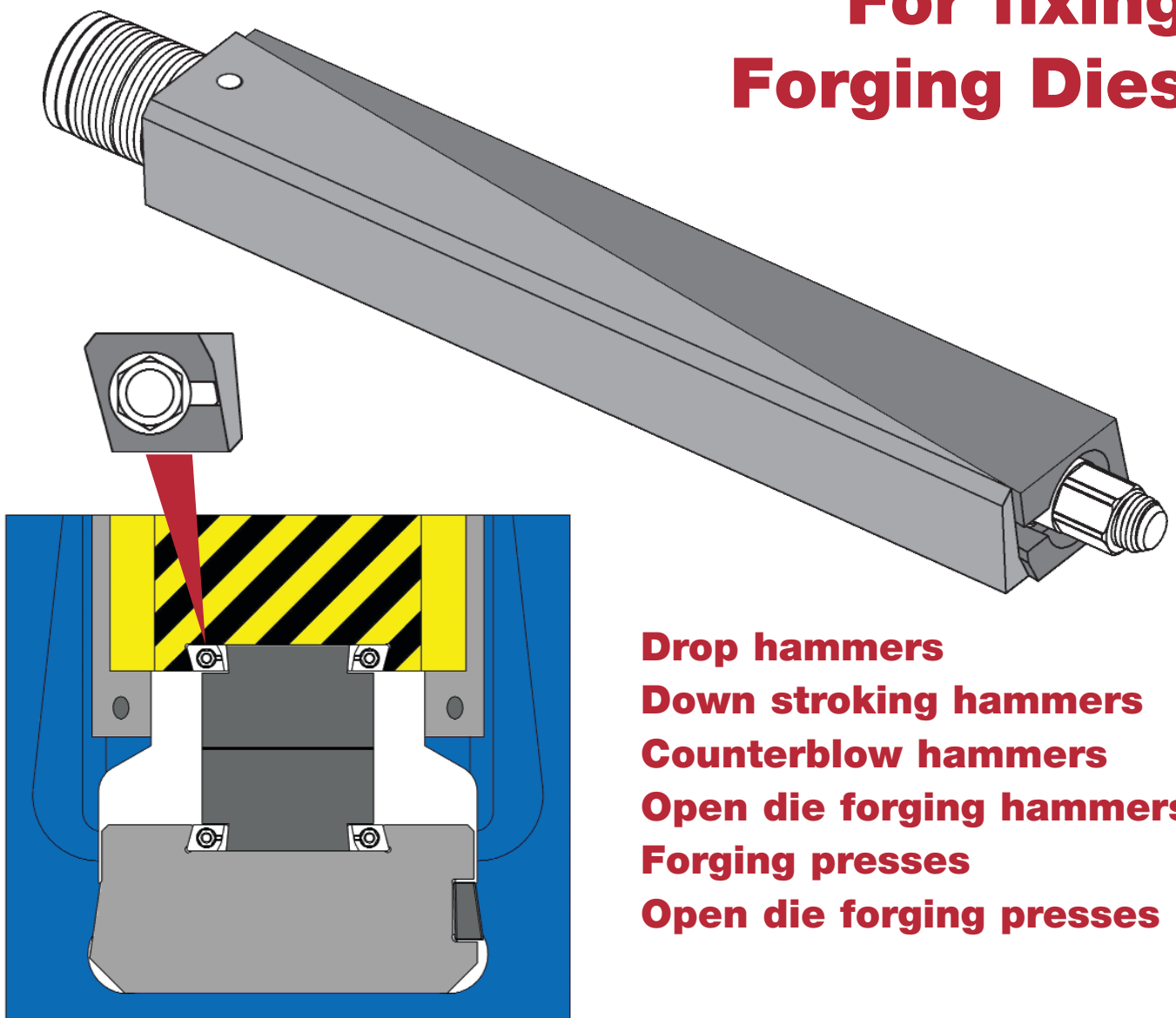


Thorsten Broer

Tensioning Keys System Feuerbacher

For fixing Forging Dies



Drop hammers
Down stroking hammers
Counterblow hammers
Open die forging hammers
Forging presses
Open die forging presses

