Technical Information Materials Groupings

Informacion Tecnica Para Grupos de Materiales • Informations Techniques / Classement des Matériaux • Technische Information für verschiedene Materialien • 技術情報 材質分類 • 材料分组技术信息

Material Group	Material Type	Hardness	BS	EN & Other Standards
Steel				
1.1	Magnetic soft steel	< 120 B	230M07, 050A12	EN1, EN2 Leadloy
1.2	Structural, case carburising	< 200 B	060A35, 080M40, 4360-50B	EM3A, 4,6,7,8, EN207, S62
1.3	Plain carbon steel	< 250 B	080M46, 080A62	EN9, 10, 43, S70
1.4	Alloy Steel	< 250 B	708M40/42, 817M40, 534A99, BM2, BT42	"EN16,17, 19(R,S) EN31, S2-10-1-8 (Soft)"
1.5	Alloy steel, hardened/tempered steel	350	B01, BM2, BT42, 826M40, 830M32	"EN24, 25,26(T,U,V) S95, S97, S98 (annealed)"
1.6	Alloy steel, hardened/tempered steel	> 350 B	801, 826M40, 830M31	EN25, 26, 27,(W,X,Z,) S97, S98, (H&T)
1.7	Alloy steel, hardened	49-55 C	B01, BD3, BH13	
1.8	Alloy steel, hardened	55-60 C	BM2, BH13	
1.9	Alloy steel, hardened	>60C		
Stainless Steel				
2.1	Free Machining Stainless	< 250 B	303 S21 416 S37	EN56, EN60
2.2	Austenetic	< 250 B	304 S15, 321 S17 316 S, 320 S12	EN80, EN58 + EN8J, 316
2.3	Ferritic + Austenetic, Martensitic	< 300 B	317 S16, 316 S16	EN58 b,e,t,j, Duplex alloys
2.4	Precipitation Hardened	< 300 B		
Cast Iron				
3.1	Lamellar graphite	< 150	grade 150, grade 400	Cast iron Soft
3.2	Lamellar graphite	>150<300	grade 200, grade 400	Cast iron Hard
3.3	Nodular graphite, malleable cast iron	< 200	420/12, P440/7 700/2. 30g/72	S.G. iron Mehanite Black & White Heart
3.4	Nodular graphite, malleable cast iron	>200<300	420/12, P440/7 700/2, 30g/72	S.G. iron Mehanite Black & White Heart
Titanium				
4.1	Unalloyed	< 200	TA1-9	Ti 99.0
4.2	Alloyed	< 270	TA10-14, TA17, TA28	Ti 2AL
4.3	Alloyed	>270<350	TA10-13, TA28	Ti AL
Nickel				
5.1	Unalloyed	< 150	NA 11, NA 12	Nickel 200, Nickel 270
5.2	Alloyed	< 270	HR203 3027-76	"Nimonic 75, Hastelloy C Monel 400, Inconel 600 Haynes Alloys 263"
5.3	Alloyed	>270<350	HR8 HR401, 601	Inconel 718, Waspalloy, Nimonic 80, Rene 41
Copper				
6.1	Copper	< 100	C101	Commercially pure
6.2	β Brass, Bronze	< 200	CZ120, CZ109, PB104	2.1030, 2.1080
6.3	¥-Brass	< 200	CZ108, CZ106	
6.4	High Strength Bronze	< 470	AB1 type	Ampco 18, Ampco 26
Aluminum, Magnesium				
7.1	Al,Mg, unalloyed	< 100	LM0, 1B, (1050A)	Magnesium Extruded Aluminium
7.2	Al alloyed, Si<0.5%	< 150	LM5, 10, 12, N4 (5251)	Low Silicon wrought & cast Aluminium
7.3	Al alloyed, Si>0.5%<10%	< 120	"LM2, 4, 16, 21, 22, 24, 25, 26,27, L109"	Silicon Alluminium
7.4	Al alloyed, Si>10%	< 120	LM6, 12, 13, 20, 28, 29, 30	Higi Silicon Alluminium
Synthetic Materials				
8.1	Thermoplastics	n/a	Polystyrene, Nylon, PVC Cellulose Acetate & Nitrate	Nylon, Hostalen Makrolon
8.2	Thermosetting plastics	n/a	Ebonite, Tufnol, Bakelite	Bakelite, Pertinax
8.3	Reinforced plastic materials	n/a	Kevlar, Printed circuit board	CFK, GFK, AFK
Hard Materials				
9.1	Cermets (Metal-ceramics)	< 550		

