

Speeds and Feeds

4 Flute Ball Nose End Mills – 3D Profiling



Material Group	Material Subgroup	Material Description	Composition / Structure / Heat Treatment		Hardness		Examples	Recommend	Ae	Ap	Parameter	Diameter (Ø)										
					HB	HRC						1/8	3/16	13/64	1/4	5/16	3/8	1/2	5/8	11/16	3/4	1
P	1	Non-alloy steel	About 0.15% C	Annealed	125		S15C, C15, 1015	☉	0.5D	1.0D	SFM(Vc)	530	530	530	530	530	530	530	530	530	530	530
	fz										.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0030	.0032	.0035	.0039	
	RPM										16227	10818	9986	8114	6491	5409	4057	3245	2950	2705	2028	
	FEED										63.89	46.00	47.18	51.11	61.33	55.37	44.72	38.33	37.17	38.33	31.62	
	2		About 0.45% C	Annealed	190	13	S45C, C45, 1045	☉	0.5D	1.0D	SFM(Vc)	530	530	530	530	530	530	530	530	530	530	530
	fz										.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0030	.0032	.0035	.0039	
	RPM										16227	10818	9986	8114	6491	5409	4057	3245	2950	2705	2028	
	FEED										63.89	46.00	47.18	51.11	61.33	55.37	44.72	38.33	37.17	38.33	31.62	
	3		About 0.45% C	Quenched & tempered	250	25		☉	0.5D	1.0D	SFM(Vc)	530	530	530	530	530	530	530	530	530	530	530
	fz										.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0030	.0032	.0035	.0039	
	RPM										16227	10818	9986	8114	6491	5409	4057	3245	2950	2705	2028	
	FEED										63.89	46.00	47.18	51.11	61.33	55.37	44.72	38.33	37.17	38.33	31.62	
	4		About 0.75% C	Annealed	270	28	SK5, Ck75, 1080	☉	0.5D	1.0D	SFM(Vc)	530	530	530	530	530	530	530	530	530	530	530
	fz										.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0030	.0032	.0035	.0039	
	RPM										16227	10818	9986	8114	6491	5409	4057	3245	2950	2705	2028	
	FEED	63.89									46.00	47.18	51.11	61.33	55.37	44.72	38.33	37.17	38.33	31.62		
	5	About 0.75% C	Quenched & tempered	300	32		☉	0.5D	1.0D	SFM(Vc)	370	370	370	370	370	370	370	370	370	370	370	
	fz									.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0029	.0031	.0035	.0039		
	RPM									11338	7559	6977	5669	4535	3779	2834	2262	2061	1890	1417		
	FEED									44.64	32.14	32.96	35.71	42.85	38.69	31.25	26.43	25.65	26.78	22.10		
	6	Low alloy steel	Annealed	180	10	SCM440, 42CrMo4, 410	☉	0.5D	1.0D	SFM(Vc)	530	530	530	530	530	530	530	530	530	530	530	
	fz									.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0030	.0032	.0035	.0039		
	RPM									16227	10818	9986	8114	6491	5409	4057	3245	2950	2705	2028		
	FEED									63.89	46.00	47.18	51.11	61.33	55.37	44.72	38.33	37.17	38.33	31.62		
	7		Quenched & tempered	275	29		☉	0.5D	1.0D	SFM(Vc)	530	530	530	530	530	530	530	530	530	530	530	
	fz									.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0030	.0032	.0035	.0039		
	RPM									16227	10818	9986	8114	6491	5409	4057	3245	2950	2705	2028		
	FEED									63.89	46.00	47.18	51.11	61.33	55.37	44.72	38.33	37.17	38.33	31.62		
	8		Quenched & tempered	300	32		☉	0.5D	1.0D	SFM(Vc)	370	370	370	370	370	370	370	370	370	370	370	
	fz									.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0029	.0031	.0035	.0039		
	RPM									11338	7559	6977	5669	4535	3779	2834	2262	2061	1890	1417		
	FEED									44.64	32.14	32.96	35.71	42.85	38.69	31.25	26.43	25.65	26.78	22.10		
	9		Quenched & tempered	350	38		☉	0.5D	1.0D	SFM(Vc)	370	370	370	370	370	370	370	370	370	370	370	
	fz									.0010	.0011	.0012	.0016	.0024	.0026	.0028	.0029	.0031	.0035	.0039		
	RPM									11338	7559	6977	5669	4535	3779	2834	2262	2061	1890	1417		
	FEED	44.64								32.14	32.96	35.71	42.85	38.69	31.25	26.43	25.65	26.78	22.10			
	10	High alloyed steel, and tool steel	Annealed	200	15	SKD, D2	☉	0.5D	1.0D	SFM(Vc)	225	225	225	225	225	225	225	225	225	225	225	
	fz									.0007	.0007	.0008	.0011	.0017	.0018	.0019	.0020	.0022	.0025	.0028		
	RPM									6815	4543	4194	3407	2726	2272	1704	1363	1239	1136	852		
	FEED									18.24	13.59	13.87	15.02	18.03	16.10	13.15	11.16	10.93	11.27	9.39		
	11.1		Quenched & Tempered	325	35	SKH, SUH, M42	☉	0.5D	1.0D	SFM(Vc)	225	225	225	225	225	225	225	225	225	225	225	
	fz									.0007	.0007	.0008	.0011	.0017	.0018	.0019	.0020	.0022	.0025	.0028		
	RPM									6815	4543	4194	3407	2726	2272	1704	1363	1239	1136	852		
	FEED									18.24	13.59	13.87	15.02	18.03	16.10	13.15	11.16	10.93	11.27	9.39		

