



Design Specifications

for

Tools

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Design specifications

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01. General

These design instructions are in addition to the written tool order an integral part of all future tool orders.

The details in the protocol of a possible start conversation have to be respected during the design and the manufacturing of the tool

All changes or deviations have to be allowed by Kirchhoff Automotive (Abteilung Werkzeugeinkauf). These has to happen in writing.

Tools must correspond to current standards and rules for accident prevention, especially of the German accident prevention and insurance association (Eisen und Stahl-Berufsgenossenschaft).

Drawings sent to Kirchhoff Automotive for acceptance of the design must be in the scale of 1:1 or at very large tools in the scale of 1:2.

02. Scope of supply „tool design“

Construction drawings are mandatory. The tool construction must be sent to Kirchhoff Automotive for acceptance. An acceptance does not release from the responsibility for the functioning of the tools and for the accuracy of the part dimensions. Your constructions will be discussed with us before tool manufacturing. You will receive the press-charts, the Kichhoff-Kutsch norm and the written manufacturing order to define the requirements.

You must provide the data of the assemblies, part drawings, 3D/Data (surfaces), 2D erosion data, **plunger-measurements** on a CD with one copy

For the warehousing of spare parts it must be guaranteed that for the spare part manufacturing the 3D data (surfaces) are supplied according to position numbers.

Format of data: Catia V4 modell
 CatiaV5 R9
 igs
 step / dwg / dxf / (2D)

The data off the single components must be complete regarding:

- fastening
- positioning
- brak-throughs(lateral sides of a punched hole
- weight (see attachment, page 2.1)

A separate BOM for all standard parts has to be administered which states supplier and order number

(see attachment, page 2.2)

Data exchange – tool construction

The data records must include the following information at the naming:

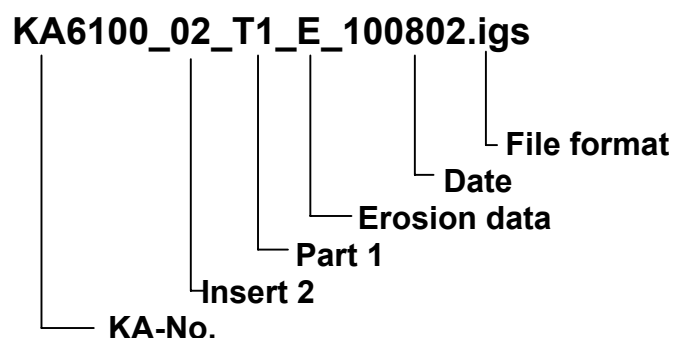
1. KA -Nr. If necessary with insert no. and part-no.
2. Identification, what kind of records:
WZ = tool data
E = erosion data
F = milling data
B = burning data
P = product data
3. date

The tool construction must include the following data shown separately:

- assembly
- cuts with position number
- single parts with position number and material details
- top view
- burning data
- erosion data
- milling data with NC Data sheets, offset – designations and milling point of origin in XYZ direction, the workpiece outlines must be included in the milling data XYZ-direction
- Bill of materials

The views must completely be with measurements

The tool data have to be denoted according the following key



03. Material selection

When the written tool order does not contain details for the material selection, these will be defined during the tool start conversation.

<u>material</u>	<u>application area</u>
St 52	bat/shelve
GG 25	casted superstructure elements
GGG 70L	blank holder paths
	Punch plates, tool superstructures outside from the active parts
1.2363	Cutter bar trimming at 3-D parts sheet thickness up to 0,8mm
	Cutting punches and blanking dies, , drawing punches, bending punches, die plates
1.2382	Active parts from casted steel
1.2436	Letter stamps
1.2842	backing plates, stripper plates
Rex M4	when discussed

04. Tool design

Threaded joints of tool components should be executed in a way that allows the easy exchange or rework (polishing, grinding) of wearing parts at the set-up tool.

The lower tool part must be screwed from the top and the upper part from the bottom

The tools must be designed to fit the press listed in the order. This is especially important for the clamping fixtures, the height where the strip comes in, the scrap disposal by the machine table and the positioning of table and ram.

Special attention has to be paid to a stable tool design that has to fit to press and hole for the parts falling through in the machine table. At casted superstructures there have to be at least 2 ribs per side in longitudinal direction

The tools have to be deigned to produce the required quantities without a problem. For later appearing hidden defects the tool manufacturer will carry all costs.

Cylinder-pins (dowel) for positioning of parts must be used as standard parts with inside thread. Pin holes must be drilled completely through, blind holes are to be avoided. All pins in the upper tool parts have to be secured against falling out by using pin locks of the company Sankyo (Spring Plug) or by using countersunk head screws.

