.0005	.0011	.0020	.0025	.0030	.0035	.0040
		220 - 350	100 - 150	Heavy Profile	33%	1.25x	325	.0006	.0014	.0024	.0031	.0037	.0042	.0051
S	<b>Cobalt Base</b> Haynes 21, 25, L-605, Mar-M302, NASA Co-W-Re Stellite, Ultimet	300 - 500	170 - 270	HEM* Profile	10%	2x	450	.0011	.0023	.0041	.0051	.0061	.0071	.0085
		275 - 400	140 - 200	Finishing	3-5%	2x	400	.0005	.0011	.0020	.0025	.0030	.0035	.0040
		70 - 120	40 - 90	Full Slotting	100%	.33x	100	.0003	.0008	.0015	.0020	.0024	.0027	.0030
	<b>Iron Base</b> A-286, Discaloy Incoloy 800-802, Multimet 16-25-6	70 - 120	40 - 90	Heavy Profile	20%	.75x	100	.0005	.0012	.0022	.0029	.0035	.0038	.0045
		150 - 210	80 - 100	HEM* Profile	8%	1.25x	170	.0008	.0022	.0040	.0053	.0064	.0071	.0083
		80-120	80 - 100	Finishing	3-5%	1.5x	100	.0003	.0008	.0015	.0020	.0024	.0027	.0030
	<b>Nickel Base</b> Hastelloy, Haynes 242, Inconel 600, 625, 718, Invar, Kovar, Monel, Nimonic, Rene 41, 77, 95, Udimet, Waspaloy	60 - 90	40 - 70	Full Slotting	100%	.33x	70	.0004	.0010	.0020	.0025	.0030	.0035	.0040
		80 - 140	40 - 70	Heavy Profile	20%	.75x	120	.0006	.0015	.0029	.0036	.0043	.0050	.0060
		150 - 200	60 - 80	HEM* Profile	8%	1.25x	170	.0011	.0028	.0053	.0066	.0079	.0092	.0111
	<b>Titanium</b> 6Al-4V, Commercially Pure Titanium Aluminide	80-120	60 - 80	Finishing	3-5%	1.5x	120	.0004	.0010	.0020	.0025	.0030	.0035	.0040
		70 - 100	40 - 80	Full Slotting	100%	.33x	70	.0003	.0008	.0016	.0020	.0023	.0027	.0030
		70 - 120	40 - 90	Heavy Profile	20%	.75x	90	.0005	.0012	.0023	.0029	.0033	.0038	.0045
<b>Titanium</b> Ti 10-2-3 Beta 21S Ti 5553	100 - 150	70 - 120	HEM* Profile	8%	1.5x	125	.0008	.0022	.0042	.0053	.0061	.0071	.0083	
	90 - 125	70 - 100	Finishing	3-5%	1.5x	125	.0003	.0008	.0016	.0020	.0023	.0027	.0030	
	120 - 180	80 - 120	Full Slotting	100%	1x	140	.0004	.0010	.0020	.0025	.0030	.0036	.0041	
	120 - 200	90 - 130	Heavy Profile	30%	1x	160	.0005	.0013	.0025	.0031	.0038	.0045	.0054	
	200 - 450	100 - 140	HEM* Profile	10%	1.5x	350	.0009	.0022	.0042	.0052	.0063	.0075	.0089	
	200 - 400	100 - 140	Finishing	3-5%	1.5x	300	.0004	.0010	.0020	.0025	.0030	.0036	.0041	
	80 - 120	60 - 100	Full Slotting	100%	.5x	100	.0003	.0007	.0015	.0020	.0023	.0027	.0030	
	90 - 140	80 - 120	Heavy Profile	20%	1x	120	.0005	.0011	.0022	.0029	.0033	.0038	.0045	
	100 - 150	80 - 120	HEM* Profile	8%	1.5x	140	.0008	.0019	.0040	.0053	.0061	.0071	.0083	
	100 - 160	100 - 120	Finishing	3-5%	1.5x	160	.0003	.0007	.0015	.0020	.0023	.0027	.0030	

Radial Chip Thinning was applied to Chip Load Data  
HEM\* = High Efficiency Machining

## MACHINING FORMULAS

$$\text{RPM} = (3.82 \times \text{SFM}) / \text{tool dia.}$$

$$\text{SFM} = \text{RPM} \times .262 \times \text{tool dia.}$$

$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times \text{RPM}$$

$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

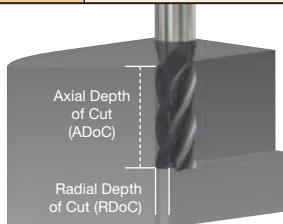
$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (\text{RPM} \times \# \text{ Flutes})$$

