PASS | TOOLING

TRUMPF

THICK TURRET

SALVAGNINI

09/2022

FREQUENTLY ASKED QUESTIONS (FAQ)

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Technical information is important for establishing the correct tool for your machine.

For example, the clearance must be calculated specifically for your punching force and material thickness. In our documentation you'll find suggestions to increase the life of the tool. You will also find detailed explanations about many topics, including back taper on punches, die clearances, shears, and punching press-fit holes.

We hope this overview will be helpful to you!

Technical support is only one step away. Please reach out to PASS Tooling for any support that you need.

INDEX

DETERMINING DIE CLEARANCE

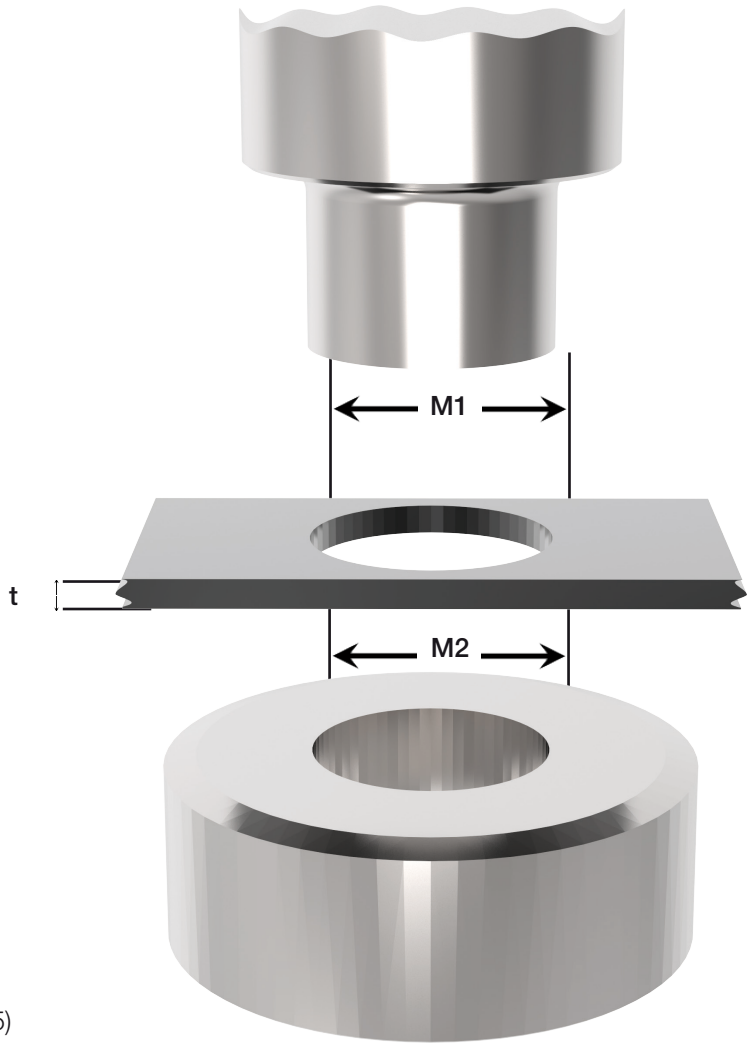
Formula for calculating the right die measure:

M2 = M1 + f x tsheet thickness

M1 = punch measure

M2 = die measure

f = multiplier



f = multiplier for sheet quality

Spring steel:	f = 0,30 mm
Stainless steel (e.g. 1.4301):	≤ 2 mm (f = 0,2)
	> 2 mm (f = 0,25)
Steel (e.g. DC01):	f = 0,20 mm
Aluminium:	f = 0,15 mm

PASS CALCULATION OF PUNCHING FORCE

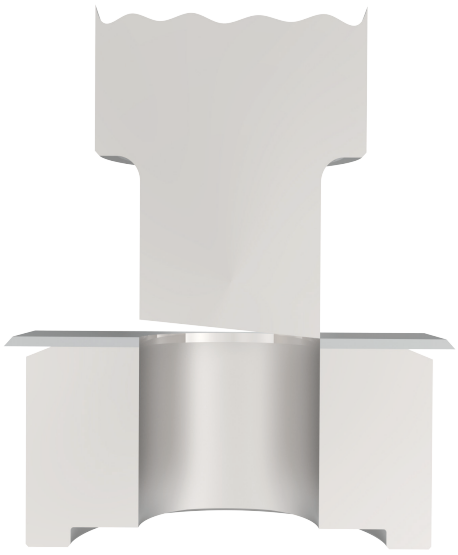
Formula for calculating the punching force:

$$F\ (\text{in kN}) = \frac{U \times t \times Rm \times 0{,}9 \times f}{1000}$$

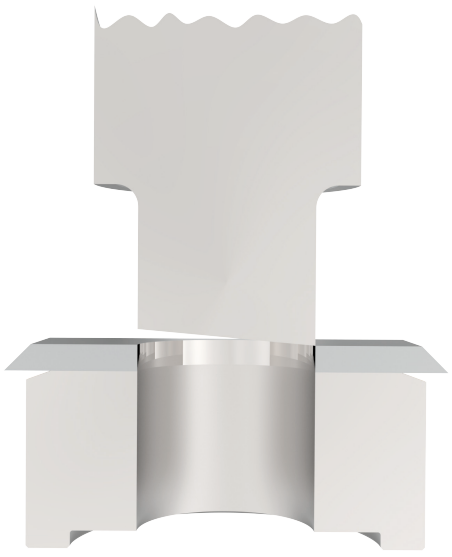
F	=	punching force in kN
U	=	circumference or perimeter of the punch shape (in mm)
t	=	sheet thickness (in mm)
Rm	=	tensile strength (in N/mm²) for stainless steel (1.4301) 720 N/mm² for steel (DC01) 420 N/mm² for aluminium (AlMg3) 220 N/mm²
f	=	factor between 0,5 - 0,95 when using punches with shear

Example round:
U = d x P
U = 10 x 3,14
U ~ 31,4 mm

Example 1:
f ~ 0,5



Example 2:
f ~ 0,8



PASS PUNCHES

WITH SHEAR FOR REDUCING THE PUNCHING FORCE AND NOISE

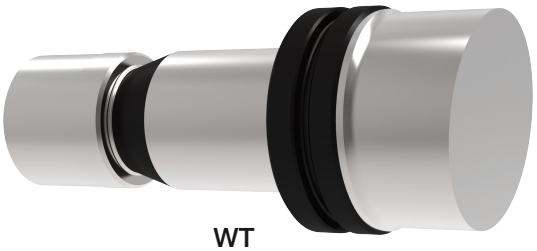
Technical application:

1. PASS punches with shear are used for complete cuts in punching up to 8 mm sheet thickness.
2. PASS punches with shear are produced exactly on your machine type.

