Construction information
ALPHA clamp

1. General information

The ALPHA clamp has been developed as a pneumatic clamping tool for specific clamping operations, mainly in the field of sheet metal processing.

Contrary to classic toggle clamps, the mechanical advantage of the toggle joint built into the ALPHA clamp affects the clamp arm via an integrated curve-driven function.

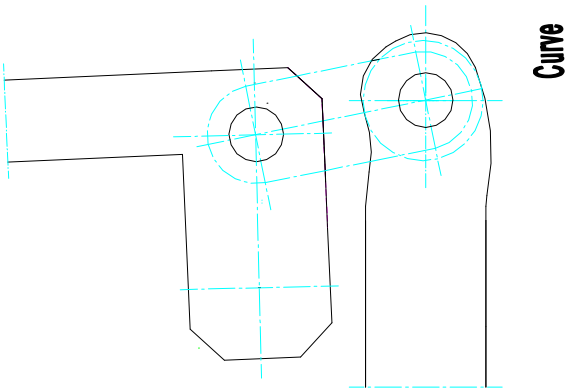


Fig. 1: Toggle clamp principle with curve-driven mechanism

Thereby, a virtually constant torque is generated within the clamping area at the square shaft output side. When pressurised, the clamp therefore always affects the component to be clamped with its maximally available force. Consequently, this highest force is independent of the preload produced through shims in the case of classic toggle clamps.

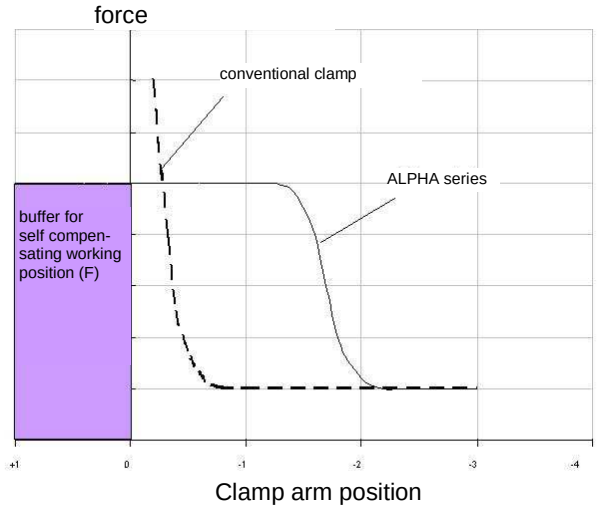
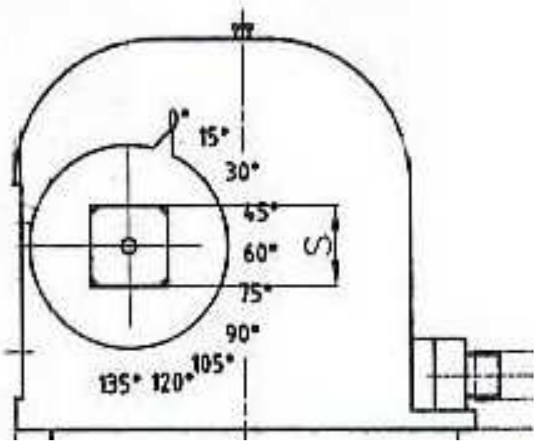


Fig. 2: ALPHA clamp force diagram

2. Vario concept for angle adjustment

The ALPHA clamp is equipped with an adjustment mechanism which provides for continuous adjustment of the opening angle within a range of 15° - 135° via an adjusting screw integrated into the cylinder bottom.

The set opening angle is displayed by the anti-loss pointers on the dials mounted to the right and left of the drive shaft. (Figure 3)



3. Sensing system

The special sensing system of the ALPHA clamp is in principle an analogous, inductive sensor which monitors all positions of the clamp arm. These clamp arm positions are taught-in for the sensor following adjustment and start of operation and they are stored in the integrated electronics. During normal operation, the integrated micro processor sends the standard digital signals to the higher level controller. Therefore, changes to the system control are not required.

Due to the precise resolution of the system, the sensing system can identify the sheet thickness of the clamp component. Thereby, component sensor function (component present) is also registered next to the end position sensing by the clamp.

In general, the sensing system is supplied with two different, freely selectable settings under the order description “T60”. Shifting between these settings is possible at any time during operation.

A. T12 setting

In factory adjustment, the sensing system functions as a purely digital position sensing system for the positions “clamp closed“ and “clamp open“ (T12).

