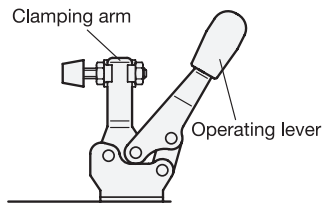


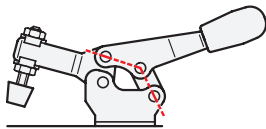
# Toggle Clamps

Overview of Types



By using the **toggle principle** toggle clamps offer decisive advantages:

The clamping arm retracts to such an extent that the workpiece can be loaded and unloaded completely unobstructed.



Even the slightest forward movement of the operating handle brings the clamping arm with the spindle assembly over the workpiece.

As can be seen from the sketch, the position of the three toggle links will lead to a multiple of the input force applied to the operating handle.

In this position the toggle clamp is not yet fully engaged and any counter force will open it.



In this position all three pivots are perfectly aligned yielding the maximum **clamping force  $F_s$**  (dead center point).

The clamping force  $F_s$  exerted on the workpiece is mainly dependent on the following criteria:

- The input force which is applied to the operating handle
- The position of the spindle assembly on the clamping lever

Since the applied force on the lever by the operator is not known, the clamping force  $F_s$  shown in the table is only specified for pneumatic clamps.

The clamping force  $F_s$  can be altered by re-adjusting the position of the spindle assembly. The clamping force increases if the entire contact area of the bolt arrives on the workpiece prior to the toggle linkage reaching dead center point. This effect is illustrated clearly when using an elastic clamping pad.



In this position the toggle linkage has arrived in the over-center lock position and the operating lever has reached a firm stop and is thus prevented from opening until it is released by the operator.

The force which the clamp is capable of withstanding in this over-center lock position without suffering permanent deformation is known as holding force  $F_H$ . The holding force has a characteristic value (co-efficient) for toggle clamps and this value is mainly dependent on:

- The size (dimensions, geometry) of the toggle clamp
- The position of the spindle assembly on the clamping arm

In the tables the **holding force  $F_H$**  of the toggle clamps is given in each case in relation to a particular position (distance  $r$ ) of the clamping arm.

On the standards sheets all clamps are shown in their clamping position. All references to force are given in N (Newton) / Lbf (pound-force).