



**ESU Europäische Stanzform Union e.V.**

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**Tolerances  
for the production of cutting dies  
for the packaging industry**

**Toleranzen  
für die Herstellung von Stanzformen  
für die Verpackungsindustrie**

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## Introduction to the result of the working group

### *Tolerances for the production of cutting dies*

On the occasion of the Fachpack 2006 in Nuremberg the **WG Tolerances for Dies** had started with nearly 20 participants - manufacturers and suppliers - in order to satisfy the need for uniform standards in final inspections and the handling of possible reclamations concerning the production of dies.

Every manufacturer knows about reclamations and his own difficult situation in the absence of universal standards concerning the demands on which the contract with the customer is based.

The working group has worked out tolerances for blanking dies, making ready and stripping dies.

The result aims at creating a universally valid directive on the basis of which dies for standard applications in the packaging industry are going to be produced. Neither the minimally possible tolerances which would cause higher production costs for the corresponding tools have been determined nor unrealistically wide limits restricting the application.

Special tools with reinforced supports and limited tolerances have explicitly not been taken into consideration. They will have to be determined by the manufacturer according to the application.

The working group agreed that the tolerance for the height of machined steel rules is extremely important. The die-maker has to guarantee by suitable measures like f. ex. broaching or clearing in tight curves that the tolerance for the height is observed during machining. But in the absence of practicable measuring methods for built-in steel rules no dimensions for the tolerance of the height have been determined.

Blanking dies which have to be specifically adjusted to the corresponding automatic diecutting machine and particularly to the blank to be worked have also not been taken into consideration.

The influence of rubber coating on tolerances which can be observed with a die was discussed and resulted in the necessity to reinstate the working group Rubber. The state of a die at the time of delivery at the manufacturer's has been determined as the basis for judging its conformity to the tolerance.

## Einleitung zum Ergebnis des ESU Arbeitskreises

### *Toleranzen für die Herstellung von Stanzformen*

Zur Fachpack in Nürnberg 2006 startete der **AK Toleranzen für Stanzwerkzeuge** mit fast zwanzig Teilnehmern - Herstellern und Zulieferern - um einem Verlangen nach einheitlichen Standards für die Endkontrolle und eventuelle Reklamationsbehandlung in der Stanzformherstellung nachzukommen.

Reklamationen kennt jeder Hersteller und ebenso auch seinen schwachen Stand, wenn keine allgemeingültigen Standards über Anforderungen vorliegen, die dem Vertrag mit dem Kunden zu Grunde liegen.

Der Arbeitskreis hat Toleranzen für Stanzwerkzeuge, Gegenrichtungen und Ausbrechwerkzeuge erarbeitet mit dem Ziel, eine allgemein gültige Richtlinie zu schaffen. Hiernach sollen Stanzwerkzeuge für Standardanwendungen der Verpackungsindustrie erstellt werden.

Weder die minimal möglichen Toleranzen wurden festgeschrieben, deren Einhaltung mit höheren Herstellkosten der Werkzeuge verbunden wäre, noch sind unrealistisch weite Grenzen gesetzt, die die Anwendung beeinträchtigen würden. Spezialwerkzeuge mit verstärkten Trägerplatten und eingegrenzten Toleranzen sind ausdrücklich nicht berücksichtigt wurden. Diese müssten in Abhängigkeit vom Anwendungsfall durch den Hersteller definiert werden.

Es hat im Arbeitskreis Einigkeit bestanden, dass die Höhentoleranz der bearbeiteten Stanzlinien von großer Wichtigkeit ist. Der Stanzformenhersteller muss bei der Bearbeitung sicherstellen, dass die Höhentoleranz durch geeignete Maßnahmen wie z.B. Räumen oder Freischliff in engen Biegungen eingehalten wird. In Ermangelung praxisgerechter Messverfahren für eingebaute Stanzlinien aber wurde auf eine maßliche Festlegung der Höhentoleranz verzichtet.

