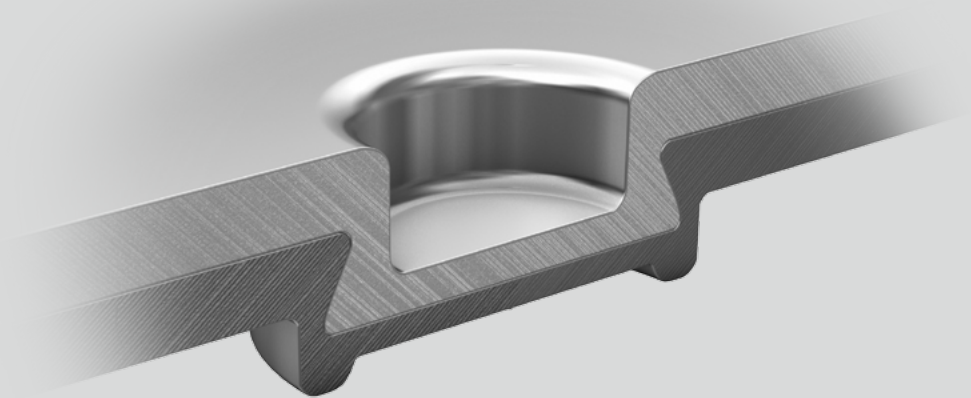
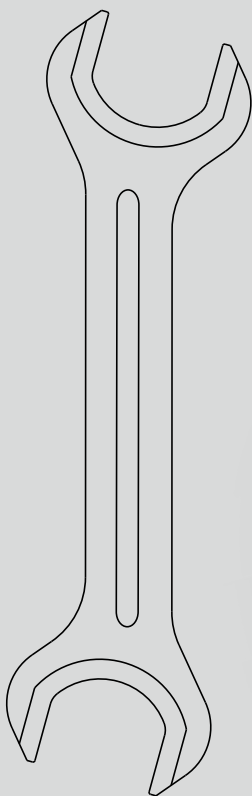


TOX®-Clinching Technology Installation and design guidelines



Data
sheet
80.18

2018/06

TOX® PRESSOTECHNIK GmbH & Co. KG
Riedstrasse 4
88250 Weingarten / Germany

Find your local contact at:
www.tox-pressotechnik.com

Installation and design guidelines

Basics

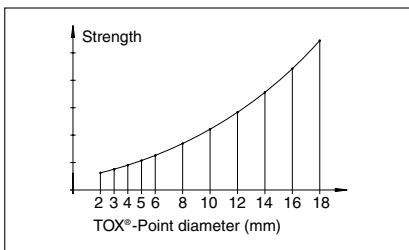
The basics for the mechanical as well as technological design of a TOX®-Clinching Joint is the TOX®-Test Report

Drive technology

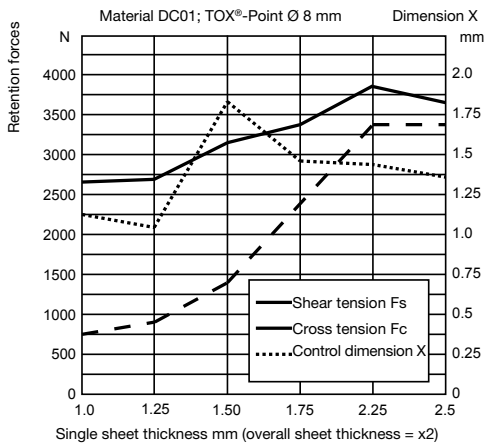
For the drive, pneumatic, hydraulic or electromechanical equipment can be used. Thanks to their special running characteristics, on the one hand the pneumo-hydraulic drive, the TOX®-Powerpackage, as well as the servo drives from the TOX®-Electric Drive series are ideally suited and offer a number of decisive advantages.

Technology

As a general rule, the larger the point diameter, the greater the joint strength.



*Joint strength (shear and pull)



Changes in material thickness:

The diagram shows the strength of the TOX®-Joint over a wide range of material thickness, using the same TOX®-Tool combination, while changing the press force and quality control dimension X.

Performed with a tool set, point diameter 8 mm, for all thicknesses.

Operational monitoring

If the press force is too low, no joint will be formed, but if it is too high, this can lead to breakage of the tool. The TOX®-Powerpackage provides an optimal monitoring facility for ensuring the right pressing force. When the set pressing force is reached, the return stroke is initiated via an impulse from an oil high-pressure switch. If the press force is not reached, e.g. due to a pressure drop in the pneumatic system, this switch-over does not take place and the TOX®-Powerpackage stops. This provides an ideal way of checking the press force for each TOX®-Point.

Process monitoring

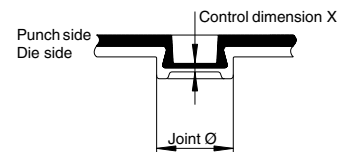
Continuous monitoring during the production process can be achieved using our process monitoring system.

Operating safety precautions

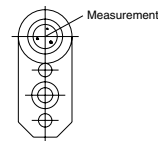
Tools must not be closed without material. Without material, the surface pressure at the tool is too high and leads to deformation or tool damage. This can be easily avoided by setting stroke limiters. They should basically be applied so that the control dimension X is obtained when the tool with sheet metal is closed.

Testing

Testing of the TOX®-Joint can be carried out non-destructively by measuring the remaining bottom thickness of the TOX®-Point, the control dimension X. The dimension X allows to establish correlation with the shear and pull load carrying capabilities of the joint.



The measurement must be performed using a measuring probe, e.g. type CMT (see data sheet TOX®-Measuring Equipment 80.09) in the center of the die.



The control dimension X is contained in the TOX®-Test Report and has a tolerance of $\pm 15\%$. For sheet thicknesses of less than 0.8 mm, this tolerance is reduced (see test report for precise details). During its service life, the bottom of the die may show wear. This does not influence the quality of the TOX®-Point as long as the die bottom is not lowered by more than 0.1 mm. After a re-adjustment, the point durability must be checked.

We recommend testing an actual production sample to determine whether the strength of the joints is adequate.

No chisel test

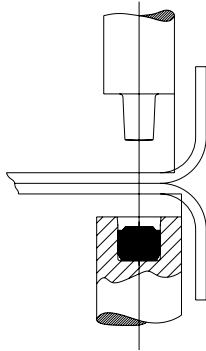
In welding technology, durability is tested, for want of a better method, by driving a chisel between the sheets at the welding spot. In contrast, the quality of the TOX®-Joint can be checked non-destructively by simply measuring the control dimension X.

Installation and design guidelines

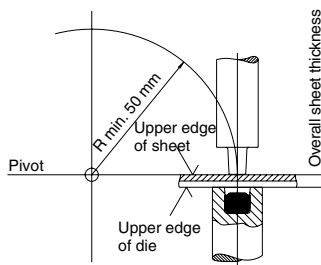
Basics

Installation information

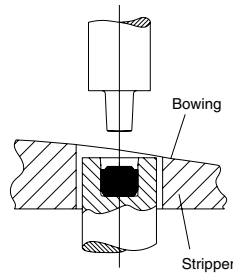
There is a risk of breakage as the tool shank hits the **bending radius**. The shoulder of the TOX®-Tools should, therefore, not make contact with the sheet.