$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

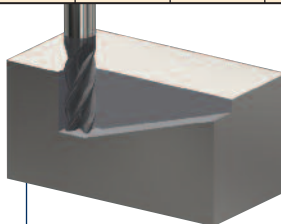


# MAXQ-5 Speed & Feed Chart

ISO Grade	Material / Grade	SFM Hardness		Application	Rad DOC % of DIA	Recommended Starting Parameters (< 32Rc)								
		< 32Rc	> 32Rc			Axial DOC x DIA	SFM Starting (<32Re)	Chip Load Per Tooth						
								1/8	1/4	3/8	1/2	5/8	3/4	1
P	<b>Carbon Steel</b> 10XX, 11XX 12XX, 15XX	400 - 600	150 - 250	Full Slotting	100%	.5x	350	.0005	.0012	.0020	.0024	.0031	.0037	.0043
		350 - 650	150 - 250	Heavy Profile	33%	1.25x	400	.0010	.0020	.0029	.0034	.0044	.0053	.0064
		500 - 850	225 - 325	HEM* Profile	15%	2x	550	.0014	.0029	.0041	.0048	.0062	.0075	.0089
		350 - 450	200 - 300	Finishing	3-5%	2x	450	.0005	.0012	.0020	.0024	.0031	.0037	.0043
	<b>Alloy Steel</b> 13XX, 40XX, 41XX, 43XX 44XX, 46XX, 47XX, 48XX	275 - 400	100 - 200	Full Slotting	100%	.5x	325	.0005	.0120	.0020	.0024	.0030	.0037	.0043
		300 - 450	150 - 225	Heavy Profile	33%	1.25x	350	.0010	.0020	.0029	.0034	.0044	.0053	.0064
		450 - 750	175 - 300	HEM* Profile	15%	2x	500	.0014	.0029	.0041	.0048	.0062	.0075	.0089
		375 - 450	200 - 250	Finishing	3-5%	2x	450	.0005	.0120	.0020	.0024	.0030	.0037	.0043
	<b>Mold &amp; Die Steel</b> 300M, 4340, 52100, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	225 - 325	70 - 150	Full Slotting	100%	.5x	275	.0003	.0010	.0150	.0020	.0024	.0029	.0033
		225 - 375	70 - 150	Heavy Profile	33%	1.25x	275	.0005	.0015	.0023	.0029	.0034	.0040	.0048
		350 - 500	150 - 275	HEM* Profile	10%	2x	400	.0009	.0026	.0039	.0049	.0057	.0067	.0081
		300 - 400	125 - 225	Finishing	3-5%	2x	350	.0003	.0010	.0150	.0020	.0024	.0029	.0033
<b>Tool Steel</b> PM STEELS	125 - 275		Full Slotting	100%	.5x	200	.0003	.0008	.0015	.0020	.0025	.0030	.0035	
	175 - 325		Heavy Profile	25%	1.25x	250	.0007	.0014	.0027	.0033	.0040	.0046	.0055	
	275 - 475		HEM* Profile	10%	2x	350	.0012	.0023	.0044	.0055	.0066	.0077	.0092	
	250 - 350		Finishing	3-5%	2x	350	.0003	.0008	.0015	.0020	.0025	.0030	.0035	
M	<b>Austenitic Stainless</b> 301, 302, 303, 304/304L/304H, 316/316L, 317L, 321/321H, 347/347H, Nitronic, 309/309S, 310/310S/310H, 330	200 - 325	80 - 200	Full Slotting	100%	.5x	275	.0004	.0010	.0018	.0022	.0027	.0033	.0040
		250 - 350	80 - 200	Heavy Profile	33%	1.25x	325	.0008	.0017	.0027	.0032	.0039	.0047	.0057
		300 - 500	150 - 275	HEM* Profile	15%	2x	400	.0011	.0023	.0038	.0045	.0052	.0066	.0080
		250 - 350	175 - 275	Finishing	3-5%	2x	350	.0004	.0010	.0018	.0022	.0027	.0033	.0040
	<b>Martensitic Stainless</b> 403, 405, 409, 410/410S/410HT, 416/416HT, 420, 422, 430, 440C	200 - 325	100 - 250	Full Slotting	100%	.5x	275	.0003	.0008	.0015	.0017	.0023	.0026	.0030
		225 - 350	100 - 250	Heavy Profile	25%	1.25x	300	.0006	.0014	.0027	.0031	.0040	.0046	.0055
		275 - 450	125 - 250	HEM* Profile	10%	2x	400	.0009	.0023	.0044	.0051	.0066	.0077	.0092
		250 - 350	150 - 275	Finishing	3-5%	2x	350	.0003	.0008	.0015	.0017	.0023	.0026	.0030
	<b>Precipitation Stainless</b> 13-8 PH, 15-5 PH, 15-7 PH 17-4 PH, 17-7 PH S143	160 - 225	90 - 180	Full Slotting	100%	.5x	200	.0003	.0008	.0160	.0021	.0025	.0030	.0035
		180 - 250	90 - 125	Heavy Profile	25%	1.25x	225	.0006	.0014	.0027	.0033	.0040	.0046	.0055
