TOX®-Punching Systems

- TOX®-Punching Tongs
- TOX®-Punching Presses
Modular – but highly customized using TOX® Building Blocks

The well thought-out TOX® modular system offers complete solutions to any punching application and allows to select the best suited system for the application.

Drive
- Pneumo-hydraulic
- Hydraulic
- Electro-mechanical

Indexing slide
(see page 5)
- for shuttling the piercing die to the work-piece
- for clean, distortion-free contact with the sheet metal

Frame
- Optimized design
- Solid construction
- Optimized tool guidance

Punching or forming tools for
- Piercing
- Notching
- Blanking

of
- Steel
- Non-ferrous metals
- Plastics

but also for
- Forming
- Bending
- Marking

Accessories
(see page 5)
- e.g. slug removal units
TOX®-Handheld and Robotic Tongs

TOX®-Handheld punching tongs SHH and SMH with hydraulic cylinder drive HZ
Compact, lightweight handheld punching tongs for manual use.
Drive provided by pneumo-hydraulic intensifier type ES.

TOX®-Punching robotic- and machine-mount-tongs SMR/SHR with hydraulic cylinder drive HZ
Compact, lightweight units conceived for robotic- or machine-mount applications.

<table>
<thead>
<tr>
<th>Type</th>
<th>Punching tongs</th>
<th>Tool opening</th>
<th>max. press force</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMH</td>
<td>Mini-Handheld tongs</td>
<td>max. 14 mm</td>
<td>45 kN</td>
</tr>
<tr>
<td>SHH</td>
<td>Handheld tongs</td>
<td>max. 190 mm</td>
<td>75 kN</td>
</tr>
<tr>
<td>SMR</td>
<td>Robotic-/Machine-mount tongs</td>
<td>max. 14 mm</td>
<td>45 kN</td>
</tr>
<tr>
<td>SHR</td>
<td>Robotic-/Machine-mount tongs</td>
<td>max. 390 mm</td>
<td>75 kN</td>
</tr>
</tbody>
</table>

Pressure intensifier, ready installed in a mobile service unit, type PHA.

Split power stroke and approach drive system, consisting of a hydraulic-/pneumo-hydraulic cylinder and a remote mounted intensifier.
TOX®-Frames and Presses

TOX®-Punching frame units SMB with TOX®-Powerpackage Drive
For combined applications. Simple, but robust design. Guidance of the tool via indexing slide.

TOX®-Punching presses with TOX®-Powerpackage Drive
For all medium or advanced punching operations. Punch forces from 10 to 2000 kN possible.

Please design a suitable press frame using the TOX® modular system.

All presses are also available with hydraulic and electric drives.

<table>
<thead>
<tr>
<th>Type</th>
<th>Tool opening</th>
<th>max. press force</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMB</td>
<td>Punching frame</td>
<td>max. 390 mm</td>
</tr>
<tr>
<td>PC</td>
<td>C-frame presses</td>
<td>max. 390 mm</td>
</tr>
<tr>
<td>MA/MAG</td>
<td>4-column presses</td>
<td>max. 390 mm</td>
</tr>
<tr>
<td>MB/MBG</td>
<td>2-column presses</td>
<td>max. 390 mm</td>
</tr>
</tbody>
</table>
Design Features

The Indexing Slide
The equalizing slide provides an indexing motion to shuttle the die or the punch to the work-piece.

The end position monitor provides integration for the sequencing process.

Slug disposal
In coordination with our customers we find an ideal solution for every application. This can be done using scrap drawers in a stationary punch station or small slug catchers or slug transducers for robotic punching tongs. Planned scrap removal prevents problems associated with working and process safety. Our extensive experience helps you avoid these potential problems.

TOX®-Powerpackage – Specials

The break through effect at the end of a punching operation causes an abrupt drop of the counterforce. This results in an instantaneous high acceleration of the working rod. The punching impact causes high noise levels and premature wear of the tools and the machine.

With a damping:
- the speed of the working rod remains nearly constant
- shocks are prevented at the end position
- noise levels are noticeably reduced

Advantages:
+ Damping can be electrically initiated at any point of the stroke
+ Damping is continuously adjustable
+ Almost constant speed of working rod
+ Reduction of cutting impact when punching
+ Option: speed control via proportional hydraulic valve
+ Option: integrated travel measuring system, type ZWK

Accessories ZED adjustable, integrated damping

Reliable process control due to integrated, adjustable damping:
The new integrated damping option allows for an adjustable constant speed of the working rod during the approach stroke and power stroke, independent of the working forces. Now it is possible to almost fully compensate for the sudden acceleration of the working rod when the opposing force is removed.

Advantages:
- Hydraulic damping of end of stroke
- Cushioning infinitely adjustable
- Total stroke infinitely adjustable
- Can be mounted in any orientation
- Protects tooling and machine
- Reduces noise levels
- Maintenance-free

Accessories ZSD Cutting impact damping

Ideal for damping in punching applications and for smooth operation of machines during approach or power strokes. Available for all TOX®-Powerpackages type EK with total stroke limiter.