For systems with circular tool movement, e.g. TOX®-PowerKurve, the punch should be placed vertically on the sheet. This ensures similar durability to that of a linear tool feed.



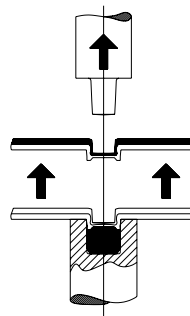
Also with component parts which are molded or do not lie flat, make sure that the "calibration", which is required as a result is not performed by the TOX®-Tool. Please contact TOX® PRESSOTECHNIK.



The strength of the holding fixtures must be able to stand up to the pressure loads of the TOX®-Tools in continuous operation. The press force is set according to the TOX®-Test Report and the pressure area according to the tool shaft diameter or contact area.

Pressure load = 350 N/mm²
(Conforms to safety S = 3)

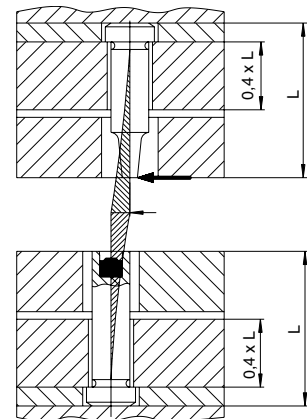
Due to the point elevation, either the component or the die needs to be moved for removal.



Tolerances

Please observe the tolerances and exact fixing when installing the TOX®-Tools. The tolerances of the TOX®-Tools are designed to ensure secure fixing.

It is essential that the alignment tolerance should be maintained between the punch and die.



These tolerances ensure the flexible bearing which is so important for the TOX®-Process.

Before mounting the TOX®-Tools to the holding plate, coat them slightly with grease.

Specification

Depending to the TOX®-Test Report it might be necessary to spray the workpiece surface and / or the TOX®-Tools with a suitable lubricant before the joining process. In these cases, the use of components of the TOX®-Spraying System (e.g. spray nozzles) must be considered constructively (see data sheet TOX®-Spraying System 80.02).

Installation and design guidelines

Stripper basics

Stripper

The stripping force to be considered is specified in the TOX®-Test Report. In the case of multiple point tools with a common stripper plate, this value should be multiplied by the number of points.

Withdrawing the punch or die forcibly without the stripper can cause deformation of the TOX®-Point and reduce its strength. There is also a risk of breaking the TOX®-Tools. Excessively high stripping forces affect the shaping process and reduce durability of the TOX®-Point.

Important

The stripper must not touch the TOX®-Tools, otherwise there is a risk of tool breakage due to side forces.

The stripping distance on the punch side must be \geq the penetration depth (PD) of the punch neck. For die side stripper travel: DD (per TOX®-Test Report) + 1.0 mm (+ part clearance if needed).

Selection of spring and stripper

1. See stripping force indicated in the TOX®-Test Report.
2. The spring is preloaded in the stripper with F_v .
3. When producing the point, the punch travel is PD = penetration depth. With this, the stripping force is increased by the spring rate R. With increasing spring travel, the lifetime of the spring is reduced, f_{max} must not be exceeded.

4. Calculation of PD = penetration depth:

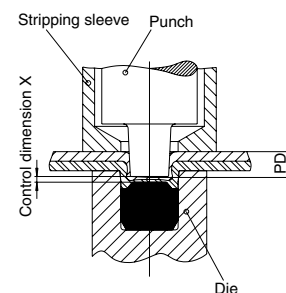
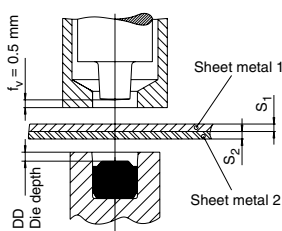
$$PD = S_1 + S_2 + DD - X$$

DD = Die depth from TOX®-Test Report

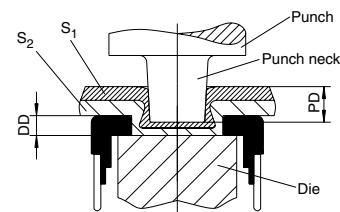
X = Control dimension from the TOX®-Test Report

S_1 = Thickness of material punch side

S_2 = Thickness of material die side



Round point die



SKB-die

5. Calculation of the stripping force F of stripper:

$$F = R \cdot (PD + f_v) + F_v$$

F_v = Preload force from data sheet 80.07

R = Rate of spring from data sheet 80.07

6. Using materials with a tendency to excessive cold welding (e.g. aluminum), the punch stripping sleeve must tightly embrace the punch neck in order to avoid a drawing-up of the material during the stripping process.

Installation and design guidelines TOX®-Round Joint Tools

Tool life quantities for TOX®-Round Joint Tools:

With qualified mechanical realization and observance of our mounting instructions and test report data, the following tool life quantities and more can be expected during the life of each tool set:

DC01: 100,000 – 400,000 joining points

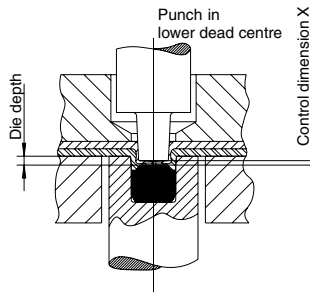
H340LAD: 100,000 – 350,000 joining points

Aluminum: 100,000 – 350,000 joining points

Stainless steel: 20,000 – 150,000 joining points

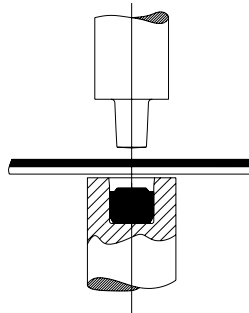
Punch and die changes are mandatory in case of:

- tool rupture
- continuous reduction of the joining point strength e.g. due to tool wear.



Oil drainage system

All the die forms with insert feature an oil drainage system. This system is necessary for very oily sheet metal and when using spray equipment.



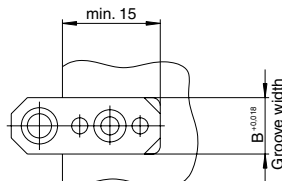
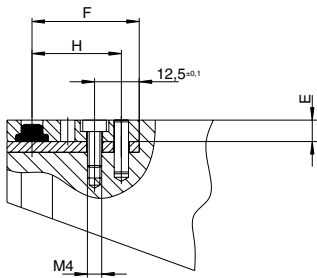
Stripper

Strippers are necessary on punch and die side and must be directly attached to the TOX®-Tool.