In the position „clamp closed“ the sensor generates a switching signal within the entire measurement range ± 2 mm for clamp arm length 100 mm (see figure 3). For the position „clamp open“, the range between 15° and 135° opening angle is completely scanned. Separate adjustment of the sensors for the currently set opening angles (see operating instructions) is not required. The switching signal for the position „clamp open“ is explicitly generated for the respective opening angle after a short, automatic teach-in phase of the sensor. If a different opening angle is moved towards (e.g. through extraneous influence on the clamp), a switching signal is not generated.

Switching range Sensing system

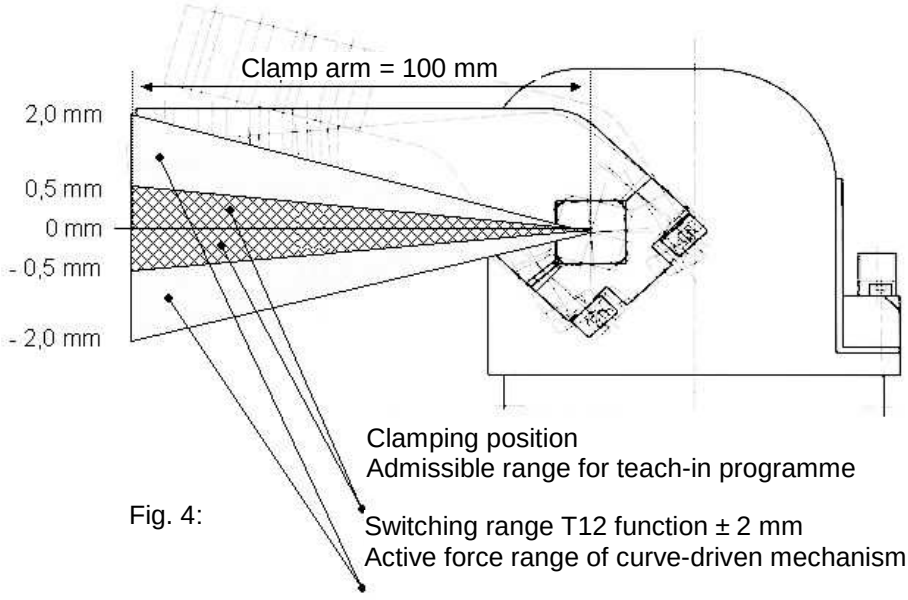


Fig. 4:

B. T60 setting

Following installation and start-up of the clamping fixture, the teach-in programme of the sensing system can be started for the T60 function. This is achieved by activation of the Reed contact (see operating instructions) with a magnet. The taught-in sensing system is then able to monitor the clamping operation and report irregularities. The sensing system identifies:

- size tolerances of the components to be clamped;
- counterforces occurring during the process;
- internal wear of the ALPHA clamp.

In these cases, the signal ”clamp closed“ is not generated for identification purposes!
Through this teach-in phase, the current angle adjustment “clamp open“ is also taught-in and permanently stored.

Clamp arm adjustment

Faultless functioning of the sensing system requires that the clamp arm is precisely positioned in closed position (component clamped) at 90° or 180°, respectively, towards the clamp. Only through this is it safeguarded that the clamp arm moves within the active force range of the curve-driven mechanism and that the available force-path reserve is sufficient. After the start of the teach-in phase (through Reed contact) this correct clamp arm position for the closed position is monitored by the sensor.

If this position is not reached, the teach-in programme is not activated. This requires a correction of the clamping point e.g. through adjustment of the shims (see clamping point construction).

Alpha clamp must be opened and closed four times to complete the teach-in phase, to programme and store the positions „clamp closed“ and „clamp open“. The “intelligent” function (T60) of the sensing system is now activated and operational.

4. Clamping point construction

The particular features of the ALPHA clamp must be considered in the construction of the clamping point. Due to the curve-driven function, the components to be clamped are always loaded with the maximally available force of the clamp. Therefore, sufficient dimensioning of the entire clamping point generally renders any adjustment obsolete.

The clamping point must be constructed in a way that the clamp arm, including loaded components and all relevant clamp pieces (incl. shims) is in an exact 90° or 180° position, respectively, to the clamp housing. With this, the entire clamping point must be sufficiently rigidly dimensioned so that the overall deflexion of effective construction elements, bracket/support and clamp arm/clamp piece, does not exceed 0.2 mm. As to higher degrees of deflexion, the clamping point must be adjusted correspondingly to ensure that the switching flag of the clamp resumes the centre position within the curve range (see sensing system).