Advantages:
- Hydraulic damping of end of stroke
- Cushioning infinitely adjustable
- Total stroke infinitely adjustable
- Can be mounted in any orientation
- Protects tooling and machine
- Reduces noise levels
- Maintenance-free
Technical Information

Material characteristics for cutting

Cutting force

The shearing process and the quality of the resulting cut surfaces depend on tool geometry, die clearance, tool sharpness as well as the type of material and its characteristics such as sheet metal thickness, material flow and microstructure. The shearing force for cutting tools with parallel ground surfaces can be determined using the following mathematical formula:

\[ F_s = I_s \times s \times k_s \]

where \( k_s \approx 0.8 \cdot R_m \)

\( F_s \) = shear force

\( I_s \) = length of cut

\( s \) = material thickness

\( R_m \) = material tensile strength

\( k_s \) = material shear strength

Using shear punches can reduce cutting forces up to 30%. The stripping force is typically about 10 – 40% of the required shearing force.

Recommended die clearance \( S \) in µm based on shear strength:

<table>
<thead>
<tr>
<th>Sheet metal thiknen. mm</th>
<th>250 N/mm²</th>
<th>250-400 N/mm²</th>
<th>400-750 N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8</td>
<td>25</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>1.0</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>1.25</td>
<td>38</td>
<td>50</td>
<td>63</td>
</tr>
<tr>
<td>1.5</td>
<td>45</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>2.0</td>
<td>60</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>2.5</td>
<td>75</td>
<td>100</td>
<td>125</td>
</tr>
<tr>
<td>3.0</td>
<td>90</td>
<td>120</td>
<td>150</td>
</tr>
<tr>
<td>3.5</td>
<td>105</td>
<td>140</td>
<td>175</td>
</tr>
<tr>
<td>4.0</td>
<td>120</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>4.5</td>
<td>135</td>
<td>180</td>
<td>225</td>
</tr>
<tr>
<td>5.0</td>
<td>150</td>
<td>200</td>
<td>250</td>
</tr>
</tbody>
</table>

Proper die clearance is essential for optimum shear effects, high cut quality and long tool life. The required die clearance \( S \) is primarily dependent on material shear strength and thickness.

<table>
<thead>
<tr>
<th>Material designation</th>
<th>( R_m ) N/mm²</th>
<th>Material designation</th>
<th>( k_s ) N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td></td>
<td>Non-ferrous metals</td>
<td></td>
</tr>
<tr>
<td>St 10</td>
<td>280...500</td>
<td>Al 99.5 Al99 soft</td>
<td>70...100</td>
</tr>
<tr>
<td>St 12</td>
<td>280...420</td>
<td>Al 99.5 Al99 half-hard</td>
<td>100...150</td>
</tr>
<tr>
<td>St 13</td>
<td>280...400</td>
<td>Al Mg 3/5/7 soft</td>
<td>180...380</td>
</tr>
<tr>
<td>St 14</td>
<td>280...380</td>
<td>Al Mg 3/5/7 half-hard</td>
<td>220...450</td>
</tr>
<tr>
<td>St 37</td>
<td>370...450</td>
<td>Al Cu soft</td>
<td>380...440</td>
</tr>
<tr>
<td>St 42</td>
<td>420...500</td>
<td>Al Cu half-hard</td>
<td>210...240</td>
</tr>
<tr>
<td>St 50</td>
<td>500...600</td>
<td>Kupfer (Cu)</td>
<td>120...140</td>
</tr>
<tr>
<td>St 60</td>
<td>600...720</td>
<td>Zinc (Zn)</td>
<td>400...450</td>
</tr>
<tr>
<td>Ck 10</td>
<td>340...400</td>
<td>Nickel (Ni)</td>
<td>200...300</td>
</tr>
<tr>
<td>Ck 35</td>
<td>500...600</td>
<td>Lead (Pb)</td>
<td>300...400</td>
</tr>
<tr>
<td>Ck 45</td>
<td>600...720</td>
<td>Al Bz 4</td>
<td>350...430</td>
</tr>
<tr>
<td>V 2A</td>
<td>620...750</td>
<td>CuZn 10 F 30</td>
<td></td>
</tr>
</tbody>
</table>
Background information

Important data for the TOX®-Punching System

In order to select the appropriate system from the TOX® modular components, the data below is required:

Punching applications in general:

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>Punching/punching pattern</th>
<th>Pre-requisites of the punching system</th>
</tr>
</thead>
</table>
| - Denomination of material  
- Tensile strength (N/mm²)  
- One layer/multi layer  
- Dimensions l x w x h (mm) | - Dimensions of punched aperture (mm)  
- Length of cutting edges (mm)  
- Thickness of material (mm)  
- Required tolerances of die clearance  
- Ground shear edges, parallel or angled  
- Number of punched apertures per component  
- Required cutting force | - Stationary or mobile punching unit  
- Required piece of punched parts per hour/day |

add drawing, if available.

TOX®-Production Systems
Application Examples of Punching Systems

The complete program for punching systems leading to individual, economical solutions for efficient sheet metal forming and more.

We offer complete solutions for many punching applications, all based on our modular concept. The modular concept made up of standard combinable modules provides the optimum layout of the TOX®-Punching Systems to fulfill the required specifications.

Please contact us!

Punching machine for piercing holes.
Our Worldwide Sales and Service Network