Ebenso unberücksichtigt blieben Nutzentrennwerkzeuge, die spezifisch für den jeweiligen Stanzautomaten und insbesondere auf den zu verarbeitende Zuschnitt abgestimmt sein müssen.

Aus der Diskussion um die Einflüsse der Gummierung auf die einhaltbaren Toleranzen der Stanzform ergab sich die Notwendigkeit der Wiederaufnahme des Arbeitskreises Gummi.

Als Grundlage der Beurteilung einer Stanzform soll der Zustand zum Zeitpunkt der Auslieferung beim Hersteller dienen.

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Diese im Eigenverlag veröffentlichte Zusammenfassung als Teil der ESU Standards ist urheberrechtlich geschützt.

Jede Verwertung außerhalb der engen Grenzen des Gesetzes zum Urheberrecht ist ohne Zustimmung des ESU-Vorstandes unzulässig und strafbar. Das gilt insbesondere für Vervielfältigungen, Übersetzungen, Einspeicherung und Verarbeitung in elektronischen Systemen.



## 1. Tolerances of the cutting die

- 1.1 Dieboards/ carrier plates
  - 1.1.1 flatness (concave/convex)
  - 1.1.2 Measures of the dieboard
- 1.2 Cutting rule
  - 1.2.1 ESU Standard rules
  - 1.2.2 Counter scoring
  - 1.2.3 Nicks for 2 Pt- and 3 Pt-rules
- 1.3 Cutting die with mounted knives
  - 1.3.1 Knife/knife-dimensions across all ups (total measure)
  - 1.3.2 Flatness just like dieboard
  - 1.3.3 Gripper/first knife distance
  - 1.3.4 Angularity of the cutting rules
  - 1.3.5 Tolerance in height
- 1.4 Rubbering
  - 1.4.1 Carton 18mm dieboard
    - 1.4.1.1 Moss rubber
    - 1.4.1.2 Cell rubber
    - 1.4.1.3 Cell vulcolan
    - 1.4.1.4 Cork
    - 1.4.1.5 Profile rubber in plastic, cork or full rubber
  - 1.4.2 Corrugated cardboard carton 15mm dieboard
    - 1.4.2.1 Moss rubber
    - 1.4.2.2 Cell rubber
    - 1.4.2.3 Cell vulcolan
    - 1.4.2.4 Profile rubber

## 2. Counter plates

- 2.1 Hard paper
  - 2.1.1 Total caliber D, material without glue
  - 2.1.2 Channel width, remaining thickness, trim holes
- 2.2 Steel counter plates
  - 2.2.1 Flatness P
  - 2.2.2 Thickness D
  - 2.2.3 Channel width
  - 2.2.4 Channel depth
  - 2.2.5 Outer dimensions

## 3. Stripping tools

- 3.1 Stripping tool upper part
  - 3.1.1 Carrier plate
  - 3.1.2 Stripping elements
  - 3.1.3 Centerline
  - 3.1.4 Foam
- 3.2 Stripping tool lower part
  - 3.2.1 Carrier plate
  - 3.2.2 Leaveouts
  - 3.2.3 Centerline, enforcement bars, separating angles
- 3.3 Gripper stripping board

