TOX®-Assembly

Assembling by force-fit
Assembling by force-fit

Pressing bearings and bushings into a housing or onto a shaft, production of precision pressed connections – for example using the reliable, long-proven TOX®-Powerpackage as the drive.

**Your solid advantages:**

+ pressing to a force or distance specification
+ pressing to a force with position monitoring, pressing to a distance with force monitoring
+ precise
+ excellent repeatability
+ noticeable reduction of Stick-Slip-Effect
+ highly flexible
+ minimal component stresses
+ quiet
+ matching controls and process monitoring
+ real time display of force/distance curve

**Exemplary processes**

**Pressing a pin to a position / distance**

**Pressing a pin to a stop / monitoring the force**

**Crimping / swaging**

**Riveting, forming, press-fitting**

**Press-fitting and measuring**
Customers have placed confidence in our pressing application for many years. In addition, we can integrate your existing tooling into one of our presses.

Simple to complex

TOX®-Presses
2- and 4-column presses or C-frames

TOX®-Drives
Matching standards

TOX®-Controls
Safety controls pneumatic or electric

TOX®-Monitoring
Process monitoring

Tooling

Base frames
Guarding frames

Rotary indexing tables
Linear slides and much more …

The individual components of the TOX® modular design principle lead to your perfect solution!
Pressing to a position  
A typical application involves pressing a pin into a thru hole. The pin needs to be pressed using a predetermined distance to a defined end position.

The Force(F)-Travel(s) diagram shows that the force increases at the beginning, and then it becomes fairly constant until the end position has been reached. Such a curve can be monitored over two entry/exit windows and one block, end position, window.

Pressing to a stop  
When a pin is pressed into a blind hole, then the end position is set by the force diagram.

The diagram shows that the force increases, and then it becomes nearly constant and increases once the end stop position has been reached.

Such a curve can be monitored by two entry/exit windows and one block window.

The same is true when pressing a sleeve or bushing to a stop. The end position is defined also by the force curve.

The diagram shows that the force increases, then it drops slightly due to sliding, and then it remains fairly constant and increases at the end until it reaches the block position. Such a curve can be monitored by an online window and a block window in conjunction with an envelope curve.

The matching press  
The TOX®-Process Monitoring EPW can be used with all types of TOX®-Presses.

TOX®-FinePress  
Simple pressing and assembly processes for a large range of operator friendly work stations.

Press frame with the TOX®-Powerpackage  
The TOX®-Powerpackage is used when more than just muscle force is needed.
From simple to complex ...

Swaging, flaring, staking

In applications such as crimping of safety studs, the press is driven to block. Also in this case, the end position is defined by the force curve.

The diagram shows a steady force increase, which ends in the block position. Such a curve can be monitored using three entry/exit windows and one block window.

In flaring applications, the distance is often the deciding factor. Depending on the flow characteristics of the material, the force requirement decreases already prior to reaching the end position.

The diagram shows a steady force increase, which reaches its high point and starts decreasing as soon as the material begins to flow. Such a curve can be monitored using three entry/exit windows and one block window.

Joining, clinching

In cold joining processes without joining elements, such as clinching, the sheet metal is deformed locally. The process ends when the residual bottom thickness (X-dimension) is obtained, i.e. a distance has been reached. (See TOX®-Joining Systems catalog for more information).

The diagram shows a steady force increase, which makes a jump when the material begins to flow and harden. The force increases until the end position (distance) is reached. Such a curve can be monitored using three entry/exit windows and an envelope curve.
Everything from one source

For more complex processes

Riveting, pressing, forming

In joining processes such as ClinchRivet, the sheet metal is cold formed as in clinching, and a rivet is inserted. The rivet is essentially a piece of the punch, which remains in the work-piece. The process is usually ended when a desired distance has been reached.

The diagram shows a steady force increase, which decrease slightly and increases constantly until the end position has been reached. This curve can be monitored using two entry/exit windows and one end window.

When setting a solid punch rivet, the material is first punched through with the rivet and then the rivet head or material is coined. The end position is also a block position.

The diagram shows that the curve increases until the material is punched, then it falls, remains fairly constant and increases when the rivet head has been inserted. Such a curve can be monitored using an envelope curve and an end window.

The riveting process requires that the joining element has been fed and placed in the part. The press tooling performs the upsetting of the rivet head. The end position of the process is defined by the force curve.

The diagram shows a sharp force increase at the beginning, and then it remains fairly constant and increases at the end. This curve can be monitored using three entry/exit windows and one block window. (See TOX®-Fastener Insertion catalog for more information).

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TOX®-ElectricDrive goes into Detail

Closed loop control

Pressing to a distance with force tolerances/-windows

A typical application consists of pressing a cam onto a shaft. The part being pressed should not go on too tight or too loose onto the shaft and must be pressed to a defined end position.
The curve starts with a steady force increase, which falls as soon as slippage occurs. The press continues to drive to the required distance. The force increases and remains constant until the end position is reached. This curve can be monitored using three entry/exit windows and one end window.

Reference pulling and pressing

Often, despite certain manufacturing tolerances, the parts have relative end positions which are decisive for the proper functioning of the assembly. For example in watchmaking, a part will be pressed into another to a defined distance. In this case, the position of the reference part and the components will be determined first, and then pressed together to a defined distance.
The diagram shows that a small amount of force is needed until the reference position has been reached. Then, the part is pressed to a defined distance. Usually, the curve is monitored with an envelope curve.