Speeds and Feeds

4 Flute Ball Nose End Mills – 3D Profiling



Material Group	Material Subgroup	Material Description	Composition / Structure / Heat Treatment		Hardness		Examples	Recommend	Ae	Ap	Parameter	Diameter (Ø)										
					HB	HRC						1/8	3/16	13/64	1/4	5/16	3/8	1/2	5/8	11/16	3/4	1
M	12	Stainless steel	Ferritic / Martensitic	Annealed	200	15	SUS 420, X40Cr13, 420	☉	0.5D	1.0D	SFM(Vc)	255	255	255	255	255	255	255	255	255	255	255
											fz	.0006	.0006	.0010	.0012	.0016	.0018	.0020	.0021	.0023	.0023	.0023
											RPM	7732	5154	4758	3866	3093	2577	1933	1546	1406	1289	966
											FEED	18.26	12.18	18.73	18.26	19.48	18.26	15.22	13.15	13.06	11.77	8.98
	13	Stainless steel	Martensitic	Quenched & Tempered	240	23		☉	0.5D	1.0D	SFM(Vc)	255	255	255	255	255	255	255	255	255	255	255
											fz	.0006	.0006	.0010	.0012	.0016	.0018	.0020	.0021	.0023	.0023	.0023
											RPM	7732	5154	4758	3866	3093	2577	1933	1546	1406	1289	966
											FEED	18.26	12.18	18.73	18.26	19.48	18.26	15.22	13.15	13.06	11.77	8.98
	14.1	Stainless steel	Austenitic		180	10	SUS 316, 316, X5CrNiMo 17 12 2	☉	0.5D	1.0D	SFM(Vc)	280	280	280	280	280	280	280	280	280	280	280
											fz	.0008	.0008	.0010	.0016	.0018	.0020	.0022	.0024	.0025	.0026	.0027
											RPM	8526	5684	5247	4263	3410	2842	2132	1705	1550	1421	1066
											FEED	26.85	17.9	20.66	27.53	24.17	22.38	18.46	16.11	15.62	14.55	11.41
	14.2	Stainless steel	PH STAINLESS STEEL		???	??	SUS 630, PH 15-5	☉	0.5D	1.0D	SFM(Vc)	255	255	255	255	255	255	255	255	255	255	255
											fz	.0008	.0008	.0010	.0016	.0018	.0020	.0022	.0024	.0025	.0026	.0027
											RPM	7732	5154	4758	3866	3093	2577	1933	1546	1406	1289	966
											FEED	24.35	16.23	18.73	24.96	21.92	20.29	16.74	14.61	14.17	13.19	10.35
K	15	Grey cast iron	Pearlitic / ferritic		180	10	FC, GG, EN-GJL-250	☉	0.5D	1.0D	SFM(Vc)	390	390	390	390	390	390	390	390	390	390	390
											fz	.0012	.0013	.0015	.0020	.0029	.0032	.0034	.0037	.0039	.0044	.0049
											RPM	11918	7946	7334	5959	4767	3973	2980	2384	2167	1986	1490
											FEED	58.18	41.29	42.74	46.92	55.56	50.68	40.82	34.91	33.78	35.04	29.09
	16	Grey cast iron	Pearlitic (Martensitic)		260	26		☉	0.5D	1.0D	SFM(Vc)	390	390	390	390	390	390	390	390	390	390	390
											fz	.0012	.0013	.0015	.0020	.0029	.0032	.0034	.0037	.0039	.0044	.0049
											RPM	11918	7946	7334	5959	4767	3973	2980	2384	2167	1986	1490
											FEED	58.18	41.29	42.74	46.92	55.56	50.68	40.82	34.91	33.78	35.04	29.09
	17	Nodular cast iron	Ferritic		160	3	FCD, GGG, EN-GJS-500-7	☉	0.5D	1.0D	SFM(Vc)	390	390	390	390	390	390	390	390	390	390	390
											fz	.0012	.0013	.0015	.0020	.0029	.0032	.0034	.0037	.0039	.0044	.0049
											RPM	11918	7946	7334	5959	4767	3973	2980	2384	2167	1986	1490
											FEED	58.18	41.29	42.74	46.92	55.56	50.68	40.82	34.91	33.78	35.04	29.09
	18	Nodular cast iron	Pearlitic		250	25		☉	0.5D	1.0D	SFM(Vc)	390	390	390	390	390	390	390	390	390	390	390
											fz	.0012	.0013	.0015	.0020	.0029	.0032	.0034	.0037	.0039	.0044	.0049
											RPM	11918	7946	7334	5959	4767	3973	2980	2384	2167	1986	1490
											FEED	58.18	41.29	42.74	46.92	55.56	50.68	40.82	34.91	33.78	35.04	29.09
	19	Malleable cast iron	Ferritic		130		FCMW, FCMP, GTS, GJMB350-10	☉	0.5D	1.0D	SFM(Vc)	390	390	390	390	390	390	390	390	390	390	390
											fz	.0012	.0013	.0015	.0020	.0029	.0032	.0034	.0037	.0039	.0044	.0049
											RPM	11918	7946	7334	5959	4767	3973	2980	2384	2167	1986	1490
											FEED	58.18	41.29	42.74	46.92	55.56	50.68	40.82	34.91	33.78	35.04	29.09
	20	Malleable cast iron	Pearlitic		230	21		☉	0.5D	1.0D	SFM(Vc)	390	390	390	390	390	390	390	390	390	390	390
											fz	.0012	.0013	.0015	.0020	.0029	.0032	.0034	.0037	.0039	.0044	.0049
											RPM	11918	7946	7334	5959	4767	3973	2980	2384	2167	1986	1490
											FEED	58.18	41.29	42.74	46.92	55.56	50.68	40.82	34.91	33.78	35.04	29.09