## 4. Blanking tools

## 5. Measurement conditions



## Tolerances for the production of cutting dies for the packaging industry, knife height up to 25mm

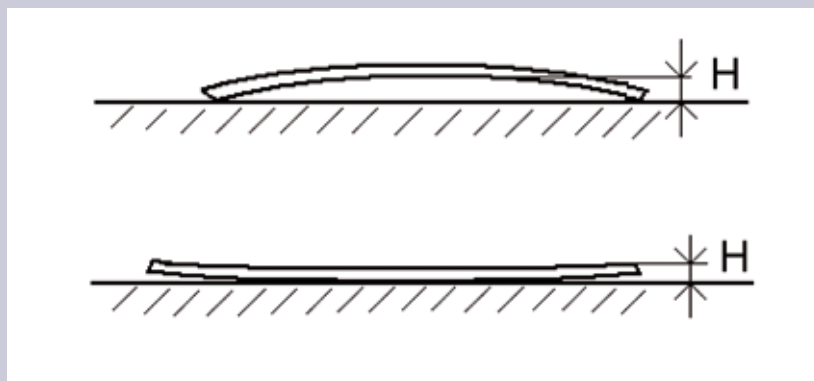
### 1. Tolerances of the cutting die

#### 1.1 Dieboards/carrier plates

material: laser plywood coated or lacquered, not enforced

##### 1.1.1 flatness (concave/convex) reference length $L < 1000\text{mm}$

	class 1	class 2	class 3
$D = 18\text{mm}$	$H < 3\text{mm}$	$H < 5\text{mm}$	$H < 7\text{mm}$
$D = 15\text{mm}$	$H < 5\text{mm}$	$H < 7\text{mm}$	$H < 9\text{mm}$
$D = 12\text{mm}$	$H < 10\text{mm}$	$H < 10\text{mm}$	$H < 10\text{mm}$
$D = 9\text{mm}$	$H < 12\text{mm}$	$H < 12\text{mm}$	$H < 12\text{mm}$



The flatness is measured when lying on a flat surface as the distance  $H$  in the middle of the board or on the side edge. For reference length greater than 1000mm the tolerance has to be extrapolated linear. The same tolerance must fit to a cutting die with mounted knives.



### 1.1.2. Measures of the dieboard

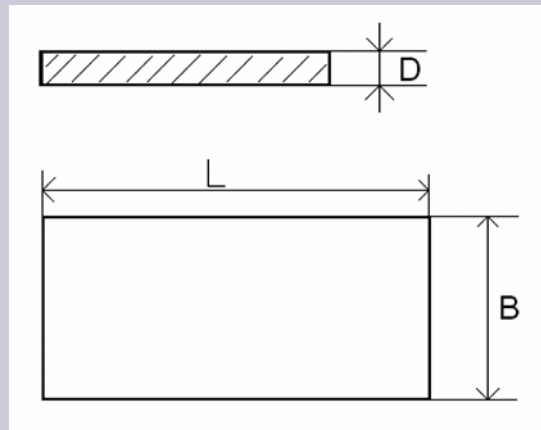
length L, width B:  $+0/-2$  mm

thickness D = 18 mm  $+0,1/-0,4$  mm

thickness D = 15 mm  $+0,4/-0,2$  mm

thickness D = 12 mm  $+/-0,5$  mm

thickness D = 9 mm  $+/-0,5$  mm



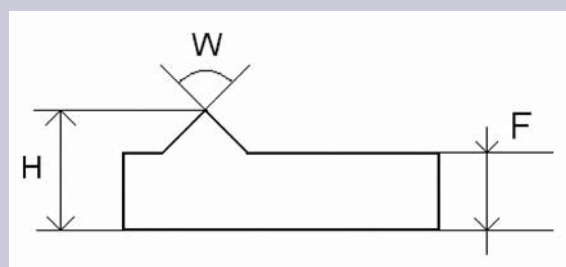
### 1.2. Cutting rule

#### 1.2.1. Standard rules referring to the ESU specifications

#### 1.2.2. Counter scoring

Tolerances in two classes in dependency to geometry and caliber of the material to be worked on

	class 1	class 2
height H (blade + base)	$+0/-0,05$ mm	$+0/-0,07$ mm
base height F	$+0/- 0,03$ mm	$+0,02/- 0,06$ mm
outer dimensions	$+0/-0,3$ mm	$+0/-0,6$ mm
counter block	$+0/-0,03$ mm	$+0/-0,06$ mm
cutting angle W	$+/-5^\circ$	$+/-7^\circ$