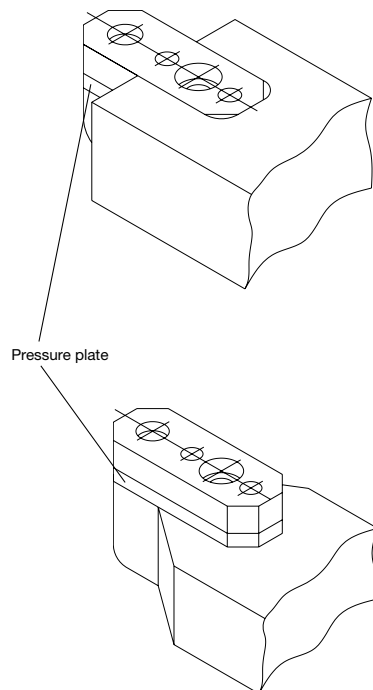
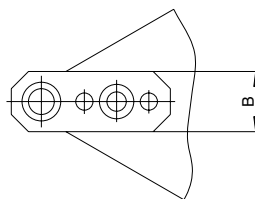
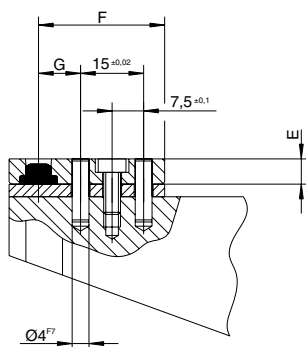
An inclination of the TOX®-Tools to the surface of the sheet metal of max. 3° is allowed with slightly lower joint strength.

The installation options shown here are applicable for both, flat dies and offset dies.

Installation with groove



Installation with dowel pin



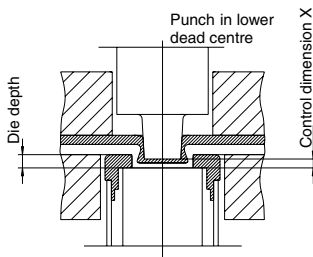
The die should always be supported by a pressure plate or hardened shim plate.

Caution: Observe installation guidelines and TOX®-Test Report

Installation and design guidelines

TOX®-SKB Die

The installation and design guidelines for TOX®-SKB Dies are not much different than those for the TOX®-Round Joint process. The following guidelines apply exclusively to the SKB die:



Caution

The rejoining of an already created point can cause the destruction of the TOX®-SKB Die and of the joint.

Stripper

Strippers are necessary on the punch side and must be placed directly on the TOX®-Tool.

The close sitting of the die to the sheet metal on the die side is compulsory. Marks of firm parts may be slightly visible but must be uniform.

An inclination of the TOX®-Tools to the sheet metal surface $\leq 1^\circ$ is allowed with a slight reduction of the retaining forces.

The flange must be wide enough to fully cover the die diameter. Partial overlap results in loss of strength and in potential cracks in the die side material.

Tool life quantities during the life of TOX®-Joining Tools with SKB die:

With qualified mechanical realization and observance of our installation instructions and test report data, the following tool life quantities and more can be expected during the life of each tool set:

DC01: 200,000 – 400,000 joining points

H340LAD: 200,000 – 350,000 joining points

Aluminum: 200,000 – 350,000 joining points

Punch and die changes are mandatory in case of:

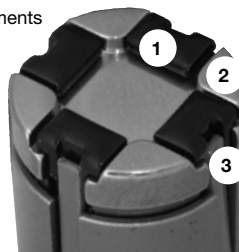
- tool rupture
- continuous reduction of the retention forces
- tool wear

TOX®-SKB Die – Ideal for complex clinching applications

The strengths of the TOX®-SKB Die

- + specially suitable for hybrid joining „Clinching + Glueing“ in connection with intermediate layers
- + due to the high flexibility regarding sheet metal thicknesses, only few standardized die types are required and the application flexibility is increased

- 1 Moving segment
- 2 Fixed segment
- 3 Spring elements

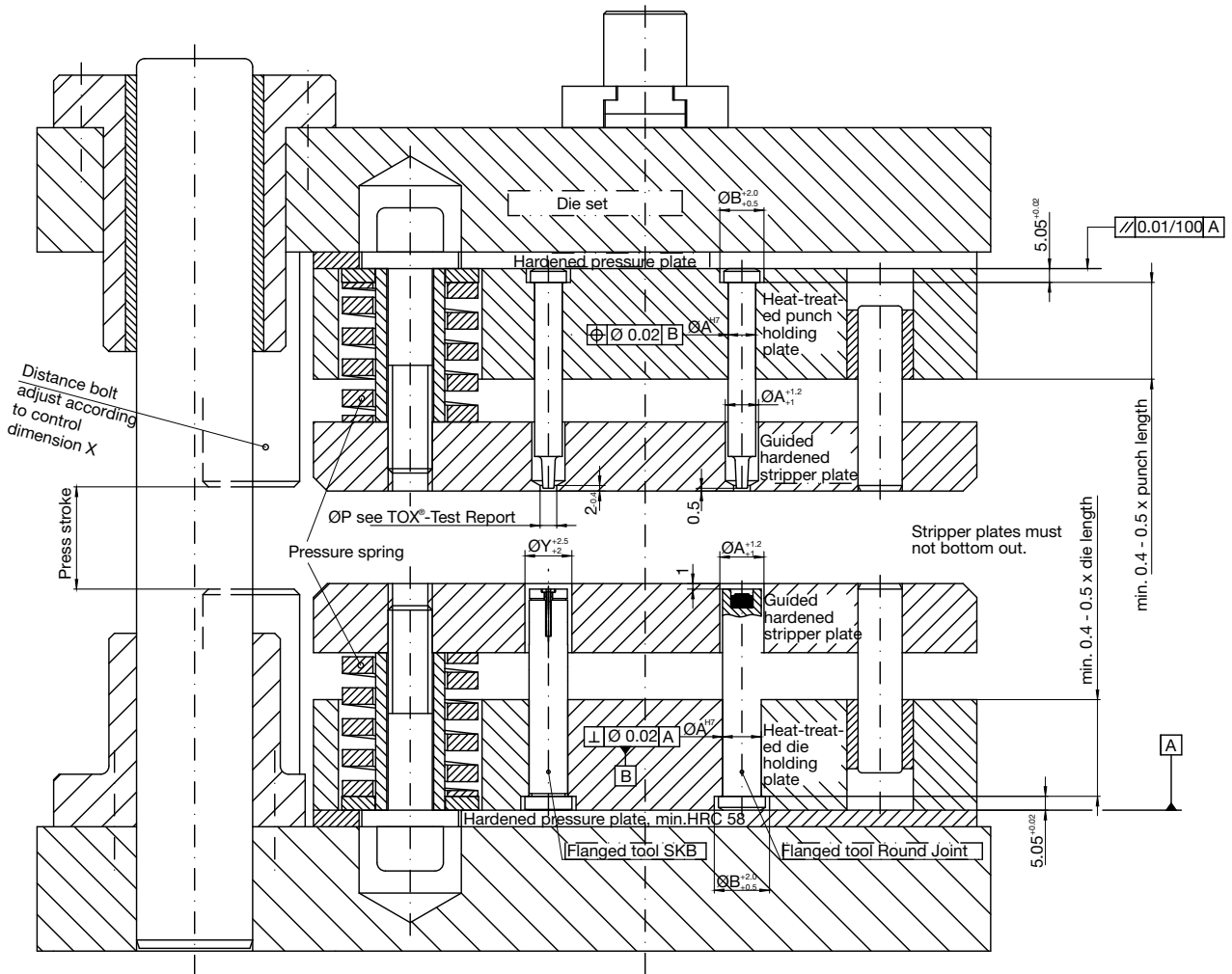


Even in the case of missing moving segments, the SKB die produces a very strong joint. The process reliability is immensely increased compared to a die with only moving segments.

