

IPC9 Series Application Guide – Speed & Feed (inch)

ISO Classification	Work Material	Type of Cut	Axial DOC	Radial DOC	Number of Flutes	Speed (SFM)	Feed (MM per Tooth)					
							1/4	3/8	1/2	5/8	3/4	1
K	Cast Iron - Gray ASTM-A48 Class 20, 25, 30, 35 & 40	Peripheral - HEM*	<=3 x D	.1 x D	9	400	0.0036	0.0054	0.0072	0.0090	0.0108	0.0144
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	400	0.0032	0.0049	0.0065	0.0081	0.0097	0.0130
		Peripheral - HEM*	>4xD-5xD	.08 x D	9	390	0.0029	0.0043	0.0058	0.0072	0.0086	0.0115
		Finish	3 x D	.015 x D	9	450	0.0013	0.0020	0.0026	0.0033	0.0039	0.0052
	Cast Iron Malleable	Peripheral - HEM*	<=3 x D	.08 x D	9	390	0.0029	0.0044	0.0058	0.0073	0.0087	0.0116
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	390	0.0026	0.0039	0.0052	0.0065	0.0078	0.0104
		Peripheral - HEM*	>4xD-5xD	.08 x D	9	375	0.0023	0.0035	0.0046	0.0058	0.0070	0.0093
		Finish	3 x D	.015 x D	9	350	0.0011	0.0016	0.0021	0.0026	0.0032	0.0042
P	Low Carbon Steel ≤ 38 Rc 1018, 1020, 12L14, 5120, 8620	Peripheral - HEM*	<=3 x D	.08 x D	9	485	0.0038	0.0056	0.0075	0.0094	0.0113	0.0150
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	485	0.0034	0.0051	0.0068	0.0084	0.0101	0.0135
		Peripheral - HEM*	>4xD-5xD	.08 x D	9	465	0.0030	0.0045	0.0060	0.0075	0.0090	0.0120
		Finish	3 x D	.015 x D	9	420	0.0014	0.0021	0.0028	0.0035	0.0042	0.0056
	Medium Carbon Steels ≤ 48 Rc 1045, 4140, 4340, 5140	Peripheral - HEM*	<=3 x D	.08 x D	9	450	0.0036	0.0053	0.0071	0.0089	0.0107	0.0142
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	450	0.0032	0.0048	0.0064	0.0080	0.0096	0.0128
		Peripheral - HEM*	>4xD-5xD	.08 x D	9	425	0.0028	0.0043	0.0057	0.0071	0.0085	0.0114
		Finish	3 x D	.015 x D	9	390	0.0013	0.0019	0.0025	0.0031	0.0038	0.0050
	Tool & Die Steels ≤ 48 Rc A2, D2, O1, S7, P20, H13	Peripheral - HEM*	<=3 x D	.08 x D	9	420	0.0032	0.0048	0.0064	0.0080	0.0096	0.0128
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	420	0.0029	0.0043	0.0058	0.0072	0.0086	0.0115
		Peripheral - HEM*	>4xD-5xD	.08 x D	9	395	0.0026	0.0038	0.0051	0.0064	0.0077	0.0102
		Finish	3 x D	.015 x D	9	365	0.0011	0.0016	0.0021	0.0026	0.0032	0.0042
M	Austenitic Stainless Steels, FeNi Alloys 303, 304, 316, Invar, Kovar	Peripheral - HEM*	<=3 x D	.08 x D	9	450	0.0032	0.0048	0.0064	0.0080	0.0096	0.0128
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	440	0.0029	0.0043	0.0058	0.0072	0.0086	0.0115
		Peripheral - HEM*	>4xD-5xD	.07 x D	9	425	0.0026	0.0038	0.0051	0.0064	0.0077	0.0102
		Finish	3 x D	.015 x D	9	390	0.0012	0.0018	0.0024	0.0030	0.0036	0.0048
	Martensitic & Ferritic Stainless Steels 410, 416, 440	Peripheral - HEM*	<=3 x D	.08 x D	9	450	0.0038	0.0056	0.0075	0.0094	0.0113	0.0150
