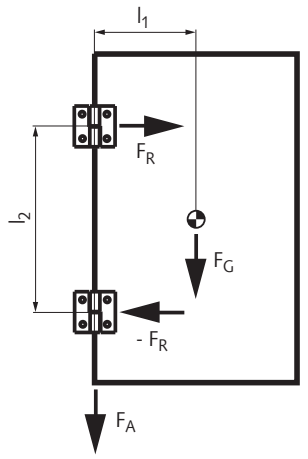
Calculation for Hinges

At hinges, the axial force F_A and radial force F_R are often stated. F_R applies to an opening angle of 90°. These specifications shall help to find the suited kind, quantity and size of hinges. The dates were found by testing, at plastic hinghes up to a little deforming. These are non-binding guide values without any liability. A large dimensioning is recommended.

At plastic hinges, the safety factor should be minimum 2. At metal hinges, the safety factor should be minimum 1.5.
The following calculation examples show the most common kinds of applications. There can no liability be assumed for misinterpretations or errors.

Hinges - Calculation, Vertical Mounting - Door mounted at the Side



F_G is the weight force in N (= mass in kg x acceleration of gravity). F_G acts in the centre of gravity. At a homogenous door, it is in the middle. At a single hinge, the weight force would cause a torque by the lever length l_1. By using several hinges, the next hinge will compensate this torque by the lever length l_2. The result is a radial force F_R at the upper hinge and an opposite radial force $-F_R$ at the lower hinge.

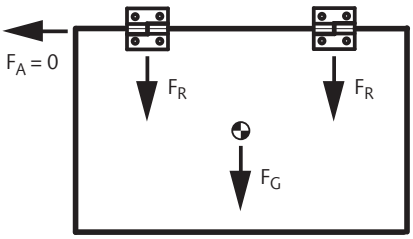
$$F_G = m \times g$$

$$F_R = \frac{F_G \times l_1}{l_2}$$

$F_A = F_G$ *if one hinge will carry the total weight force. This is the normal case at large tolerances.*

$F_A = \frac{F_G}{2}$ *if both hinges will carry the total weight force. This requires small tolerances and very exactly mounting.*

Hinges - Calculation, Horizontal Mounting - Door mounted at the Top or at the Bottom



F_G is the weight force in N (= mass in kg x acceleration of gravity). F_G acts in the centre of gravity. At a homogenous door, it is in the middle. The weight force is distributed to all hinges and acts as a radial force F_R. At this kind of application, there is no axial force F_A.

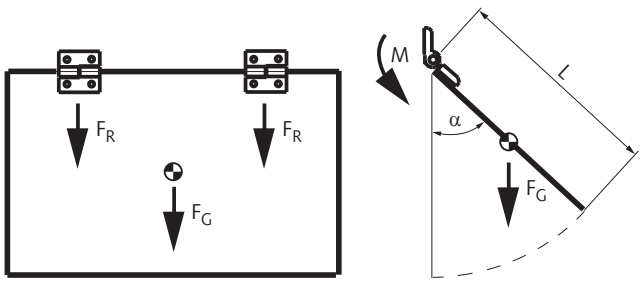
$$F_G = m \times g$$

z = number of hinges

$$F_R = \frac{F_G}{z}$$

$$F_A = 0$$

Hinges - Calculation, Torque Calculation for Frictional Hinges



Frictional hinges (torque hinges) like M233 and M437 can hold open a door or against its weight force or against an external force.
F_G is the weight force in N (= mass in kg x acceleration of gravity). F_G acts in the centre of gravity. At a homogenous door, it is in the middle. The weight force causes a torque M by the lever length L/2, depending on the opening angle α between the door and the vertical. The required number of hinges is the result of the calculated torque M diveded by the stated fricton torque of a single hinge.
At this kind of application, there is no axial force F_A.

$$M = \frac{F_G \times L \times \sin \alpha}{2}$$

z = required number of hinges

M_S = friction moment of a single hinge

$$z = \frac{M}{M_S}$$