Installation in column-mounted tools

Please take into consideration $\varnothing Y$ for SKB dies compared to the TOX®-Round Joint tools with solid die (see data sheet Clinching Tools and Accessories 80.07).

Caution: Observe installation guidelines and TOX®-Test Report



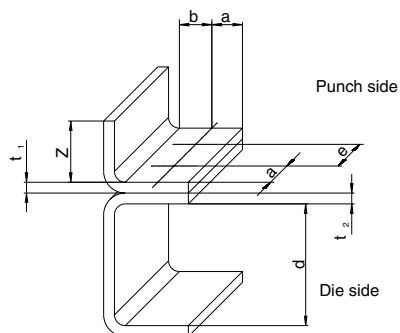
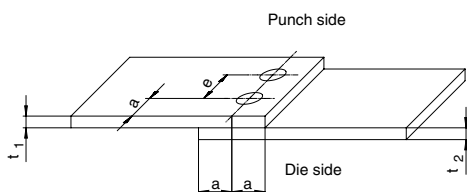
Design guidelines

Distances and flange dimensions

The values below are intended as a design requirement for designers of the TOX®-Joining process.

If it is not possible to design your particular application using this guideline, please contact us.

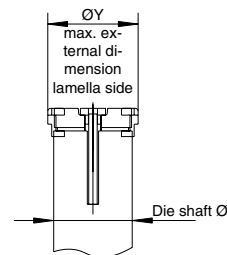
| | Round Point Die | | | | | | | | SKB Die | | |
|---|--|-------------|-------------|-------------|-------------|------------------|--------------|--------------|-------------|-------------|-------------|
| | 2 | 3 | 4 | 5 | 6 | preferred series | | | 6 | 8 | 10 |
| Point diameter [mm] | | | | | | 8 | 10 | 12 | | | |
| Die diameter outside [mm] | 4 | (7)** 10 | (8)** 10 | 10 | 12 | 14 | 16 | 20 | 12 | 14 | 16 |
| Sheet thickness Punch side [mm] t_1 | $t_1 = \text{approx. } 2.5 \text{ to } 3.0 \times t_2$ | | | | | | | | | | |
| Sheet thickness Die side [mm] t_2 | $t_2 = \text{approx. } 2 \text{ to } 2.5 \times t_1$ | | | | | | | | | | |
| Overall sheet thickness [mm] $t_1 + t_2$ | 0.3- 1.4 | 0.5- 1.5 | 0.6- 2.0 | 1.0- 2.5 | 1.0- 3.0 | 1.6- 6.0 | 1.75- 7.0 | 4.5- 11.0 | 0.4- 2.5 | 0.6- 5.0 | 1.0- 6.0 |
| Edge distance [mm] $\geq a$ | 2 | 5 | 5 | 5 | 6 | 7 | 8 | 10 | 7.5 | 8 | 8.5 |
| Distance to start of border radius [mm] $\geq b$ | 2 | 5 | 5 | 5 | 6 | 7 | 8 | 10 | 7.5 | 8 | 8.5 |
| Point to point distance [mm] $\geq e^*$ | 4 | 10 | 10 | 10 | 12 | 14 | 16 | 20 | 14 | 16 | 18 |
| Min. die height [mm] | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 14 | 14 | 14 |
| Clearance [mm] $\geq d$ | 15 | 15 | 15 | 20 | 20 | 20 | 25 | 30 | 30 | 30 | 35 |
| Flange length [mm] Z | unlimited | | | | | | | | | | |



* + tolerance range

** Possible, not standard

Please take note of the stripper dimensions when determining the distance from edges and radius borders (a , b , as well as the points to one another (e)) (see data sheet Clinching Tools and Accessories 80.07).



Please take into consideration OY for SKB dies compared to the TOX®-Round Joint tools with solid die (see data sheet Clinching Tools and Accessories 80.07).

TOX®-Joint Diameters for various materials

Efficiency of the TOX®-Clinching Technology

| Sheet material | Sheet thickness | Sheet surface | Sheet layers |
|-----------------------|---|------------------------------|-----------------|
| + metallic | + same thickness | + dry | + 2 ply |
| + same materials | + thick in thin 2.5 : 1 | + oiled | + 3 ply |
| + different materials | thin in thick 1:2 | + uncoated | + intermediate: |
| + sheets/profiles | + min. single thickness approx. 0.2mm | + coated on one or all sides | textil |
| | + max. overall thickness approx. 12.0mm | + painted | plastic |
| | | + plastic-coated | plastic foils |
| | | | paper |
| | | | adhesive |

Recommendation
Material **hard** (punch side)
Material **soft** (die side)

Recommendation
Sheet **thick** (punch side)
Sheet **thin** (die side)

In order to maintain the electrical conductivity in the connection of similar and dissimilar materials, the use of TOX®-Round Joint tools is recommended.

The journey to reliable and quick clinching joint

On the following pages, material combinations, material thicknesses and the corresponding TOX®-Joint diameters can be found. Additionally, you get **information on the feasible holding forces** and the required point diameter.

You will receive detailed data and our guarantee for your joint with a TOX®-Test Report from our test lab. For this purpose, please complete the form on the last page and send it together with your test material to TOX® PRESSOTECHNIK.

Material designation

| Designation EN 10027 | Designation DIN 17600 | Designation EN 10027 | Designation DIN 17600 | Designation EN 10027 | Designation DIN 17600 |
|----------------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|
| DC01 | St 12 | DX52 (Z) | St 03 Z 275 SB | H340LAD | ZStE 340 |
| DC01 | St 1203 | DX53 | St 05 | H420LAD | ZStE 420 |
| DC01 | St 2k 60 | DX53D (Z) | ST 05 Z140 NA | S235 | ST 37 |
| DC03 | RRSt 13 | DX54D | St 06Z | S315 | QStE 300 |
| DC04 | FePo4 | ENAW-5182 | AlMg5Mn | S355 | QSt 52-3 |
| DC04 | St 14 | ENAW-5182 | AlMg5Mn W27 bonazinc | S355 | St 52 |
| DC04 | St 1403 | ENAW-5754 H111 | AlMg3 W19 | S380 | QStE 380 |
| DC04 (Z) | St14 ZE75 | ENAW-5754 H12 | AlMg3F22 | S420 | QStE 420 |
| DX51D | St 02 | ENAW-5754 H12 | AlMg3F22 | S500 | QStE 500 |
| DX52 | St 3 | H220BD | ZStE 220 | | |