The complete tool structure has to be pinned (dowel) continuously. Tools drawers have to be locked in place, where a disassembly of the press must still be possible.

Stripper plates in the upper tool part are to be screwed together from the bottom, they should have circumferential space of 0,2 mm in the area of the plunger.

The complete tool design is to be pinned (dowel) and screwed so that a wrong set up is not possible, marking of the part position is not sufficient

All punches have to be guided by punch plates. Plate guidance cuts must not be used. Welds to cutting plates, punches and in the area of the forming are not allowed

At progression tools with more than 400 ton force the minimum screw size of for socket screws should not go under M16. Every time two securing bolts must be used. If plastic or spiral springs are used, these have to be bolted together as spring packages A number of holding bolts should not go under 4 + 2.

At progression tools it must be guaranteed that the stripper plate is not able to tilt during the cutting start. This shall happen by distance pieces that are 0,2 mm lower that the top edge of the stripes on which the stripper plate will bear on.

Bending against the stripper will just be accepted in exemption after discussion with Kirchhoff Automotive. The exact construction will then be discussed in every single case.

Blankholders must be displaced by impact pieces. These should be able to be demounted easily. They should be adjusted to the appearing forces to the highest possible degree.

The tools must guarantee - by the process sequence and by suitable coatings- that parts can be processed without using oil.

Ejector pins have to be placed in the tool's upper part, in the bending punch as well as at the separating of the part in the stripper plate.

Heel punches at bending punches have to be supported by a fitting key (heel block), heel block of non-ferrous heavy metal with a solid lubricant. Plate thickness at least 10 mm. Bolting joints by countersunk screws should be avoided to create a surface as large as possible.

05. Tool guidances

To secure the tool against torsion of upper against lower part one pillar has to be placed unsymmetrical at a 4 pillar guidance, with a 2 pillar guidance the diameters of the pillars have to be different.

If a block guiding is used, the torsion must be avoided by selecting different sizes of the blocks.

If spring relief pieces are used within the tool, it must be ensured, that the guiding pillar will dip at least $1,5 \times D$ into the guide bush to guarantee a proper centring at the tool fixture of the upper part.

Guiding pillars and bushes are to be used according DIN/ISO as follows

- Guide pillars DIN 9825 / ISO 9182-2 without a collar
- Guide pillars DIN 9825 / ISO 9182-5 with collar
- Guide Bushes DIN 9834 / ISO 9448 with collar

Closed Pillar guidances must have exhaust hole of at least 10 mm diameter

Part lifter or strip lifter with a stroke of more than 40 mm have to be guided by pillars with ball-cages or spring-bolts of made by Sankyo.

- Guide bushes DIN 9831 / ISO 9448 –3 with ball cage

06. Cutting elements in the lower tool part

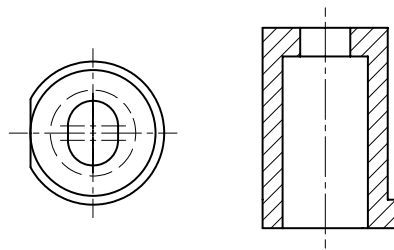
The blanking die and hole bush thickness must not be smaller than 32 mm. The backing plates for the hole bushes must be worked into the mounting plate.

Hole bushings always have to be executed as standard bushes with collar. The approved suppliers must purchase them.

Where it is technically not possible to use these bushes it must be ensured, that the hole bushes will stay in their seat, e.g. by a fit-in key

The standard dimensions must not be changed.

Hole bushes with elongated hole respectively hole bushes, used in contour shapes, must in principle be secured against twisting (by a cylindrical pin or spline. The locking area to prevent twisting must be executed parallel to the long side (see sketch)



At material thicknesses of more than 1 mm, backing plates for the hole bushes must be used.

Hole bushes without collar must be supported by backing plates, too.