Unit Definitions

Vc = Surface Feet per Minute
Fz = Inch Per Tooth
RPM = Revolutions per Minute

Feed = Inch per Minute
Ae = Width of Cut
Ap = Depth of Cut

Speeds and Feeds

4 Flute Ball Nose End Mills – 3D Profiling



Material Group	Material Subgroup	Material Description	Composition / Structure / Heat Treatment		Hardness		Examples	Recommend	Ae	Ap	Parameter	Diameter (Ø)										
					HB	HRC						1/8	3/16	13/64	1/4	5/16	3/8	1/2	5/8	11/16	3/4	1
S	31	Heat Resistant Super Alloys	Fe Based	Annealed	200	15	X12 NiCrSi 36-16, 1.4864	O	0.2D	0.3D	SFM(Vc)	70	70	70	70	70	70	70	70	70	70	70
											fz	.0006	.0006	.0007	.0011	.0012	.0014	.0015	.0017	.0018	.0018	.0019
											RPM	2109	1406	1298	1054	843	703	527	422	383	351	264
											FEED	4.65	3.1	3.47	4.65	4.12	3.87	3.15	2.79	2.72	2.49	1.99
	32		Fe Based	Cured	280	30		O	0.2D	0.3D	SFM(Vc)	70	70	70	70	70	70	70	70	70	70	70
											fz	.0006	.0006	.0007	.0011	.0012	.0014	.0015	.0017	.0018	.0018	.0019
											RPM	2109	1406	1298	1054	843	703	527	422	383	351	264
											FEED	4.65	3.1	3.47	4.65	4.12	3.87	3.15	2.79	2.72	2.49	1.99
	33		Ni or Co Based	Annealed	250	25	Inconel 718, NiCr20TiAl, 2.4631	O	0.2D	0.3D	SFM(Vc)	70	70	70	70	70	70	70	70	70	70	70
											fz	.0006	.0006	.0007	.0011	.0012	.0014	.0015	.0017	.0018	.0018	.0019
											RPM	2109	1406	1298	1054	843	703	527	422	383	351	264
											FEED	4.65	3.1	3.47	4.65	4.12	3.87	3.15	2.79	2.72	2.49	1.99
	34			Cured	350	38	NiCu30Al, 2.4375	O	0.2D	0.3D	SFM(Vc)	70	70	70	70	70	70	70	70	70	70	70
											fz	.0006	.0006	.0007	.0011	.0012	.0014	.0015	.0017	.0018	.0018	.0019
											RPM	2109	1406	1298	1054	843	703	527	422	383	351	264
											FEED	4.65	3.1	3.47	4.65	4.12	3.87	3.15	2.79	2.72	2.49	1.99
	35			Cast	320	34	G-X120Mn12, 1.3401	O	0.2D	0.3D	SFM(Vc)	70	70	70	70	70	70	70	70	70	70	70
											fz	.0006	.0006	.0007	.0011	.0012	.0014	.0015	.0017	.0018	.0018	.0019
											RPM	2109	1406	1298	1054	843	703	527	422	383	351	264
											FEED	4.65	3.1	3.47	4.65	4.12	3.87	3.15	2.79	2.72	2.49	1.99
	36	Titanium Alloys	Pure Titanium		400 Rm			O	0.5D	0.3D	SFM(Vc)	155	155	155	155	155	155	155	155	155	155	155
											fz	.0007	.0007	.0009	.0015	.0016	.0018	.0019	.0021	.0023	.0023	.0024
											RPM	4706	3137	2896	2353	1882	1569	1177	941	856	784	588
											FEED	13.34	8.89	10.03	13.71	11.86	11.12	9.08	8.00	7.82	7.16	5.65
	37		Alpha + Beta Alloys	Hardened	1050 Rm		TiAl6V4, 3.7165	O	0.5D	0.3D	SFM(Vc)	155	155	155	155	155	155	155	155	155	155	155
											fz	.0007	.0007	.0009	.0015	.0016	.0018	.0019	.0021	.0023	.0023	.0024
											RPM	4706	3137	2896	2353	1882	1569	1177	941	856	784	588
											FEED	13.34	8.89	10.03	13.71	11.86	11.12	9.08	8.00	7.82	7.16	5.65