Special steel

| TOX®-Round Joint Ø (mm) | Total sheet thickness (mm) | | material/coating | | shear strength (N) | tensile strength (N) | pressing force (kN) |
|-------------------------|----------------------------|----------|---------------------------------|---------------------------------|--------------------|----------------------|---------------------|
| | side | die side | punch side | die side | | | |
| 10 | 2.50 | 1.25 | 1.4401 | 1.4401 | 8500 | 4400 | 105 |
| 8 | 0.60 | 2.00 | 1.4016 | 1.4016 | 1600 | 1300 | 67 |
| 6 | 0.50 | 0.50 | 1.4510 | 1.4510 | 1700 | 650 | 37 |
| 6 | 0.60 | 1.00 | 1.4016 | 1.4016 | 1800 | 1300 | 35 |
| 6 | 0.70 | 0.70 | 1.4016 | 1.4016 | 2000 | 1100 | 40 |
| 6 | 0.75 | 1.00 | V2A | V2A | 2000 | 1500 | 45 |
| 6 | 0.80 | 0.75 | 1.4301 | 1.4316 | 1700 | 950 | 40 |
| 6 | 0.90 | 0.90 | 1.403 plastic foil | 1.403 plastic foil | 2100 | 1050 | 42 |
| 6 | 1.00 | 1.00 | 1.4512 | 1.4512 | 2400 | 2200 | 40 |
| 6 | 1.00 | 1.00 | 1.4571 | 1.4571 | 2800 | 1650 | 37 |
| 6 | 1.00 | 1.00 | 1.4016 | 1.4016 | 2600 | 2100 | 47 |
| 6 | 1.25 | 0.60 | 1.4016 | 1.4016 | 3400 | 1400 | 32 |
| 5 | 0.60 | 0.60 | 1.4016 | 1.4016 | 1700 | 1000 | 30 |
| 5 | 0.70 | 0.70 | special steel one side enameled | special steel one side enameled | 1500 | 770 | 32 |
| 5 | 0.80 | 0.80 | 1.4301 | 1.4301 | 2000 | 930 | 30 |
| 4 | 0.80 | 0.80 | 1.4301 | 1.4301 | 1100 | 500 | 21 |

Others

| TOX®-Round Joint Ø (mm) | Total sheet thickness (mm) | | material/coating | | shear strength (N) | tensile strength (N) | pressing force (kN) |
|-------------------------|----------------------------|----------|------------------|------------------|--------------------|----------------------|---------------------|
| | side | die side | punch side | die side | | | |
| 12 | 6.00 | 5.00 | Cu | Cu | 6200 | 4200 | 101 |
| 6 | 0.30 | 0.60 | tin plate | tin plate | 560 | 320 | 30 |
| 6 T | 0.80 | 0.80 | Cu | Cu | 1550 | 800 | 42 |
| 6 T | 0.80 | 1.00 | Cu ETP | Cu | 1950 | 1200 | 43 |
| 6 | 1.00 | 1.00 | Cu | Cu | 1300 | 900 | 26 |
| 6 | 1.00 | 1.50 | CW409J | CW409J | 1600 | 1250 | 40 |
| 5 | 0.50 | 0.50 | tin plate | tin plate | 770 | 400 | 20 |
| 5 T | 1.00 | 1.00 | Cu ETP R290-3 | Cu ETP R290-3 | 1600 | 1000 | 17 |
| 5 T | 1.50 | 0.60 | Cu ETP R290 | Cu ETP R290 | 1750 | 500 | 23 |
| 4 | 0.70 | 0.80 | brass, chromated | brass, chromated | 930 | 500 | 14 |
| 4 | 0.75 | 0.50 | CW505L | CW505L | 730 | 350 | 13 |
| 4 T | 0.80 | 0.60 | Cu ETP | Cu ETP | 1200 | 650 | 17 |
| 4 T | 1.00 | 0.40 | Cu ETP R240 | Cu ETP R290-3 | 950 | 220 | 13 |
| 4 | 1.00 | 0.60 | Ms63 nickeled | CW508L | 1000 | 480 | 16 |
| 4 T | 1.00 | 0.80 | Cu ETP R240 | Cu ETP R290-3 | 1300 | 600 | 15 |
| 3 | 0.40 | 0.75 | CW409J Zn20 | CW409J Zn20 | 240 | 110 | 10 |
| 3 | 0.80 | 0.30 | new silver | new silver | 450 | 210 | 9 |
| 3 T | 0.80 | 0.80 | E-Cu | E-Cu | 400 | 350 | 12 |
| 3 T | 0.80 | 1.20 | E-Cu | E-Cu | 300 | 180 | 9 |
| 2 | 0.25 | 0.25 | CuSn0.15 | CuSn0.15 | 125 | 55 | 3.5 |
| 2 | 0.60 | 0.60 | CuZn37 | CuZn37 | 260 | 60 | 3.6 |
| 2 | 0.80 | 0.30 | C2600R-1/2 | CAC19 | 390 | 170 | 4 |

T = TWINpoint. Diameter per single joint.