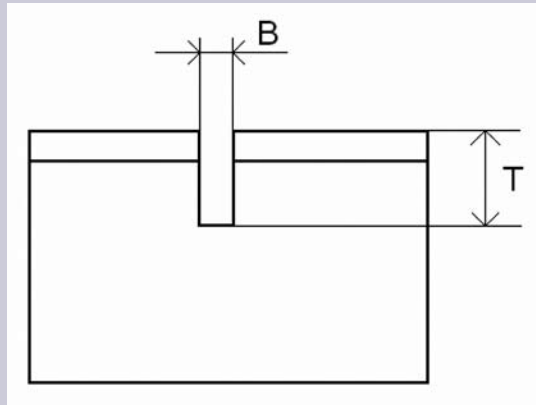




1.2.3. Nicks for 2 Pt- and 3 Pt-rules

Width B depending on material and customers indication depth  $T > 1,5 \times$  caliber of material, for corrugated board caliber of clinched material

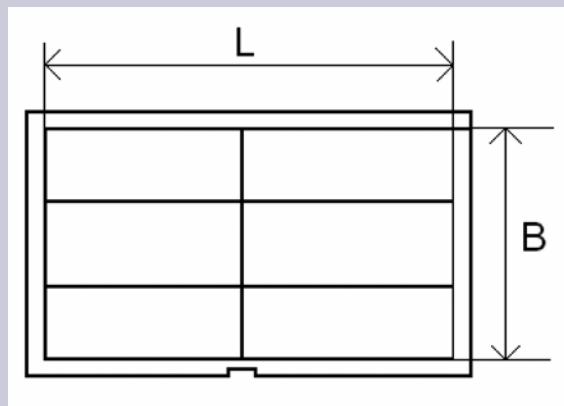
	class 1	class 2	class 3
width B	+0,05/- 0,02	+0,07/- 0,02	+0,1/- 0
depth T	+1,0/- 0	+1,5/- 0	+2,0/- 0



1.3. cutting die with mounted knives dieboard: laser plywood coated or lacquered, not enforced

1.3.1. knife/knife-dimensions across all ups (total measure)

	class 1	class 2	class 3
tolerance in mm/m	+0,5/- 0,3	+0,7/- 0,4	+1,0/- 0,5

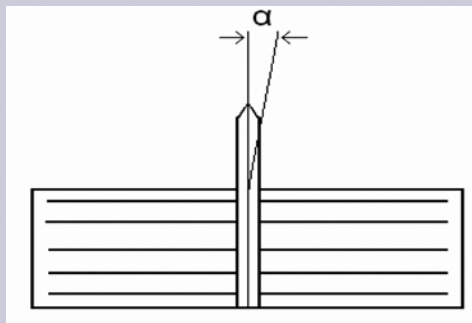




1.3.2. flatness just like dieboard (i.e. point 1.1.1.)

1.3.3. gripper/first knife  
distance A depending on machine type or customers indication  
+0/-0,3 mm

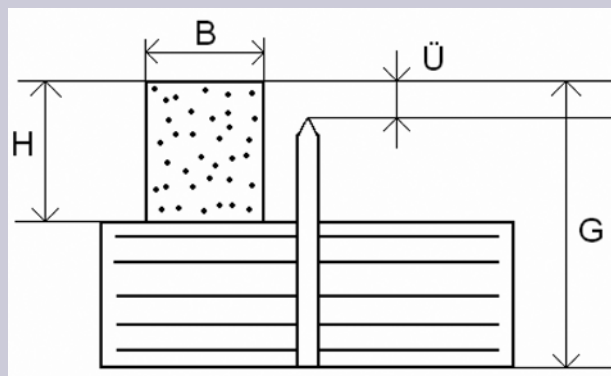
1.3.4. angularity of the cutting rules  
 $a = \pm 1,0^\circ$



1.3.5. tolerance in height

The tolerance in height of the cutting dies is mostly determined by the tolerance of the cutting rules. In the absence of practicable measure procedures no special tolerances are defined.

