

IPT9/IPC9 Application Guide – Speed & Feed (metric)

ISO Code	Work Material	Type of Cut	Axial DOC	Radial DOC	No. of Flutes	Speed (M/min)	Feed (MM per Tooth)						
							6.0	8.0	10.0	12.0	16.0	20.0	25.0
K	Gray ASTM-A48 Class 20, 25, 30, 35 & 40	Peripheral - HEM	≤ 3 x D	.1 x D	9	122	.0864	.1152	.1434	.1728	.2298	.2868	.3456
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	122	.0778	.1037	.1291	.1555	.2068	.2581	.3110
		Peripheral - HEM	> 4 - 5 x D	.08 x D	9	119	.0691	.0922	.1147	.1382	.1838	.2295	.2765
	Cast Iron Malleable	Finish	3 x D	.015 x D	9	137	.0312	.0416	.0518	.0624	.0830	.1036	.1248
		Peripheral - HEM	≤ 3 x D	.08 x D	9	119	.0696	.0928	.1155	.1392	.1851	.2311	.2784
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	119	.0626	.0835	.1040	.1253	.1666	.2079	.2505
P	Low Carbon Steels ≤ 38 Rc 1018, 1020, 12L14, 5120, 8620	Peripheral - HEM	> 4 - 5 x D	.08 x D	9	114	.0557	.0742	.0924	.1114	.1481	.1848	.2227
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	107	.0252	.0336	.0418	.0504	.0670	.0837	.1008
		Finish	3 x D	.015 x D	9	148	.0900	.1200	.1494	.1800	.2394	.2988	.3600
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	148	.0810	.1080	.1344	.1620	.2154	.2689	.3240
	Medium Carbon Steels ≤ 48 HRC 1045, 4140, 4340, 5140	Peripheral - HEM	> 4 - 5 x D	.08 x D	9	142	.0720	.0960	.1195	.1440	.1915	.2390	.2880
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	128	.0336	.0448	.0558	.0672	.0894	.1115	.1344
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	137	.0852	.1136	.1414	.1704	.2266	.2828	.3408
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	137	.0767	.1022	.1273	.1533	.2040	.2546	.3067
	Tool and Die Steels ≤ 48 Rc A2, D2, O1, S7, P20, H13	Peripheral - HEM	> 4 - 5 x D	.08 x D	9	130	.0682	.0909	.1131	.1363	.1813	.2263	.2726
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	119	.0300	.0400	.0498	.0600	.0798	.0996	.1200
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	128	.0768	.1024	.1275	.1536	.2043	.2550	.3072
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	128	.0691	.0922	.1147	.1382	.1838	.2295	.2765
M	Martensitic & Ferritic Stainless Steels 410, 416, 440	Peripheral - HEM	> 4 - 5 x D	.08 x D	9	120	.0614	.0819	.1020	.1229	.1634	.2040	.2457
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	111	.0252	.0336	.0418	.0504	.0670	.0837	.1008
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	137	.0900	.1200	.1494	.1800	.2394	.2988	.3600
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	134	.0810	.1080	.1344	.1620	.2154	.2689	.3240
	Austenitic Stainless Steels, FeNi Alloys 303, 304, 316, Invar, Kovar	Peripheral - HEM	> 4 - 5 x D	.07 x D	9	130	.0720	.0960	.1195	.1440	.1915	.2390	.2880
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	119	.0300	.0400	.0498	.0600	.0798	.0996	.1200
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	137	.0768	.1024	.1275	.1536	.2043	.2550	.3072
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	137	.0691	.0922	.1147	.1382	.1838	.2295	.2765
	Precipitation Hardening Stainless Steels 17-4, 15-5	Peripheral - HEM	> 4 - 5 x D	.08 x D	9	130	.0614	.0819	.1020	.1229	.1634	.2040	.2457
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	119	.0288	.0384	.0478	.0576	.0766	.0956	.1152
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	134	.0744	.0992	.1235	.1488	.1979	.2470	.2976
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	134	.0670	.0893	.1111	.1339	.1781	.2223	.2678
S	Titanium Alloys 6Al-4V, 6-2-4	Peripheral - HEM	> 4 - 5 x D	.08 x D	9	126	.0595	.0794	.0988	.1190	.1583	.1976	.2381
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	116	.0240	.0320	.0398	.0480	.0638	.0797	.0960
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	123	.0492	.0656	.0817	.0984	.1309	.1633	.1968
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	123	.0443	.0590	.0735	.0886	.1178	.1470	.1771
	Difficult-to-Machine Titanium Alloys 10-2-3	Peripheral - HEM	> 4 - 5 x D	.08 x D	9	119	.0394	.0525	.0653	.0787	.1047	.1307	.1574
		Peripheral - HEM	> 3 - 4 x D	.08 x D	9	107	.0192	.0256	.0319	.0384	.0511	.0637	.0768
	Precipitation Hardening Stainless Steel M 13-8	Peripheral - HEM	> 2.5 - 3.5 x D	.07 x D	9	102	.0480	.0640	.0797	.0960	.1277	.1593	.1920
		Peripheral - HEM	> 2.5 - 3.5 x D	.06 x D	9	99	.0432	.0576	.0717	.0864	.1149	.1434	.1728
	Hastalloy, Waspalloy	Peripheral - HEM	> 2.5 - 3.5 x D	.06 x D	9	93	.0384	.0512	.0637	.0768	.1021	.1275	.1536
		Peripheral - HEM	> 1.5 - 2.5 x D	.08 x D	9	88	.0168	.0224	.0279	.0336	.0447	.0558	.0672
		Peripheral - HEM	> 1.5 - 2.5 x D	.08 x D	9	30	.1080	.1440	.1793	.2160	.2873	.3585	.4320
		Peripheral - HEM	> 1.5 - 2.5 x D	.08 x D	9	29	.0972	.1296	.1613	.1944	.2585	.3227	.3888
Inconel 718, Rene 88	Peripheral - HEM	> 2.5 - 3 x D	.06 x D	9	26	.0864	.1152	.1434	.1728	.2298	.2868	.3456	
	Peripheral - HEM	> 2.5 - 3 x D	.06 x D	9	27	.0576	.0768	.0956	.1152	.1532	.1912	.2304	
	Peripheral - HEM	> 1.5 - 2.5 x D	.06 x D	9	29	.1092	.1456	.1813	.2184	.2904	.3625	.4368	
	Peripheral - HEM	> 1.5 - 2.5 x D	.06 x D	9	27	.0983	.1310	.1631	.1965	.2614	.3263	.3931	
Finish	Peripheral - HEM	> 2.5 - 3 x D	.06 x D	9	26	.0874	.1165	.1450	.1747	.2324	.2900	.3494	
	Finish	2 x D	.01 x D	9	26	.0552	.0736	.0916	.1104	.1468	.1832	.2208	

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

- D** Tool Diameter
- Z** Number of Flutes
- RPM** Revolutions per Minute
- SFM** Surface Feet per Minute
- M/min** Surface Meters per Minute
- IPM** Inches per Minute
- MMPM** Millimeters per Minute
- IPT** Inch per Tooth
- MMPT** Millimeters per Tooth
- MRR** Metal Removal Rate
- RDOC** Radial Depth of Cut
- ADOC** Axial Depth of Cut

Technical Resources

Information on tips and adjustments for the following milling operations can be found in our Technical Resources section beginning on page 129.

- HEM slotting
- Face milling
- Helical entry ramping
- Straight line ramping
- Long tool projection adjustments
- Ball nose milling adjustments
- Other helpful tips and calculations