Examples of TOX®-Joint diameters and holding forces

Steel uncoated

| TOX®-Round Joint Ø (mm) | Total sheet thickness (mm) | | material/coating | | shear strength (N) | tensile strength (N) | pressing force (kN) |
|-------------------------|----------------------------|----------|------------------|----------|--------------------|----------------------|---------------------|
| | punch side | die side | punch side | die side | | | |
| 12 | 3.00 | 2.00 | DC01 | DC01 | 7800 | 6100 | 98 |
| 10 | 0.75 | 1.00 | DC01 | DC01 | 3000 | 1600 | 82 |
| 10 | 1.00 | 0.75 | DC01 | DC01 | 3400 | 1100 | 82 |
| 10 | 1.00 | 1.00 | DC01 | DC01 | 3500 | 1700 | 72 |
| 10 | 1.00 | 1.50 | DC01 | DC01 | 3100 | 2500 | 86 |
| 10 | 1.50 | 1.00 | DC01 | DC01 | 5400 | 2200 | 89 |
| 10 | 2.00 | 0.90 | DC01 | DC01 | 4700 | 2100 | 57 |
| 10 | 2.00 | 2.00 | S420MC | S420MC | 4800 | 4000 | 70 |
| 10 | 2.00 | 2.75 | S315 | S315 | 3900 | 3300 | 68 |
| 10 | 2.50 | 2.50 | DC01 | DC01 | 5000 | 5300 | 76 |
| 10 | 3.00 | 3.00 | DC01 | DC01 | 6500 | 5800 | 95 |
| 8 | 0.75 | 1.00 | DC01 | DC01 | 2000 | 1200 | 51 |
| 8 | 0.75 | 1.25 | H220BD | H220BD | 1850 | 1600 | 45 |
| 8 | 1.00 | 1.00 | H420LAD | H420LAD | 4000 | 2200 | 52 |
| 8 | 1.00 | 1.00 | DC01 | DC01 | 2700 | 1400 | 49 |
| 8 | 1.00 | 1.50 | DC01 | DC01 | 2400 | 2700 | 54 |
| 8 | 1.00 | 2.00 | DC01 | DC01 | 2500 | 2400 | 55 |
| 8 T | 1.20 | 1.20 | H 400 TD | H 400 TD | 4100 | 1950 | 70 |
| 8 | 1.50 | 1.00 | DC01 | DC01 | 3800 | 1900 | 60 |
| 8 | 1.50 | 1.50 | H340LAD | H340LAD | 3600 | 2000 | 50 |
| 8 T | 2.00 | 1.50 | S355MC | DD 13 | 8150 | 4750 | 75 |
| 8 | 2.00 | 2.00 | S420MC | S420MC | 3600 | 2600 | 55 |
| 8 T | 2.00 | 2.00 | S420MC | S420MC | 8900 | 7050 | 79 |
| 8 | 3.00 | 1.50 | S420MC | S420MC | 6200 | 4400 | 50 |
| 6 | 0.60 | 0.60 | H180BD | H180BD | 1300 | 650 | 27 |
| 6 S | 0.60 | 0.60 | St 07 | St 07 | 1100 | 580 | 21 |
| 6 | 0.75 | 1.00 | DC01 | DC01 | 1400 | 1200 | 36 |
| 6 | 1.00 | 0.75 | DC01 | DC01 | 2000 | 1000 | 36 |
| 6 | 1.00 | 1.00 | DC01 | DC01 | 1800 | 1400 | 33 |
| 6 | 1.00 | 1.50 | DC01 | DC01 | 1500 | 2100 | 40 |
| 6 | 1.50 | 1.00 | DC01 | DC01 | 2100 | 1800 | 28 |
| 6 T | 1.50 | 1.50 | St | St | 1900 | 650 | 32 |
| 5 | 1.50 | 0.63 | DC01 | DC01 | 1700 | 800 | 17 |
| 5 T | 1.50 | 1.00 | DC01 | DC01 | 3100 | 1500 | 39 |
| 4 | 1.00 | 1.00 | DC01 | DC01 | 1300 | 850 | 15 |
| 3 | 0.25 | 0.25 | steel | steel | 260 | 130 | 11 |
| 2 | 0.35 | 0.20 | St | St | 220 | 60 | 3 |

Steel coated/enamelled

| TOX®-Round Joint Ø (mm) | Total sheet thickness (mm) | | material/coating | | shear strength (N) | tensile strength (N) | pressing force (kN) |
|-------------------------|----------------------------|----------|-----------------------------------|-----------------------------------|--------------------|----------------------|---------------------|
| | punch side | die side | punch side | die side | | | |
| 12 | 3.00 | 2.50 | DX53D (Z) | DX53D (Z) | 6300 | 4300 | 62 |
| 12 | 3.00 | 3.00 | S235JR | S235JR | 7000 | 6000 | 120 |
| 12 | 3.30 | 3.30 | S355JOC powder coated | S355JOC powder coated | 7200 | 6200 | 100 |
| 12 | 4.00 | 4.00 | S235JR | S235JR | 7500 | 7500 | 120 |
| 10 | 1.45 | 1.70 | DC01 (Z) SB | DC01 (Z) SB | 3750 | 3400 | 62 |
| 10 | 1.50 | 2.00 | DC01 galvanized | DC01 galvanized | 3500 | 2600 | 65 |
| 10 | 2.00 | 2.00 | DC01 enamelled | DC01 enamelled | 3900 | 3800 | 65 |
| 10 S | 2.50 | 1.00 | DX51D | DX51D | 4100 | 1200 | 43 |
| 10 | 3.00 | 3.00 | DC01 galvanized | DC01 galvanized | 6100 | 5300 | 7 |
| 10 | 4.00 | 2.50 | steel enamelled | steel enamelled | 6250 | 6200 | 78 |
| 8 | 0.40 | 2.00 | DX51D | DX51D | 510 | 290 | 44 |
| 8 S | 0.60 | 0.80 | DX56D | DX56D | 1450 | 850 | 35 |
| 8 S | 0.60 | 1.20 | DX56D | DX56D | 1100 | 950 | 38 |
| 8 | 0.70 | 1.20 | DX54D hot galvanized | DX54D hot galvanized | 1800 | 1000 | 50 |
| 8 | 0.75 | 1.25 | DC04 galvanized | DC04 galvanized | 2000 | 1400 | 38 |
| 8 | 0.90 | 0.90 | DX53D enamelled | DX53D enamelled | 2050 | 1500 | 62 |
| 8 | 0.90 | 0.90 | DC01enamelled on one side | DC01 enamelled on one side | 1900 | 1100 | 45 |
| 8 | 1.00 | 1.00 | DX51D | DX51D | 3500 | 2400 | 45 |
| 8 | 1.00 | 1.00 | S235JR | S235JR | 2500 | 1500 | 40 |
| 8 | 1.00 | 1.25 | DX52D Z275 SB, enamelled | DX52D Z275 SB, enamelled | 2100 | 1550 | 45 |
| 8 | 1.00 | 1.50 | DX52D Z275 SB, enamelled | DX52D Z275 SB, enamelled | 1950 | 1700 | 38 |
| 8 T | 1.20 | 0.60 | DX54D | DX54D | 2600 | 750 | 36 |
| 8 T | 1.20 | 1.50 | DX53D | DX53D | 2870 | 1800 | 42 |
| 8 | 1.25 | 1.25 | steel powder coated | steel powder coated | 2100 | 1300 | 37 |
| 8 | 1.50 | 0.80 | DX51D | DC01 | 3300 | 2000 | 42 |
| 8 | 1.70 | 1.20 | DC01 KTL-enamelled | DC01 KTL-enamelled | 2800 | 1600 | 43 |
| 8 | 1.75 | 1.75 | S380MC pickled | S380MC pickled | 3350 | 2800 | 51 |
| 8 | 2.20 | 2.20 | steel enamelled | steel enamelled | 2900 | 2400 | 50 |
| 8 | 2.50 | 2.50 | steel enamelled | steel enamelled | 3350 | 2800 | 50 |
| 6 S | 0.40 | 0.50 | DX53D | DX51D | 450 | 250 | 20 |
| 6 S | 0.50 | 0.50 | DX53D | DX51D | 550 | 250 | 12 |
| 6 | 0.50 | 0.80 | DC01 enamelled | DC01 bright | 800 | 500 | 36 |
| 6 | 0.50 | 0.90 | S235JR (Z) | S235JR (Z) | 950 | 530 | 30 |
| 6 | 0.70 | 0.70 | steel F30 100 µ zinc | steel F30 100 µ zinc | 1500 | 1100 | 32 |
| 6 | 0.75 | 0.75 | DC01 enamelled | DC01 enamelled | 1040 | 730 | 30 |
| 6 | 0.75 | 0.75 | DX51D galvanized | DX51D galvanized | 1500 | 1300 | 30 |
| 6 | 0.80 | 0.80 | AP04ZM | AP04ZM | 1600 | 1150 | 33 |
| 6 | 0.80 | 0.80 | DC01 galvanized + enamelled | DC01 galvanized + enamelled | 1200 | 1000 | 30 |
| 6 | 0.80 | 1.00 | DC03 white/gold | DX51D (Z) | 1200 | 1150 | 33 |
| 6 | 0.90 | 0.90 | DC01 enamelled on one side | DC01 enamelled on one side | 1300 | 1000 | 32 |
| 6 S | 1.00 | 0.60 | DX56D | DX56D | 1400 | 700 | 20 |
| 6 | 1.00 | 0.80 | DC03 enamelled | DC03 enamelled on one side | 1600 | 1100 | 33 |
| 6 | 1.00 | 1.00 | DC04 hot aluminized | DC04 hot aluminized | 2400 | 1800 | 35 |
| 6 | 1.20 | 1.20 | steel PVC-enamelled | steel PVC-enamelled | 1300 | 1100 | 33 |
| 6 S | 1.50 | 0.60 | DX56D | DX56D | 2200 | 700 | 20 |
| 5 | 0.44 | 0.44 | steel aluminized | steel aluminized | 930 | 390 | 15 |
| 5 | 0.50 | 0.50 | steel aluminized | steel aluminized | 1000 | 550 | 20 |
| 5 | 0.55 | 0.55 | DC01 enamelled | DC01 enamelled | 1000 | 730 | 22 |
| 5 | 0.60 | 0.40 | S235JR hot aluminized | S235JR hot aluminized | 1100 | 400 | 20 |
| 5 | 0.60 | 1.00 | DC04 aluminized | DC04 hot galvanized | 750 | 600 | 30 |
| 5 | 0.75 | 1.00 | DX51D zinc-coated | DX51D zinc-coated | 1000 | 700 | 22 |
| 5 T | 1.25 | 0.87 | DX51D | DX51D | 2600 | 1350 | 34 |
| 5 | 1.50 | 0.90 | DX53D galvanized | DX51D enamelled | 2400 | 1250 | 25 |
| 4 | 0.30 | 0.30 | DC04 galvanized | DC04 galvanized | 380 | 120 | 13 |
| 4 | 0.50 | 0.80 | steel enamelled | steel enamelled | 940 | 700 | 28 |
| 4 | 0.60 | 0.60 | DC04 aluminized | DC04 aluminized | 710 | 470 | 17 |
| 4 T | 0.75 | 1.00 | DX54D | DX51D | 800 | 320 | 27 |
| 4 | 0.80 | 0.80 | steel enamelled with plastic foil | steel enamelled with plastic foil | 1000 | 800 | 20 |
| 3 | 0.60 | 0.60 | steel galvanized | steel galvanized | 400 | 270 | 8 |
| 3 | 0.70 | 0.70 | steel enamelled | steel enamelled | 610 | 360 | 15 |
| 3 | 0.85 | 0.85 | DC01 electro-galvanized | DC01 hot galvanized | 1130 | 790 | 20 |
| 2 | 0.20 | 0.20 | DC03+LC-MA | DC03+LC-MA | 150 | 55 | 5 |