Technical Information for Endmills

Informacion Tecnica Para Fresas de Carburo • Informations Techniques pour les Fraises • Technische Information für Schaftfräser • エンドミル技術情報 • 端铣刀的技术信息

Suggested Endmill Starting Feed Per Tooth

Cutting Diameter	0.4-1 mm	1-2mm	3mm	4mm	5mm	6mm	7-8mm	9-10mm	11-15mm	16-20mm	25mm
Material Group	**vc m/min**										
1.1	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130
1.2	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130
1.3	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130
1.4	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130
1.5	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.060	0.100
1.6	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.060	0.100
1.7	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.060	0.100
1.8	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.060	0.100
1.9											
2.1	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.075	0.100
2.2	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.075	0.100
2.3	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.075	0.100
2.4											
3.1	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
3.2	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
3.3	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130
3.4	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130
4.1	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130
4.2	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130
4.3	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.075	0.100
5.1	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.075	0.100
5.2	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.075	0.100
5.3	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.075	0.100
6.1	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
6.2	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
6.3	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
6.4	0.008	0.010	0.013	0.016	0.018	0.022	0.030	0.038	0.052	0.075	0.100
7.1	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
7.2	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.950	0.130	0.150
7.3	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
7.4	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
8.1	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
8.02	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
8.3	0.012	0.018	0.022	0.027	0.035	0.045	0.060	0.075	0.095	0.130	0.150
9.1	0.010	0.014	0.017	0.021	0.025	0.030	0.045	0.055	0.070	0.090	0.130

- Recommendations based on axial loads of ≤ 1Xs the cutter diameter for profiling and .5 Xs the diameter for slotting. Starting recommendations only.
- Recomendaciones Basadas En Las Cargas Axiales De ≤ 1Xs De El Diametro De Corte Para Dar Forma & .5 Xs El Diametro Para El Ranurado. Recomendacion Solamente Para El Inicio
- Recommandations basées sur des charges axiales ≤ 1Xs, le diamètre de coupe pour le profilage, et 0,5 Xs le diamètre pour le rainurage . Recommandations de départ seulement.
- Empfehlungen basieren auf seitlicher Schnittkraft von ≤ 1Xs des Fraeser-Durchmessers fuer Profilfräsen und 0.5Xs des Durchmessers fuer Nutenfräsen. Dies sind nur Anfangs-Empfehlungen
- 推奨値は倣い削りで "≤1×刃径"、溝削りで "0.5 X 直径" の軸方向切込み量に基づいています。加工開始時は必ず上記の表に従って下さい。
- 推荐值基于1)(对于成型加工)轴向负荷≤1Xs的刀具直径的 和 2)(对于开槽加工)≤0.5 XS刀具直径建议分析。只是初始值建议

Technical Information for Endmills

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Endmills	2 FL Standard Endmill	3 FL Standard Endmill	4 FL Standard Endmill	2 FL Standard Endmill	3 FL Standard Endmill	4 FL Standard Endmill	2 FL Long Endmill	3 FL Long Endmill	4 FL Long Endmill	2 FL Long Endmill	3 FL Long Endmill	4 FL Long Endmill
												