On the next page you will find possible execution for PASS punches with shear.

Usual variations are:

for tooling system TRUMPF



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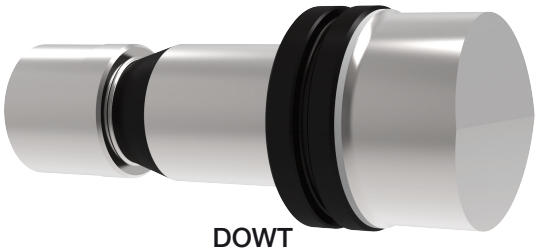
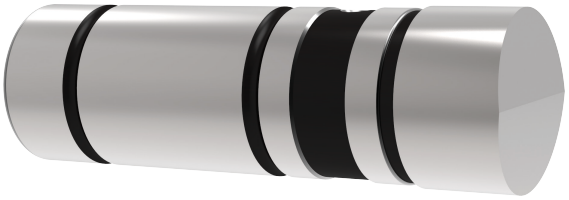


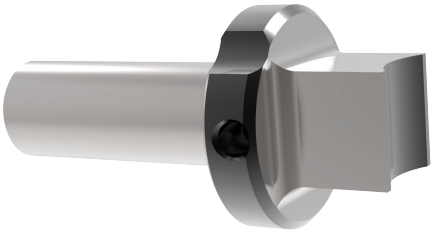
DOWT

for tooling system THICK TURRET



DOWT

for tooling system SALVAGNINI



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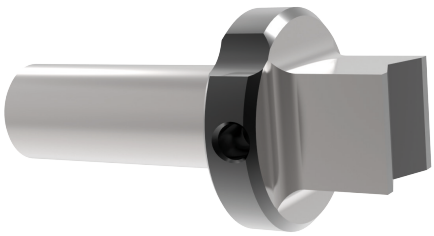
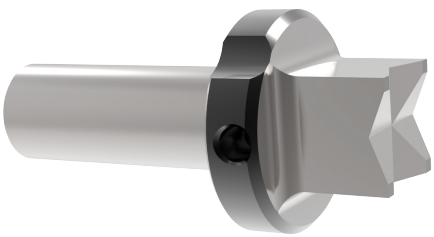


2 PT

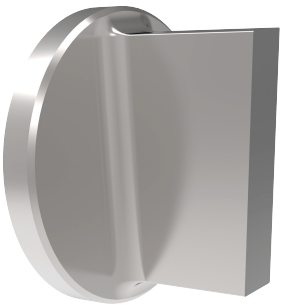


4 PT

PASS PUNCHES

WITH SHEAR FOR REDUCING THE PUNCHING FORCE AND NOISE

Possible shear variations for PASS punches:



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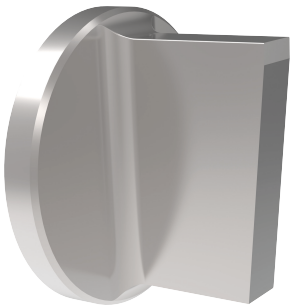
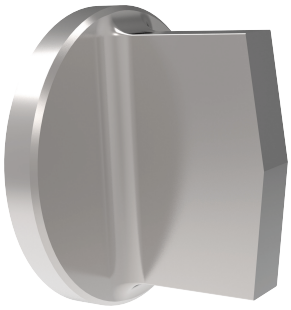


WTC



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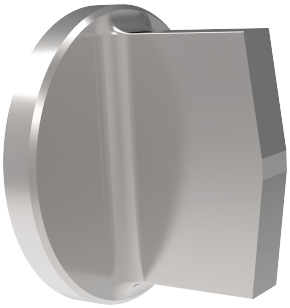

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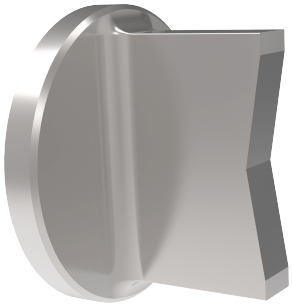
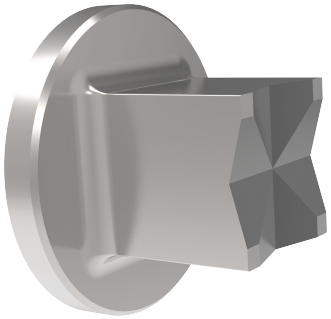
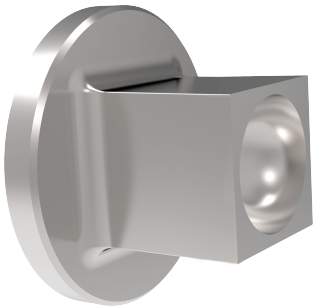


2PT



4PT



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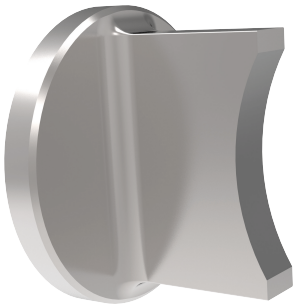