Unit Definitions

Vc = Surface Feet per Minute
Fz = Inch Per Tooth
RPM = Revolutions per Minute

Feed = Inch per Minute
Ae = Width of Cut
Ap = Depth of Cut

Speeds and Feeds

4 Flute Ball Nose End Mills – Side Cutting



Material Group	Material Subgroup	Material Description	Composition / Structure / Heat Treatment		Hardness		Examples	Recommend	Ae	Ap	Parameter	Diameter (Ø)													
					HB	HRC																			
												1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32	3/8	7/16	1/2	5/8	3/4	1
P	1	Non-alloy steel	About 0.15% C	Annealed	125		S15C, C15, 1015	⊙	0.5D	1.5D (1.2D)	SFM(Vc)	500	500	500	500	500	500	500	525	550	550	550	550	550	550
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0019	.0021	.0026	.0025
											RPM	15249	12200	10166	8714	7625	6778	6100	5834	5616	4811	4210	3368	2806	2105
											FEED	12.01	15.37	17.61	18.53	19.21	22.95	25.94	29.86	33.59	32.20	31.16	28.11	28.73	21.21
	2	Non-alloy steel	About 0.45% C	Annealed	190	13	S45C, C45, 1045	⊙	0.5D	1.5D (1.2D)	SFM(Vc)	500	500	500	500	500	500	500	525	550	550	550	550	550	550
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0019	.0021	.0026	.0025
											RPM	15249	12200	10166	8714	7625	6778	6100	5834	5616	4811	4210	3368	2806	2105
											FEED	12.01	15.37	17.61	18.53	19.21	22.95	25.94	29.86	33.59	32.20	31.16	28.11	28.73	21.21
	3	Non-alloy steel	About 0.45% C	Quenched & tempered	250	25		⊙	0.5D	1.5D (1.2D)	SFM(Vc)	500	500	500	500	500	500	500	525	550	550	550	550	550	550
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0019	.0021	.0026	.0025
											RPM	15249	12200	10166	8714	7625	6778	6100	5834	5616	4811	4210	3368	2806	2105
											FEED	12.01	15.37	17.61	18.53	19.21	22.95	25.94	29.86	33.59	32.20	31.16	28.11	28.73	21.21
	4	Non-alloy steel	About 0.75% C	Annealed	270	28	SK5, Ck75, 1080	⊙	0.5D	1.5D (1.2D)	SFM(Vc)	500	500	500	500	500	500	500	525	550	550	550	550	550	550
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0019	.0021	.0026	.0025
											RPM	15249	12200	10166	8714	7625	6778	6100	5834	5616	4811	4210	3368	2806	2105
											FEED	12.01	15.37	17.61	18.53	19.21	22.95	25.94	29.86	33.59	32.20	31.16	28.11	28.73	21.21
	5	Non-alloy steel	About 0.75% C	Quenched & tempered	300	32		⊙	0.5D	1.5D (1.2D)	SFM(Vc)	350	350	350	350	350	350	350	370	385	385	385	385	385	385
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0018	.0021	.0026	.0025
											RPM	10727	8581	7151	6129	5363	4767	4291	4089	3912	3353	2934	2347	1956	1467