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List of contents

	Feuerbacher tensioning keys
page 3	History

	Examples of applications
page 4 – 7	Hydraulic Down Stroking Hammer
page 8 + 9	Pneumatic Down Stroking Hammer
page 10 + 11	Screw press
page 12 – 15	Open die forging press
page 16 + 17	Open die forging hammer

	Applications
page 18 + 19	Various applications and possible clamping arrangements

	Versions of Feuerbacher tensioning keys
page 20 + 21	Feuerbacher tensioning key version “SB”, dimensions and weights
page 22 + 23	Feuerbacher tensioning key version “DK” and “D”, dimensions and weights

	Guidance values for Feuerbacher tensioning key sizes and forging die weights
page 24 + 25	For Version “SB” and “DK”

	Copyright
page 26	Trademarks and intellectual property

Feuerbacher tensioning keys – Introduction

The **Feuerbacher** tensioning keys are the result of many years development, working in close co-operation with our customers. The keys incorporate numerous innovative ideas introduced on the basis of experience and

always aimed at achieving optimum long term reliability. As a result we have a world wide base of satisfied Feuerbacher tensioning keys customers.

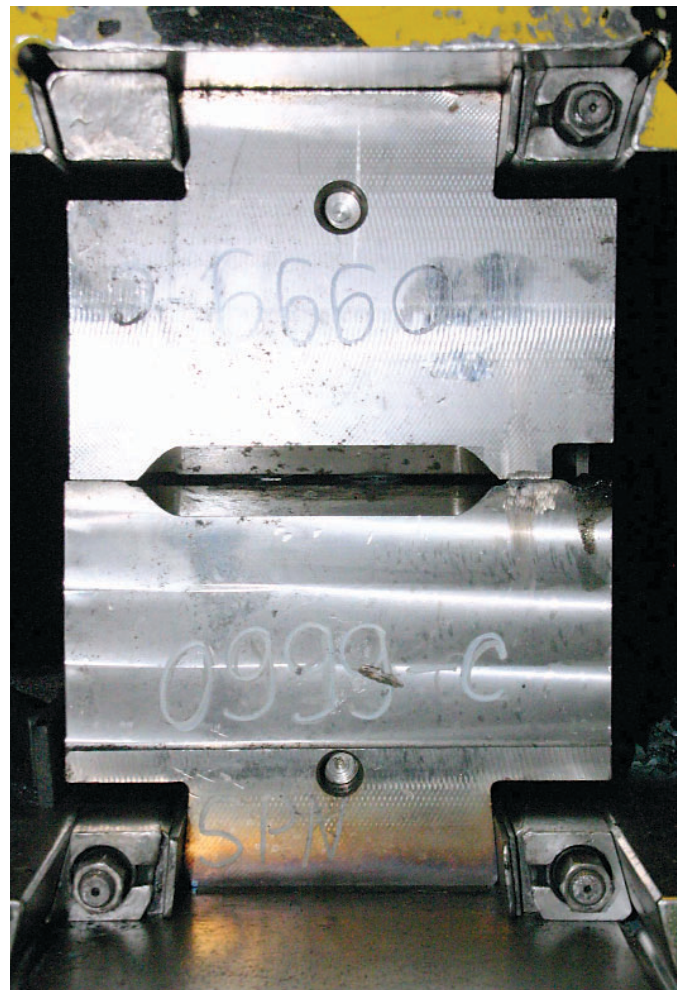


History

The Feuerbacher tensioning keys were initially developed for die clamping on forging hammers in the early 1960s.

Feuerbacher in Heidenheim, Germany obtained a series of patents for various developments of the basic concept. Thorsten Broer acquired the rights for the registered name and for the patents in the 1990s.