In a similar example, when a gear is pressed onto a shaft, the position on the shaft, and especially the distance to the work-piece, is very important.
The reference position is determined in advance, with the aid of a measuring sensor, in order to react to any deviation from the theoretical target dimension.
The diagram shows that the force is only needed until the reference position is reached. Then, the part is slowly pressed further to the end position. The curve is monitored using an envelope curve.

The matching press

The TOX®-ElectricDrive performs the measuring and the controller adjusts the motion.

Complete presses

A complete system offers a stand-alone solution.

Presses with multiple drives

A complete system ready to be integrated into your production line.

If your assembly process has not been shown, we can surely assist you. Please contact us.
Process Evaluation

Measuring, displaying, evaluating

TOX®-EPW
The Force(F)-Travel(s) diagram shows that, using the press monitoring EPW, one can measure, display and evaluate the Force-Travel curve even in simple assembly stations.

Measuring process
The force and distance values captured by the sensors are stored in the unit, and the corresponding curve is displayed on the screen. The curve can be evaluated by means of the user defined windows, envelope curves and trigger functions, and the results used as a OK or NOK signal. The following measuring functions are available for the various applications:

- Measuring function \( y = f(x) \)
The measurand Y (force) is displayed and evaluated as a function of the measurand X (travel). A selectable X-pattern defines the reading of the X-Y pair of values.

- Measuring function \( y = f(x,t) \)
The measurand Y is displayed and evaluated as a function of the measurand X. A selectable time pattern t defines the reading of the X-Y pair of values.

Evaluating windows
There are three window types available for evaluating the curves. These windows can be combined in the measuring program of the TOX®-EPW process monitoring.

(1) Block window: This type of window defines the entry side for the curve. In addition, the curve ends inside this window. When both conditions are met, then the forward stroke ends and the returns stroke is introduced (the process is evaluated as OK). One block window is allowed per measuring program.

(2) Entry/exit window: This type of window defines the entry and exit sides for the curve. The entry and exit sides can be freely selected. The process is evaluated as OK when the curve enters and exits the selected sides of the window.

(3) Online window: This window type is specially designated for pressing and joining operations. It is placed in the meshing stage of the pressing curve and controls – in real time – if the mating parts mesh correctly and don’t jam. The process is aborted immediately if the curve does not meet the requirements.

Envelope Curves
In addition to the evaluating windows, the curve can be measured using an envelope curve. Curves are used to define the upper and lower limits. The process must fall between the defined envelope band. The envelope band is customized over a learning function by running prototype parts, whereby the user can decide for each part if the corresponding curve should be used to define the envelope band. Individual envelope curves can be shifted manually either horizontally or vertically. During the evaluation, the keys can be used to expand the envelope curve for an NOK assembly. This allows the experience and knowledge of the user to be used in the automated evaluation procedure.

Envelope curves and evaluation windows can be combined. Up to ten evaluating windows along with the envelope curve can be implemented to measure and evaluate the process curve.
Process Evaluation

Reference points for curve evaluation
Absolute value: the curve evaluation can be started or stopped based on a force trigger, distance trigger or by PLC. The absolute value is defined by the user. These reference points are very useful for pressing and joining processes, in which both components have the same relative start position.

TOX®-softWare HMI
The TOX®-softWare HMI (Human Machine Interface), in conjunction with the servo TOX®-ElectricDrive, offers the following functions in addition to the evaluation methods already described:
- Sequential control: Summarization of pressing processes for an assembly sequence.
- User friendly parameterization: Programming not required.
- Data bank: Configurable export data for integration of quality data in the existing production system.
- Export function for quality data on file system levels.

Please see catalog “TOX®-ElectricDrive” for specific information.

The complete press-fitting station
It is easy to configure your TOX®-Assembly-System:

1. Collection of the most important project data
   • Space requirements: How much room is available in the workshop?
   • Process speed: What cycle time is required?
   • Process parameters: What press force and distance are required?
   • Energy requirements: Electric power and/or air available?
   • Operator loaded or robotic work station?

2. Selection of station components
   • Drive: TOX®-Powerpackage or TOX®-ElectricDrive?
   • Design: C-frame or column press frame?
   • Process and tooling: Part fixturing, part presence sensing, cycle times?
   • Controls and safety: Safety controls or integration in an assembly line?
   • Process monitoring: Which process data should be obtained?

3. Contact TOX® PRESSOTECHNIK
   • With the help of the data provided by you, the TOX® experts will provide a customized solution for the realization of your project.
Application examples
Application examples

TOX®-Function Elements

TOX®-Presses and TOX®-Drives have been in use for many years in applications such as inserting, insertion of self-piercing or rivet elements. See catalog TOX®-Fastener-Insertion.
Our Worldwide Sales and Service Network

Product Range

- TOX®-Powerpackage
- TOX®-PowerKurver
- TOX®-ElectricDrive
- TOX®-FinePress
- TOX®-Presses
- TOX®-Controls
- TOX®-Monitoring
- TOX®-Joining-Systems
- TOX®-Tongs
- TOX®-Punching
- TOX®-Coining
- TOX®-Press-Fitting
- TOX®-Production Systems

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Subject to technical alternations.