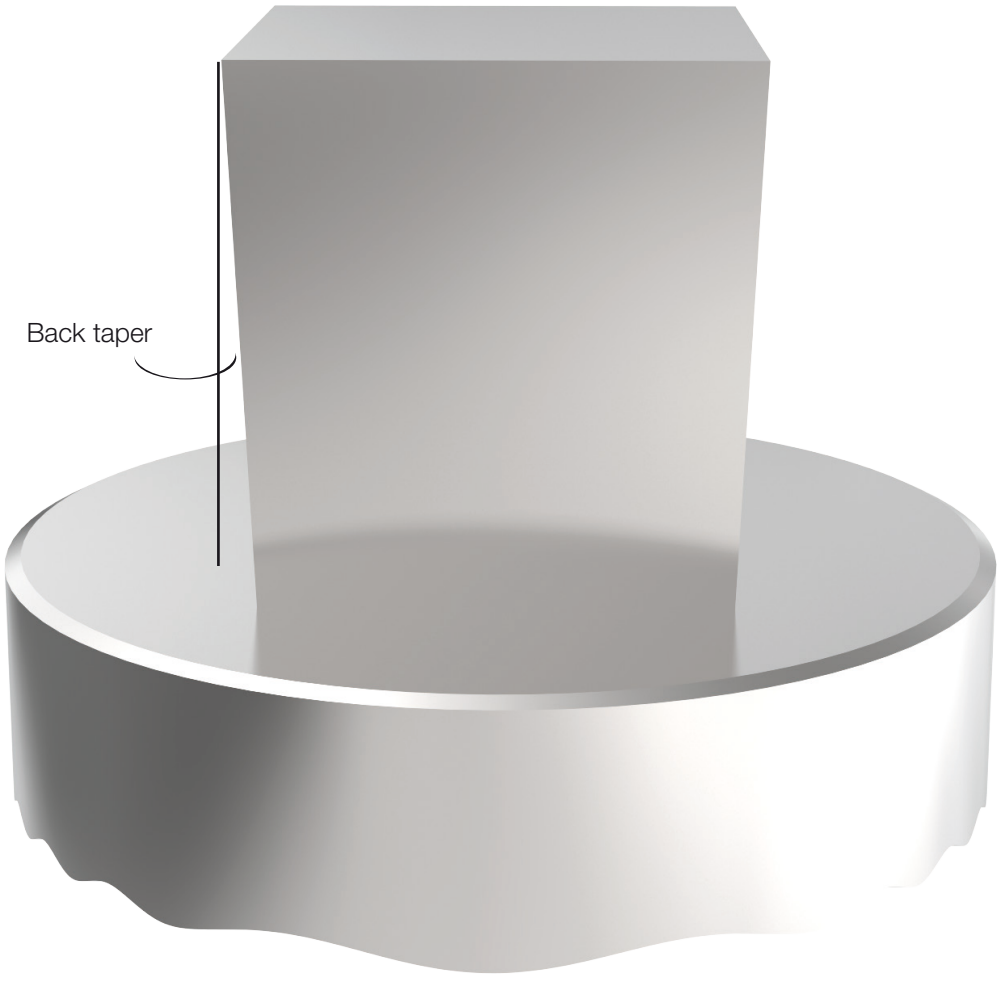
R

BACK TAPER ON PUNCHES

PASS punches are normally produced with back taper to reduce galling and premature punch wear.

However it should be mentioned that back taper is very important when punching materials such as stainless steel or very thick material to reduce galling and eliminate breakage of the tool corners and edges.

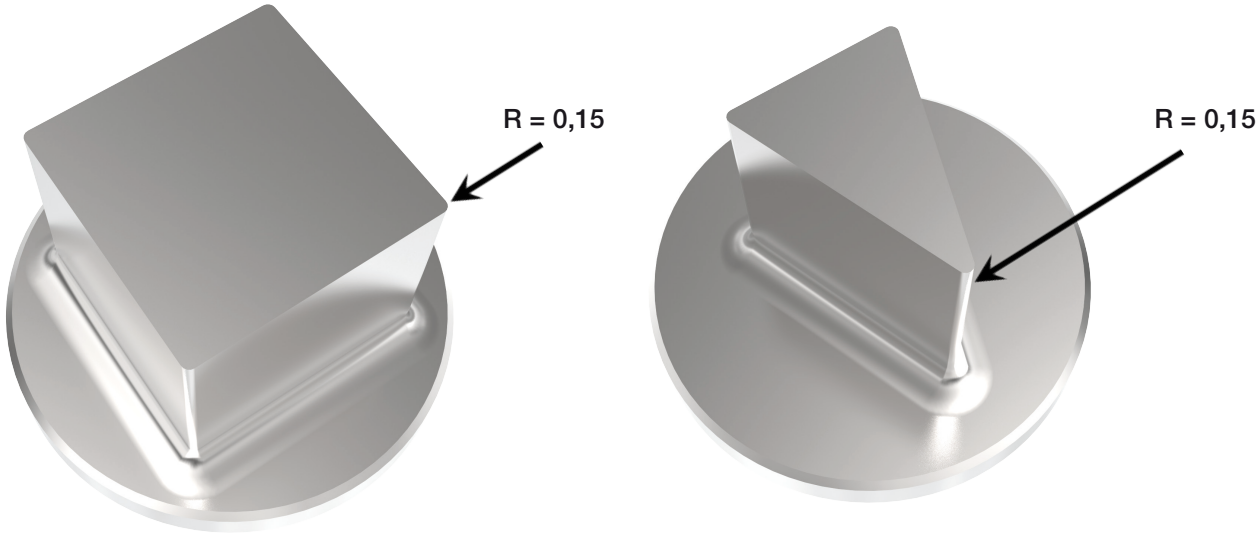
We recommend a line polished version for cutting parts, which have to be produced sink-eroded (special shape with internal shape, e.g. cross-form, U-form, etc.) and in high qualitity sheets.



PASS CORNER RADIUS ON PUNCHES

PASS punches are automatically produced with corner radius R = 0,15 mm. This process increases the lifetime as the corner abrasive wear will be decreased considerably.

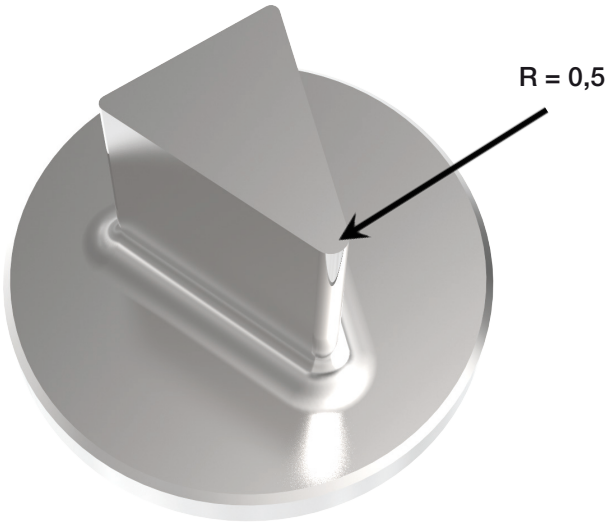
E.g.: square and triangle punch



The corner radius can be changed on customer‘s request.