Series	Uncoated	Uncoated	Uncoated	PowerA	PowerA	PowerA	Uncoated	Uncoated	Uncoated	PowerA	PowerA	PowerA
	300-0, -1, **301**-0, -1, **302**-0, -1, **303**-0, -1, **309**-0, -2	**300**-4, -5, **301**-4, -5, **302**-4, -5, **303**-4, -5, **310**-0, -2	**300**-2, -3, **301**-2, -3, **302**-2, -3, **303**-2, -3, **310**-0, -2	**300**-0, -1, **301**-0, -1, **302**-0, -1, **303**-0, -1, **309**-0, -2	**300**-4, -5, **301**-4, -5, **302**-4, -5, **303**-4, -5, **310**-0, -2	**300**-2, -3, **301**-2, -3, **302**-2, -3, **303**-2, -3, **310**-0, -2	**304**-0, -2,-4, 5, -6, -7	**305**-0, -2,-4, 5, -6, -7	**306**-0, -2,-4, 5, -6, -7	**304**-0, -2,-4, 5, -6, -7	**305**-0, -2,-4, 5, -6, -7	**306**-0, -2,-4, 5, -6, -7
Material Group	vc m/min											
1.1	79-122	79-122	79-122	159-244	159-244	159-241	49-71	49-71	49-71	100-138	100-141	100-141
1.2	79-122	79-122	79-122	159-244	159-244	159-241	49-71	49-71	49-71	100-138	100-141	100-141
1.3	61-80	61-80	61-80	121-161	120-161	120-161	35-51	35-51	35-51	70-101	70-101	70-101
1.4	61-80	61-80	61-80	120-161	120-161	120-161	35-51	35-51	35-51	70-101	70-101	70-101
1.5	40-61	40-61	40-61	120-161	120-161	79-161	25-36	25-36	25-36	50-71	50-71	50-71
1.6	20-40	20-40	20-40	41-83	41-83	40-80	16-20	16-20	16-20	31-46	31-46	31-46
1.7				41-83	41-83	40-80				31-46	31-46	31-46
1.8				41-83	41-83	40-80				31-46	31-46	31-46
1.9												
2.1	40-80	40-80	40-80	79-161	79-161	79-161	25-49	25-49	25-49	49-98	49-98	49-98
2.2	31-49	31-49	31-49	61-101	61-101	61-101	20-31	20-31	20-31	40-61	40-61	40-61
2.3	25-40	25-40	25-40	49-80	49-80	49-80	16-25	16-25	16-25	31-49	31-49	31-49
2.4	22-37	22-37	22-37	46-68	46-68	46-68				25-43	25-43	25-43
3.1	49-80	49-80	49-80	100-153	100-153	100-153	35-61	35-61	35-61	70-122	70-122	70-122
3.2	40-71	40-71	40-71	79-141	79-141	79-141	31-49	31-49	31-49	61-101	61-101	61-101
3.3	35-49	35-49	35-49	70-101	70-101	70-101	25-36	25-36	25-36	49-71	49-71	49-71
3.4	25-40	25-40	25-40	49-80	49-80	49-80	20-31	20-31	20-31	40-61	41-61	41-61
4.1	61-101	61-101	61-101	121-199	121-199	121-199	35-61	35-61	35-61	70-121	70-122	70-122
4.2	40-61	40-61	40-61	79-122	79-122	79-122	25-36	25-36	25-36	49-71	50-71	50-71
4.3	20-31	20-31	20-31	40-61	40-61	40-61	16-22	16-22	16-22	31-40	31-40	31-40
5.1	61-101	61-101	61-101	121-199	121-199	121-199	35-61	35-61	35-61	70-121	70-122	70-122
5.2	31-61	31-61	31-61	61-122	61-122	61-122	20-36	20-36	20-36	40-71	40-71	40-71
5.3	20-49	20-49	20-49	40-101	40-101	40-101	16-31	16-31	16-31	31-61	31-61	31-61
6.1	100-202	100-202	100-202	197-412	197-412	197-412	61-122	61-122	61-122	121-244	197-244	197-244
6.2	129-171	129-171	129-171	257-351	257-351	257-351	100-122	100-122	100-122	200-244	197-244	197-244
6.3	129-171	129-171	129-171	257-351	257-351	257-351	100-122	100-122	100-122	200-244	197-244	197-244
6.4	22-49	22-49	22-49	50-101	50-101	50-101	20-36	20-36	20-36	40-71	41-71	41-71
7.1	151-458	151-458					100-305	100-305				
7.2	151-458	151-458					100-305	100-305				
7.3	40-80	40-80					31-61	31-61				
7.4	35-49	35-49					25-36					
8.1	79-159	79-159					61-122	61-122				
8.2	70-130	70-130					50-101	50-101				
	70-130	70-130					50-101	50-101				
9.1	4-8	4-8	4-8	8-16	8-16	8-16						

Speeds and Feeds for Material Applications

Velocidades y Avances Para las Aplicaciones de Materiales • Vitesses et Avances selon matériaux usinés • Schnittgeschwindigkeiten und Vorschübe für verschiedene Materialien • 被削材別切削条件 • 应用在不同加工材料的速度和进给

2 FL X-Long Endmill	3 FL X-Long Endmill	4 FL X-Long Endmill	2 FL X-Long Endmill	3 FL X-Long Endmill	4 FL X-Long Endmill	2 FL Square End, Minimill	2 FL Ball End, Minimill	4 FL Square End, Minimill	4 FL Ball End, Minimill	2 FL Square End, Minimill	2 FL Ball End, Minimill	4 FL Square End, Minimill	4 FL Ball End, Minimill
													