1.4. rubbering  
(height H, width B, supernatant Ü)



1.4.1. carton 18mm carrier plate

1.4.1.1. moss rubber  
hardness 25 – 35 Shore(A) +/- 5 shore



height  $H = 7,1 - 7,6$  mm, defined height 7,0 mm or 7,5 mm depending on production tolerance (0,5 mm) and total height, (max. compression 40%)  
total height  $G = 25$  mm  $+0,7/-0,3$  mm  
width  $B > 7$  mm  
supernatant  $\ddot{U} > 0,9$  mm

#### 1.4.1.2. cell rubber

height  $H = 7,5$  mm  $+0,5/-0,3$  mm  
total height  $G = 25$  mm  $+1,1/-0,2$  mm  
width  $B > 7,5$  mm  
supernatant  $\ddot{U} > 1,0$ mm

#### 1.4.1.3. cell vulcolan

volume weight: RG 35 – RG 65 (350 –650 kg/m<sup>3</sup>)  
height  $H = 7,0$  mm  $+0,3/-0,2$  mm  
total height  $G = 25$  mm  $+0,4/-0,6$  mm  
width  $B > 7$  mm  
supernatance  $\ddot{U} > 0,6$  mm

#### 1.4.1.4. cork

hardness 65 Shore(A) +/- 5 shore  
height  $H = 7,0$  mm  $+/-0,2$  mm  
total height  $G = 25$  mm  $+0,3/-0,6$  mm  
width  $B = 7$  mm  
supernatant  $\ddot{U} > 0,6$  mm

#### 1.4.1.5. profile rubber in plastic, cork or full rubber

depending on producers' specifications and customers' requirements

#### 1.4.2. corrugated cardboard carton 15mm dieboard (12mm dieboard, defined measure +3,0 mm)

##### 1.4.2.1. moss rubber

hardness: 15 – 20 shore(A) +5 shore, 25 shore(A) +/-5 shore  
height  $H = 10$  mm  $+0,6/-0,3$  mm  
total height  $G = 25$  mm  $+1,0/-0,5$  mm  
width  $B = 10$  mm  
supernatant  $\ddot{U} > 0,7$  mm

##### 1.4.2.2. cell rubber

height  $H = 11$  mm  $+0,8/-0,2$  m





total height  $G = 26 \text{ mm} +1,2/-0,4 \text{ mm}$   
width  $B = 11 \text{ mm}$   
supernatant  $\ddot{U} > 1,8 \text{ mm}$

1.4.2.3. vulcolan  
volume weight: RG 35 – RG 65 (350 –650 kg/m<sup>3</sup>)  
height  $H = 10 \text{ mm} +0,5/-0,2 \text{ mm}$   
total height  $G = 25 \text{ mm} +0,9/-0,4 \text{ mm}$   
width  $B = 10 \text{ mm}$   
supernatant  $\ddot{U} > 0,8 \text{ mm}$

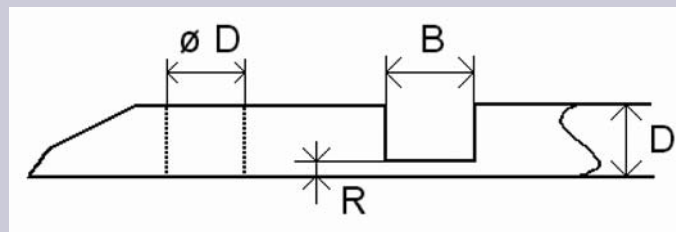
1.4.2.4. profile rubber  
depending on producers' specifications and customers' requirements

## 2. counter plates

### 2.1. hard paper

2.1.1. total caliber D, material without glue  
 $D < 0,8 \text{ mm} +/- 0,03 \text{ mm}$   
 $D \geq 0,8 \text{ mm} +/- 0,04 \text{ mm}$