											FEED	8.45	10.81	12.39	13.03	13.51	16.14	18.24	20.93	23.41	22.44	21.71	19.59	20.02	14.78
	6	Low alloy steel		Annealed	180	10	SCM440, 42CrMo 4, 410	⊙	0.5D	1.5D (1.2D)	SFM(Vc)	500	500	500	500	500	500	500	525	550	550	550	550	550	550
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0019	.0021	.0026	.0025
											RPM	15249	12200	10166	8714	7625	6778	6100	5834	5616	4811	4210	3368	2806	2105
											FEED	12.01	15.37	17.61	18.53	19.21	22.95	25.94	29.86	33.59	32.20	31.16	28.11	28.73	21.21
	7	Low alloy steel		Quenched & tempered	275	29		⊙	0.5D	1.5D (1.2D)	SFM(Vc)	500	500	500	500	500	500	500	525	550	550	550	550	550	550
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0019	.0021	.0026	.0025
											RPM	15249	12200	10166	8714	7625	6778	6100	5834	5616	4811	4210	3368	2806	2105
											FEED	12.01	15.37	17.61	18.53	19.21	22.95	25.94	29.86	33.59	32.20	31.16	28.11	28.73	21.21
	8	Low alloy steel		Quenched & tempered	300	32		⊙	0.5D	1.5D (1.2D)	SFM(Vc)	350	350	350	350	350	350	350	370	385	385	385	385	385	385
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0018	.0021	.0026	.0025
											RPM	10727	8581	7151	6129	5363	4767	4291	4089	3912	3353	2934	2347	1956	1467
											FEED	8.45	10.81	12.39	13.03	13.51	16.14	18.24	20.93	23.41	22.44	21.71	19.59	20.02	14.78
	9	Low alloy steel		Quenched & tempered	350	38		⊙	0.5D	1.5D (1.2D)	SFM(Vc)	350	350	350	350	350	350	350	370	385	385	385	385	385	385
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0011	.0013	.0015	.0017	.0018	.0021	.0026	.0025
											RPM	10727	8581	7151	6129	5363	4767	4291	4089	3912	3353	2934	2347	1956	1467
											FEED	8.45	10.81	12.39	13.03	13.51	16.14	18.24	20.93	23.41	22.44	21.71	19.59	20.02	14.78
	10	High alloyed steel, and tool steel		Annealed	200	15	SKD, D2	⊙	0.5D	1.5D (1.2D)	SFM(Vc)	210	210	210	210	210	210	210	220	230	230	230	230	230	230
											fz	.0001	.0002	.0003	.0004	.0004	.0006	.0007	.0009	.0011	.0012	.0013	.0015	.0018	.0018
											RPM	6418	5134	4278	3667	3209	2852	2567	2445	2343	2008	1757	1406	1171	879
											FEED	3.03	4.85	5.39	5.49	5.56	6.74	7.68	8.86	9.96	9.33	8.86	8.19	8.30	6.23
	11.1	High alloyed steel, and tool steel		Quenched & Tempered	325	35	SKH, SUH, M42	⊙	0.5D	1.5D (1.2D)	SFM(Vc)	210	210	210	210	210	210	210	220	230	230	230	230	230	230
											fz	.0001	.0002	.0003	.0004	.0004	.0006	.0007	.0009	.0011	.0012	.0013	.0015	.0018	.0018
											RPM	6418	5134	4278	3667	3209	2852	2567	2445	2343	2008	1757	1406	1171	879
											FEED	3.03	4.85	5.39	5.49	5.56	6.74	7.68	8.86	9.96	9.33	8.86	8.19	8.30	6.23



