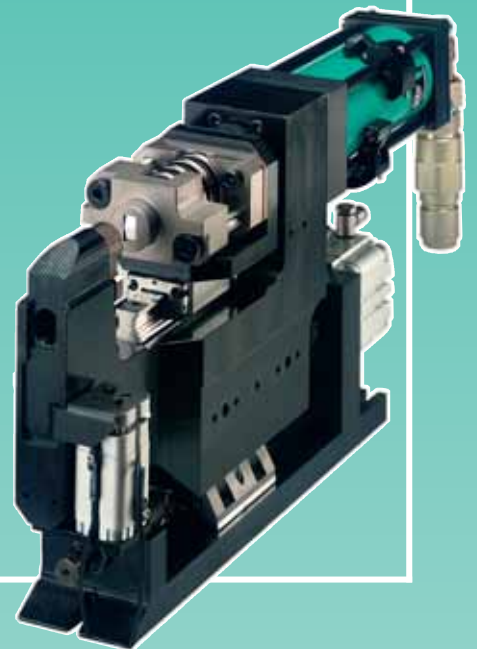




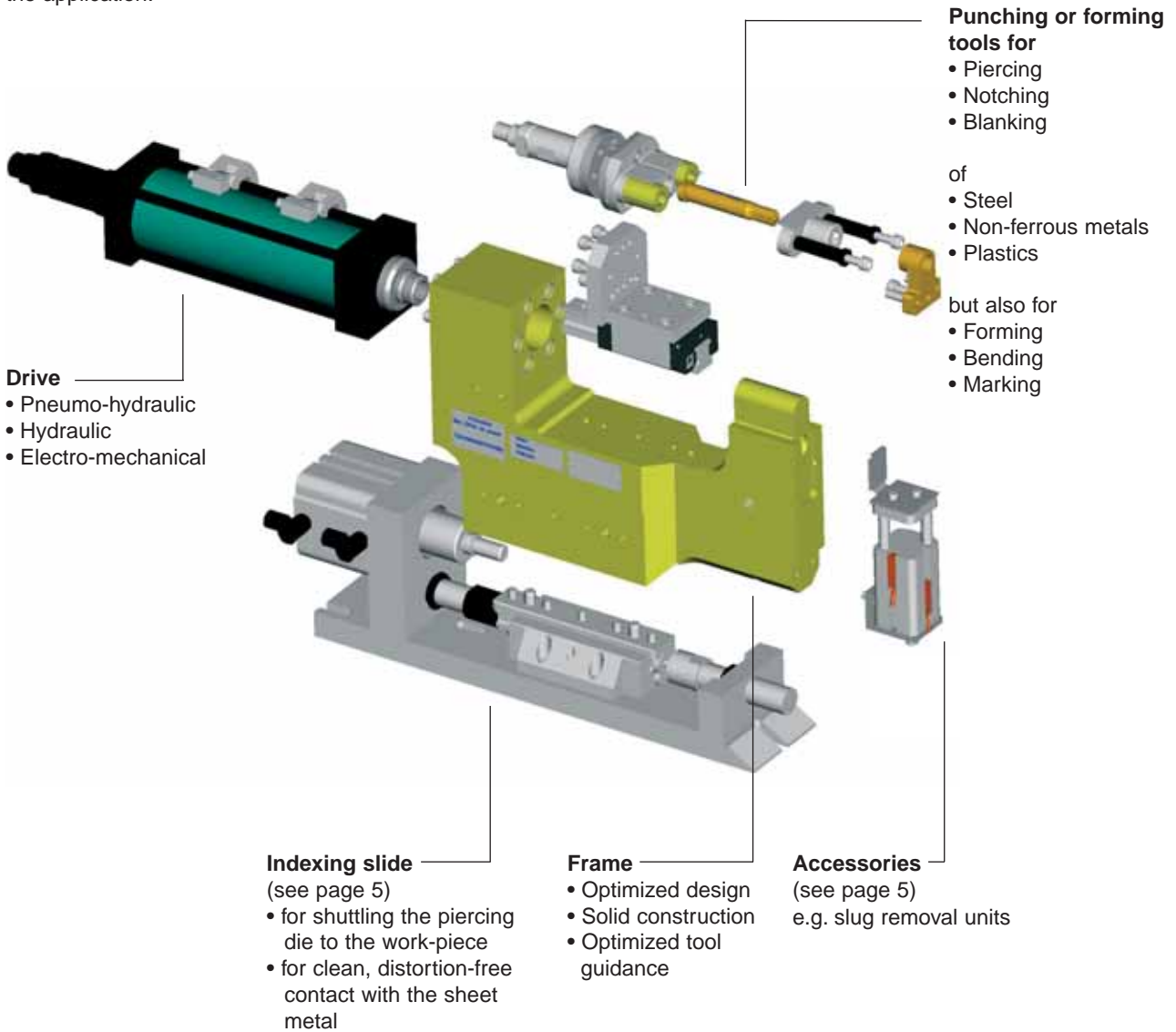
TOX®-Punching Systems

- 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.