If the die plate has different levels, inserts have to be to facilitate sharpening. So one height can be reworked without need to do all heights

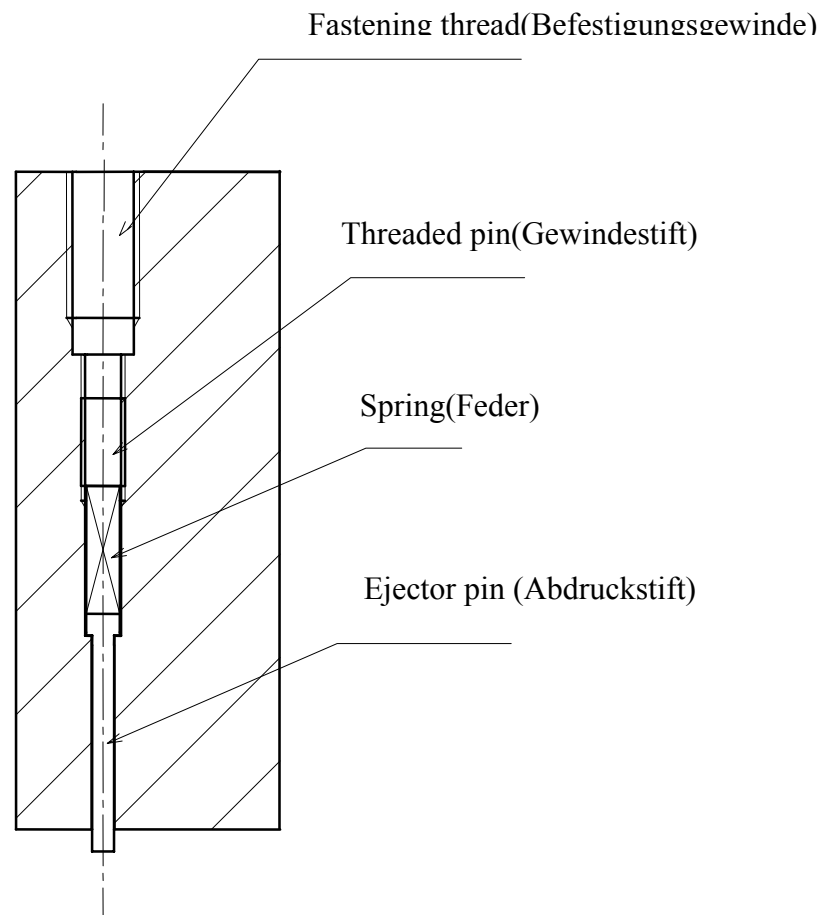
Clearances in die plates, e.g. for beads, must have a depth of at least 8 mm, to prevent an early rework of the exposure, at the follow up of the die plate.

Die plates for the outer trimming of parts with 3D contours should be executed without cone shapes, if possible, to allow manual rework. Then the trimming contour must be opened to the outside do allow a decent scrap disposal.

Die plate inserts in contours have to be provided with additional threads, the threads should preferable be placed in the screw holes.

07. Cutting elements in the upper tool part

Cutting punches must in principle be provided with ejector-pins – where possible - .(not as rubber inserts or ball thread pins).



A maximum length off the cutting punch of 100 mm + back guidance must not be exceeded, except for Kirchhoff Automotive allowed it.

All cutting punches have to be fixed through the top plate with cylinder head bolts DIN 912, so that the head lies on the hardened backing plate. The thickness of the backing plate must be at least 10 mm. All screw connections of the punch must be accessible through the top plate.

When there is the possibility that - at the cutting - a lateral shear occurs (e.g. at the cutting of a strip) the cutting punch must be provided with a heel block. Reducing Cutting force by different lengths of the cutting punches.

Hole- and cutting-punch must dip 5 mm into the material, also after angled polish!

When pilots are located in the blanking out punches, in their area ejector pins have to be located.

Cutting punches with shaped contours must not be discharged from the shaft to the edge. Sunk-eroded punches should just be used as exemptions.

Above the cutting punches a hardened backing plate must be used.

Cutting punches that cannot be screw fastened because of their size must secure against falling out by pins without an inside thread or by balls. Upset heads will not be accepted.

Cutting punches must be fixed by a punching plate, which must have a thickness off at least 35 mm.

piercing punches

All hole punches must in principle be equipped with ejector pins. At the shank hole punches must be relieved towards the cutting edge. A maximum length of **100 mm** must not be exceeded, unless otherwise agreed by Kirchhoff.

Standard Piercing punches must exclusively be used, which must not be reworked. The standard parts must be purchased as a complete part at the approved suppliers.

Piercing punches < 4 mm must be guided by adaptive sleeves as specified in VDI 3374. The shape off the head must be executed with a collar. (see Fibro: adaptive sleeves with ejector pin (Einsatzhülsen mit Druckstift), Form 233).

If the tool is equipped with various piercing punches, they must have different shaft diameters to avoid confusion. If this is not possible, for each hole the piercing punch diameter with the according number of punches must be labelled in the punching plate.

Piercing punches must be secured in a punching plate with a minimum thickness of 35 mm. The punch must be able to be changed without reworking the shape of the head.