Uncoated	Uncoated	Uncoated	PowerA	PowerA	PowerA	Uncoated	Uncoated	Uncoated	Uncoated	PowerA	PowerA	PowerA	PowerA
315-0, -2, -4	**316**-0, -2, -4	**317**-0, -2, -4	**315**-0, -2, -4	**316**-0, -2, -4	**317**-0, -2, -4	**307**-1	**307**-0	**307**-5	**307**-4	**307**-1	**307**-0	**307**-5	**307**-4
vc m/min													
32-51	32-51	32-51	64-71	64-71	64-71	79-122	79-122	79-122	79-122	159-244	159-244	159-244	159-244
32-51	32-51	32-51	64-71	64-71	64-71	79-122	79-122	79-122	79-122	159-244	159-244	159-244	159-244
25-33	25-33	25-33	49-65	49-65	49-65	61-80	61-80	61-80	61-80	121-161	121-161	121-161	121-161
25-33	25-33	25-33	49-65	49-65	49-65	61-80	61-80	61-80	61-80	120-161	120-161	120-161	120-161
17-25	17-25	17-25	34-49	34-49	34-49	40-61	40-61	40-61	40-61	120-161	120-161	120-161	120-161
10-17	10-17	10-17	19-34	19-34	19-34	20-40	20-40	20-40	20-40	41-83	41-83	41-83	41-83
			16-33	16-33	16-33					41-83	41-83	41-83	41-83
			16-33	16-33	16-33					41-83	41-83	41-83	41-83
16-33	16-33	16-33	31-65	31-65	31-65	40-80	40-80	40-80	40-80	79-161	79-161	79-161	79-161
13-22	13-22	13-22	25-43	25-43	25-43	31-49	31-49	31-49	31-49	61-101	61-101	61-101	61-101
11-16	11-16	11-16	23-31	23-31	23-31	25-40	25-40	25-40	25-40	49-80	49-80	49-80	49-80
			20-28	20-28	20-28	22-37	22-37	22-37	22-37	46-68	46-68	46-68	46-68
20-33	20-33	20-33	40-65	40-65	40-65	49-80	49-80	49-80	49-80	100-153	100-153	100-153	100-153
16-28	16-28	16-28	31-55	31-55	31-55	40-71	40-71	40-71	40-71	79-141	79-141	79-141	79-141
14-20	14-20	14-20	28-40	28-40	28-40	35-49	35-49	35-49	35-49	70-101	70-101	70-101	70-101
10-16	10-16	10-16	19-31	19-31	19-31	25-40	25-40	25-40	25-40	49-80	49-80	49-80	49-80
25-40	25-40	25-40	49-80	49-80	49-80	61-101	61-101	61-101	61-101	121-199	121-199	121-199	121-199
17-25	17-25	17-25	34-49	34-49	34-49	40-61	40-61	40-61	40-61	79-122	79-122	79-122	79-122
8-13	8-13	8-13	16-25	16-25	16-25	20-31	20-31	20-31	20-31	40-61	40-61	40-61	40-61
25-40	25-40	25-40	49-81	49-81	49-81	61-101	61-101	61-101	61-101	121-199	121-199	121-199	121-199
13-25	13-25	13-25	25-49	25-49	25-49	31-61	31-61	31-61	31-61	61-122	61-122	61-122	61-122
10-22	10-22	10-22	16-40	16-40	16-40	20-49	20-49	20-49	20-49	40-101	40-101	40-101	40-101
40-80	40-80	40-80	80-161	80-161	80-161	100-202	100-202	100-202	100-202	197-412	197-412	197-412	197-412
52-69	52-69	52-69	103-138	103-138	103-138	129-171	129-171	129-171	129-171	257-351	257-351	257-351	257-351
52-69	52-69	52-69	16-40	16-40	16-40	129-171	129-171	129-171	129-171	257-351	257-351	257-351	257-351
10-22	10-22	10-22				22-49	22-49	22-49	22-49	50-101	50-101	50-101	50-101
61-183	61-183					151-458	151-458	151-458	151-458				
61-183	61-183					151-458	151-458	151-458	151-458				
16-33	16-33					40-80	40-80	40-80	40-80				
14-22	14-22					35-49	35-49	35-49	35-49				
32-65	32-65					79-159	79-159	79-159	79-159				
29-52	29-52					70-130	70-130	70-130	70-130				
29-52	29-52					70-130	70-130	70-130	70-130				
						4-8	4-8	4-8	4-8	8-16	8-16	8-16	8-16