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Speeds and Feeds

4 Flute Ball Nose End Mills – Side Cutting



Material Group	Material Subgroup	Material Description	Composition / Structure / Heat Treatment		Hardness		Examples	Recommend	Ae	Ap	Parameter	Diameter (Ø)															
					HB	HRC						1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32	3/8	7/16	1/2	5/8	3/4	1		
M	12	Stainless steel	Ferritic / Martensitic	Annealed	200	15	SUS 420, X40Cr13, 420	☉	0.5D	1.5D (1.2D)	SFM(Vc)	485	485	485	485	485	485	485	485	485	485	485	485	485	485	485	
											fz	.0002	.0002	.0004	.0004	.0005	.0007	.0009	.0011	.0013	.0014	.0015	.0018	.0022	.0022	.0022	
											RPM	14852	11882	9901	8487	7426	6601	5941	5401	4951	4243	3713	2970	2475	1857	1857	1857
											FEED	9.36	11.23	14.03	14.7	15.2	18.48	20.58	23.81	26.51	24.39	22.8	21.05	21.44	16.08	16.08	16.08
	13		Martensitic	Quenched & Tempered	240	23		☉	0.5D	1.5D (1.2D)	SFM(Vc)	485	485	485	485	485	485	485	485	485	485	485	485	485	485	485	485
											fz	.0002	.0002	.0004	.0004	.0005	.0007	.0009	.0011	.0013	.0014	.0015	.0018	.0022	.0022	.0022	
											RPM	14852	11882	9901	8487	7426	6601	5941	5401	4951	4243	3713	2970	2475	1857	1857	1857
											FEED	9.36	11.23	14.03	14.7	15.2	18.48	20.58	23.81	26.51	24.39	22.8	21.05	21.44	16.08	16.08	16.08
	14.1			Austenitic	180	10	SUS 316, 316, X5CrNi Mo 17 12 2	☉	0.5D	1.5D (1.2D)	SFM(Vc)	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
											fz	.0002	.0003	.0005	.0006	.0007	.0009	.0011	.0015	.0019	.0020	.0022	.0024	.0030	.0030	.0030	
											RPM	10635	8508	7090	6077	5317	4727	4254	3867	3545	3039	2659	2127	1772	1329	1329	1329
											FEED	8.37	10.72	14.51	14.83	15.07	17.12	18.76	23.14	26.8	24.64	23.03	20.77	21.49	16.12	16.12	16.12
	14.2			PH STAINLESS STEEL	???	??	SUS 630, PH 15-5	☉	0.5D	1.5D (1.2D)	SFM(Vc)	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310
											fz	.0002	.0003	.0005	.0006	.0007	.0009	.0011	.0015	.0019	.0020	.0022	.0024	.0030	.0030	.0030	
											RPM	9535	7628	6356	5448	4767	4238	3814	3467	3178	2724	2384	1907	1589	1192	1192	1192
											FEED	7.51	9.61	13.01	13.30	13.51	15.35	16.82	20.75	24.02	22.09	20.65	18.62	19.02	14.26	14.26	14.26
K	15	Grey cast iron	Pearlitic / ferritic		180	10	FC, GG, EN-GJL-250	☉	0.5D	1.5D (1.2D)	SFM(Vc)	365	365	365	365	365	365	365	365	385	405	405	405	405	405	405	
											fz	.0002	.0004	.0006	.0007	.0008	.0011	.0013	.0016	.0019	.0021	.0023	.0026	.0032	.0031	.0031	
