TOX®-Punching Systems

- TOX®-Punching Tongs
- TOX®-Punching Presses
The well thought-out modular system of TOX® PRESSOTECHNIK provides complete solutions for almost all punching applications. The configuration of the system required for the application is done by selecting the appropriate components.
TOX®-Powerpackage – Specials

TOX®-Powerpackage with power bypass (ZLB)

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

**Advantages:**
+ Hydraulic damping of end of stroke
+ Cushioning infinitely adjustable
+ Total stroke infinitely adjustable
+ Protects tooling and machine
+ Noticeable noise reduction
+ Low Maintenance

The electrical adjustable solution for all damping functions. Many adjustment options are available e.g. damping and speed as well as Soft-Touch.

**Advantages:**
+ Hydraulic damping can be electrically initiated at any point of the stroke
+ Damping is continuously adjustable
+ Reduction of cutting impact when punching
+ Stroke sensing ZHU (without sensors) and positive stop with elastomeric damping FUD integrated
+ Option: speed control via proportional hydraulic valve
+ Option: integrated travel measuring system, type ZKW
Drive kinematics

Examples from the TOX®-Modular Kit System:
The kinematics and the drive are designed in accordance to the required punching application.
The modular kit system allows to optimally adapt the press respectively the C-bow geometry, the drive and the pivoting curve to the piece part.

Linear kinematics

<table>
<thead>
<tr>
<th>Pneumatic drive</th>
<th>Pneumohydraulic drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Pneumatic drive image]</td>
<td>![Pneumohydraulic drive image]</td>
</tr>
</tbody>
</table>

**Characteristics**
- 0.7 t punching force max.
- Stable framing design with guide carriage
- Cutting impact damping by spring assemblies in the holding-down clamp
- Additional damping can be integrated
TOX®-Punching Systems are ideally suited for highly productive production processes. The extensive product program of TOX® PRESSOTECHNIK covers handheld tongs, machine tongs and robot tongs as well as C-frame presses and further press versions.

**Pivoting kinematics**

**Pneumatic drive**

**Characteristics**
- All advantages of the TOX®-PowerKurver with up to 5 t punching force
- Opening angle selectable from 30° to 90°
- Cutting impact damping by spring assemblies in the holding-down clamp

**Pneumohydraulic drive**

**Characteristics**
- Very compact design
- Especially designed for cutting processes
- Good integration into workpiece carrier substructure
Technical Information

Material characteristics for cutting

Tensile strength $R_m$ (N/mm²) or shear strength $k_s$ (N/mm²) for various materials

<table>
<thead>
<tr>
<th>Material designation</th>
<th>$R_m$ N/mm²</th>
<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>
<td>Non-metals</td>
<td></td>
</tr>
<tr>
<td>DC01</td>
<td>270…410</td>
<td>Al 99.5 Al99 soft</td>
<td>70…100</td>
<td>Paper and cardboard</td>
<td>20…50</td>
</tr>
<tr>
<td>DC03</td>
<td>270…370</td>
<td>Al 99.5 Al99 half-hard</td>
<td>100…150</td>
<td>Hard board</td>
<td>70…90</td>
</tr>
<tr>
<td>DC04</td>
<td>270…350</td>
<td>Al Mg 3/5/7 soft</td>
<td>180…380</td>
<td>Klingerit u.ä.</td>
<td>40…60</td>
</tr>
<tr>
<td>DX51</td>
<td>270…500</td>
<td>Al Mg 3/5/7 half-hard</td>
<td>220…450</td>
<td>Synthetic resin</td>
<td>100…140</td>
</tr>
<tr>
<td>S235</td>
<td>370…450</td>
<td>Al Cu soft</td>
<td>160…220</td>
<td>Synthetic resin, pure</td>
<td>20…30</td>
</tr>
<tr>
<td>S275</td>
<td>430…580</td>
<td>Al Cu half-hard</td>
<td>380…440</td>
<td>Mica</td>
<td>50…80</td>
</tr>
<tr>
<td>S355</td>
<td>500…600</td>
<td>Kupfer (Cu)</td>
<td>210…240</td>
<td>Wood</td>
<td>10…30</td>
</tr>
<tr>
<td>E335</td>
<td>590…770</td>
<td>Zinc (Zn)</td>
<td>120…140</td>
<td>Birch plywood</td>
<td>20…30</td>
</tr>
<tr>
<td>C35E</td>
<td>600…750</td>
<td>Nickel (Ni)</td>
<td>400…450</td>
<td>Celluloid</td>
<td>40…60</td>
</tr>
<tr>
<td>C45E</td>
<td>650…800</td>
<td>Lead (Pb)</td>
<td>200…300</td>
<td>Leather</td>
<td>7</td>
</tr>
<tr>
<td>1.4301</td>
<td>540…750</td>
<td>Al Bz 4</td>
<td>300…400</td>
<td>Soft rubber</td>
<td>7</td>
</tr>
<tr>
<td>1.4305</td>
<td>500…700</td>
<td>CuZn 10 F 30</td>
<td>350…430</td>
<td>Hard rubber</td>
<td>20…60</td>
</tr>
</tbody>
</table>

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:

$$F_s = l_s \times s \times k_s$$

where $k_s = 0.8 \cdot R_m$

$F_s$ = shearforce

$l_s$ = 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 $k_s$

<table>
<thead>
<tr>
<th>Sheet metal thickn. 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 effect, high cut quality and long tool life. The required die clearance ($S$) is primarily dependent on material shear strength and thickness.
Important data for the configuration of a TOX®-Punching System

In order to select the appropriate system from the TOX®-Modular System, the data below is required:

### Piece part
- Denomination of material
- Tensile strength (N/mm²)
- One layer/multilayer
- Dimensions l x w x h (mm)
- Thickness of material (mm)

### Punching pattern
- Dimensions of punched aperture (mm)
- Length of cutting edges (mm)
- Required tolerances
- Number of punched apertures per component

### Pre-requisites of the punching system
- Stationary or mobile punching unit
- Type of the slug removal unit
- Required piece of punched parts per hour/day

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**Application Examples of Punching Systems**

Punching press (100 tons) with pneumohydraulic drive TOX®-Powerpackage including cutting impact damping ZSD and parts handling

Punching machine with several punching tongs at one pneumohydraulic intensifier
Our Worldwide Sales and Service Network

Product Range

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

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