

Chip Load

Find the optimal feed rate and RPM for your combination of target material and CNC cutting tool that you are using.

Chip Load Chart, how to?

There are certain parameters to consider before setting any cutting file if you want to achieve the required finish and accuracy. Chip load can be defined as the size or thickness of the chip that is removed with each flute per revolution. When material is machined the cutter must revolve at a specific RPM and feed at a specific feed rate to achieve the proper Chip load. There are also several factors to be considered when choosing the proper RPM and feed rate.

The chip load is a measurement of the thickness of material removed by each cutting edge during a cut. This is a valuable piece of information that can then be used to calculate new set ups.

Calculations are as follows: $\text{Chip Load} = \text{Feed Rate (inches per minute)} / (\text{RPM} \times \text{number of flutes})$.

Example: $\text{Chip Load} = 500 \text{ inches per minutes} / (15,000 \text{ RPM} \times 2 \text{ flutes})$ Chip Load = .017".

Chip loads are based on material thickness of average size for cutting edge length of tool. These recommendations do not apply to thicker material or specialized cutting tools. These Chip loads are only a recommended starting point only. Therefore, tooling damage may still occur and use of this chart does not warranty against tool breakage.

Tool Diameter	Hard wood	Softwood & plywood	MDF/Particle Board
1/8"	.003" – .005"	.004" – .006"	.004" – .007"
1/4"	.009" – .011"	.011" – .013"	.013" – .016"
3/8"	.015" – .018"	.017" – .020"	.020" – .023"
1/2" & up	.019" – .021"	.021" – .023"	.025" – .027"

Tool Diameter	High Pressure Laminate	Phenolic
1/8"	.003" – .005"	n/a
1/4"	.009" – .012"	.004" – .006"
3/8"	.015" – .018"	.006" – .008"
1/2" & up	.023" – .025"	.010" – .012"

Notes on finding the right Chip load for your material

RPM Selection

Usually, the higher the RPM, the better the surface finish becomes. However, the higher the RPM, the higher the friction generated between the tool and the workpiece. This friction is what creates the mechanical wear on the cutting edge. Your goal is to select the lowest RPM possible for each application.

Simple method to find the optimal RPM.

1. Start off using an RPM derived for the chip load for the material you are cutting.
2. Increase the cutting speed (feed rate) until the quality of the part's finish starts to decrease or the part is starting to move. Then decrease speed by 10%.
3. Next decrease RPM until finish deteriorates again, and then bring it back up until acceptable.
4. This optimizes RPM and speed so that you are taking the largest possible chips.

Other valuable formulas:

Feed Rate = RPM x number of flutes x chip load

RPM = feed rate / (number of flutes x chip load)

Metric conversion: Divide inches per minute by 39.374 (example: 300 inches per minutes divided by 39.374 = 7.62 meters per minute)

Chip Load Calculator

There is a chip load calculator on the Shopbot computer. You should be able to find a direct link to it on the desktop. It is also available through the tools menu in the Shopbot software.