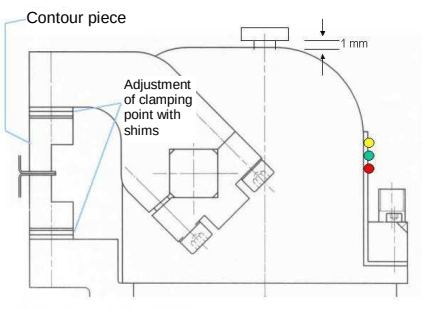


Fig. 5: Principle of clamping point construction including adjustment

The correct zero position can also be verified mechanically without connected sensing system: in correct zero position, the release button on the clamp head is pushed upwards by max. 1 mm by the toggle bar. In this position, the switching flag is situated in the centre range of the power curve.

5. Options

a.) Holding function

For the purpose of safety-relevant applications (e.g. gripper system, overhead installation), the ALPHA clamp can be equipped with a pneumatic holding function (version “H“). This pneumatic self-locking function keeps the drive cylinder in the „clamp closed“ position via an unlockable, pressurised check valve integrated into the cylinder bottom. Due to this pressurization, the clamp cannot be opened automatically. The pneumatic self-lock is released via switching of the main valve or through manual activation of the check valve. A special, external pneumatic control is not required.

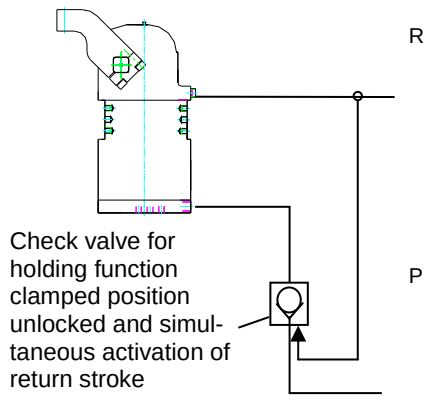


Fig 6: Circuit diagram of check valve

Principally, all clamps to be used with robotic grippers must be equipped with pneumatic self-locking systems.

b.) Self-locking toggle mechanism

As an alternative to the new curve-driven power concept, the ALPHA clamp is available in the form of the variant “APH ... V“ featuring a conventional toggle mechanism with self-locking function. As with the previous models, the clamp arm moves into a defined end position (90°/180°). There is no self compensating working position, hence the integrated sensing system T60 is not operable. This version is particularly suited for clamping tasks without opposing position (e.g. centring pins).

c.) Manual feed:

As the ALPHA clamps does not work with the classic self-lock, a manual lever is offered for this version, which is externally attached to the clamp arm without interfering with the internal kinetics of the clamp.

In addition, a spring-loaded stop is available for the position „clamp closed“, which keeps the clamp arm in closed position until the clamp is pressurised. This solution lends itself preferably to difficult installation positions (overhead).

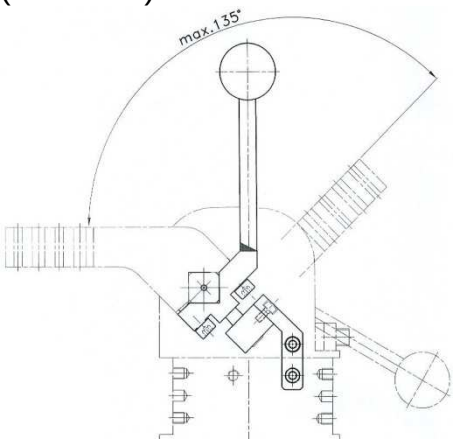


Fig 7: Optional manual feed with closed stop

Moreover, another spring-loaded stop can be ordered for the „clamp closed“ position, which is adjusted to the respective opening angle (in 15° intervals). With it, the clamp arm is fixed in open position.

Both end position stops can be alternatively mounted to the right and left of the housing.

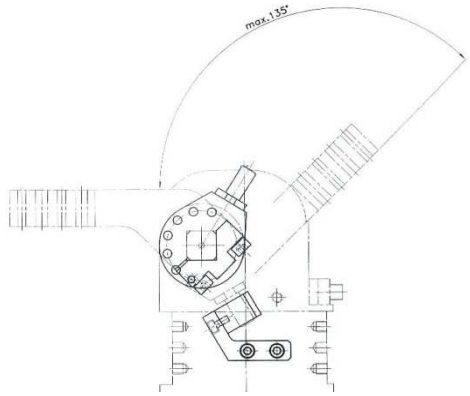


Fig. 8: End position stop for the position “clamp open“