TOX®-Handheld and Robotic Tongs

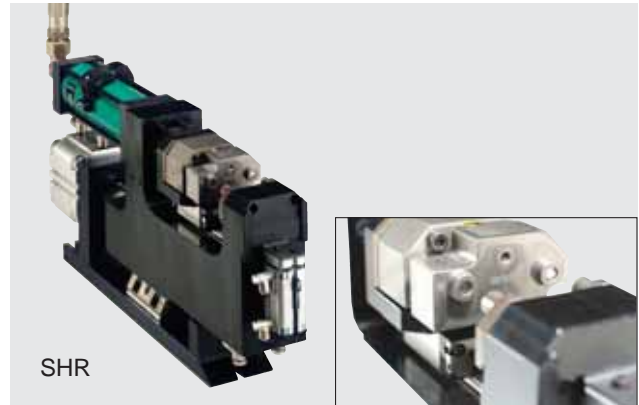
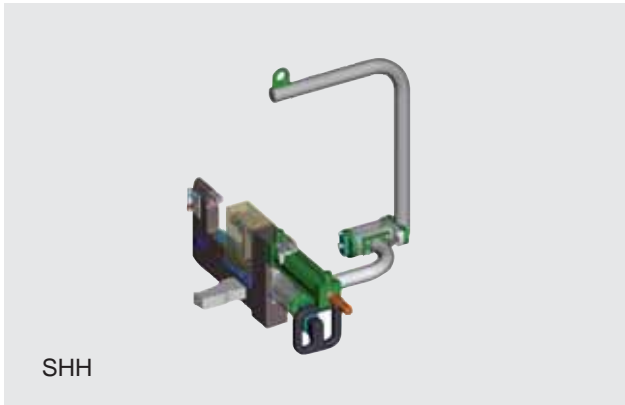
TOX®-Handheld punching tongs SHH and SMH with hydraulic cylinder drive HZ

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

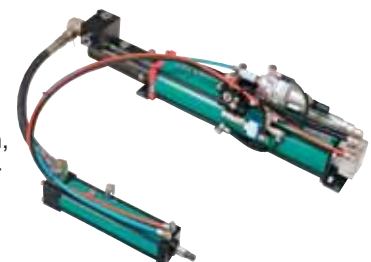
Compact, lightweight units conceived for robotic- or machine-mount applications.



Type	Punching tongs	Tool opening	max. press force
SMH	Mini-Handheld tongs	max. 14 mm	45 kN
SHH	Handheld tongs	max. 190 mm	75 kN
SMR	Robotic-/Machine-mount tongs	max. 14 mm	45 kN
SHR	Robotic-/Machine-mount tongs steel construction	max. 390 mm	75 kN



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.



Punching frame SMB

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



Solid C-frame presses PC

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



2-Column presses MB/MBG



4-Column presses MA/MAG

All presses are also available with hydraulic and electric drives.

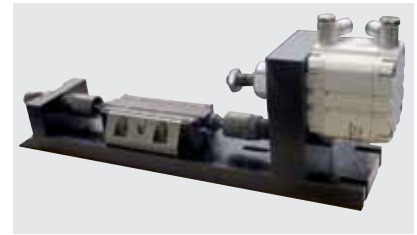
Type		Tool opening	max. press force
SMB	Punching frame	max. 390 mm	20 to 300 kN
PC	C-frame presses	max. 390 mm	40 to 1000 kN
MA/MAG	4-column presses	max. 390 mm	10 to 2000 kN
MB/MBG	2-column presses	max. 390 mm	10 to 2000 kN

Design Features

The Indexing Slide

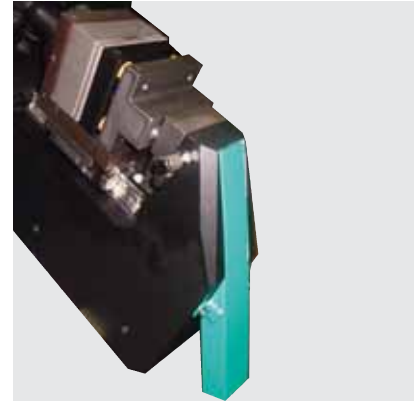
The equalizing slide provides an indexing motion to shuttle the die or the punch to the work-piece.