											RPM	11216	8972	7477	6409	5608	4985	4486	4290	4115	3527	3087	2469	2058	1543	1543	1543
											FEED	10.60	14.13	16.48	17.16	17.66	21.19	24.02	27.70	31.11	29.44	28.19	25.28	26.25	19.20	19.20	19.20
	16		Pearlitic (Martensitic)		260	26		☉	0.5D	1.5D (1.2D)	SFM(Vc)	365	365	365	365	365	365	365	365	385	405	405	405	405	405	405	
											fz	.0002	.0004	.0006	.0007	.0008	.0011	.0013	.0016	.0019	.0021	.0023	.0026	.0032	.0031	.0031	
											RPM	11216	8972	7477	6409	5608	4985	4486	4290	4115	3527	3087	2469	2058	1543	1543	1543
											FEED	10.60	14.13	16.48	17.16	17.66	21.19	24.02	27.70	31.11	29.44	28.19	25.28	26.25	19.20	19.20	19.20
	17	Nodular cast iron	Ferritic		160	3	FCD, GGG, EN-GJS-500-7	☉	0.5D	1.5D (1.2D)	SFM(Vc)	365	365	365	365	365	365	365	365	385	405	405	405	405	405	405	
											fz	.0002	.0004	.0006	.0007	.0008	.0011	.0013	.0016	.0019	.0021	.0023	.0026	.0032	.0031	.0031	
											RPM	11216	8972	7477	6409	5608	4985	4486	4290	4115	3527	3087	2469	2058	1543	1543	1543
											FEED	10.60	14.13	16.48	17.16	17.66	21.19	24.02	27.70	31.11	29.44	28.19	25.28	26.25	19.20	19.20	19.20
	18	Pearlitic		250	25		☉	0.5D	1.5D (1.2D)	SFM(Vc)	365	365	365	365	365	365	365	365	385	405	405	405	405	405	405	405	
										fz	.0002	.0004	.0006	.0007	.0008	.0011	.0013	.0016	.0019	.0021	.0023	.0026	.0032	.0031	.0031		
										RPM	11216	8972	7477	6409	5608	4985	4486	4290	4115	3527	3087	2469	2058	1543	1543	1543	
										FEED	10.60	14.13	16.48	17.16	17.66	21.19	24.02	27.70	31.11	29.44	28.19	25.28	26.25	19.20	19.20	19.20	
	19	Malleable cast iron	Ferritic		130		FCMW, FCMP, GTS, GJMB35 0-10	☉	0.5D	1.5D (1.2D)	SFM(Vc)	365	365	365	365	365	365	365	365	385	405	405	405	405	405	405	
											fz	.0002	.0004	.0006	.0007	.0008	.0011	.0013	.0016	.0019	.0021	.0023	.0026	.0032	.0031	.0031	
											RPM	11216	8972	7477	6409	5608	4985	4486	4290	4115	3527	3087	2469	2058	1543	1543	1543
											FEED	10.60	14.13	16.48	17.16	17.66	21.19	24.02	27.70	31.11	29.44	28.19	25.28	26.25	19.20	19.20	19.20
	20		Pearlitic		230	21		☉	0.5D	1.5D (1.2D)	SFM(Vc)	365	365	365	365	365	365	365	365	385	405	405	405	405	405	405	
											fz	.0002	.0004	.0006	.0007	.0008	.0011	.0013	.0016	.0019	.0021	.0023	.0026	.0032	.0031	.0031	
											RPM	11216	8972	7477	6409	5608	4985	4486	4290	4115	3527	3087	2469	2058	1543	1543	1543
											FEED	10.60	14.13	16.48	17.16	17.66	21.19	24.02	27.70	31.11	29.44	28.19	25.28	26.25	19.20	19.20	19.20