T = TWINpoint. Diameter per single joint.
S = SKB joint

Aluminum

| TOX®-Round Joint Ø (mm) | Total sheet thickness (mm) | | material/coating | | shear strength (N) | tensile strength (N) | pressing force (kN) |
|-------------------------|----------------------------|----------|--------------------|--------------------|--------------------|----------------------|---------------------|
| | punch side | die side | punch side | die side | | | |
| 12 | 3.00 | 3.00 | ENAW-5754 | ENAW-5754 | 3000 | 2850 | 61 |
| 12 | 5.20 | 2.80 | ENAW-5019 | ENAW-5019 | 3700 | 3500 | 66 |
| 12 | 5.80 | 5.70 | aluminum profile | aluminum profile | 2700 | 1100 | 64 |
| 12 | 6.00 | 3.90 | aluminum profile | aluminum profile | 3100 | 2300 | 64 |
| 10 | 1.00 | 1.00 | ENAW-5754 | ENAW-5754 | 1600 | 1100 | 58 |
| 10 | 1.00 | 1.20 | ENAW-5754 | ENAW-5754 | 2100 | 1500 | 45 |
| 10 | 1.00 | 1.50 | ENAW-5754 | ENAW-5754 | 1700 | 1800 | 45 |
| 10 | 1.20 | 1.50 | ENAW-5754 | ENAW-5083 | 1600 | 1150 | 36 |
| 10 S | 1.50 | 2.50 | ENAW-5182 | ENAW-5182 | 2900 | 2000 | 45 |
| 10 | 2.00 | 1.00 | ENAW-5754 | ENAW-5754 | 3200 | 800 | 52 |
| 10 | 2.00 | 2.50 | ENAW-5556A | ENAW-6082 | 1800 | 1550 | 44 |
| 10 S | 2.50 | 1.50 | ENAW-5182 | ENAW-5182 | 3500 | 1050 | 41 |
| 10 | 2.50 | 2.50 | ENAW-5556A | ENAW-6082 | 2100 | 1950 | 44 |
| 8 | 0.80 | 0.80 | ENAW-5556A | ENAW-5556A | 1100 | 800 | 28 |
| 8 | 1.00 | 1.00 | ENAW-5754 | ENAW-5754 | 1000 | 900 | 30 |
| 8 | 1.00 | 1.50 | ENAW-5754 | ENAW-5754 | 1100 | 1200 | 32 |
| 8 | 1.00 | 2.00 | ENAW-5754 | ENAW-5754 | 1000 | 1200 | 37 |
| 8 | 1.00 | 2.00 | ENAW-5005 | ENAW-5005 | 560 | 580 | 18 |
| 8 | 1.20 | 1.20 | ENAW-6082 | ENAW-5556A | 1700 | 1400 | 27 |
| 8 | 1.50 | 1.00 | ENAW-5754 | ENAW-5754 | 2000 | 1200 | 40 |
| 8 | 2.00 | 1.00 | ENAW-5754 | ENAW-5754 | 2500 | 1300 | 40 |
| 8 S | 2.00 | 1.00 | AlMg4.5Mn0.4 | AlMg4.5Mn0.4 | 3000 | 1000 | 44 |
| 8 T | 3.00 | 2.00 | AlSi1MgMn | AlMg0.7Si | 2700 | 1200 | 46 |
| 6 S | 0.50 | 0.50 | Al99.5 | Al99.5 | 250 | 100 | 12 |
| 6 | 1.00 | 1.00 | ENAW-5754 | ENAW-5754 | 1000 | 900 | 30 |
| 6 | 1.00 | 1.50 | ENAW-5754 | ENAW-5754 | 800 | 1000 | 23 |
| 6 | 1.50 | 1.00 | ENAW-5754 | ENAW-5754 | 1100 | 1100 | 20 |
| 6 | 2.00 | 1.00 | ENAW-5754 | ENAW-5754 | 1600 | 1200 | 37 |
| 5 | 1.00 | 0.80 | ENAW-5182 bonazinc | ENAW-5182 bonazinc | 950 | 600 | 20 |
| 3 | 0.50 | 0.50 | ENAW-5556A | ENAW-5556A | 210 | 180 | 7 |
| 2 | 0.40 | 0.40 | Al 98.8 | Al 98.8 | 55 | 50 | 2.2 |

