M525 Series Application Guide (inch) • Speed & Feed

ISO Classification	Work Material	Type of Cut	Axial DOC	Radial DOC	Number of Flutes	Speed (SFM)	Feed (Inches per Tooth)						
							1/8	1/4	3/8	1/2	5/8	3/4	1
S	Titanium Alloys	Slotting	.5 x D	1 x D	5	250	.0005	.0009	.0014	.0018	.0023	.0028	.0037
	6Al-4V, 6-2-4	Peripheral - Rough	1 x D	.3 x D	5	300	.0006	.0013	.0019	.0025	.0031	.0038	.0050
		Peripheral - HEM*	3 x D	.05 x D	5	330	.0018	.0036	.0055	.0073	.0091	.0109	.0146
		Finish	1.5 x D	.015 x D	5	300	.0006	.0013	.0019	.0026	.0032	.0038	.0051
	Difficult to machine Titanium Alloys	Slotting	.25 x D	1 x D	5	200	.0003	.0007	.0010	.0014	.0017	.0020	.0027
	10-2-3	Peripheral - Rough	1 x D	.25 x D	5	250	.0005	.0010	.0015	.0020	.0025	.0029	.0039
		Peripheral - HEM*	3 x D	.05 x D	5	275	.0015	.0030	.0045	.0059	.0074	.0089	.0119
		Finish	1.5 x D	.01 x D	5	250	.0006	.0012	.0017	.0023	.0029	.0035	.0046
M	Austenitic Stainless Steels, FeNi Alloys	Slotting	.5 x D	1 x D	5	275	.0006	.0012	.0018	.0024	.0030	.0036	.0048
	303, 304, 316, Invar, Kovar	Peripheral - Rough	1.25 x D	.3 x D	5	350	.0008	.0016	.0025	.0033	.0041	.0049	.0065
		Peripheral - HEM*	3 x D	.05 x D	5	390	.0025	.0049	.0074	.0099	.0123	.0148	.0198
		Finish	2 x D	.015 x D	5	350	.0008	.0017	.0025	.0033	.0042	.0050	.0067
	Precipitation Hardening Stainless Steels	Slotting	.5 x D	1 x D	5	250	.0005	.0010	.0015	.0020	.0025	.0030	.0040
	17-4, 15-5, 13-8	Peripheral - Rough	1.25 x D	.3 x D	5	325	.0007	.0014	.0020	.0027	.0034	.0041	.0055
		Peripheral - HEM*	3 x D	.05 x D	5	360	.0020	.0040	.0059	.0079	.0099	.0119	.0158
		Finish	1.5 x D	.015 x D	5	325	.0007	.0014	.0021	.0028	.0035	.0042	.0056
P	Low Carbon Steels <= 38 Rc	Slotting	.5 x D	1 x D	5	325	.0007	.0014	.0021	.0028	.0035	.0042	.0056
	1018, 1020, 12L14, 5120, 8620	Peripheral - Rough	1.25 x D	.3 x D	5	400	.0010	.0019	.0029	.0038	.0048	.0057	.0076
		Peripheral - HEM*	3 x D	.07 x D	5	450	.0028	.0056	.0084	.0120	.0140	.0168	.0224
		Finish	2 x	.015 x D	5	400	.0010	.0019	.0029	.0039	.0049	.0058	.0078
	Medium Carbon Steels <= 48 HRC	Slotting	.5 x D	1 x D	5	300	.0006	.0013	.0019	.0026	.0032	.0038	.0051
	1045, 4140, 4340, 5140	Peripheral - Rough	1.25 x D	.3 x D	5	375	.0009	.0017	.0026	.0035	.0044	.0052	.0070
		Peripheral - HEM*	3 x D	.05 x D	5	415	.0026	.0052	.0077	.0103	.0129	.0155	.0207
		Finish	2 x D	.015 x D	5	375	.0009	.0018	.0027	.0036	.0044	.0053	.0071
	Tool and Die Steels <= 48 Rc	Slotting	.5 x D	1 x D	5	275	.0005	.0011	.0016	.0022	.0027	.0032	.0043
	A2, D2, O1, S7, P20, H13	Peripheral - Rough	1.25 x D	.3 x D	5	350	.0007	.0015	.0022	.0029	.0037	.0044	.0059
		Peripheral - HEM*	3 x D	.05 x D	5	390	.0022	.0043	.0065	.0087	.0108	.0130	.0173
		Finish	2 x D	.015 x D	5	350	.0007	.0015	.0022	.0030	.0037	.0045	.0060
	Martensitic & Ferritic Stainless Steels	Slotting	.5 x D	1 x D	5	300	.0006	.0013	.0019	.0026	.0032	.0038	.0051
	410, 416, 440	Peripheral - Rough	1.25 x D	.3 x D	5	375	.0009	.0017	.0026	.0035	.0044	.0052	.0070
		Peripheral - HEM*	3 x D	.05 x D	5	415	.0026	.0052	.0077	.0103	.0129	.0155	.0207
		Finish	2 x D	.015 x D	5	375	.0009	.0018	.0027	.0036	.0044	.0053	.0071
K	Cast Iron	Slotting	.5 x D	1 x D	5	300	.0006	.0012	.0018	.0024	.0030	.0036	.0048
	Gray	Peripheral - Rough	1.25 x D	.3 x D	5	375	.0008	.0016	.0025	.0033	.0041	.0049	.0065
		Finish	2 x D	.015 x D	5	375	.0008	.0017	.0025	.0033	.0042	.0050	.0067
	Cast Iron	Slotting	.5 x D	1 x D	5	275	.0005	.0010	.0015	.0020	.0025	.0030	.0040
	Malleable	Peripheral - Rough	1.25 x D	.3 x D	5	350	.0007	.0014	.0020	.0027	.0034	.0041	.0055
		Peripheral - HEM*	3 x D	.05 x D	5	390	.0020	.0040	.0060	.0081	.0101	.0121	.0161
		Finish	2 x D	.015 x D	5	350	.0007	.0014	.0021	.0028	.0035	.0042	.0056