E.g.:

R = 0,5 mm instead of R = 0,15 mm for stainless steel
in order to increase tool life.



PASS TOOL VARIETY

HWS

HWS tools are made of a secondary hardened cold work steel with superior toughness. This type of steel is especially suitable for dies.

Advantages for customer:

- excellent cost in accordance to performance

H-PM®

H-PM® tools are produced with steel made on powder-metallurgical base with a high degree of purity.

This guarantees a segregational uniformed microstructure in the complete cross-section of the tool.

Advantage for customer:

- excellent cost in accordance to performance
- good stability for edges by increased toughness
- high tool lifetime due to the unformed microstructure
- increased current hit-flex-capability; suitable as an excellent base for dies

X3-PM:

The X3-PM tools are made of a high-end powder-metallurgical steel with the best possible performance characteristics for punches in the punching technology due to the best possible degree of purity.

The segregational uniformed microstructure with high vanadium concentration in the complete cross-section of the punch guarantees best possible wear resistance regarding tool lifetime.

Advantage for customer:

- best efficiency by multiple increase of the punch hit count
- best possible stability for cutting edges
- extremely high abrasion resistance
- utmost compressive strength

X8-PM:

The X8-PM tools are made of a high-end powder-metallurgical steel the best possible performance characteristics for dies in the punching technology caused by best possible degree of purity.

The high ductility of the segregational uniformed microstructure guarantees best possible fatigue limit. This kind of steel is especially suitable for dies with risk-breakage in regard to special shapes.

Advantage for customer:

- best possible absorption of hit-flex stress; prevents fatigue breakage
- high abrasion resistance

PASS COATING VERSIONS / DRAW-POLISHING

TO REDUCE MATERIAL BUILD-UP

H-PM® tools are produced with steel made on powder-metallurgical base with a high degree of purity to fullfil the highest punching demands.

Furthermore we attach great importance to a high quality hardening process by repeated temporing and deep-freeze subsequently.

This process guarantees an extremely high hardness with an outstanding wear resistance of our punching tools.

Associated with modern production methods (grinding of the cutting edges with special grinding wheels) we can ensure that the wide range of different sheet qualities can be punched up to 1.600 N/mm² – no matter if it concerns mild alloyed aluminium, mild steel, stainless steel or spring band steel.

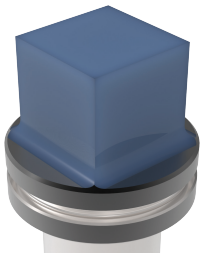
A high punch hardness as well as an excellent grinding surface are important in order to counteract the problem with edge build-up.

Tests show us that the well-known TICN coating is a good coating to increase the lifetime (especially working with stainless steel). However, the problem of material buildup on the edges have not really been counteracted.

Built-up edges are known especially when working with

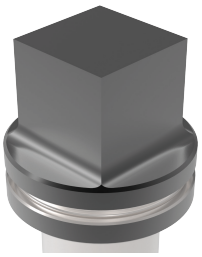
- galvanised steel
- aluminium

After specialized tests at PASS Tooling the below mentioned coatings turned out to be the most successful coatings:



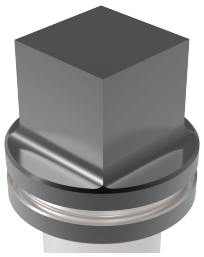
TICN

for working with
stainless steel



A-MAX

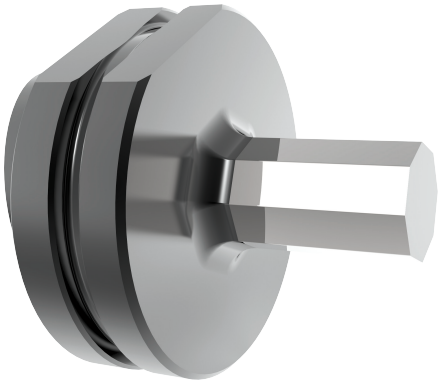
for dry processing with
aluminium sheet



T-MAX

for working with
galvanised sheet / zincor

We recommend draw-polished punch edges to increase tool lifetime and reduce material build up (prices on request):



