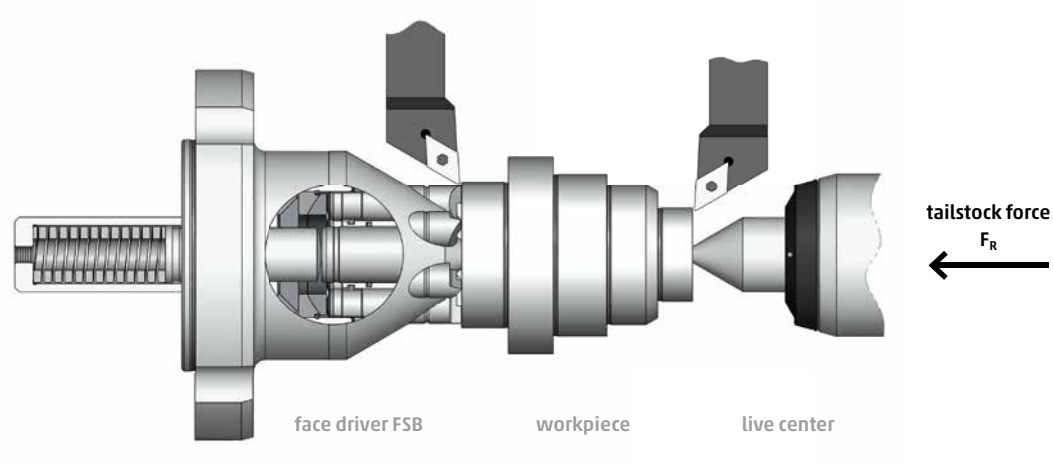
Face Drivers FSB / SB · Calculations

tailstock force / maximum chip cross section of metal removing

PRINCIPLE: The tailstock force pushes the workpiece agianst the movable center pin of the face driver. The center pin will draw back until the surface of the workpiece bears against the drive pins.



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

$$F_R = [(q_{max} \times 1000 \times \frac{D}{d}) + 1000] \times m$$

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 tailstock force, maximum chip cross section is calculated as follows:

$$q_{max} = \frac{\frac{F_R}{m} - 1000}{1000 \times \frac{D}{d}}$$

EXPLANATORY NOTES: The calculations refer to tooling against the face driver. In case of tooling against tailstock the calculated chip cross section is reduced by approx. 40 %. 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:**

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

BS	[N / mm]	chisel load
F_R	[N]	tailstock force
n	[-]	number of drive pins
s	[mm]	chisel length

EXEMPLIFICATION: turning with FSB 3 face driver, 6 drive pins, respective length of chisel 4 mm, tailstock force 7200 N

$$BS = \frac{7200\ N}{6 \times 4\ mm} = 300\ \frac{N}{mm}$$

CALCULATION EXAMPLE for type FSB / SB

Specific data of machine and workpiece:
maximum tailstock force: 10000 N
material of the workpiece: C15E
diameter of the workpiece,
side of face driver: Ø 48 mm
turning diameter: Ø 90 mm

Selection of face driver:
face driver FSB 3 / clamping Ø 44 mm
6 drive pins each 4 mm chisel length

- **tailstock force F_R:**
  In order to ensure sufficient entrainment (see chisel load of drive pins) a tailstock force of approx. 7200 N has to be supplied.

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

$$F_R = 300\ \frac{N}{mm} \times 6 \times 4\ mm = 7200\ N$$

Determination of material factor m:
as per adjustment chart material factor: m (C15E) = 1.1

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

$$q_{max} = \frac{\frac{7200\ N}{1,1} - 1000}{1000 \times \frac{90\ mm}{44\ mm}} = 2,71\ mm^2$$

EXPLANATORY NOTES: This calculation refers to tooling against the face driver. The calculated chip cross section refers to the ultimate turning 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.