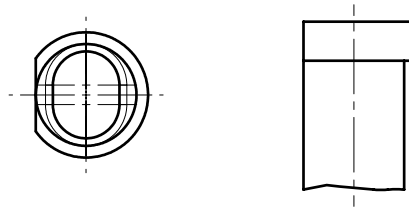
Only piercing punches of minimum HSS quality are admissible.

A hardened backing plate is to be used above the piercing punch.

The design must ensure that screwed connections of tool components do not impair easy exchange of piercing punches; this can for example be achieved by providing separate punch plates, piercing punches that are accessible from the upper tool part through hard plates and ejector pins.

Slotted hole punches must be secured in the punch plate by a cylindrical pin (dowel). The pin should not have an internal thread to prevent twisting. The

locking area to prevent twisting should be executed parallel to the long side (see sketch)



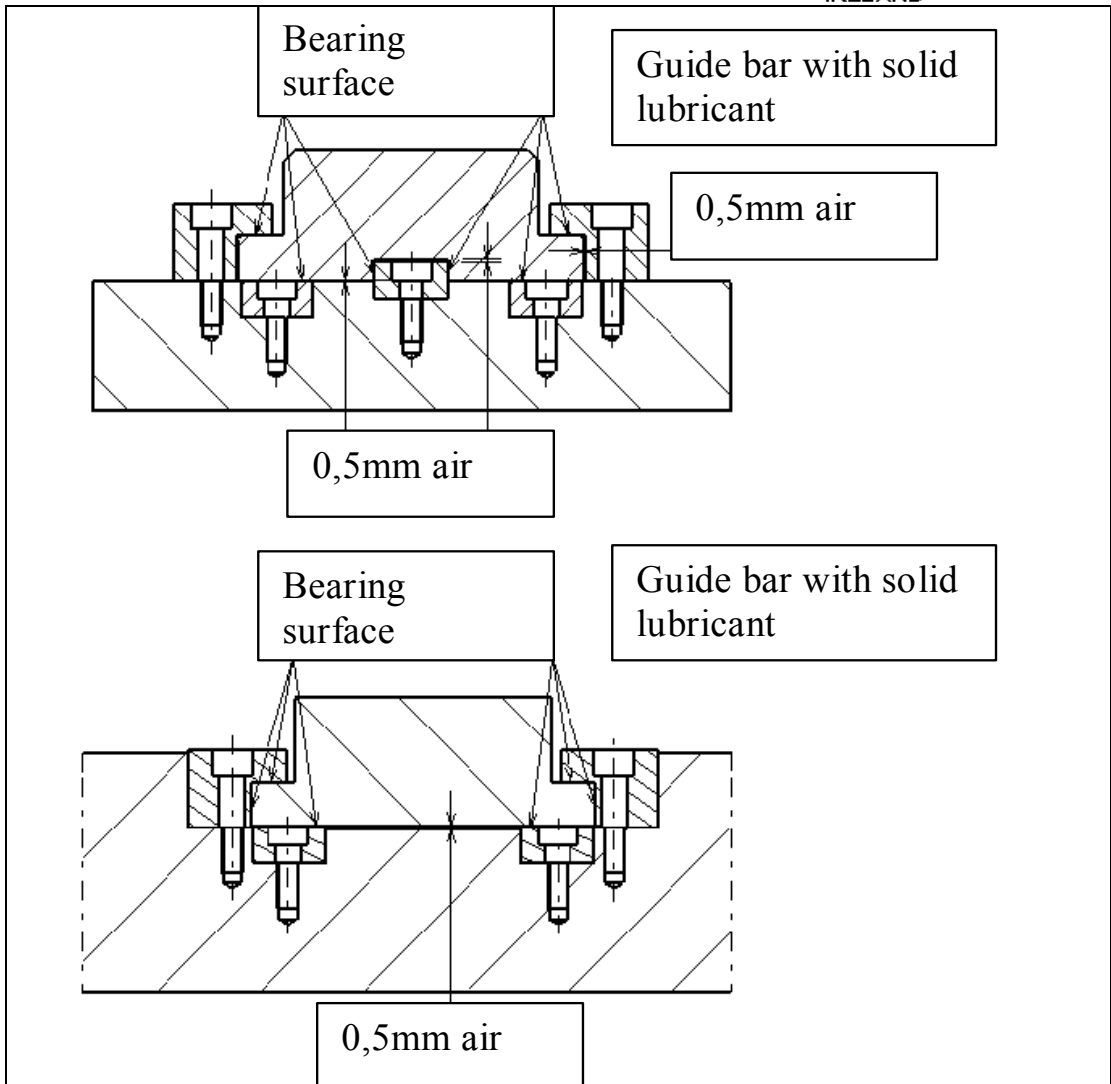
08. Mould slides within the tools

Standard slides must be used. The slides must exclusively purchased by the approved suppliers.