		225 - 450	125 - 250	HEM* Profile	10%	2x	400	.0009	.0023	.0044	.0055	.0066	.0077	.0092
		225 - 325	150 - 275	Finishing	3-5%	2x	325	.0003	.0008	.0160	.0021	.0025	.0030	.0035
K	<b>Cast Iron Grey</b> 20A, 25A, 30A, 35A, 40A, 45A, 50A	250 - 400	130 - 300	Full Slotting	100%	.5x	375	.0003	.0011	.0020	.0025	.0030	.0035	.0040
		250 - 450	170 - 300	Heavy Profile	33%	1.25x	425	.0006	.0019	.0031	.0037	.0043	.0048	.0059
		300 - 550	350 - 500	HEM* Profile	10%	2x	500	.0011	.0032	.0051	.0061	.0071	.0081	.0098
		300 - 400	300 - 400	Finishing	3-5%	2x	400	.0003	.0011	.0020	.0025	.0030	.0035	.0040
	<b>Cast Ductile / Nodular</b> 40010, 60-40-18, 65-45-12 32510, 32518	120 - 300	80 - 140	Full Slotting	100%	.5x	275	.0003	.0008	.0015	.0020	.0025	.0030	.0035
		220 - 350	100 - 150	Heavy Profile	33%	1.25x	325	.0006	.0014	.0024	.0031	.0037	.0042	.0051
		300 - 500	170 - 270	HEM* Profile	10%	2x	450	.0011	.0023	.0041	.0051	.0061	.0071	.0085
		275 - 400	140 - 200	Finishing	3-5%	2x	400	.0003	.0008	.0015	.0020	.0025	.0030	.0035
S	<b>Cobalt Base</b> Haynes 21, 25, L-605, Mar-M302, NASA Co-W-Re Stellite, Ultimet	70 - 120	40 - 90	Full Slotting	100%	.33x	100	.0002	.0005	.0011	.0014	.0018	.0023	.0027
		70 - 120	40 - 90	Heavy Profile	20%	.75x	100	.0005	.0012	.0022	.0029	.0035	.0038	.0045
		150 - 210	80 - 100	HEM* Profile	8%	1.25x	170	.0008	.0022	.0040	.0053	.0064	.0071	.0083
		80-120	80 - 100	Finishing	3-5%	1.5x	100	.0002	.0005	.0011	.0014	.0018	.0023	.0027
	<b>Iron Base</b> A-286, Discaloy Incoloy 800-802, Multimet 16-25-6	60 - 90	40 - 70	Full Slotting	100%	.25x	70	.0003	.0008	.0015	.0019	.0025	.0030	.0035
		80 - 140	40 - 70	Heavy Profile	20%	.75x	120	.0006	.0015	.0029	.0036	.0043	.0050	.0060
		150 - 200	60 - 80	HEM* Profile	8%	1.25x	170	.0011	.0028	.0053	.0066	.0079	.0092	.0111
		80-120	60 - 80	Finishing	3-5%	1.5x	120	.0003	.0008	.0015	.0019	.0025	.0030	.0035
	<b>Nickel Base</b> Hastelloy, Haynes 242, Inconel 600, 625, 718, Invar, Kovar, Monel, Nimonic, Rene 41, 77, 95, Udimet, Waspaloy	70 - 100	40 - 80	Full Slotting	100%	.25x	70	.0002	.0005	.0011	.0015	.0019	.0022	.0026
		70 - 120	40 - 90	Heavy Profile	20%	.75x	90	.0005	.0012	.0023	.0029	.0033	.0038	.0045
		100 - 150	70 - 120	HEM* Profile	8%	1.5x	125	.0008	.0022	.0042	.0053	.0061	.0071	.0083
		90 - 125	70 - 100	Finishing	3-5%	1.5x	125	.0002	.0005	.0011	.0015	.0019	.0022	.0026
	<b>Titanium</b> 6Al-4V, Commercially Pure Titanium Aluminumide	120 - 180	80 - 120	Full Slotting	100%	.5x	140	.0003	.0008	.0015	.0020	.0025	.0030	.0034
		120 - 200	90 - 130	Heavy Profile	30%	1x	160	.0005	.0013	.0025	.0031	.0038	.0045	.0054
		200 - 450	100 - 140	HEM* Profile	10%	1.5x	350	.0009	.0022	.0042	.0052	.0063	.0075	.0089
		200 - 400	100 - 140	Finishing	3-5%	1.5x	300	.0003	.0008	.0015	.0020	.0025	.0030	.0034
	<b>Titanium</b> Ti 10-2-3 Beta 21S Ti 5553	80 - 120	60 - 100	Full Slotting	100%	.25x	100	.0002	.0005	.0011	.0015	.0018	.0022	.0026
		90 - 140	80 - 120	Heavy Profile	20%	1x	120	.0005	.0011	.0022	.0029	.0033	.0038	.0045
100 - 150		80 - 120	HEM* Profile	8%	1.5x	140	.0008	.0019	.0040	.0053	.0061	.0071	.0083	
100 - 160		100 - 120	Finishing	3-5%	1.5x	160	.0002	.0005	.0011	.0015	.0018	.0022	.0026	