LIFETIME OF TOOLS I REGRIND ADVICE

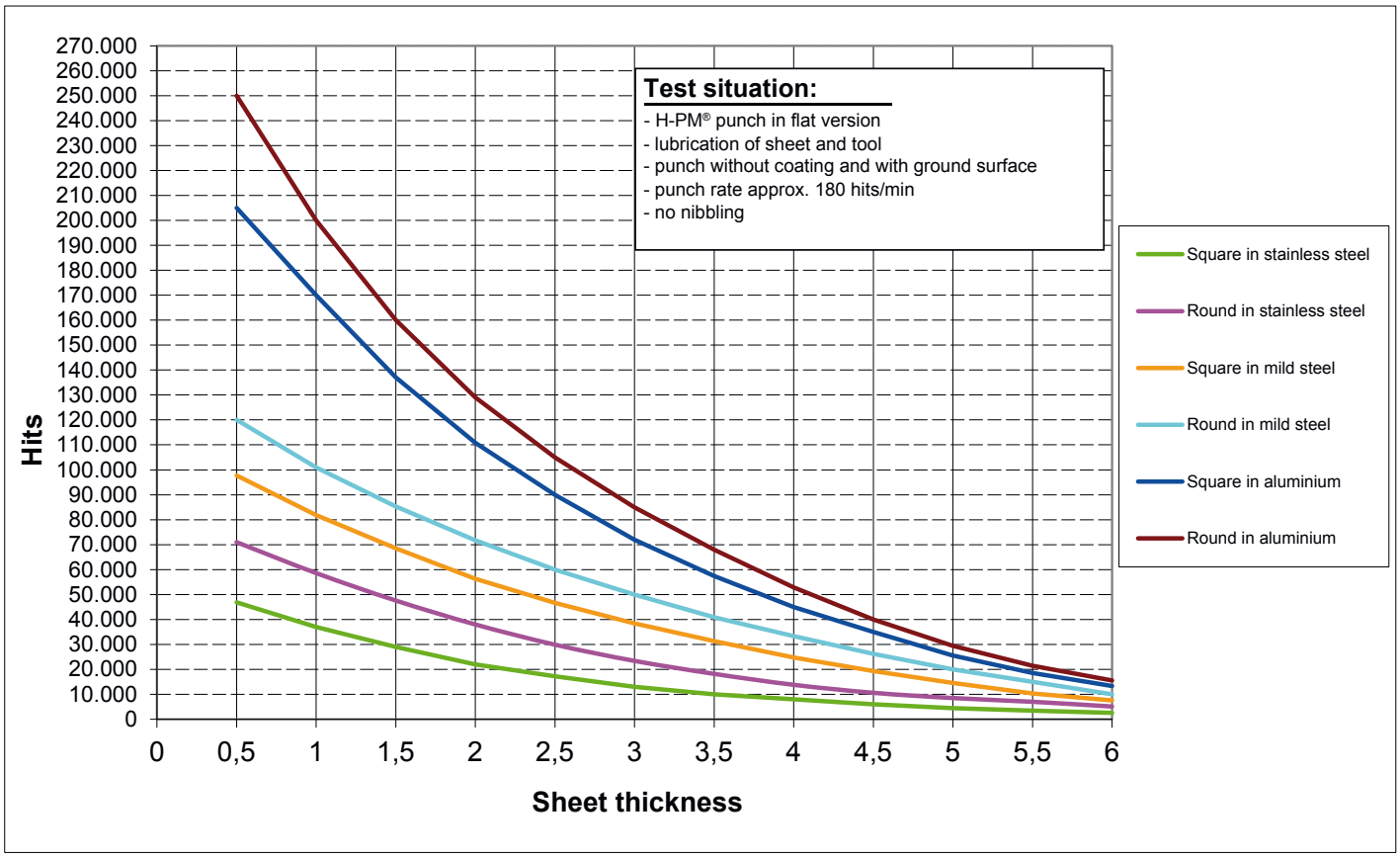
For approximately 30 years we collected technical information from our customers which allows references to be made for operation times of tools and regrinding times.

Today we place this collected data at your disposal with the purpose to facilitate the estimated lifetime of tools.

The following chart is compiled by indicating the recommended regrind after the relavant quantity of hits as there will be a difference for the regrind of the different machine types (tooling system).

The chart, however, should clarify as well that the punching process contains a big variety of influencing factors affecting possibly more or less the increase or decrease of the punching hits.

A precondition by using this data is preconditioned and optimal adjusted punching machine with a solid C- or O-frame.



LIFETIME OF TOOLS I REGRIND ADVICE

Influencing factors	Factor
Galvanised steel / stainless steel with foil / aluminium anodised	0,5 - 0,8
No sheet lubrication	0,4 - 0,6
Punch coating (TICN for stainless steel / T-MAX for galvanised steel / A-MAX for aluminium)	2,0 - 4,0
PASS X3-PM punch	6,0 - 10,0
Nibbling	0,7 - 0,9
Notching	0,5 - 0,7
Shear	0,8 - 0,9
Punching rate > 300 hits / min.	0,8 - 0,9
Cutting part with EDM surface	0,4 - 0,8
Cutting part with polished surface	1,5 - 3,0
Cutting part smaller than 1,5x sheet thickness	0,6 - 0,8
Cutting part smaller than 1,0x sheet thickness	0,3 - 0,5
Using of a too small clearance	0,4 - 0,9

In the following example you will get an idea how the different influencing factors can effect the tool life:

Factors:
square punch
s = 2.0 stainless steel
nibbling
punching rate > 300 hits

A calculation can be variable depending of the factor which will be used:

Using the smallest factor (safety calculation):

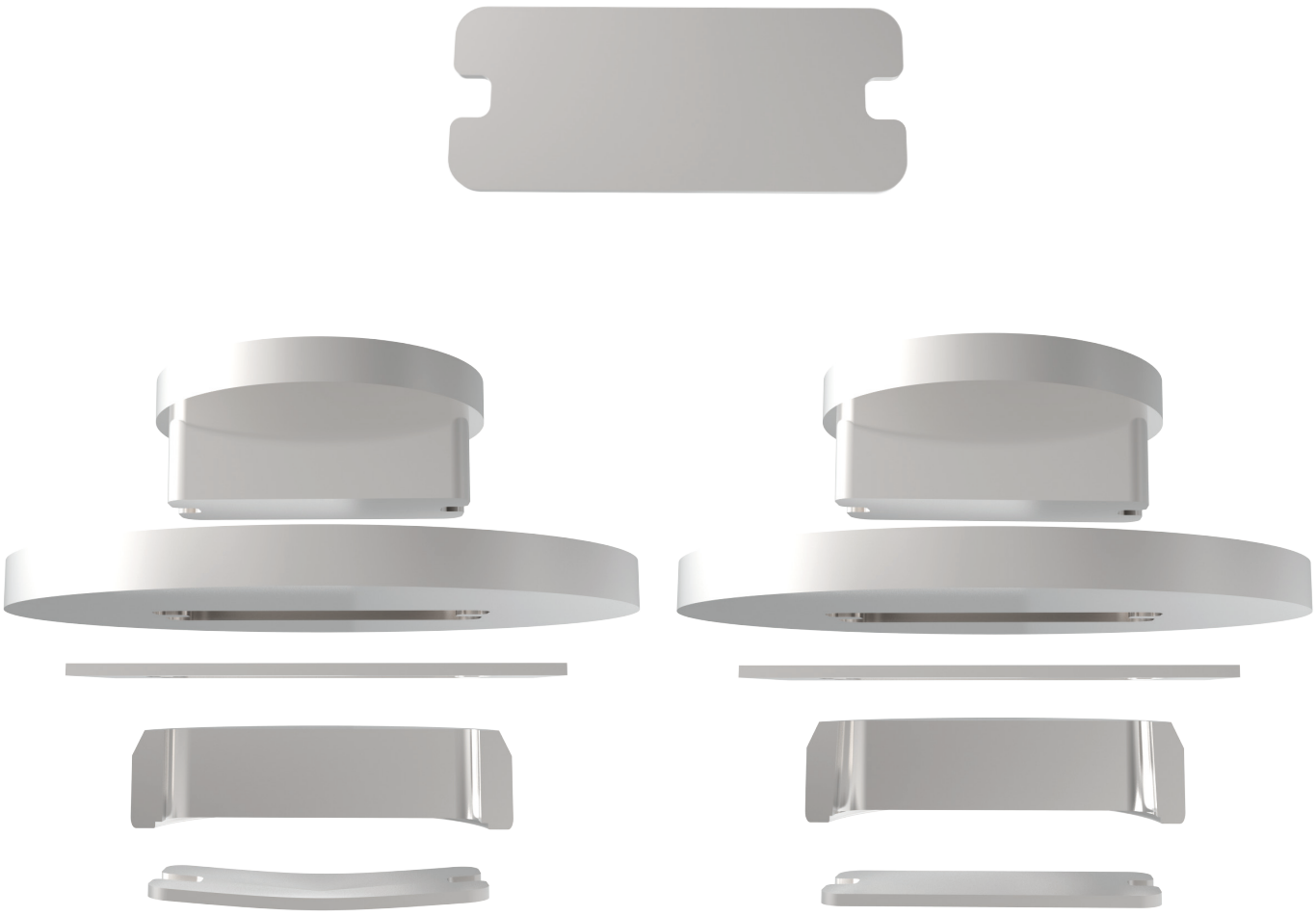
22.000 x 0,9 x 0,9 =	12320
(hit quantity (chart) x factor nibbling x factor punching rate > 300 hits)	Lifetime