If the slides are self-made they must be

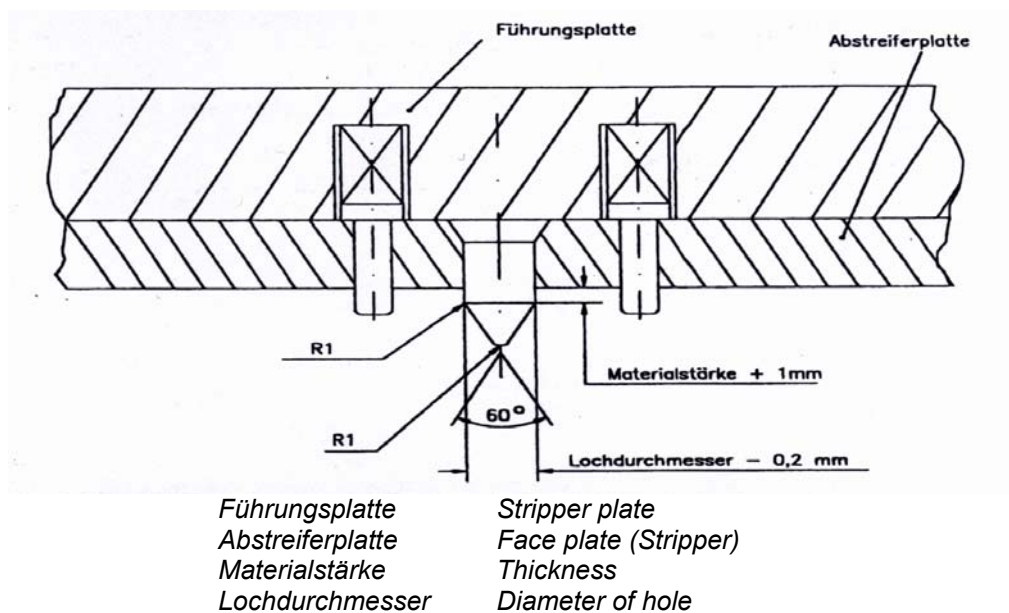
- Equipped with standard wear parts made of Bronze with a solid lubricant
- Driver and slide have to be shouldered
- At horizontal slides slug breakers (Butzenbrecher) must be introduced
- Strippers made of Polyurethane are not permissible.
- Positioning of the slides exclusively by elbow bars is not allowed (see sketch)
- When various slides are used, confusion must be prevented

Top hanging slides should be driven by a slide bed located in the bottom tool part. If this is not possible, the stripper plate must be caught by a cone distance piece



09. Pilot / coarse inserts

Pilots are to be designed according to the KI standard and must be hung in the stripper plate; in addition, 2 ejector pins are to be inserted close to the pilots. Rubber ejectors are not permissible.



At transfer tools the parts must additionally be positioned by location pins. This has to happen in each step. These should be arranged to prevent a false delivery caused by the transfer. The height of the coarse inserts should be 50 mm above the deposit height.

10. spring elements

At elastic guides, lifter (Ausheber) or other moving parts, that must be limited in their stroke, these must be fastened by distance tubes and washers supplied by Steinel. Just Standard sizes are accepted. The use of shoulder fitting screws is prohibited.

Lifter and Blankholders must be protected circumferentially, to prevent accidents and soiling, that might lead to a broken die

Coil Compression springs ISO10243 must be designed for a long operating life and must be positioned by a guide pin.

10.1 Gas pressure springs

At gas pressure springs the working stroke must not exceed 90% of the max. stroke.

The cylinders must be connected to the bottom parts of the gas spring simply by loose flanges or a screw connection.

When gas pressure springs are used in pockets and Borings, these must be equipped with a penetrating boring, to prevent the collection of oil and fats.

Gas pressure springs used at the housing must be cylindrically. They must not have an outside thread or fixed flanges.

10.2 Networked gas pressure springs

When the tool order requires a networking of the gas pressure springs by tube connections, the single springs must be screwed to a separate plate. If necessary, the tubes must also be fixed. A filling armature model PC – 1- 02 as well as a quick coupler CEJN and a return valve must be used. The filling pressure must be noted on a label at the filling armature.

If a tank plate is compulsory, a maximal compression of 25% must not be exceeded. Adjustable gas cylinders (brand Nitrogas nodel NS) must be used. The tank plate must be equipped with a control unit PC -1- 02, as well as a quick coupling CEJN and a return valve.