Apply radial chip thinning formula when RDoC < 0.5 x tool dia.



Ramp Angle = 1° - 3°  
Reduce chipload by 20% of slotting rates.



See chart for SFM reductions for projection length > 2.5 x tool dia.

Radial Chip Thinning was applied to Chip Load Data  
HEM\* = High Efficiency Machining

REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER	
PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%



## SMC Premium

### ACHIEVE HIGHER FEED RATES

The open flute form increases chip flow which results in higher feed rates.

### INCREASE YOUR DEPTH OF CUT

The tapered web increases the end mill's toughness and the variable helix reduces the cutting forces, therefore an increase the depth of cut can be achieved.

### ACHIEVE A HIGHER MATERIAL REMOVAL RATE

Chip control, higher feed rates and increased depth of cut ensure a higher material removal rate.

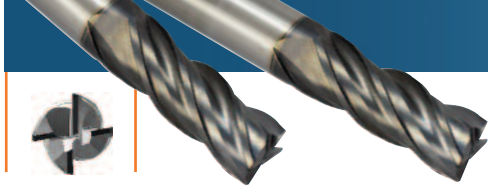
### REALIZE A SUPERIOR SURFACE FINISH

The combination of Variable Helix and Variable Index prevents harmonics, reducing chatter, therefore leaving a superior finish on the work piece.

### INCREASE YOUR TOOL LIFE

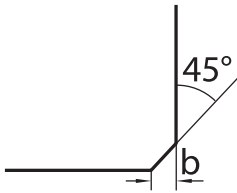
A combination of the substrate, the advanced cutting edge conditioning and the innovative PVD high performance coating, results in increased tool life.