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

Common Machining Formulas

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

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

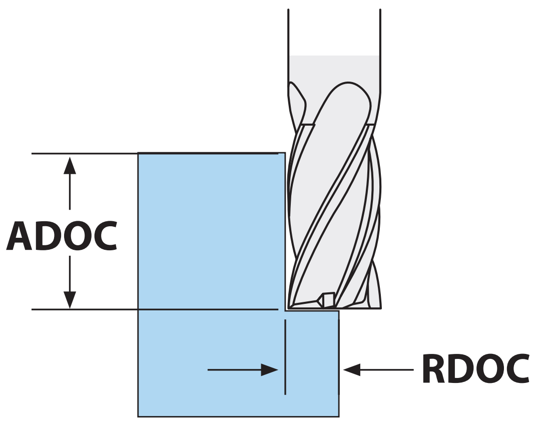
$$IPM = RPM \times IPT \times Z$$

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

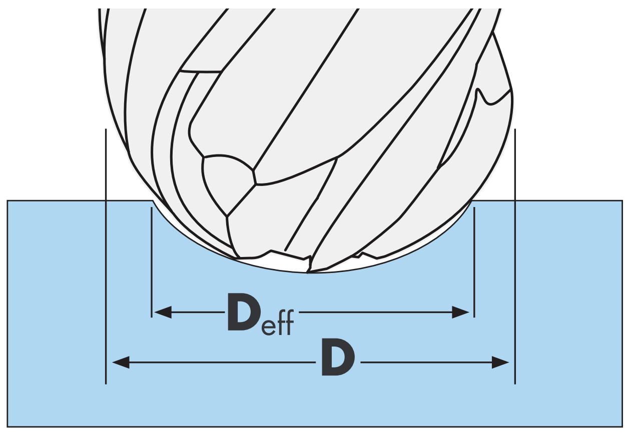
Radial Chip Thinning Adjustment $$IPT_{adj} = \frac{IPT \times (D/2)}{\sqrt{(D \times RDOC) - RDOC^2}}$$

Ball Nose "Effective Diameter" $$D_{eff} = 2x \sqrt{R^2 - (R - ADOC)^2}$$

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

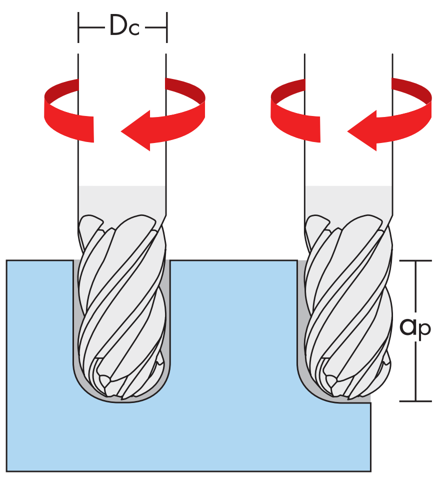


Apply chip thinning adjustment when RDOC < D



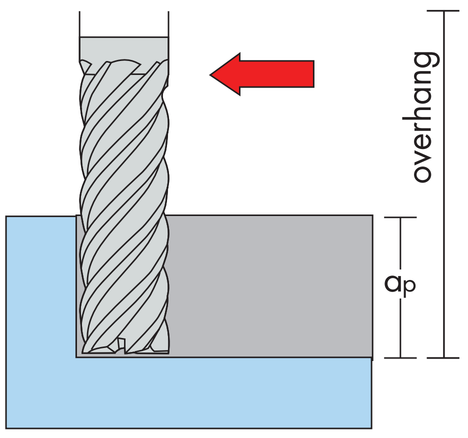
Use D_{eff} when making shallow cuts with full radius

Adjustments – Apply these adjustments when programming the following applications.



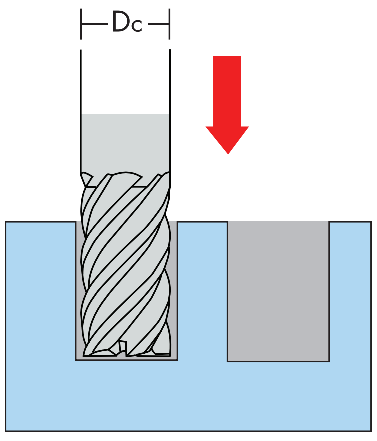
1. Ball end mills

- Reduce chipload by 25% from roughing/slotting recommendation when axial DOC (ap) exceeds 75% of Dc



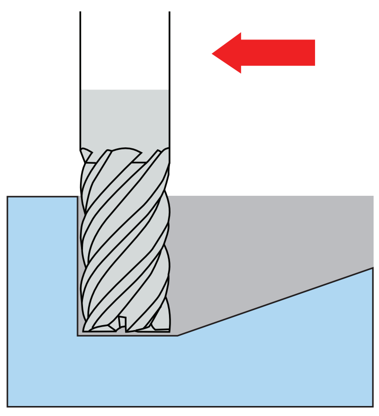
2. Long reach mills with large overhang

- Reduce speed rate and chipload by 10%



3. Plunge entry into work piece

- Reduce chipload by 80% of recommended slotting rate
- Peck mill if axial DOC (ap) exceeds 50% of Dc



4. Ramp entry into work piece

- Ramp at 1.5°–2.5° angle
- Reduce chipload by 20% of recommended slotting rate