The control unit should be placed impact protected in a clearance of the tank plate. The filling pressure must be noted on a label at the filling armature.

11. Tool distances and spring reliefs

Distance pieces must be painted in RAL 3000. It must be possible to remove distance pieces from a press-mounted tool. If possible from the viewpoint of tool engineering, spring-relief elements that are fixed to the tool (chain) are to be provided. Distance pieces and spring-relief elements must comply with the KI standard ([see appendix page 11.1-2](#))

Progression tools must be designed in such a way that the stripper plate cannot tip when the strip is cut. To achieve this mount distance pieces whose top edges are about 0.2 mm below the top edge of the strip and on which the stripper plate placed.

Spring relief pieces must be painted in RAL 1021. They must be well visible for the operator. (e.g. not covered by the blank holder). Storing spaces marked by colours and provided with a boring must be available.

12. Tool Centring

Tools must be positioned according to the press graph.

13. Tool clamping

The clamping areas for the clamping screws must be designed to ensure a clamping height of 47 mm +/- 1 mm with a plate thickness of 100 mm.

For presses using hydraulic clamps clamping plates according to Kirchhoff Standard (see Attachment, page 13.1) must be used, if the clamping is done at casted upper parts without an additional body plate. ([see attachment page 13.1](#))

At Bodyplates of St 52 steel it is sufficient if the clamping is done directly by the plate without a clamping ring. It must be ensured that the clamps of the single tool steps remain moveable, if the plate thickness is lower than 70 mm.

A consistent clamping height of the single tool inserts is important. Multiple clamping of the upper tool parts in different heights is not allowed.

All clamps located in the Top or bottom die set must be used at the hydraulic clamping.

14. Tool locking/securing

Feed control

All presses of Kirchhoff Automotive are equipped with „Unidor“ tool safety devices. All new tools must be designed with compatible Toolsafety devices in arrangement with Kirchhoff Automotive (Toolroom and production)

The feed control must be located at the end of the progressive tool. The definition of the installation point and the mode of the pulse generator in the tool is required before the start of the tool manufacture. This has to happen together with the definition of the metal band development. As a rule pulse generators by Unidor or Pulsotronic should be used.

The connections for the pulse generators have to be placed around the tool to enable easy plugging. The installation must be transport proofed. Whenever possible, feed controls according to KA Standard should be used. ([see Attachment page 14.1-.2-.3](#))

Parts control

Transfer tools with active grabs have to use stationcheck the parts in each step from both sides by station controls. When shovels are used it is sufficient to check from one side. ([see attachment page 14.4](#))

15. Pneumatics

pneumatic cylinder and accessories have to be purchased by Festo

Standard Cylinders that enable a contact free endposition scan must exclusively be used.

The air hoses PU must have a minimum inside diametre of 6 mm. Their colour must be blue and black.

- * blue extend, close
- * close retract, open

Hoses must be installed with connections of type CK.

Air hoses must be fixed to the tool by tube clampings „Festo“ or other suitable materials.

16. Part labelling

If part labelling by letter punches is required, these must be located in a punch plate. It must be ensured that the letter punches cannot be confused, if several gravures are done in one tool. ([see attachment page 16.1](#))

Letter punches must not be used in shaping tools or in mobile parts. They must not use these as an anvil, too.

Part identification by T-type punches have to be put in according to manufacturer code. The definition which code is to be used in the part is done by the tool purchase department. ([see attachment page 16.2-3-4-5-6-7](#))

17. tool labelling

Kirchhoff Kutsch-type plates must be placed at the bottom tool part at the operator's side (Front of the press).

All tools have to be labelled at the front and at the side with red paint (RAL 3003). The letter height must be about 30 mm an. The label must show KA-number and work sequence number. (e.g. 5048 AFO 2)

Running direction (→), total weigh and the weight of the upper tool part have to be applied.

All parts in the tool have to be marked according to their installation position with a consecutive number. The number must be at a well visible spot to prevent an incorrect installation (place and position).

At stage tools the first cut must be labelled clearly visible with a groove and red paint on the die plate. Outside the tool, the badge „First cut“(Erstanschnitt) must be placed.

Tools for more than one part version must clearly indicate the necessary alterations. (punched numbers, badges). A detailed plan has to be added to the tool.

18. Scrap disposal and parts removal

Scrap should be avoided in the area where the parts drop out. This should happen by a suitable design of the metal blank development.

Stable Scrap chutes must be placed in the bottom die set where this is not possible because of the part or the tool design. The chutes should face in the direction of the press table drop out opening.

