



# Cutting parameters (face milling cutters)

Calculation and practical hints

## Calculations

The basis for the calculation of speed and feed is the following table with information on cutting speeds and tooth feed. These are experimentally determined

guide values for rough orientation, which can vary in practice depending on the machine and peripherals.

Guide values for milling parameters (face milling)								
	Cutting speed m/min.	Cutter diameter						
		Ø 10 mm	Ø 12 mm	Ø 14 mm	Ø 16 mm	Ø 18 mm	Ø 20 mm	Ø 30 mm
Tooth feed in mm / tooth / revolution								
Cast aluminum > 6% Si	250	0,057	0,067	0,084	0,095	0,105	0,114	0,147
Aluminum Wrought alloy	350	0,054	0,063	0,079	0,090	0,100	0,108	0,134
Soft plastic	300	0,120	0,144	0,176	0,192	0,215	0,240	0,312
Hard plastic	250	0,110	0,132	0,154	0,176	0,198	0,220	0,246
Hard wood	250	0,080	0,096	0,113	0,128	0,145	0,160	0,185
Soft wood	200	0,100	0,115	0,135	0,151	0,165	0,182	0,218
Brass, Copper, Bronze	250 ... 350	0,033	0,039	0,042	0,055	0,060	0,066	0,084

n = Speed of the milling cutter in rpm  
 vc = Cutting speed in m/min  
 d = Cutter diameter in mm  
 z = Number of teeth  
 fz = Tooth feed  
 vf = Feed rate in mm/min

## Speed

The following formula is used to determine the speed:

$$n [\text{rpm}] = (vc [\text{m/min}] \times 1000) / (3,14 \times \text{Ø } d1 [\text{mm}])$$

**Example:**

$$vc = 350 \text{ m/min (from table)}$$

$$d = \text{Ø } 30 \text{ mm}$$

$$(350 \times 1.000) / (3,14 \times 30) = 3.715 \text{ U/min}$$

## Feeding rate

The following formula is used to determine the feeding rate:

$$vf = N \times z \times fz$$

**Example:**

An aluminum wrought alloy and a three-flute 30 mm face milling cutter are given.

$$n = 3.715 \text{ U/min (from speed calculation)}$$

$$fz = 0,134 \text{ (from table)}$$

$$z = 3$$

$$3.715 \times 3 \times 0,134 = 1493,43 \text{ mm/min}$$

## Practical tips

### Immersion depth

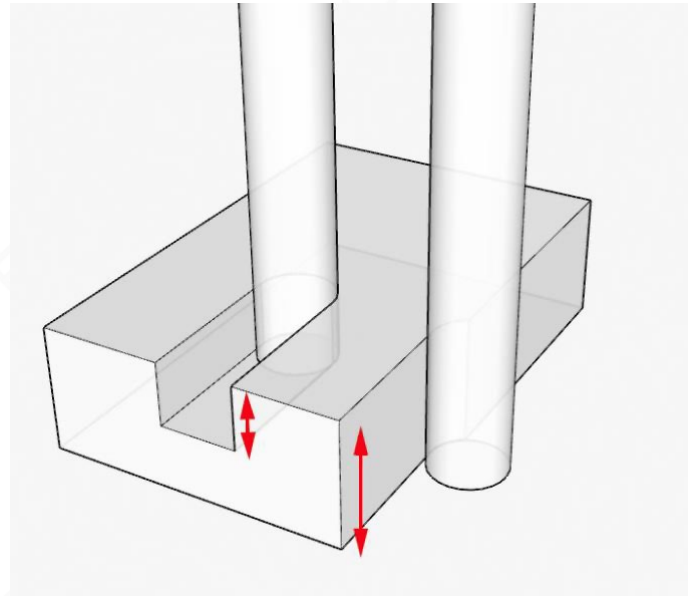
When milling a groove, we recommend the following immersion depth:

- Non-ferrous metals: up to 0.5 times the diameter
- Wood, plastics: up to twice the diameter
- Hard foam: up to 5 times the diameter

When milling contours, we recommend a lateral in-feed of approx. 25% of the cutter diameter with 100% immersion depth.

