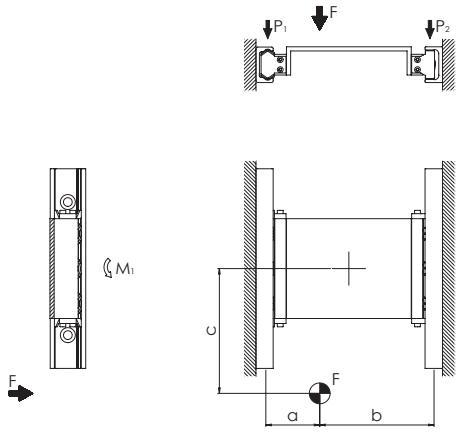
Calculation Formulas

Examples

Formulas for determining the forces on the most heavily loaded slider.

Horizontal movement

Static test



Slider load:

$$P_1 = F \cdot \frac{b}{a+b}$$

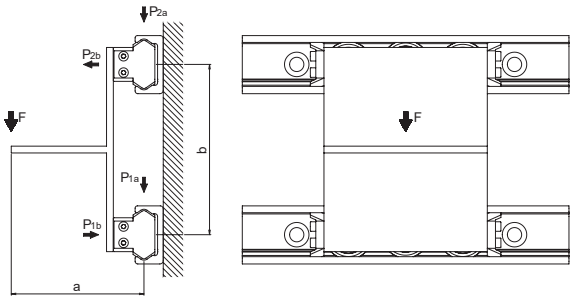
$$P_2 = F - P_1$$

In addition each slider is loaded by a moment:

$$M_1 = \frac{F}{2} \cdot c$$

Horizontal movement

Static test



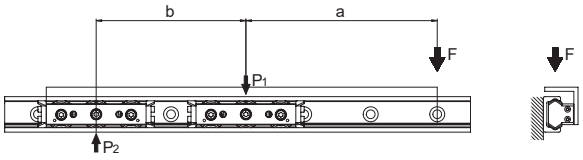
Slider load:

$$P_{1a} \cong P_{2a} = \frac{F}{2}$$

$$P_{2b} \cong P_{1b} = F \cdot \frac{a}{b}$$

Horizontal movement

Static test



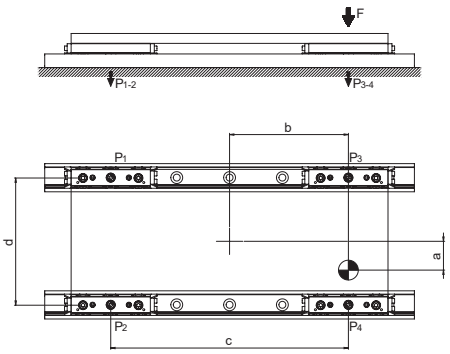
Slider load:

$$P_2 = F \cdot \frac{a}{b}$$

$$P_1 = P_2 + F$$

Horizontal movement

Static test



Note: It is defined that the slider no. 4 is always located closest to the point where the force is applied.

Slider load:

$$P_1 = \frac{F}{4} - \left(\frac{F}{2} \cdot \frac{b}{c}\right) - \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$

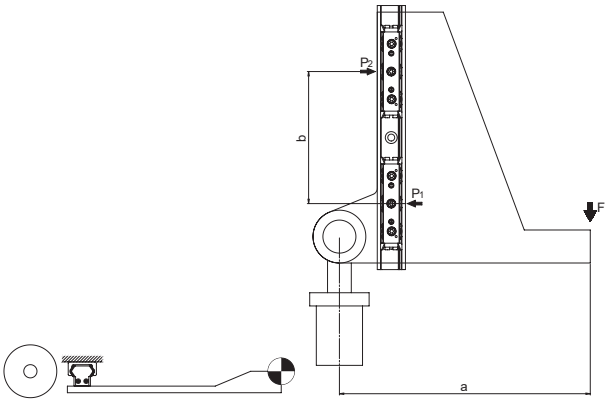
$$P_2 = \frac{F}{4} - \left(\frac{F}{2} \cdot \frac{b}{c}\right) + \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$

$$P_3 = \frac{F}{4} + \left(\frac{F}{2} \cdot \frac{b}{c}\right) - \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$

$$P_4 = \frac{F}{4} + \left(\frac{F}{2} \cdot \frac{b}{c}\right) + \left(\frac{F}{2} \cdot \frac{a}{d}\right)$$

Vertical movement

Static test

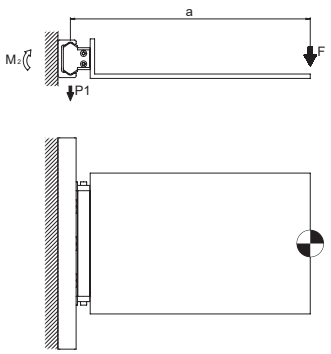


Slider load:

$$P_1 \approx P_2 = F \cdot \frac{a}{b}$$

Horizontal movement

Static test



Slider load:

$$P_1 = F$$

$$M_2 = F \cdot a$$

Explanation of the calculation formula

F	= effective force (N)
F_g	= weight-force (N)
P_1, P_2, P_3, P_4	= effective load on the slider (N)
M_1, M_2	= effective moment (Nm)
m	= mass (kg)

Service life

The dynamic load capacity C is a conventional variable used for calculating the service life. This load corresponds to a nominal service life of 100 km. For values of the individual slider. The following formula links the calculated theoretical service life to the dynamic load capacity and the equivalent load:

$$L_{km} = 100 \cdot \left(\frac{C}{P} \cdot \frac{f_c}{f_i} \cdot f_h\right)^3$$

L_{km} = theoretical service life(km)
C = dynamic load capacity (N)
P = effective equivalent load (N)
f_c = contact factor (N)
f_i = application coefficient
f_h = stroke factor

The equivalent load P corresponds in its effects to the sum of the forces and moments working simultaneously on a slider. If these different load components are known, P results as follows:

$$P = P_1 + \left(\frac{P_a}{C_{0ax}} + \frac{M_1}{M_x} + \frac{M_2}{M_y} + \frac{M_3}{M_z}\right) \cdot C_{0rad}$$

Here the external loads are assumed as constant in time. Brief loads, which do not exceed the maximum load capacities, do not have any relevant effect on the service life and can therefore be neglected. The contact factor f_c refers to applications in which several sliders pass the same rail section. If two or more sliders move over the same point of a rail, the contact factor to be taken into account in the formula for calculation of the service life.

Number of sliders	1	2	3	4
f_c	1	0,8	0,7	0,63

The application coefficient f_i takes into account the operational conditions in the service life calculation. It has a similar significance to the safety factor S_0 in the static load test. It is calculated as described in the following table:

Neither shocks nor vibrations, smooth and low-frequency direction change; clean operating conditions; low speeds (<1 m/s)	1 - 1,5
Slight vibrations, average speeds (1 - 2,5 m/s) and average frequency of direction change	1,5 - 2
Shocks and vibrations, high speeds (>2,5 m/s) and high-frequency direction change, extreme dirt contamination	2 - 3,5

The stroke factor f_h takes into account the higher load of the raceways and rollers during short strokes on the same total length of run. The corresponding values are taken from the following graph (for strokes longer than 1 m, f_h =1):