CNC Depth of Cut and Spindle Power

How-to guide: what the workbook does, how to use it and what every number means. mfgcalcs.com

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Check every milling operation's axial depth against the spindle power and the flute length: the deepest usable pass, the removal rate and the spindle load your program asks for.

For: CNC programmers, machinists, manufacturing engineers and estimators planning milling operations across machines of different power.

Version 1.0.0 · updated 11 November 2026

Quick start

1. On Setup, type the shop and job and your spindle load limit, then list your machines (spindle power and drive efficiency) and work materials (unit power from your tooling supplier).
2. On Operations, give each milling operation a row: machine, material, tool, radial depth, feed rate, flute length and the axial depth the program uses.
3. Fix anything the Check column names.
4. Open the Dashboard: operations that ask more than the spindle can give, the usable depth of every operation and its spindle load.

What is in the workbook

Start Here	Read this first: what the workbook does and how to use it.
Setup	Shop and job, your spindle load limit, the machines with their spindle power, and the materials with their unit power.
Operations	One row per milling operation: radial depth, feed and flute length in; usable axial depth, removal rate and spindle load out.
Dashboard	Usable axial depth against the programmed depth, removal rate and spindle load for every operation.
Method	How every number is calculated, with assumptions, limits and sources.
Verify	Self-check: the workbook's formulas recomputed on fixed inputs against an independent reference.

What each number means

Quantity	How it is calculated	Units
Cutting power per inch	Unit power (Setup) x radial depth x feed rate.	hp/in
Power-limited depth	Spindle power x drive efficiency / cutting power per inch.	in
Usable depth	The smaller of the power-limited depth and the flute length.	in

Quantity	How it is calculated	Units
Limited by	Spindle power when the power-limited depth is below the flute length; Flute length otherwise.	-
Removal rate	Usable depth x radial depth x feed rate.	in^3/min
Load at usable depth	Usable depth x cutting power per inch / drive efficiency / spindle power.	%
Load at programmed depth	Programmed depth x cutting power per inch / drive efficiency / spindle power.	%
Spindle status	Under capacity at or below the Setup limit; Near capacity up to 100%; Over capacity above it.	-

Assumptions, limitations, sources and the self-check (the Verify sheet, which recomputes the workbook's formulas on fixed test inputs) are in the workbook. The last page shows the Dashboard with the example data for Brennan Tool and Die, a fictional business.

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Engineering estimates for planning and improvement work. Verify the results against your own process, data and standards before you rely on them.

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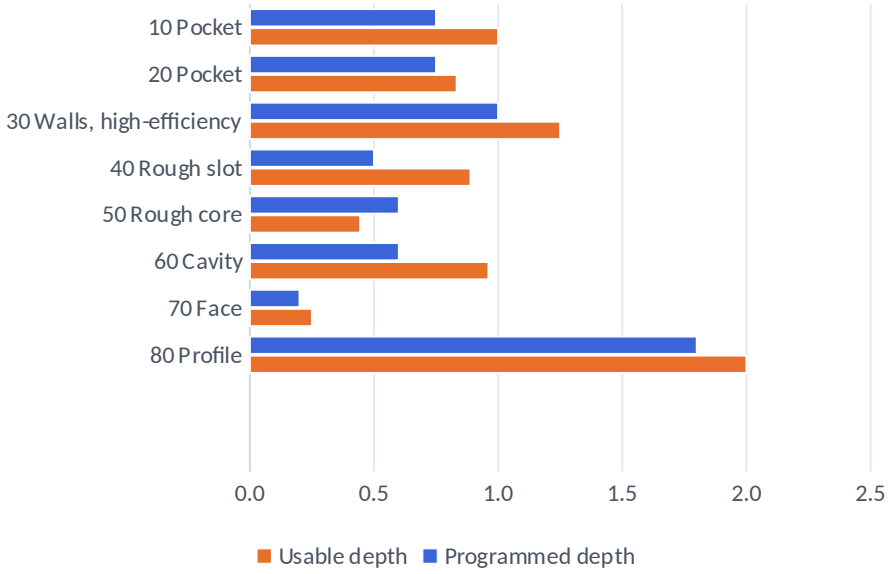
Usable axial depth against the programmed depth, removal rate and spindle load for every operation.

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Brennan Tool and Die (example), Mould base MB-118: 8 operations. Inch and hp; spindle load limit 85%.

OPERATIONS OVER THE SPINDLE	HIGHEST LOAD, PROGRAMMED DEPTH	OPERATIONS LIMITED BY POWER	OPERATIONS
1	**135%**	**4**	**8**
Programmed depth needs over 100%	Limit 85%	Usable depth below flute length	Rows on Operations
	Above target		

Programmed and usable axial depth (in)



Spindle load at the programmed depth