All chutes must be very stable and screw connected. Welding the chute to the tool is not allowed. It should be easy to extend the chutes, if necessary.

The chutes should be wide enough to transport also free falling parts without catching. The maximum diagonals must be observed. Separating the scrap with separating-cutters should be avoided → cut it free before

Every piece of scrap must fall separately and not as a package, even at complex shapes.

Presses > 400 t require that the scrap is transported by chutes or belt conveyers to the outside.

Hole bushings or small pieces of scrap (< 180 mm) can be disposed by the hole in the press table.

Parts transport

(see attachment page 18.1)

conveyor belts

(see attachment page 18.2 -.3)

19. Coating of active parts

All hardened active parts such as bending punches, pulling forms must be annealed after roughing to reduce inner tension. To prevent warpage of the part at the coating, the annealing temperature must be at least 520°C (secondary area)

Die plates and punches must be hardened, nitration is not allowed.

Coatings must be done with the CVD TIC / TIN procedure, the extend will be defined in the construction conversation.

The drawing mould must be made of GGG 70 L, that surface hardened by laser or plasmanitrided, if the tool order does not require a segmentation of the active parts.

A maximum part size of 350 mm should not be exceeded at segmentation. Threads should be provided for transportation.

19.1 Hardness requirements

part	material	Hardness
cutting punches	1.2379	58 + 2 HRC
cutting punches	REX M4	60 +2 HRC
die plates	1.2379	58 + 2 HRC
die plates	REX M4	60 +2 HRC
bending punches	1.2379	56 + 2 HRC
Drawing moulds	1.2382	56 + 2 HRC
Stripper plates	1.2842	54 +2 HRC
Backing plates	1.2842	56 + 2 HRC
Letter punches	1.2436	58 + 2 HRC
Blank holder	GGG 70 L	58 + 4 HRC
		Eht. Min 0,5 mm
Drawing moulds	GGG 70 L	58 + 4 HRC
		Eht. Min 0,5 mm

20. painting

The main tool colour is bright ivory (Hellelfenbein) (RAL 1015). Each tool must be painted twice.

Distance pieces must be painted red (RAL 3000), spring reliefs and areas to store them yellow (RAL 1021)

All untreated surfaces of casted superstructures must be painted, even inside the tool.

21. Desin of weld projections

If projections are required, these must be done according ISO 8167.

The standard are projections group C. If this is not possible because of space restrictions of the part group B can be used after approval by Kirchhoff Kutsch.

Projections for higher Strength requirements

(ISO 8167 : 1989) group C

Deutsche Fassung EN 28167 : 1992

thickness t	Projection diametre d1	
$t \leq 0,5$	2,5	
$0,5 < t \leq 0,63$	3,2	
$0,63 < t \leq 1$	4	
$1 < t \leq 1,6$	5	
$1,6 < t \leq 2,5$	6,3	
$2,5 < t \leq 3$	8	

d11) +0,1/0	a2)	d
2,5	0,63	0,8
3,2	0,8	1
4	1	1,25
5	1,25	1,6
6,3	1,6	2
8	2	2,5
The diametre of the punch d3 must be $\geq d1$) see part 3 height limits of a		

Dimensions:

The diameter limits of the projection diameter d1 is +1mm, the limit of the height is a $\pm 10\%$, with the exemption, that a number of projections is welded simultaneously in one stage where the height of each must not vary more than 5%

Annotation1: The height a is defined by the stroke height

Annotation 2: At different sheet sizes, the projection of the thicker one must be made with the dimensions off the thinner sheet.

Projections for standard use

(ISO 8167 : 1989) group B

German version EN 28167 : 1992

Sheet thickness t	Projection diameter d1	
$t \leq 0,5$	2	
$0,5 < t \leq 0,63$	2,5	
$0,63 < t \leq 1$	3,2	
$1 < t \leq 1,6$	4	
$1,6 < t \leq 2,5$	5	
$2,5 < t \leq 3$	6,3	

D1) +0,1/0	a ²⁾	d
2	0,5	0,63
2,5	0,63	0,8
3,2	0,8	1
4	1	1,25
5	1,25	1,6
6,3	1,6	2

