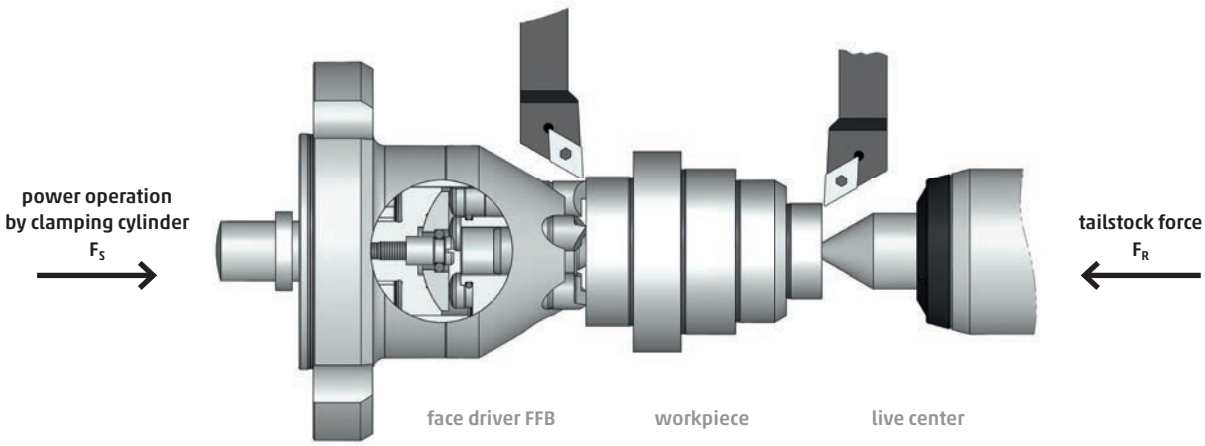
Face Drivers FFB / FFBH · Calculations

force of clamping cylinder / maximum chip cross section

PRINCIPLE: The tailstock force pushes the workpiece against the fixed center pin of the face driver. The drive pins are activated by the clamping cylinder mounted into the machine.



■ **force of clamping cylinder F_S:**
The force onto the face driver required for metal removing is calculated on the basis of the empirical formula:

$$F_S = [(q_{max} \times 1100 \times \frac{D}{d}) + 1300] \times m$$

F_R	[N]	tailstock force
q_{max}	[mm²]	maximum of chip cross section for metal removing
D	[mm]	cutting diameter
d	[mm]	clamping diameter
m	[-]	material factor (see adjustment-chart below)

■ **maximum chip cross section q_{max}:**
At a given force of clamping cylinder, the maximum chip cross section is calculated as follows:

$$q_{max} = \frac{\frac{F_S}{m} - 1300}{1100 \times \frac{D}{d}}$$

■ **tailstock force F_R:**
In case of tooling against the face driver the tailstock force has to be approx. 20 % more than the force of the clamping cylinder F_S.
In case of tooling against the tailstock, the tailstock should be approx. 40 - 50 % higher than the force of the clamping cylinder, if not, then the chip cross section should be reduced by approx. 30 %. (as there is an addition of force of clamping cylinder and cutting force).

EXPLANATORY NOTES: The first chip, however, should always be machined toward the face driver, in order to achieve an ideal penetration of the drive pins. The ratio D / d should not exceed 2, otherwise it would work inefficiently.

Material factor m adjustment chart:

material factor m	**1.4**	**1.2**	**1.1**	**1.0**	**0.8**
Rm [N / mm²]	1000	800	700	600	400
examples	42CrMo4	16MnCr5	C 15E (Ck 15)	S355J0	S235J0
		25CrMo4	C 45E (Ck 45)	35S20	

Chisel load of drive pins

Keep the chisel load within the following range:
250 - 350 N per mm chisel length

■ **the chisel load is calculated as follows:**

EXEMPLIFICATION: turning with FFB 3 face driver, 3 drive pins respective length of chisel 7 mm, force of clamping cylinder 6300 N

$$BS = \frac{F_S}{n \times s}$$

$$BS = \frac{4500\ N}{3 \times 5\ mm} = 300\ \frac{N}{mm}$$

BS	[N / mm]	chisel load
F_S	[N]	force of clamping cylinder
n	[-]	number of drive pins
s	[mm]	chisel length

CALCULATION EXAMPLE for type FFB / FFBH

Specific data of machine and workpiece:

maximum force of clamping cylinder:	12000 N
material of the workpiece:	16MnCr5
diameter of the workpiece, side of face driver:	Ø 62 mm
tooling diameter:	Ø 120 mm

Selection of face driver:
face driver FFB 4 / clamping Ø 59 mm
5 drive pins each 7.5 mm chisel length

■ **force of clamping cylinder F_S:**
In order to ensure sufficient entrainment (see chisel load of drive pins), a clamping cylinder force of approx. 11250 N is needed.

$$BS = \frac{F_S}{n \times s}$$

$$F_S = 300\ \frac{N}{mm} \times 5 \times 7{,}5\ mm = 11250\ N$$

■ **maximum chip cross section q_{max}:**
The maximum chip cross section (at OD-Ø) is calculated as follows:

$$q_{max} = \frac{\frac{11250\ N}{1{,}2} - 1300}{1100 \times \frac{120\ mm}{59\ mm}} = 3{,}61\ mm^2$$

Calculation of material factor m:
as per adjustment chart material factor: m (16MnCr5) = 1.2

EXPLANATORY NOTES: The calculated chip cross section refers to the extreme outer tooling diameter. In case of further tooling towards the axis of rotation of the workpiece, even larger chip cross sections can be achieved (» formula), commensurate with turning diameter.