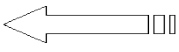
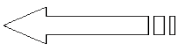
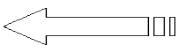
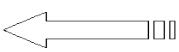
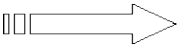
Using the biggest factor:

22.000 x 0,9 x 0,9 =	17820
(hit quantity (chart) x factor nibbling x factor punching rate > 300 hits)	Lifetime

IMPROVING PART FLATNESS

There are some measures to be taken, when parts have to be produced through the dies to improve the part flatness (blanking out parts).



flat		punch		whisper shear 1/2 of s	
normal		stripper		active	
cylindric cut		die		big free angle	
normal		clearance		significantly decreased (depends on the material)	

PASS TOOLS

THAT RELEASE SHEET STRESS AND WARPING

You would like to produce a sheet with a large amount of holes. Sheet distortion results due to the small hole spacing. There is no patent solution for it. BUT: there are some countermeasures!

Fundamentally you should keep in mind that:

- you make the right choice for clearance
- you should use only sharp / ground tools
- use an active stripper or fully guided cluster punch

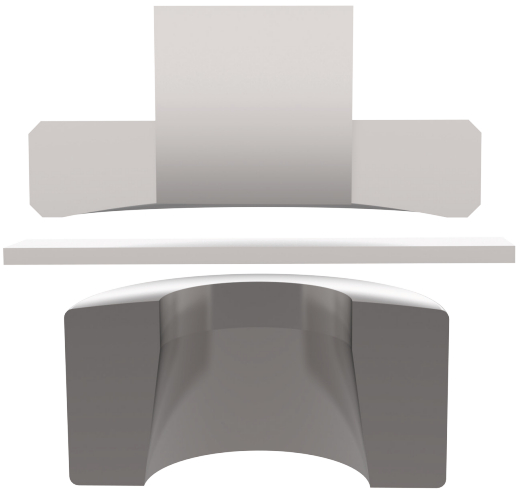
Should all of these points not be enough, there is the option to use tools that release sheet stress and warping.

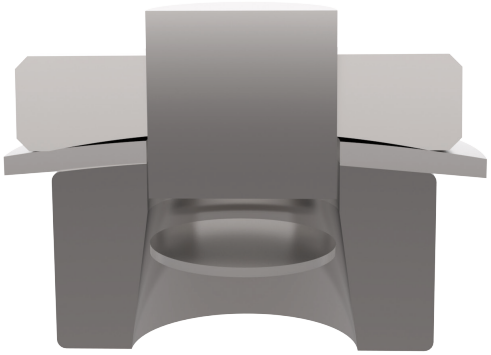
In this case there are toolings with convex surface:

Stripper is produced concavelly
(attention: use only active stripper)

Influence:

On each hit the sheet will be pretensioned and adjusted against the usual emboss.





PASS - MAX. DEPTH OF COUNTERSINKS

Countersinks in sheets are possible (e.g. for countersink screws). Please note the following information:

1.) In order to make deformations (material deformations) it is necessary to pre-punch the clearance hole.

This pre-punch diameter is normally bigger than the finished clearance hole.

2.) Technical guidance value for 90° countersinks:

Aluminium sheet:	min. 0,25 mm zyl. part or depth max. 90% of s
Steel:	min. 0,25 mm zyl. part or depth max. 80% of s
Stainless steel:	min. 0,55 mm zyl. part or depth max 66% of s

3a

3.) If the screw head height is higher than the sheet thickness there are two possibilities to create the countersink:

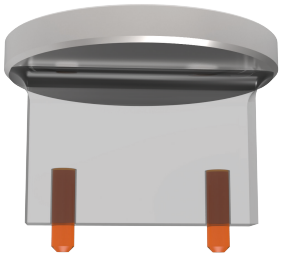
a) A bigger screw thread clearance hole is required as DIN or ISO forces. Keep in mind that the surface area for the head support is reduced and the strength calculation must be adjusted accordingly.

b) The sheet can be embossed to create the countersink. Be aware that a raised emboss may create problems with further sheet handling.