# SMC Premium

## 4 Flute



### EDGE PROTECTION CHAMFER (Corner Chamfer)

Cutting Diameter	b
3/16	0.006
1/4 - 3/8	0.008
1/2 - 3/4	0.012
1	0.016

Cutting Dia	SHK Dia	LOC	OAL	No of Flutes	Corner Radius	ENDURASpeed EDP #
3/16	3/16	3/8	2	4	Corner Chamfer 0.010"	● SMCP500002 ● SMCP500004
3/16	3/16	1/2	2	4	Corner Chamfer 0.010"	● SMCP500042 ● SMCP500044
1/4	1/4	1/2	2 1/2	4	Corner Chamfer 0.015" 0.030"	● SMCP500006 ● SMCP500008 ● SMCP500010
1/4	1/4	5/8	2-1/2	4	Corner Chamfer 0.015" 0.030"	● SMCP500046 ● SMCP500048 ● SMCP500050
3/8	3/8	5/8	2 1/2	4	Corner Chamfer 0.015" 0.030"	● SMCP500012 ● SMCP500014 ● SMCP500016
3/8	3/8	1	3	4	Corner Chamfer 0.015" 0.030"	● SMCP500052 ● SMCP500054 ● SMCP500056
1/2	1/2	5/8	3	4	Corner Chamfer 0.030" 0.060"	● SMCP500018 ● SMCP500020 ● SMCP500022
1/2	1/2	1 1/4	3 1/2	4	Corner Chamfer 0.030" 0.060"	● SMCP500058 ● SMCP500060 ● SMCP500062
5/8	5/8	3/4	3	4	Corner Chamfer 0.030" 0.060"	● SMCP500024 ● SMCP500026 ● SMCP500028
5/8	5/8	1 1/4	3 1/2	4	Corner Chamfer 0.030" 0.060"	● SMCP500064 ● SMCP500066 ● SMCP500068
3/4	3/4	1	4	4	Corner Chamfer 0.030" 0.060"	● SMCP500030 ● SMCP500032 ● SMCP500034
3/4	3/4	1 1/2	4	4	Corner Chamfer 0.030" 0.060"	● SMCP500070 ● SMCP500072 ● SMCP500074
1	1	1 1/2	5	4	Corner Chamfer 0.030" 0.060"	● SMCP500036 ● SMCP500038 ● SMCP500040
1	1	2	5	4	Corner Chamfer 0.030" 0.060"	● SMCP500076 ● SMCP500078 ● SMCP500080

● = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 64

### MACHINING FORMULAS

$$\text{RPM} = (3.82 \times \text{SFM}) / \text{tool dia.}$$

$$\text{SFM} = \text{RPM} \times .262 \times \text{tool dia.}$$

$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times \text{RPM}$$

$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (\text{RPM} \times \# \text{ Flutes})$$

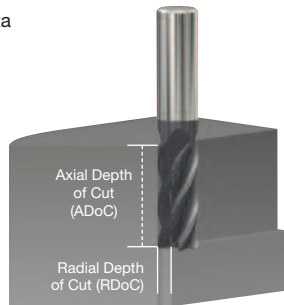
$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