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

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



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:

- + 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



Technical Information

Material characteristics for cutting

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

Material designation	R_m N/mm ²	Material designation	R_m N/mm ²	Material designation	k_s N/mm ²
Steel		Non-ferrous metals		Non-metals	
St 10	280...500	Al 99,5 Al99 soft	70...100	Paper and cardboard	20...50
St 12	280...420	Al 99,5 Al99 half-hard	100...150	Hard board	70...90
St 13	280...400	Al Mg 3/5/7 soft	180...380	Klingerit u.ä.	40...60
St 14	280...380	Al Mg 3/5/7 half-hard	220...450	Synthetic resin	100...140
St 37	370...450	Al Cu soft	160...220	Synthetic resin, pure	20...30
St 42	420...500	Al Cu half-hard	380...440	Mica	50...80
St 50	500...600	Kupfer (Cu)	210...240	Wood	10...30
St 60	600...720	Zinc (Zn)	120...140	Birch plywood	20...30
Ck 10	340...400	Nickel (Ni)	400...450	Celluloid	40...60
Ck 35	500...600	Lead (Pb)	200...300	Leather	7
Ck 45	600...720	Al Bz 4	300...400	Soft rubber	7
V 2A	620...750	CuZn 10 F 30	350...430	Hard rubber	20...60

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 $k_s \approx 0.8 \cdot R_m$

F_s = shearforce

l_s = length of cut

s = material thickness

R_m = material tensile strength

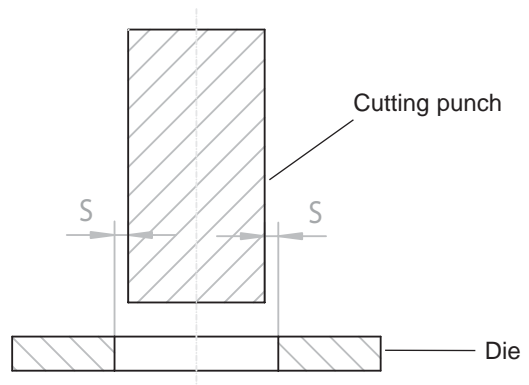
k_s = material shear strength

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:

Sheet metal thckn. mm	250 N/mm ²	250-400 N/mm ²	400-750 N/mm ²
0,8	25	32	40
1,0	30	40	50
1,25	38	50	63
1,5	45	60	75
2,0	60	80	100
2,5	75	100	125
3,0	90	120	150
3,5	105	140	175
4,0	120	160	200
4,5	135	180	225
5,0	150	200	250

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.



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:

Workpiece

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

add drawing, if available.

Punching/punching pattern

- 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

add drawing, if available.

Pre-requisites of the punching system

- Stationary or mobile punching unit
- Required piece of punched parts per hour/day

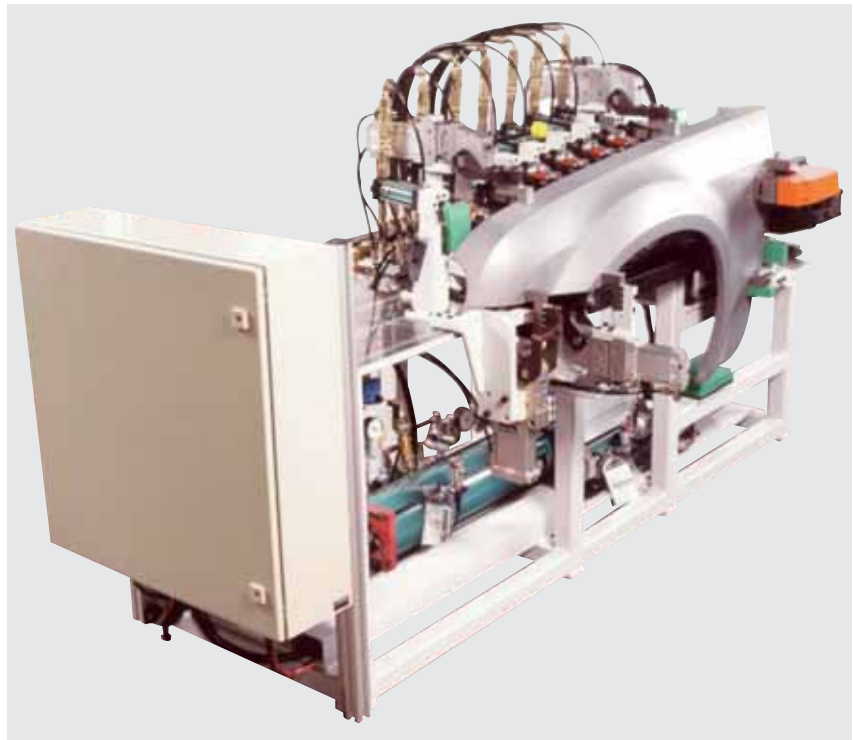
TOX®-Production Systems Application Examples of Punching Systems



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

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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