Today the full ranges of our Feuerbacher tensioning key types are protected registered designs.



Example: Forging hammer



Hydraulic down stroking hammer

Year of construction 2012

Impact energy 160 kJ

Weight of dies **approx. 2500 kg**

Feuerbacher tensioning key 93.900 SB

Externally mounted cup spring washers

Two halves of the key assembly fully supported

Supporting clamping screw

Thread M30

Angles 5°/15°

Application

The upper die is attached to the tup by a tensioning key. For the lower die 2 tensioning keys are used.

Fitted insert blocks and bushes are available both in the tup and in the slot insert.

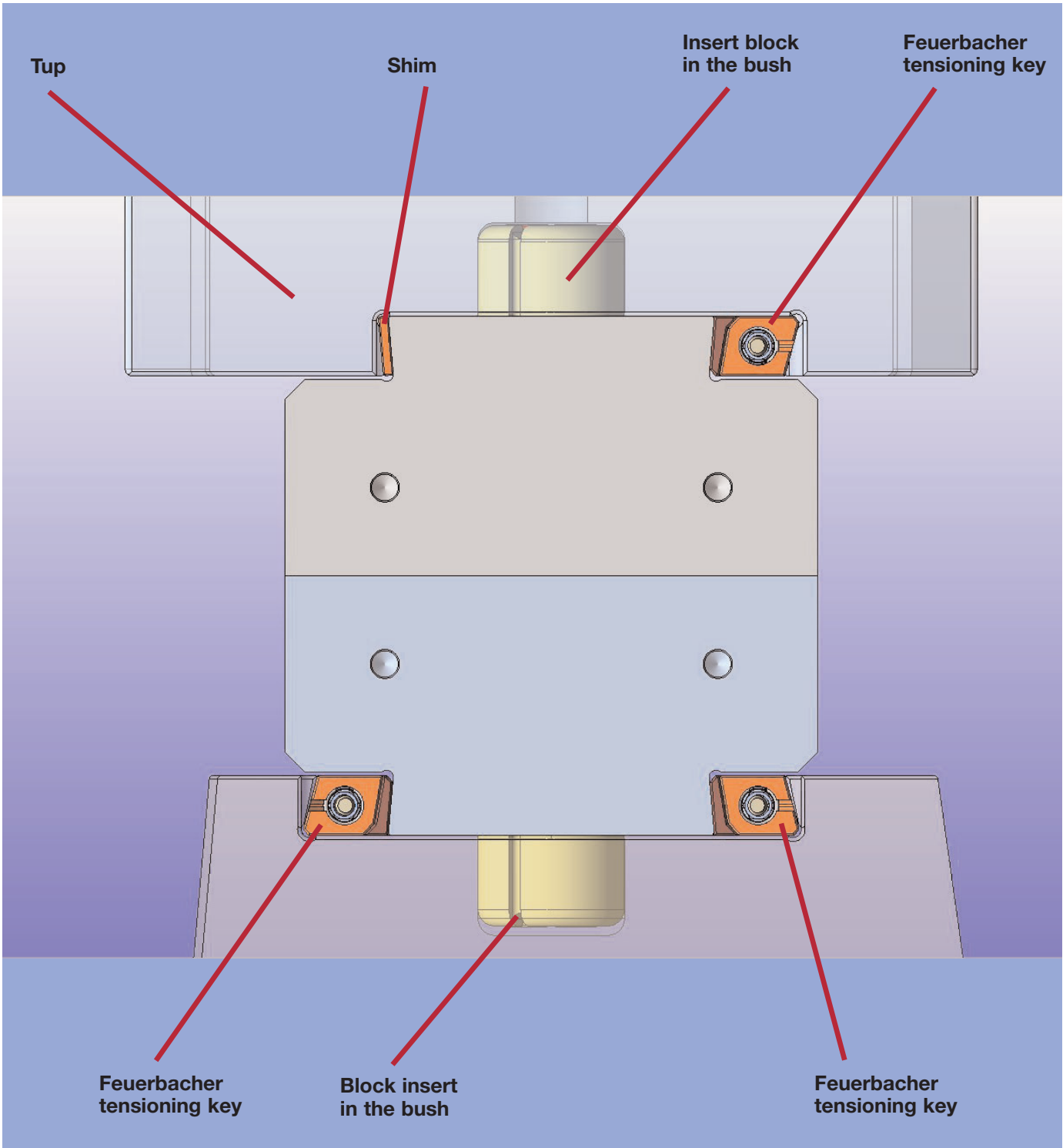
The offset in the front to back direction of the upper die can be adjusted using the tup slot insert.