# SMC Chart

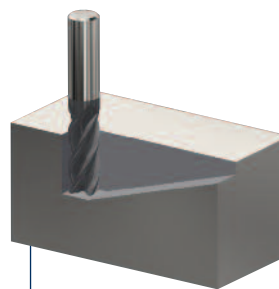
ISO Grade	Material / Grade	SFM Hardness		Application	Recommended Starting Parameters (< 32Rc)								
		< 32Rc	> 32Rc		Rad DOC % of DIA	Axial DOC x DIA	SFM Starting (<32Rc)	Chip Load Per Tooth					
								1/4	3/8	1/2	5/8	3/4	1
P	<b>Carbon Steel</b> 10XX, 11XX 12XX, 15XX	400 - 600	150 - 250	Full Slotting	100%	.5x	350	.0016	.0025	.0028	.0036	.0044	.0050
		350 - 650	150 - 250	Heavy Profile	33%	1.25x	400	.0020	.0032	.0036	.0044	.0054	.0062
		500 - 850	225 - 325	HEM* Profile	15%	2x	550	.0029	.0044	.0050	.0062	.0075	.0086
		350 - 450	200 - 300	Finishing	3-5%	2x	450	.0016	.0025	.0028	.0036	.0044	.0050
	<b>Alloy Steel</b> 13XX, 40XX, 41XX, 43XX 44XX, 46XX, 47XX, 48XX	275 - 400	100 - 200	Full Slotting	100%	.5x	325	.0016	.0025	.0028	.0036	.0044	.0050
		300 - 450	150 - 225	Heavy Profile	33%	1.25x	350	.0020	.0032	.0036	.0044	.0054	.0062
		450 - 750	175 - 300	HEM* Profile	15%	2x	500	.0029	.0044	.0050	.0062	.0075	.0086
		375 - 450	200 - 250	Finishing	3-5%	2x	450	.0016	.0025	.0028	.0036	.0044	.0050
	<b>Mold &amp; Die Steel</b> 300M, 4340, 52100, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	225 - 325	70 - 150	Full Slotting	100%	.5x	275	.0012	.0017	.0024	.0028	.0033	.0038
		225 - 375	70 - 150	Heavy Profile	33%	1.25x	275	.0015	.0022	.0031	.0034	.0041	.0046
		350 - 500	150 - 275	HEM* Profile	10%	2x	400	.0026	.0037	.0051	.0056	.0068	.0077
		300 - 400	125 - 225	Finishing	3-5%	2x	350	.0012	.0017	.0024	.0028	.0033	.0038
	<b>Tool Steel</b> PM STEELS	125 - 275		Full Slotting	100%	.5x	200	.0010	.0020	.0025	.0030	.0035	.0040
		175 - 325		Heavy Profile	25%	1.25x	250	.0013	.0027	.0034	.0039	.0046	.0052
		275 - 475		HEM* Profile	10%	2x	350	.0022	.0045	.0057	.0065	.0076	.0087
		250 - 350		Finishing	3-5%	2x	350	.0010	.0020	.0025	.0030	.0035	.0040
M	<b>Austenitic Stainless</b> 301, 302, 303, 304/304L/304H, 316/316L, 317L, 321/321H, 347/347H, Nitronic, 309/309S, 310/310S/310H, 330	130 - 210	60 - 130	Full Slotting	100%	.75x	150	.0011	.0020	.0022	.0027	.0033	.0043
		160 - 220	60 - 130	Heavy Profile	33%	1.25x	175	.0014	.0025	.0027	.0033	.0040	.0053
		300 - 500	150 - 275	HEM* Profile	15%	2x	375	.0020	.0035	.0038	.0046	.0056	.0074
		160 - 220	115 - 180	Finishing	2-5%	2x	175	.0011	.0020	.0022	.0027	.0033	.0043
	<b>Martensitic Stainless</b> 403, 405, 409, 410/410S/410HT, 416/416HT, 420, 422, 430, 440C	160 - 260	80 - 200	Full Slotting	100%	.5x	200	.0008	.0015	.0017	.0023	.0026	.0033
		180 - 280	80 - 200	Heavy Profile	25%	1.25x	225	.0010	.0021	.0024	.0030	.0035	.0044
		275 - 450	125 - 250	HEM* Profile	10%	2x	375	.0017	.0035	.0040	.0050	.0058	.0073
		200 - 280	120 - 220	Finishing	2-5%	2x	225	.0008	.0015	.0017	.0023	.0026	.0033
	<b>Precipitation Stainless</b> 13-8 PH, 15-5 PH, 15-7 PH, 17-4 PH, 17-7 PH S143	130 - 180	80 - 160	Full Slotting	100%	.5x	125	.0008	.0015	.0017	.0023	.0026	.0033
		145 - 200	80 - 100	Heavy Profile	25%	1.25x	150	.0010	.0021	.0024	.0030	.0035	.0044
		225 - 450	125 - 250	HEM* Profile	10%	2x	375	.0017	.0035	.0040	.0050	.0058	.0073
		200 - 260	120 - 220	Finishing	2-5%	2x	200	.0008	.0015	.0017	.0023	.0026	.0033
K	<b>Cast Iron Grey</b> 20A, 25A, 30A, 35A, 40A, 45A, 50A	250 - 400	130 - 300	Full Slotting	100%	.5x	375	.0016	.0025	.0030	.0035	.0040	.0046
		250 - 450	170 - 300	Heavy Profile	33%	1.25x	425	.0021	.0032	.0039	.0043	.0050	.0058
		300 - 550	350 - 500	HEM* Profile	10%	2x	500	.0035	.0053	.0064	.0072	.0083	.0096
		300 - 400	300 - 400	Finishing	3-5%	2x	400	.0016	.0025	.0030	.0035	.0040	.0046
	<b>Cast Ductile / Nodular</b> 40010, 60-40-18, 65-45-12 32510, 32518	120 - 300	80 - 140	Full Slotting	100%	.5x	275	.0010	.0020	.0025	.0030	.0035	.0040
		220 - 350	100 - 150	Heavy Profile	33%	1.25x	325	.0012	.0025	.0031	.0036	.0042	.0048
		300 - 500	170 - 270	HEM* Profile	10%	2x	450	.0020	.0041	.0052	.0060	.0070	.0081
		275 - 400	140 - 200	Finishing	3-5%	2x	400	.0010	.0020	.0025	.0030	.0035	.0040

Radial Chip Thinning was applied to Chip Load Data  
HEM\* = High Efficiency Machining

REDUCE SFM WHEN END MILL IS PROJECTING FROM THE TOOL HOLDER	
PROJECTION LENGTH	REDUCE SPEEDS & FEEDS
< 2.5 X Ø	0%
2.5 X Ø	15%
3 X Ø	20%
4 X Ø	55%
5 X Ø	65%
6 X Ø	75%



Apply radial chip thinning formula when RDoC < 0.5 x tool dia.