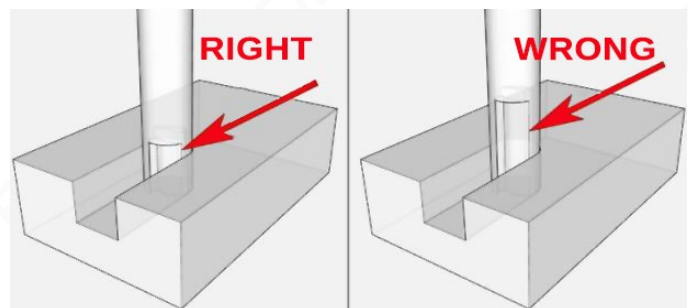
**i Note:**

*Here, too, the information depends heavily on the structure and stability of the machine.*



### Choice of length of cutter

In order to prevent the cutter from vibrating and swinging open, we recommend that the cutter is always as short as possible or only as long as necessary.



Drawings: [ZenziWerken](#)

### Cooling / lubricating

In the case of non-ferrous metals, cooling takes place in the best case with minimum quantity lubrication in conjunction with a lubricant. Furthermore, the lubrication improves the surface quality and the service life of the tool.

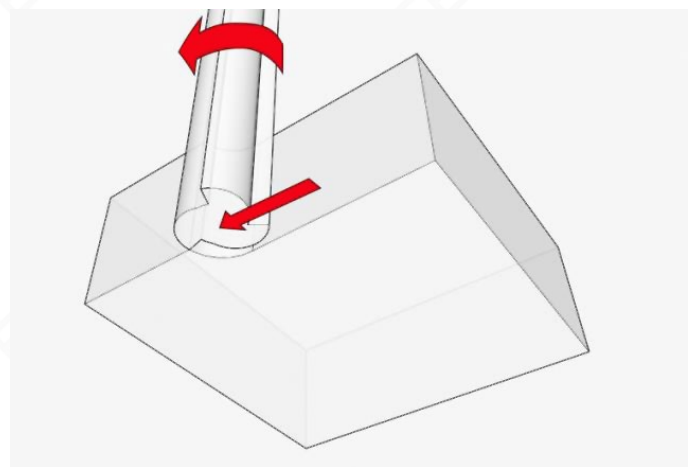
With acrylic glass, a very good surface can be achieved by lubricating it with soapy water.

## Down-cut / up-cut milling

### Down-cut milling

With down-cut milling, the milling cutter pulls itself into the workpiece, which can lead to the portal or the Z-axis being pulled in an uncontrolled manner in the direction of the workpiece due to reverse play of the spindle. This leads to a very unclean milling pattern and can even lead to the cutter breaking if the chip is too large at that moment.

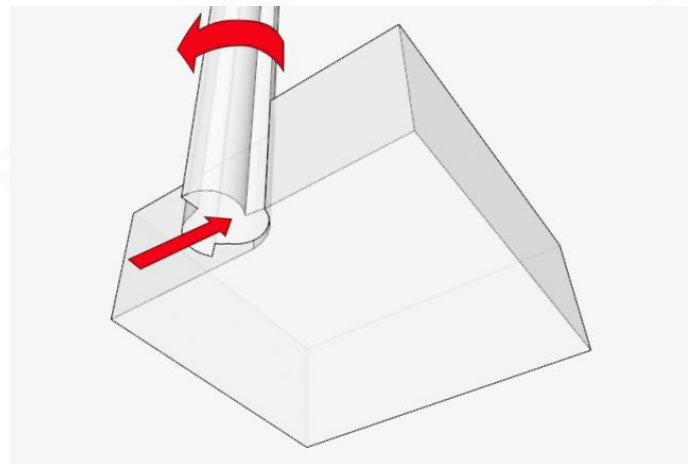
**If backlash-free recirculating ball spindles are installed without backlash, down-cut is preferred over up-cut milling.**



### Up-cut milling

In up-cut milling, the milling cutter pushes itself away from the workpiece, which quickly leads to the cutting edge being pushed out of the workpiece with very little chip removal. This creates chatter marks that are neither useful for a beautiful surface nor for the service life of the cutter.

**Up-cut milling is favored on machines with backlash in the threaded spindles.**



Drawings: [ZenziWerken](#)

## Mill with reduced neck

The maximum possible depth infeed is usually limited to the spiral length of the milling cutter, otherwise the shaft will rub against the workpiece.

The reduced neck enables milling depths over se-

veral infeeds up to the maximum usable length that exceeds the spiral length.