The offset in the left to right direction is adjusted by means of the lower tensioning keys.

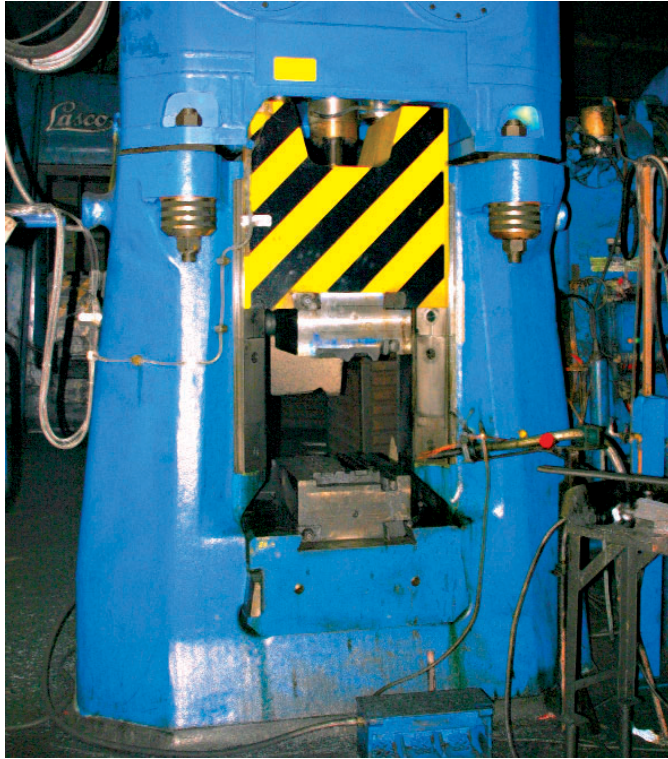
The maximum permissible length of the dies is approximately 1200 mm.