2.1.2. channel width, remaining thickness (without glue foil), trim holes  
channel width  $B +0,06/-0,03 \text{ mm}$   
remaining thickness  $R = 0,13 \text{ mm} +/-0,03 \text{ mm}$   
trim holes  $D = 4,95 \text{ mm} +/-0,02 \text{ mm}$   
chamfer and differing defined measures or tolerances depending on customers' indications



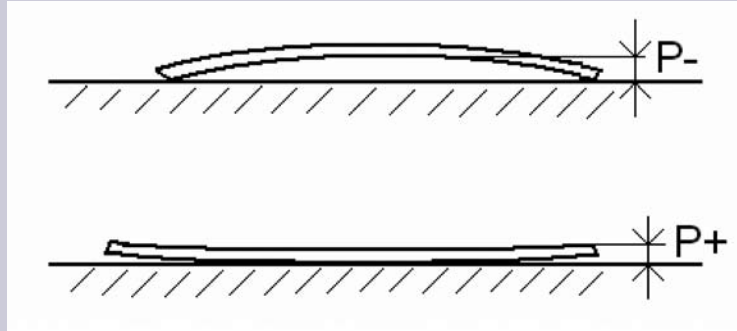


## 2.2. steel counter plates

### 2.2.1. flatness P

35 HRC: +/- 3 mm in reference to 1m

48 HRC: +3/-2 mm in reference to 1m



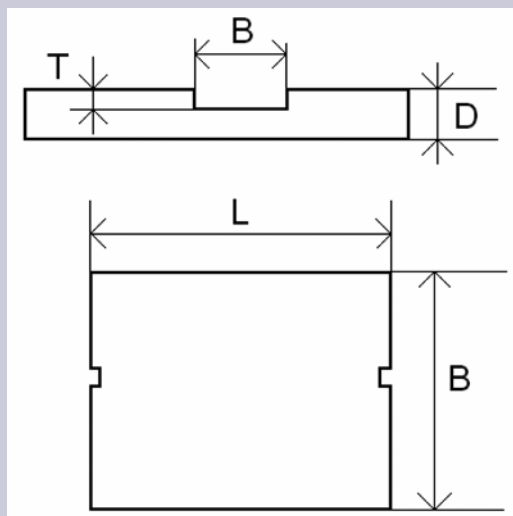
### 2.2.2. thickness D +/-0,1 mm

### 2.2.3. channel width B +0,07/-0 mm or customers' indications

### 2.2.4. channel depth T +0,1/-0 mm or customers' indications

### 2.2.5. outer dimensions

length x width +/- 0,2 mm



## 3. stripping tools

Dimensions and tolerances are not valid for dynamic pinless stripping systems

### 3.1. stripping tool upper part

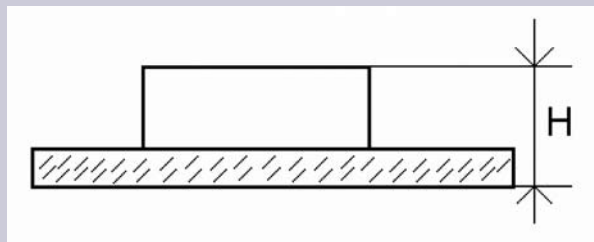


### 3.1.1. carrier plate

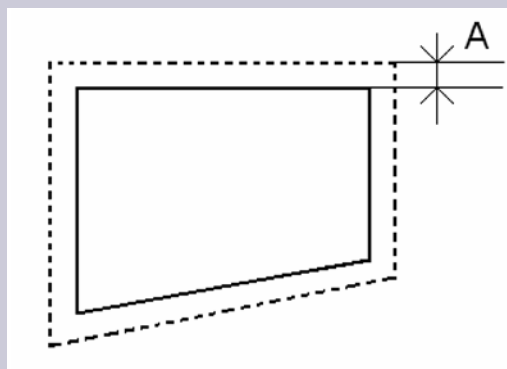
15 mm or machine specifications and customers' indications, tolerances same as diecut carrier plates