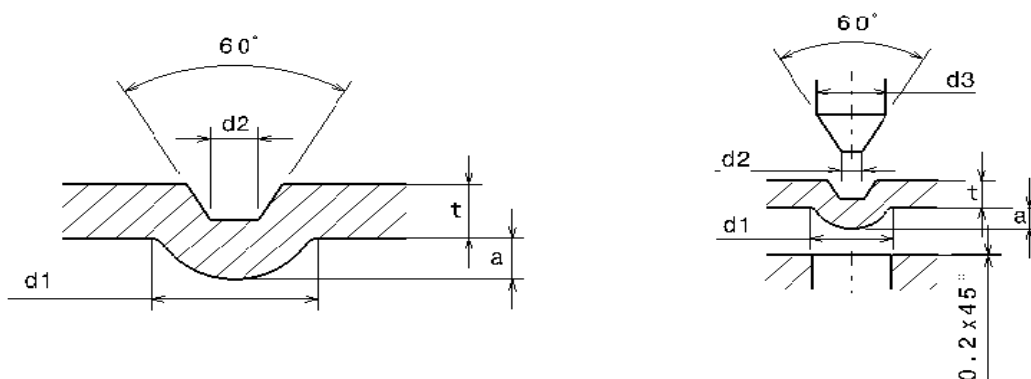
The diameter of the punch d3 must be $\geq d1$
²⁾ see part 3 height limits of a

Dimensions:

The diameter limits of the projection diameter d1 is +1mm, the limit of the height is a $\pm 10\%$, with the exemption, that a number of projections is welded simultaneously in one stage where the height of each must not vary more than 5%

Annotation1: The height a is defined by the stroke height

Annotation 2: At different sheet sizes, the projection of the thicker one must be made with the dimensions off the thinner sheet.



22. Tool transport and weights

Transport elements at top, bottom and tool inserts are included in the order

For mounting and demounting all tool parts heavier than 15 kg must be provided with a thread for ring screws.

Tools for automatic punching machines < 150 t must be equipped with a lifting lug or a lifting screw according to VDI 3366.

It must be observed that a minimum distance of 40 mm to the top or bottom edge of the tool is kept.

Tools for punching machines > 150 t require carrying cheeks according KA-Standard at upper and lower tool part. 8 lifting eye bolts are included in the delivery. (see attachment pages 22.1-2-3-4-5)

Tools for the Sapi Transfer or manually fed machines require forklift pockets at the tool. Possible shapes (see attachment 22.6-7)

Tool weights (see attachment 22.8)

23. Delivery of tools Anlieferung Werkzeuge

Tool deliveries at Kirchhoff Automotive require the supply of a complete punch strip. Transfer tools require the supply of the parts of each step of production plus 50 sample parts, as well as a construction drawing of the delivered tool revision on CD.

Tools returning from rework must again be delivered including a complete punched strip as well as 10 parts. The construction must be updated and made available for Kirchhoff Automotive.

If there are defects off the tools, so that they must be sent back to the manufacturer, Kirchhoff Automotive will organise the transport. The tool manufacturer will organise the re-delivery.

The supplier will carry all transport costs.

24. Gripper systems

Transfertools with active gripping systems require the use of grippers made by DESTACO.

Kurvenklemmgreifer Typ	84A32 – 20100	standard use
Kurvenklemmgreifer Typ	84A32 – 20500	for limited space problems
Kurvenklemmgreifer Typ	84A32 – 20300	opening to both sides

25. Material use of the part

material width tolerances for band strip material::

< 500 mm	-0	+0,5
> 500 mm	-0	+ 2,5

Strip guidance must be designed for these tolerances

Trimming of 2D parts should not produce a scrap-base larger than...

T = material thickness

5	x	T	upto 0,8 mm material thickness
4	x	T	upto 1,2 mm material thickness
2,5	x	T	upto 2,0 mm material thickness
2	x	T	upto 2,6 mm material thickness
1,5	x	T	upto 3,5 mm material thickness

at the thinnest spot..

26. Suppliers of standard parts and components

To enable a simple stock holding of spare parts it is important to purchase these standard parts listed in the attachment ([attachment pages 26.1-.2-.3-.4-.5-.6](#)) exclusively at the named suppliers.

Standard parts of other suppliers must not be used.

27. Warranty terms and conditions

The warranty period is 2 years or at least 100.000 strokes. This is not valid for wear parts.

The responsibility for the tool lies at the supplier. The responsibility for the function includes a trouble-free production process. The min. production-quantities and the parts' dimensions agreed in the tool order must be met.

Spare parts will be produced by Kirchhoff Automotive according to the data of the supplier. It will not be checked, if the supplier data equal the current tool. If it turns out that these data are wrong or incomplete, the resulting costs will be carried by the supplier.

It is incumbent on the supplier to be present at the try out of the tool at Kirchhoff Automotive. If defects or dysfunction of the tool cause damage, resulting charges go to the suppliers account.