3b

PROBLEMS WITH SLUGS

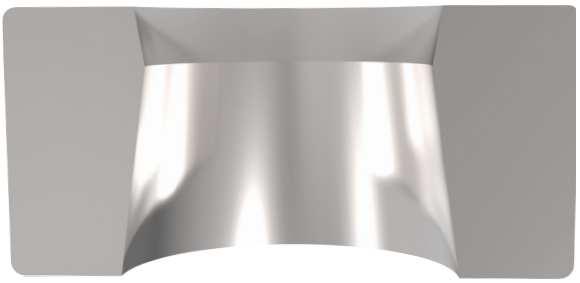
There are special, technical possibilities to avoid slugs, e.g. on machines without vacuum or punching with the vacuum offline.



1.) Punch with rubber ejector pin

2.) Rooftop shear or inverted rooftop shear

3.) Dies with slug-stop / slug-snap

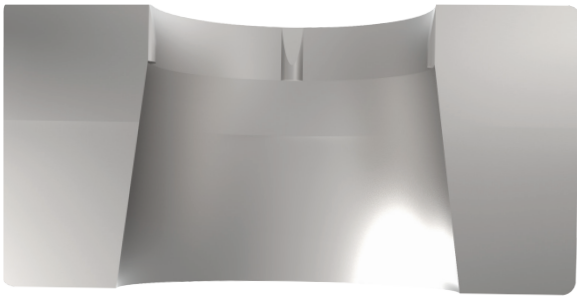


a) slug-stop

PASS dies for tooling system SALVAGNINI are produced in standard version with a slug-stop version (without additional costs). This means that the upper part of the cutting part is produced with a negative angle. The slug will be held with the complete circumference in the die.

This is not recommended for:

- shapes smaller than 1,25 mm
- clearance smaller 0,1 mm



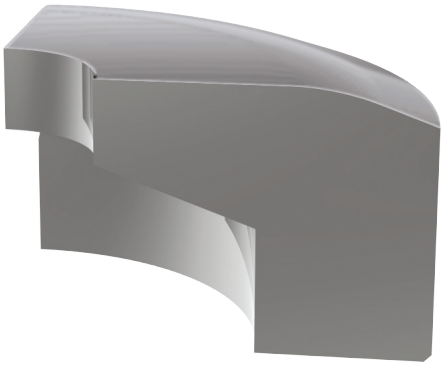
b) slug-snap

Alternatively we offer our slug-snap version (additional costs). In this case special holding bolts are included in the die, clamping the slug positively (better than the slug-stop version). The slug-snap version is also more convenient for shapes smaller than 1,25 mm and clearance smaller 0,1 mm.

LOW-SCRATCH MATERIAL HANDLING

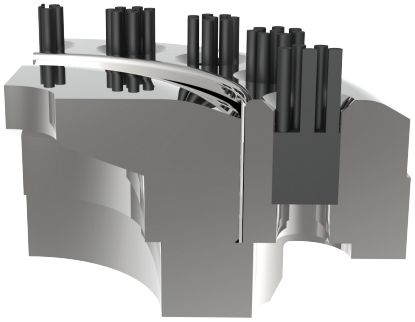
HANDLING POLISH, BRUSH, SOFT PADS

There is often a problem with the die causing scratches on the sheet. Of course you can order steel with protective foils, however there are other options with the tooling.



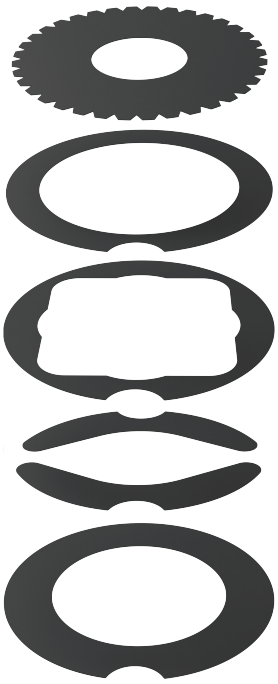
1.) Polishing the die

The entire horizontal surface is polished. Furthermore, a large radius is blended onto the edge of the die and this is also polished.



2.) Adapter rings (for dies) with brush inserts

The adapter ring is fitted with a ”brushing ring“ with several brush inserts in order to lift the sheet above the cutting surface of the die.



3.) Using PASS soft pads

With a special foil pad which can be sticked directly on the die, stripper or adapter ring, scratches can be minimized. These pads are available in different versions.

PUNCHING PRESS-FIT HOLES

Exact size or press fit holes can be punched relatively simple.

1.) Tool (first hit)

Producing a pre-hole with a standard tool

2.) Tool (second hit)

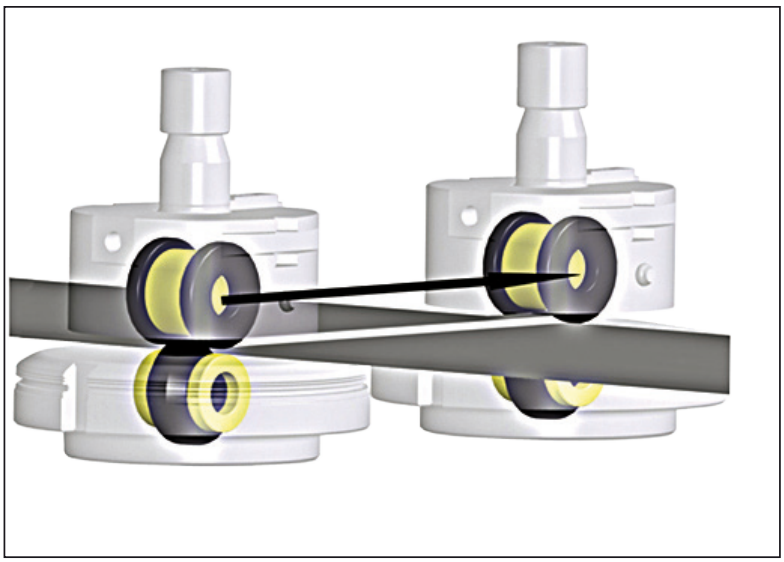
Calibrating with restricted clearance and coated punch

Our engineers will assist you for calculating these tools.

