

Steels - P157 (Continued)										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load Per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	543	0.04xØ	0.05xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Low Alloy < 1500 N/mm ²	427	0.04xØ	0.05xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High Alloy Annealed < 1000 N/mm ²	541	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High Alloy Hardened < 1300 N/mm ²	377	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	High Alloy Hardened < 1600 N/mm ²	344	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Stainless Steel	Ferric	82	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Martensitic	66	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 < 40%	82	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 > 40%	66	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Sulphured	98	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
High Temperature Alloy	Fe-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Cast Iron	Non-Alloy	755	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Low-Alloy	541	0.04xØ	0.05xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High-Alloy	377	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	1001	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy > 180 HB	853	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy	755	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High Alloy	541	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Spheroidal Cast Iron	Non-Alloy < 180 HB	1001	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy > 180 HB	853	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Alloy	705	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
White Malleable Cast Iron	< 180 HB	1001	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 180 HB	853	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Black Malleable Cast Iron	< 180 HB	1001	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 180 HB	853	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Copper	Non-Alloy	1394	0.1xØ	0.15xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Wrought Alloy Non-Hardened	1181	0.1xØ	0.15xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Wrought Alloy Hardened	968	0.1xØ	0.15xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039

Steels - P190 / P191										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load Per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Nitriding Steel	< 1000 N/mm ²	98	0.5xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 1000 N/mm ²	74	0.5xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	115	0.5xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Non-Alloy 800-1000 N/mm ²	98	0.5xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy < 800 N/mm ²	98	0.5xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 800-1000 N/mm ²	82	0.5xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1000-1300 N/mm ²	74	0.5xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1300-1600 N/mm ²	66	0.5xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Stainless Steel	Ferric	82	0.5xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Martensitic	66	0.5xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 < 40%	57	0.5xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 > 40%	82	0.5xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Sulphured	98	0.5xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
High Temperature Alloy	Fe-Alloy	49	1xØ	0.4xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Ni-Alloy not hardened	49	1xØ	0.4xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Ni-Alloy hardened	49	1xØ	0.4xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Co-Alloy	49	1xØ	0.4xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
Cast Iron	Non-Alloy	328	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low-Alloy	262	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High-Alloy	197	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Stainless Cast Steel	Ferric/Martensitic	164	1xØ	0.7xØ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic	164	1xØ	0.7xØ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	328	1xØ	0.7xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 180 HB	295	1xØ	0.7xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloy	262	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy	197	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spheroidal Cast Iron	Non-Alloy < 180 HB	312	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy > 180 HB	279	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	246	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033

* Feeds and speeds are starting points for overall lengths of 4" and shorter.
For end mills with overall lengths over 4" decrease the feeds and speeds.

CERATIZIT \ Performance Feeds & Speeds

Steels - P190 / P191 (Continued)										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load Per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
White Malleable Cast Iron	< 180 HB	295	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Black Malleable Cast Iron	< 180 HB	295	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Titanium	Non-Alloy	148	1xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Annealed	131	1xØ	0.7xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Alloyed-Hardened	82	1xØ	0.7xØ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025

Steels - P120										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load Per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	295	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	> 500 N/mm ²	213	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Construction Steel	Non-Alloy < 500 N/mm ²	295	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 500 N/mm ²	213	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	180	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Spring Steel	Annealed < 250 HB	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Cementation Steel	< 150 HB	279	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	150-200 HB	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 200 HB	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Nitriding Steel	< 1000 N/mm ²	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 1000 N/mm ²	164	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Non-Alloy 800-1000 N/mm ²	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy < 800 N/mm ²	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 800-1000 N/mm ²	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1000-1300 N/mm ²	148	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Non-Alloy Tool Steel	General	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	164	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Low Alloy < 1200 N/mm ²	131	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy Annealed < 1000 N/mm ²	131	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Tool Steel for Warm Processing	High Alloy Annealed < 1000 N/mm ²	131	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Stainless Steel	Ferritic	164	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Martensitic	131	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 < 40%	164	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 > 40%	164	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Sulphured	180	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
High Temperature Alloy	Fe-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Cast Iron	Non-Alloy	295	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Low-Alloy	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Stainless Cast Steel	Ferritic/Martensitic	131	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic	164	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	361	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Non-Alloy > 180 HB	312	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Alloy	262	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Spheroidal Cast Iron	Non-Alloy < 180 HB	361	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 180 HB	312	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	262	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
White Malleable Cast Iron	< 180 HB	361	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	312	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Black Malleable Cast Iron	< 180 HB	361	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	312	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Titanium	Non-Alloy	197	1xØ	0.4xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloyed-Annealed	164	1xØ	0.4xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Hardened	131	1xØ	0.4xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028

* Feeds and speeds are starting points for overall lengths of 4" and shorter.
For end mills with overall lengths over 4" decrease the feeds and speeds.