General



Example: Forging hammer



Hydraulic down stroking hammer

Year of construction 2007

Impact energy 25 kJ

Weight of built-in upper die approx. 350 kg

Max. permissible die weight **approx. 1200 kg**

Feuerbacher tensioning key 60.550 SB

Height 60 mm, width 94 mm, length 550 mm

Externally mounted cup spring washers

Fully supported vertical contact face

Supporting clamping screw

Thread M27

Angles 5°/15°

Application

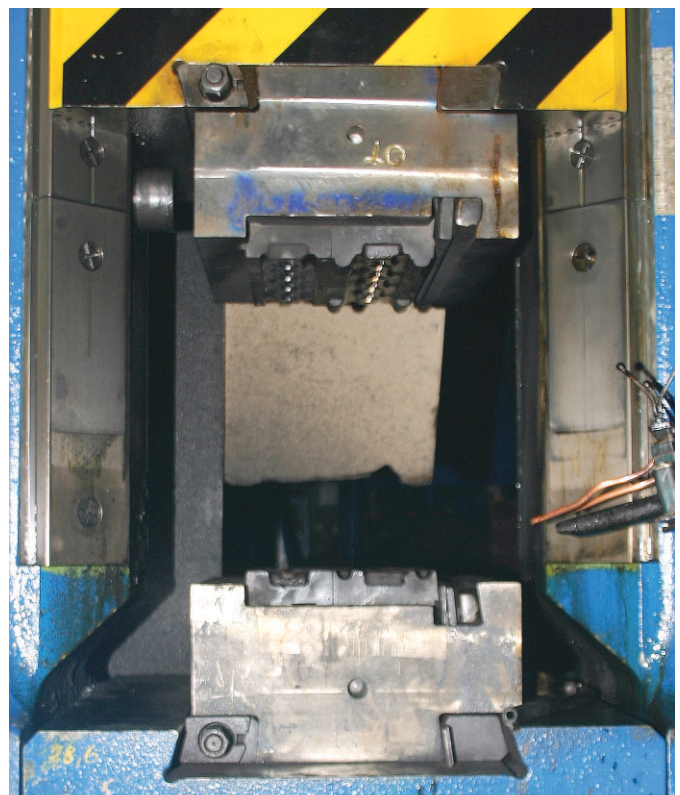
The die holder is used for single and multi-part die inserts.

The parts of the holder are each clamped by means of a **Feuerbacher tensioning key** and a shim. Both keys are provided with a block insert to prevent longitudinal displacement.

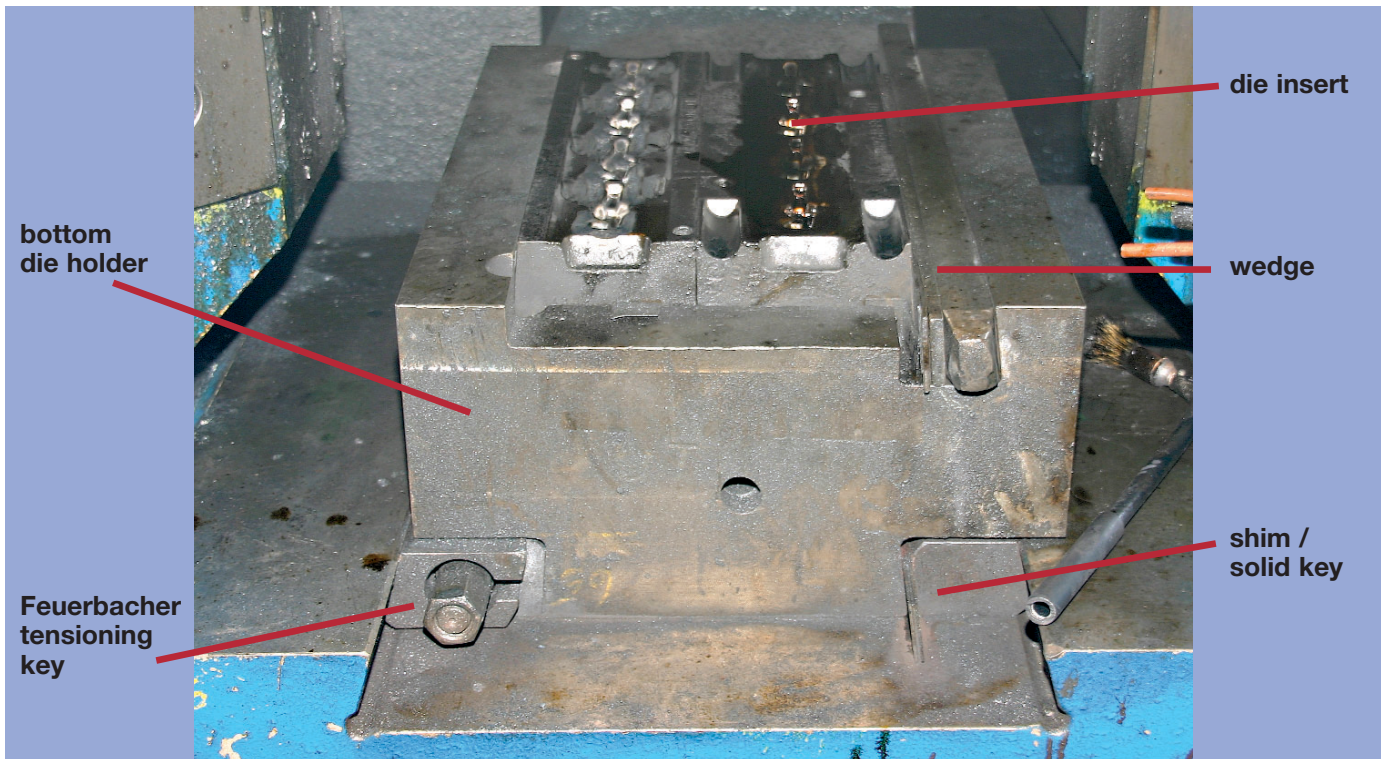
When exchanging the die **only the die inserts must be replaced**. The base holders remain in the hammer.

