

CUTTING DATA

Solid Carbide End Mills

Starting speeds and feeds for square, ball nose, corner radius, aluminum, roughing, micro and long-neck solid carbide end mills.

Metric	Vc / RPM / fz / Vf	P M K N S H	Starting values
--------	--------------------	-------------	-----------------

How to use this guide

Choose the workpiece group, select a chip load by diameter, calculate RPM and feed, then adjust for geometry and engagement. Start near the lower end when rigidity, hardness or overhang is uncertain.

Base cutting speed by workpiece

ISO	Workpiece / hardness	Starting Vc (m/min)	Starting note
P	Carbon / low-alloy steel, <=30 HRC	90-150	General coated carbide
P	Alloy / pre-hardened steel, 30-45 HRC	60-100	Reduce for full slotting
M	Austenitic / PH stainless steel	40-75	Stable engagement; avoid rubbing
K	Gray / nodular cast iron	80-140	Dry or air blast often suitable
N	Aluminum / non-ferrous	250-450	Polished 2F/3F can use upper end
S	Titanium alloys	25-50	Control radial engagement
S	Nickel-based alloys	20-40	Limit heat concentration
H	Hardened steel, 45-55 HRC	45-75	Dedicated high-hardness geometry
H	Hardened steel, 55-65 HRC	25-50	Prefer small radial engagement

CHIP LOAD & ENGAGEMENT

Starting feed per tooth by diameter

Cutter D	Starting fz (mm/tooth)	Lower end when	Upper end when
0.5-1 mm	0.002-0.006	Long neck / hard steel	Short rigid tool
>1-2 mm	0.004-0.012	Slotting / weak setup	Stable side milling
>2-3 mm	0.006-0.018	Deep reach	Stable general cut
>3-6 mm	0.012-0.035	Full slot / stainless	Low radial engagement
>6-10 mm	0.020-0.055	Long overhang	Rigid side milling
>10-16 mm	0.035-0.080	High engagement	Stable roughing
>16-20 mm	0.050-0.110	Power-limited setup	Rigid high-power setup

Core formulas

$$\text{RPM } n = (1000 \times Vc) / (\pi \times D)$$

$$\text{Feed } Vf = n \times z \times fz$$

Starting engagement

Operation	ae	ap
Full slot	100% D	0.2-0.6 D
Side roughing	10-30% D	0.5-1.0 D
Finishing	2-8% D	0.5-1.5 D
Low-radial HEM	5-15% D	0.8-1.5 D

TOOL FAMILY ADJUSTMENT

Modifiers from the base table

Tool type	Vc multiplier	fz multiplier	Key point
Square End Mills	1.00	1.00	Baseline
Ball Nose End Mills	0.9-1.0	0.70-0.90	Use effective cutting diameter
Corner Radius End Mills	0.90-1.00	0.90-1.00	Close to square-end data
End Mills for Aluminum	1.2-1.6 vs. N baseline	1.0-1.4	Polished flutes; strong chip evacuation
Roughing End Mills	0.80-0.90	1.10-1.30	Chip-splitting edge supports feed
Micro End Mills	0.85-1.00	Use diameter table	Runout dominates
Long-Neck End Mills	0.70-0.90	0.50-0.75	Reduce as overhang increases
Custom & Specialty	0.70-1.00	0.60-1.00	Start from nearest standard geometry

Disclaimer: Starting references only. Specific flute count, coating, helix, edge prep, overhang, holder runout and toolpath can require different settings. Never exceed machine, holder or tool ratings.