### 3.1.2. stripping elements

height H depending on machine specifications +/- 1 mm, or customers' indications



distance A  $\geq$  2 mm from cutting contour, might be smaller depending on job and customers' indications



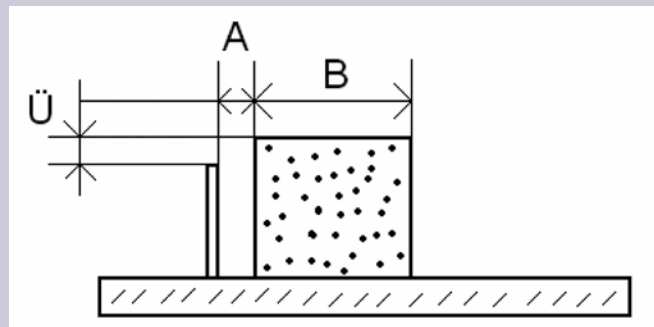
### 3.1.3. Centerline depending on machine specifications

### 3.1.4. Foam

width B  $>$  35mm

distance A  $\geq$  3 mm from stripping element

supernatant  $\ddot{U}$  = 4-7 mm higher than stripping elements



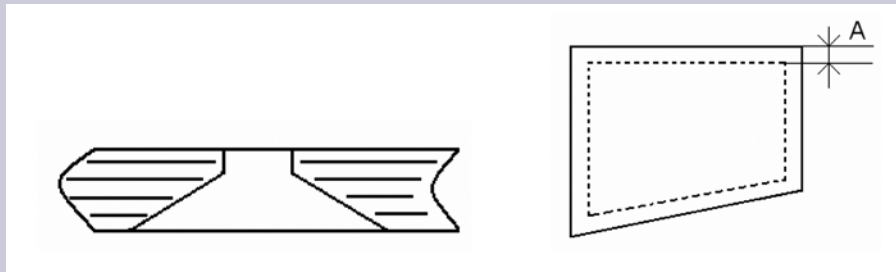
### 3.2. stripping tool lower part

#### 3.2.1. carrier plate

12 mm or machine specifications and customers' indications, tolerances same as diecut carrier plate

#### 3.2.2. leaveouts

distance  $A \geq 2$  mm from cutting contour, or depending on customers' indications, backside milled



3.2.3. Centerline, enforcement bars, separating angles, screwing depending on machine specifications and customers' indications

### 3.3. gripper stripping board, in one or two parts

depending on machine specifications and customers' indications

### 4. blanking tools

basic measurements depending on machine specifications and customers' indications, other editions have to be built concerning the layout and material.



## Measurement conditions

Measurement conditions, measurement locations and measurement procedures stand in direct context to the tolerances. The measurement location is the production location of the diemaker before delivery. Influences from transport have to be avoided or neutralized by means of a suitable packaging of the producer and settling before use by the receiver of the tools. The measurement procedures have to accumulate a tolerance of more than a tenth better than the defined tolerance of the tools.

The measurement conditions depend on the behaviour of a multiplex dieboard. The temperature range for thermal balance of the tool lies between 20° up to 28°C. The dieboard humidity has to be 10-12% when checking the tool tolerances which meet the humidity of the tools at the time of delivery. Changes in humidity of the multiplex dieboard during transport take much time (some weeks) and have to be avoided by suitable storage. Exact measurement of humidity, as it takes place at the plywood producers, require a kiln check during which the test piece will be destroyed, and therefore not practicable. Simple measurement methods by conductance checks are rather inaccurate and can only be taken on the surface without destroying the tool and therefore do not give any information about the sheets' internal humidity. The carrier plates' humidity can only be secured by suitable storage at the diemakers' and the customers' facilities for long terms.

If further stability in dimensions is demanded in reference to measure tolerances and environmental influences, enforced dieboards can be used which are not part of the general guidelines.