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	450	0.0034	0.0051	0.0068	0.0084	0.0101	0.0135
		Peripheral - HEM*	>4xD-5xD	.08 x D	9	425	0.0030	0.0045	0.0060	0.0075	0.0090	0.0120
		Finish	3 x D	.015 x D	9	390	0.0013	0.0019	0.0025	0.0031	0.0038	0.0050
	Precipitation Hardening Stainless Steels 17-4, 15-5, 13-8	Peripheral - HEM*	<=3 x D	.08 x D	9	440	0.0031	0.0047	0.0062	0.0078	0.0093	0.0124
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	440	0.0028	0.0042	0.0056	0.0070	0.0084	0.0112
		Peripheral - HEM*	>4xD-5xD	.07 x D	9	415	0.0025	0.0037	0.0050	0.0062	0.0074	0.0099
		Finish	3 x D	.015 x D	9	380	0.0010	0.0015	0.0020	0.0025	0.0030	0.0040
S	Titanium Alloys 6Al-4V, 6-2-4	Peripheral - HEM*	<=3 x D	.1 x D	9	405	0.0021	0.0031	0.0041	0.0051	0.0062	0.0082
		Peripheral - HEM*	>3xD-4xD	.08 x D	9	405	0.0018	0.0028	0.0037	0.0046	0.0055	0.0074
		Peripheral - HEM*	>4xD-5xD	.08 x D	9	390	0.0016	0.0025	0.0033	0.0041	0.0049	0.0066
		Finish	3 x D	.015 x D	9	350	0.0008	0.0012	0.0016	0.0020	0.0024	0.0032
	Difficult to Machine Titanium Alloys 10-2-3	Peripheral - HEM*	<=2.5 x D	.08 x D	9	335	0.0020	0.0030	0.0040	0.0050	0.0060	0.0080
		Peripheral - HEM*	>2.5xD-3.5xD	.07 x D	9	325	0.0018	0.0027	0.0036	0.0045	0.0054	0.0072
		Peripheral - HEM*	>3.5xD-4xD	.06 x D	9	305	0.0016	0.0024	0.0032	0.0040	0.0048	0.0064
	Hastalloy, Waspalloy	Finish	3 x D	.01 x D	9	290	0.0007	0.0011	0.0014	0.0018	0.0021	0.0028
		Peripheral - HEM*	<=1.5 x D	.08 x D	9	100	0.0045	0.0068	0.0090	0.0113	0.0135	0.0180
		Peripheral - HEM*	>1.5xD-2.5xD	.08 x D	9	95	0.0041	0.0061	0.0081	0.0101	0.0122	0.0162
		Peripheral - HEM*	>2.5xD-3.5xD	.06 x D	9	85	0.0036	0.0054	0.0072	0.0090	0.0108	0.0144
	Inconel 718, Rene 88	Finish	2 x D	.01 x D	9	90	0.0024	0.0036	0.0048	0.0060	0.0072	0.0096
		Peripheral - HEM*	<=1.5 x D	.07 x D	9	95	0.0046	0.0068	0.0091	0.0114	0.0137	0.0182
		Peripheral - HEM*	>1.5xD-2.5xD	.06 x D	9	90	0.0041	0.0061	0.0082	0.0102	0.0123	0.0164
		Peripheral - HEM*	>2.5xD-3xD	.06 x D	9	85	0.0036	0.0055	0.0073	0.0091	0.0109	0.0146
	Finish	2 x D	.01 x D	9	85	0.0023	0.0035	0.0046	0.0058	0.0069	0.0092	

D = Tool Diameter * HEM = High-efficiency machining (chip-thinning calculations have already been applied to HEM parameters shown)

Common Machining Formulas:

$$RPM = \frac{SFM \times 3.82}{D}$$

$$SFM = RPM \times D \times .262$$

$$IPM = RPM \times IPT \times Z$$

$$MRR = RDOC \times ADOC \times IPM$$

D Tool Cutting Diameter
Z Number of Flutes
RPM Revolutions per Minute
SFM Surface Feet per Minute
IPM Inches per Minute
IPT Inch per Tooth
MRR Metal Removal Rate
RDOC Radial Depth of Cut
ADOC Axial Depth of Cut