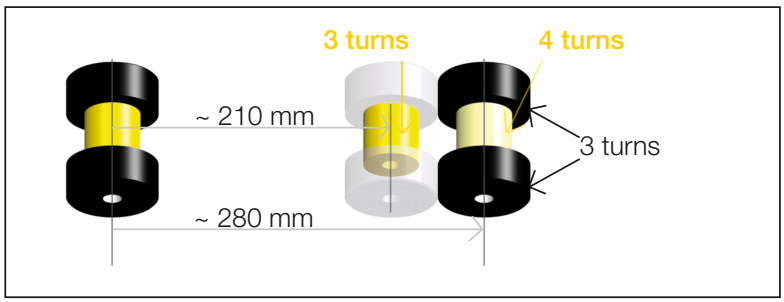
ps:®wheel WITH SEGMENTED WHEELS

The ps:®wheel (beading or offset tool) is usable in a large variety of sheet materials and thicknesses. Due to our unique “differential” design, each wheel operates individually from each other (Patent-no.: EP 1 688 195/ US 7343767).

The ps:®wheel tool with our segmented wheel design is not only for smaller turns. This tool also demonstrates its value and efficiency when operating in straight line production. See the examples below:



When producing a bead of 280 mm the black marked wheels make 3 turns, the yellow wheels 4 turns.



Please see the additional demonstration showing the operation of each wheel in the upper part of the tool at the production of a bead of 280 mm.

Definition and value:

Due to each wheel operating individually each wheel maintains the best rotation speed and contact with the sheet without interfering with the other wheel. The result of this design is much less friction which in turn greatly reduces sheet warpage. This is especially true in straight line operations. The risk of chatter marks will also be greatly reduced, because each wheel operates with their own circumferential speed – no matter if this tool is working with tight radius or on straight lines.

This unique design regarding our “differential” technology increases the longevity of the tool. Of course all of our ps:®wheel tools are supplied with our special integrated lubrication system and special coated shafts. This allows the smooth running and operation characteristic of all ps:®wheel tools.

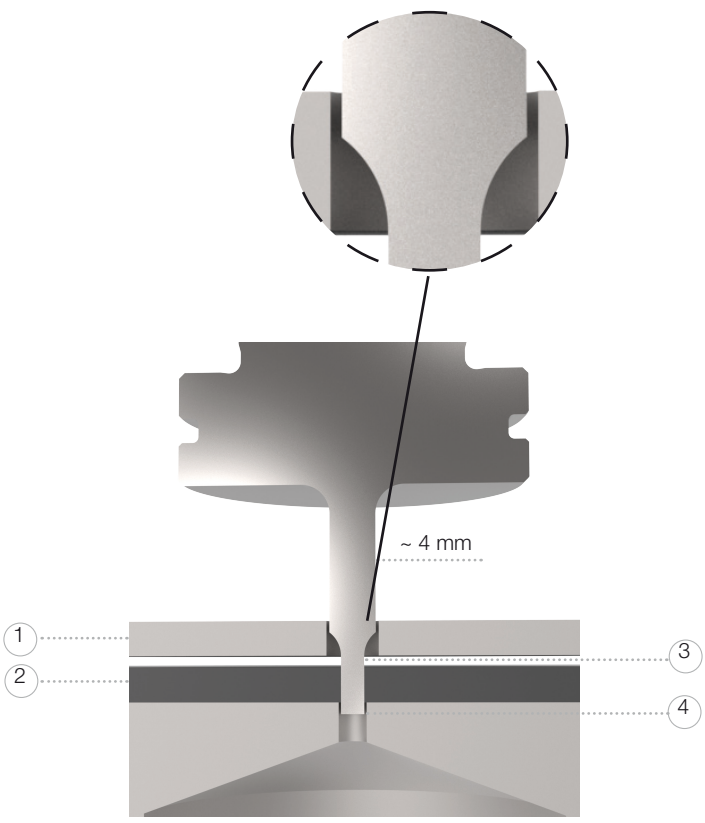
PASS PUNCHES WITH REINFORCED SHOULDER

All PASS punches are produced with a 4 mm reinforced shoulder as soon as the cutting section is required smaller than 4 mm.

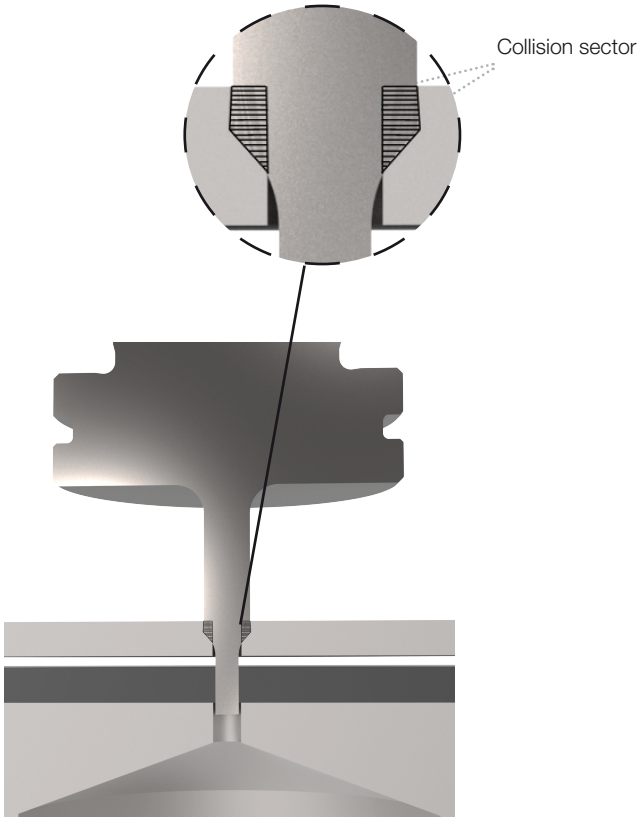
This guarantees that you will get a tool with highest stability in order to punch also thicker and high-strength sheets.

However, the correct stripper size has to be selected in subject to machine type, tool design, sheet thickness (1), punching depth (2), stripper thickness (3) and stripper overlap (4).

It might be possible that it gets necessary to use a stripper with an appropriate big shape (width min. 4,5 mm) in order to get sure that the reinforced punch shoulder can immerse into the stripper.



CORRECT



WRONG

NOTES

NOTES

SALVAGNINI | THICK TURRET | TRUMPF

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