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4 Flute Ball Nose End Mills – Side Cutting



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					HB	HRC						1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32	3/8	7/16	1/2	5/8	3/4	1		
S	31	Heat Resistant Super Alloys	Fe Based	Annealed	200	15	X12 NiCrSi 36-16, 1.4864	O	0.25D	1.0D	SFM(Vc)	85	85	85	85	85	85	85	85	85	85	85	85	85	85		
											fz	.0002	.0003	.0003	.0004	.0005	.0006	.0007	.0010	.0013	.0014	.0015	.0017	.0021	.0020		
											RPM	2598	2078	1732	1484	1299	1154	1039	945	866	742	649	520	433	325		
											FEED	2.05	2.29	2.18	2.34	2.45	2.82	3.11	3.87	4.5	4.15	3.89	3.52	3.68	2.66		
	32		Cured	280	30		O	0.25D	1.0D	SFM(Vc)	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	
										fz	.0002	.0003	.0003	.0004	.0005	.0006	.0007	.0010	.0013	.0014	.0015	.0017	.0021	.0020			
										RPM	2598	2078	1732	1484	1299	1154	1039	945	866	742	649	520	433	325			
										FEED	2.05	2.29	2.18	2.34	2.45	2.82	3.11	3.87	4.5	4.15	3.89	3.52	3.68	2.66			
	33		Annealed	250	25	Inconel 718, NiCr20Ti Al, 2.4631	O	0.25D	1.0D	SFM(Vc)	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	
										fz	.0002	.0003	.0003	.0004	.0005	.0006	.0007	.0010	.0013	.0014	.0015	.0017	.0021	.0020			
										RPM	2598	2078	1732	1484	1299	1154	1039	945	866	742	649	520	433	325			
										FEED	2.05	2.29	2.18	2.34	2.45	2.82	3.11	3.87	4.5	4.15	3.89	3.52	3.68	2.66			
	34		Cured	350	38	NiCu30Al, 2.4375	O	0.25D	1.0D	SFM(Vc)	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	
										fz	.0002	.0003	.0003	.0004	.0005	.0006	.0007	.0010	.0013	.0014	.0015	.0017	.0021	.0020			
										RPM	2598	2078	1732	1484	1299	1154	1039	945	866	742	649	520	433	325			
										FEED	2.05	2.29	2.18	2.34	2.45	2.82	3.11	3.87	4.5	4.15	3.89	3.52	3.68	2.66			
	35		Cast	320	34	G-X120Mn 12, 1.3401	O	0.25D	1.0D	SFM(Vc)	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	
										fz	.0002	.0003	.0003	.0004	.0005	.0006	.0007	.0010	.0013	.0014	.0015	.0017	.0021	.0020			
										RPM	2598	2078	1732	1484	1299	1154	1039	945	866	742	649	520	433	325			
										FEED	2.05	2.29	2.18	2.34	2.45	2.82	3.11	3.87	4.5	4.15	3.89	3.52	3.68	2.66			
	36	Titanium Alloys	Pure Titanium		400 Rr		O	0.35D	1.0D	SFM(Vc)	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190		
										fz	.0002	.0003	.0004	.0005	.0006	.0008	.0010	.0013	.0017	.0018	.0020	.0022	.0027	.0027			
										RPM	5806	4645	3871	3318	2903	2581	2323	2111	1935	1659	1452	1161	968	726			
										FEED	3.66	5.12	6.71	7.05	7.32	8.33	9.14	11.14	12.80	12.02	11.43	10.06	10.36	7.89			
	37		Alpha + Beta Alloys	Hardened	4050 R		TiAl6V4, 3.7165	O	0.35D	1.0D	SFM(Vc)	190	190	190	190	190	190	190	190	190	190	190	190	190	190		
											fz	.0002	.0003	.0004	.0005	.0006	.0008	.0010	.0013	.0017	.0018	.0020	.0022	.0027	.0027		
											RPM	5806	4645	3871	3318	2903	2581	2323	2111	1935	1659	1452	1161	968	726		
											FEED	3.66	5.12	6.71	7.05	7.32	8.33	9.14	11.14	12.80	12.02	11.43	10.06	10.36	7.89		



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