Combined joining

| TOX®-Round Joint Ø (mm) | Total sheet thickness (mm) | | material/coating | | shear strength (N) | tensile strength (N) | pressing force (kN) |
|-------------------------|----------------------------|----------|---------------------------|-------------------------|--------------------|----------------------|---------------------|
| | punch side | die side | punch side | die side | | | |
| 12 | 4.00 | 1.25 | S420MC | DC04 | 10000 | 5400 | 125 |
| 12 | 5.00 | 1.25 | S355J2G4 | DC04 | 10000 | 6000 | 115 |
| 10 | 1.50 | 1.30 | steel zinc-coated | ENAW-6082 anodized | 2200 | 1400 | 50 |
| 10 | 1.80 | 1.60 | aluminum profile enameled | steel enameled | 2200 | 1900 | 54 |
| 10 | 3.00 | 2.50 | S500MC | DX52D | 7500 | 4450 | 78 |
| 10 | 3.10 | 1.20 | aluminum profile anodized | steel enameled | 3300 | 3200 | 52 |
| 8 | 0.80 | 1.00 | DC04 | ENAW-5182 bonazinc | 1900 | 1400 | 50 |
| 8 | 0.80 | 1.20 | DC04 (ZE75) | ENAW-5182 bonazinc | 2000 | 1500 | 40 |
| 8 | 1.00 | 0.80 | H340LAD | DC04 | 3100 | 1000 | 50 |
| 8 | 1.20 | 0.80 | ENAW-5182 | DC04 (ZE75) | 1750 | 1000 | 40 |
| 8 | 1.25 | 1.00 | H340LAD | DC04 | 3600 | 2300 | 46 |
| 8 | 1.30 | 1.00 | ENAW-6082 | DC04 enameled | 1300 | 1200 | 40 |
| 8 S | 1.50 | 1.50 | AlMg3.5Mn | DP-K34/60 | 1150 | 450 | 64 |
| 8 | 2.50 | 1.20 | ENAW-5754 | 1.4016 | 2550 | 1400 | 47 |
| 6 | 0.50 | 1.00 | 1.4301 with plastic foil | DC01 zinc-coated | 1050 | 600 | 30 |
| 6 | 0.60 | 1.20 | DC01 | H340LAD | 950 | 720 | 35 |
| 6 | 0.80 | 1.25 | 1.4301 | ENAW-6082 | 1400 | 500 | 40 |
| 6 | 1.00 | 1.00 | aluminum | DC01 zinc-coated | 720 | 450 | 28 |
| 6 | 1.00 | 1.00 | aluminum anodized | DC01 electro galvanized | 1100 | 700 | 31 |
| 6 | 1.00 | 2.00 | ENAW-5556A | zinc die-casting | 560 | 300 | 22 |
| 6 | 1.40 | 1.20 | ENAW-6082 | DC04 enameled | 1080 | 800 | 30 |
| 5 | 1.00 | 0.40 | DC01 zinc-coated | 1.4301 | 1550 | 400 | 26 |
| 5 | 1.00 | 1.50 | DC01 (ZE75) | zinc die-casting | 1030 | 200 | 23 |
| 3 | 0.80 | 0.60 | DC01 zinc-coated | CW452K | 520 | 310 | 11 |

Aluminum surface treated

| TOX®-Round Joint Ø (mm) | Total sheet thickness (mm) | | material/coating | | shear strength (N) | tensile strength (N) | pressing force (kN) |
|-------------------------|----------------------------|----------|--------------------|-------------------------|--------------------|----------------------|---------------------|
| | punch side | die side | punch side | die side | | | |
| 8 | 1.20 | 1.20 | aluminum anodized | Al 99.5 | 1600 | 1100 | 82 |
| 8 | 1.40 | 1.20 | ENAW-5754 anodized | ENAW-5556A KTL-enameled | 1750 | 1650 | 36 |
| 8 | 1.70 | 1.30 | ENAW-6082 anodized | ENAW-6082 anodized | 2100 | 1900 | 37 |
| 8 | 4.00 | 2.00 | aluminum profile | aluminum sheet enameled | 3400 | 2400 | 51 |
| 6 | 0.50 | 0.50 | aluminum enameled | aluminum enameled | 530 | 400 | 12 |

T = TWINpoint. Diameter per single joint.
S = SKB joint

... and many more combinations. Please order your test report!

Order form for TOX®-Test Report

TOX® PRESSOTECHNIK offers the only way for a reliable application of clinching with functional guarantee!

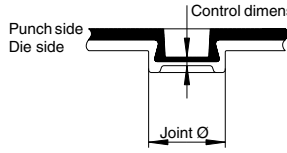
Please fill in the framed areas as completely as possible.

| | |
|--|---|
| <p>Your name and address:</p> <p>Tel.-No.</p> <p>Fax-No.</p> <p>E-Mail</p> <p>Your TOX® PRESSOTECHNIK contact person:</p> | <p>Choose from following TOX®-Test alternatives:</p> <p>1. Qualification test, TOX®-Test Report with joint strength data of test sample strips, joining of up to 2 components. With the supply of 20 sheet metal strips minimum 25x50 mm or adequate flat metal sheets, for material on punch and die side each. Free of charge <input type="checkbox"/></p> <p>Additional to 1:</p> <p>2. With components supplied, requiring preparatory work for test samples, at cost. <input type="checkbox"/></p> <p>Additional to 1 or 2:</p> <p>3. Joining of component samples. Quantity pcs. <input type="checkbox"/></p> |
|--|---|

Information on your application:

| | |
|---|---|
| Project / component designation: | Production rate per year: |
| Required/calculated joint strength: Shear Strength (N), | Pull Strength(N), Data not available <input type="checkbox"/> |
| Anticipated start of production: | |

For the TOX®-Tests the following information is also required together with the, the above mentioned test material:

| | | |
|---|---|---|
| Requested TOX®-Joint Ø (mm), please circle: 1.5, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 26, best possible | | Round joint or variant (see catalog TOX®-Joining Systems): |
| Material (punch side): |  | Material (die side): |
| Thickness (mm): | | Thickness (mm): |
| Coating (type, thickness): | | Coating (type, thickness): |
| Surface: dry <input type="checkbox"/> oily <input type="checkbox"/> | | Surface: dry <input type="checkbox"/> oily <input type="checkbox"/> |
| Intermediate layer <input type="checkbox"/> no <input type="checkbox"/> yes, material: | Thickness: | Coating: |

Supplementary information/sketch/drawing