Reduce chipload by 20% of slotting rates.



See chart for SFM reductions for projection length > 2.5 x tool dia.



## MDR Ballnose

Optimized for High Speed Machining techniques with low radial engagement.

Featuring better reach angles, greater overall reach length, LMT Onsrud's tapered design, reinforced cutting edge and ENDURASpeed Red coating, the MDR 2 Flute ball nose end mill is specifically designed for mold steels.

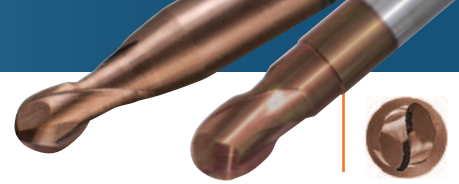
- ENDURASpeed Red coating combined with a reinforced cutting edge ensures longer tool life.
- Engineered to provide more clearance to make complex contours attainable.
- Unique conical design stabilizes the tool for superior finish.





# MDR Ballnose

## 2 Flute



### INCH

Cutting DIA	SHK DIA	LOC	OAL	Extended Reach	Angle	No of Flutes	Corner Radius	ENDURASpeed EDP #
1/16	1/4	1/16	3	1/8	8	2	0.031	● MDR2641036
3/32	1/4	3/32	3	3/16	8	2	0.047	● MDR2641037
1/8	1/4	1/8	3	1/4	9	2	0.063	● MDR2641038
3/16	1/4	3/16	3	3/8	9	2	0.094	● MDR2641039
1/4	1/4	1/4	3 1/2	1/2	-	2	0.125	● MDR2641040
5/16	5/16	5/16	4	3/4	-	2	0.156	● MDR2641041
3/8	3/8	3/8	4	7/8	-	2	0.188	● MDR2641042
1/2	1/2	1/2	4 1/2	1 1/8	-	2	0.250	● MDR2641043

● = In-Stock

Lead Times for non-stock EDP Numbers are 6 working days for uncoated tools and 8 working days for coated tools.

See Speed & Feed Chart Page 67

Cutting Diameter (inch)	Tolerances (inch) Diameter	SHK
1/16 - 3/32	+0/-0.0010	h6
> 3/32 - 1/4	+0/-0.0012	h6
> 1/4 - 3/8	+0/-0.0016	h6
> 3/8 - 1/2	+0/-0.0020	h6

ISO Grade	Material / Grade	Machinability Rating	Application	Recommended Starting Parameters (< 32Rc)											
				Axial DOC	SFM Hardness			SFM Starting (<32Rc)	Chip Load Per Tooth						
					<40Rc	<40-50Rc	<50Rc		1/16	3/32	1/8	3/16	1/4	3/8	1/2
P	Mold & Die Steel	35 - 65%	Finishing	3%	750-1000	800-1200	800-1200	1000	.0008	.0012	.0022	.0025	.0030	.0045	.0060
	300M, 4340, 52100, M50, A2,														
	D2, H13, L2, M2, P20, S7, T15, W2														

## MACHINING FORMULAS

$$\text{RPM} = (3.82 \times \text{SFM}) / \text{tool dia.}$$

$$\text{SFM} = \text{RPM} \times .262 \times \text{tool dia.}$$

$$\text{FEED RATE (in/min)} = \text{chipload} \times \# \text{ flutes} \times \text{RPM}$$

$$\text{Material Removal Rate (in}^3\text{/min)} = \text{Feed Rate} \times \text{ADoC} \times \text{RDoC}$$

$$\text{Feed/Tooth (in)} = \text{Feed Rate} / (\text{RPM} \times \# \text{ Flutes})$$

$$\text{Radial Chip Thinning} = \frac{\text{Chipload} \times (\text{dia}/2)}{\sqrt{(\text{dia} \times \text{RDoC}) - \text{RDoC}^2}}$$

