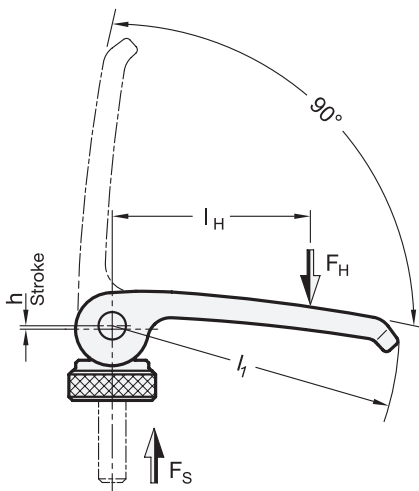


General information



The eccentric principle has two advantages: A large clamping force F_S and a self-locking mechanism as soon as the dead centre is exceeded.

All theoretical attempts to describe the ratio between manual and clamping force will ultimately rest only on assumptions in some parameters. The actually prevailing conditions are influenced by a number of different factors.

The values given in the tables below are therefore based on practical specifications and findings and rest on test series which have shown which clamping forces can be achieved by applying the specified manual forces.

The maximum permitted pretensioning force of each thread size will not be exceeded by operating the lever.

Clamping and manual forces

l_1 Lever size	$\approx F_H$ Manual force	$\approx I_H$ Lever, manual force	$\approx F_S$ Screw force / Clamping force		
			GN 927 / GN 927.4	GN 927.3 / GN 927.5	GN 927.2 / GN 927.7
44 1.73	75 N 17 lbf	44 1.30	1250 N 281 lbf	1750 N 393 lbf	1450 N 326 lbf
63 2.48	125 N 28 lbf	47 1.85	1250 N 506 lbf	3100 N 697 lbf	2600 N 585 lbf
82 3.23	200 N 45 lbf	62 2.44	3700 N 832 lbf	5000 N 1124 lbf	4300 N 967 lbf
101 3.98	350 N 79 lbf	76 2.99	6100 N 1371 lbf	8000 N 1798 lbf	7000 N 1574 lbf

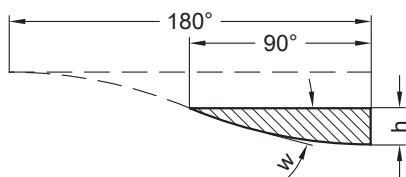
Calculation

To account for the above theoretical and arithmetical alternative for determining clamping and manual forces, a potential solution will be shown below which will ultimately also prove the plausibility of the values given in the table using a calculation example.

When theoretically determining the clamping force F_S resulting from the manual force, two points must be observed in particular:

First, there are the geometrical conditions existing at the eccentric which call for an arithmetically complex approach if one wishes to take account of the exact conditions. Secondly, the friction occurring at several points will have a strong impact on the achievable clamping force

1st alternative, eccentric



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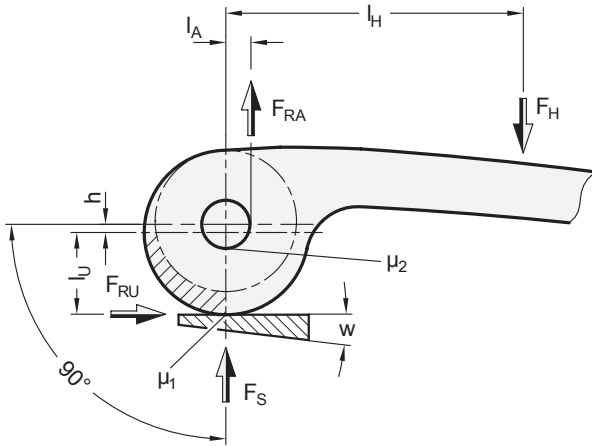
Substitute calculation model

In simple terms and assuming a constant gradient, the existing sine curve may be seen as a wedge which will result in a sufficiently accurate and approximate substitute calculation model which is a great deal less complex.

A friction value will be assumed for the axis of rotation and the circumference of the eccentric, which will in reality be strongly influenced by external factors and may therefore diverge accordingly.

2nd alternative, eccentric

A 90° motion of the manual level covers the stroke h.



F_s	Screw force / clamping force (resulting)
F_H	Manual force
l_H	Lever arm of the manual force
F_{RU}	Friction force at circumf.
l_U	Lever arm at circumference
F_{RA}	Friction force at the axis
l_A	Lever arm at the axis
w	Substitute wedge angle
h	Stroke at 90° rotation of the lever
μ_1	Friction coefficient at circumf.
μ_2	Friction coefficient at the axis

Calculation

Clamping force	Friction coefficient (wedge angle, ¼ circle)
$F_s = F_H \times l_H / ((l_U \times (\mu_w + \mu_1)) + (l_A \times \mu_2))$	$\mu_w = h \times 4 / \pi \times 2 \times l_U$

Example

Clamping lever with eccentric cam GN 927.7-101-M8-B
 with manual force $F_H = 350$ N, friction coefficient $\mu_1 = 0.2$ and $\mu_2 = 0.1$ plus lever arm $l_A = 5$ mm and $l_U = 11.5$ mm

$$F_s = 350 \text{ N} \times 76 \text{ mm} / ((11.5 \text{ mm} \times (0.083 + 0.2)) + (5 \text{ mm} \times 0.1)) = 7000 \text{ N}$$

The following friction coefficients μ may be used for potential friction pairings:

Plastic / Plastic ≈ 0.25	Steel / Steel (lubricated) ≈ 0.1	Steel / Steel ≈ 0.2
Plastic / Steel ≈ 0.15	Stainless Steel / Stainless Steel (lubricated) ≈ 0.1	Stainless Steel / Stainless Steel ≈ 0.2

Safety notices

The design of applications involving clamping levers with eccentric cam should always be made including an adequate safety factor. Usual safety factors for static loads 1.2 to 1.5; pulsating 1.8 to 2.4 and alternating 3 to 4. To be increased proportionally in applications with higher safety requirements.

Disclaimer:

The information and recommendations we give are made without commitment and excluding any liability, unless we have committed ourselves expressly and in writing to give such information and recommendations. All products are standard parts designed for a variety of different uses and have as such been subjected to extensive standard tests; users should determine in their own test series, for which we will not be liable, whether a product will be suitable for certain special applications and uses.