# LMT Onsrud LP - END MILL REQUEST FORM

1081 S. Northpoint Blvd. • Waukegan, Illinois 60085 • Phone (847) 362-1560 • Fax (800) 557-6720 • www.onsrud.com

\*Starred Items = Required information

\*Distributor's Reference Number \_\_\_\_\_

\*Distributor Name \_\_\_\_\_

\*Distributor Address \_\_\_\_\_

\*Contact \_\_\_\_\_

\*Telephone \_\_\_\_\_ \*Fax \_\_\_\_\_

End user name \_\_\_\_\_

Customer Quote number \_\_\_\_\_

End user address \_\_\_\_\_

Contact \_\_\_\_\_

\*Telephone \_\_\_\_\_ \*Fax \_\_\_\_\_

\*Material being machined \_\_\_\_\_ Hardness \_\_\_\_\_

Machine type (Check all that apply):  Vertical  Horizontal  Multi Spindle  Geared Head  Belt Drive  Other

Machine Make and Model \_\_\_\_\_

H.P.= \_\_\_\_\_ Rigidity of Set-Up \_\_\_\_\_

Max. Spindle Speed \_\_\_\_\_ Spindle Taper \_\_\_\_\_

Coolant Type \_\_\_\_\_ Through the Spindle Coolant  Yes  No

\*Style of Milling  Slotting  Profiling  Pocketing  Multi Axis

Approval drawings  Not necessary  Required

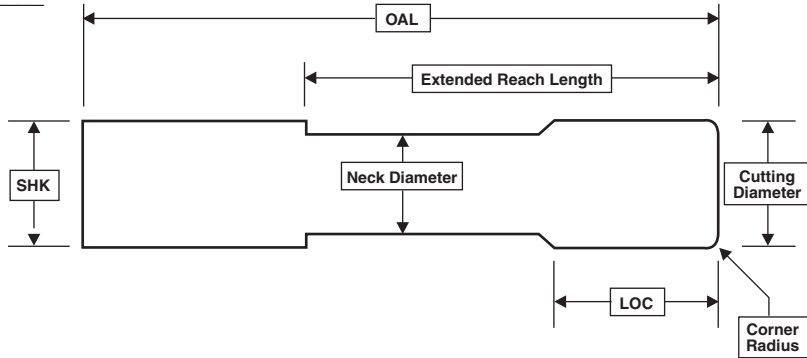
\*Tool Material (Specify if other than carbide) \_\_\_\_\_

Tool Modification (Tool to be modified) \_\_\_\_\_

Corner Radius  Chamfer  Weldon Flat  Whistle Notch

Quote Quantities \_\_\_\_\_

Yearly Quantities \_\_\_\_\_



Cutting Diameter \_\_\_\_\_

Shank Diameter \_\_\_\_\_

Length of Cut (LOC) \_\_\_\_\_

Neck Diameter \_\_\_\_\_

Extended Reach Length \_\_\_\_\_

Overall Length (OAL) \_\_\_\_\_

Number of Flutes \_\_\_\_\_

Corner Radius \_\_\_\_\_

Coating \_\_\_\_\_

Coolant Through \_\_\_\_\_

Cylindrical Margin \_\_\_\_\_

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## LMT Onsrud Terms & Conditions

**Shipping** - F.O.B. Waukegan, IL. All shipments ground unless otherwise specified.

**Claims** – Any claims for shortage, damage or loss must be made within 30 days of invoice date. United Parcel Service is a preferred method of shipment because of reliability and ease of tracing problem shipments.

**Guarantee** - Our products are guaranteed against defects in material and quality of manufacture when used in the proper manner. If tools are returned and found to be defective, we will repair or replace the tools. Continued tool breakage caused by improper tool usage without the knowledge of LMT Onsrud's technical staff is not a condition for return and replacement of such tools.

**Errors** - LMT Onsrud, LP cannot be held responsible for incorrect parts made with our products due to mislabeling or defect.

**Return Goods Policy** – No merchandise can be returned without prior authorization. Credit will not be issued for merchandise returned without a return authorization number. Product must be a current revision catalog item in new and saleable condition. All returns subject to a 15% restocking fee or offsetting order of equal value.

**Specials** - LMT Onsrud, LP has the right to over or under ship by 10% all specials. Special orders less than 10 pieces are subject to +/- 1 piece. Specials and modified tools are not returnable for credit. Specials cancelled will be assessed an in-process charge based on the status of the order and expenses incurred at the time of cancellation. If a special tool has been completed, the tool will be shipped and the price quoted will be billed.

**Safety Precautions** – Cutting tools should only be used to perform operations that are compatible with the original tool design. Safety glasses and other appropriate safety equipment should be worn by all people in the vicinity of tool use.

**Prices & Terms** - All prices and terms are subject to change without notice. All orders are subject to acceptance at LMT Onsrud.



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