The offset in the die can be adjusted by using thin metal shims.

In this case the inserts themselves are clamped using conventional **wedges**.



Detail – bottom die

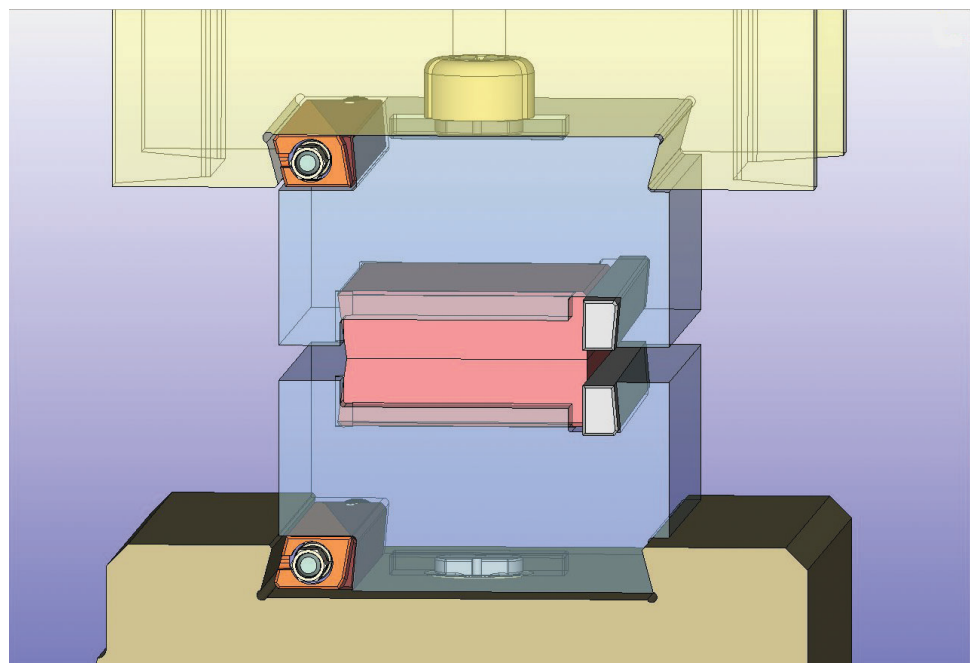


Alternative arrangements

As an alternative to using a shim, the holder can also, on one side, be **clamped directly against the ram** or the anvil bed.

The advantage of this possibility is the **greater contact area** of the impact faces.

Thereby the tendency for tilting is reduced considerably.



Example: Pneumatic down stroking hammer



Pneumatic down stroking hammer

Year of construction 1979

Impact energy 63 kJ

Weight of die **approx. 1650 kg**

Fixing for die holder:

Feuerbacher tensioning key 60.500 SB

Externally mounted cup springs

Fully supporting vertical contact face

Supporting clamping screw

Thread M27

Angles 5°/15°

Fixing for die inserts:

Feuerbacher tensioning key 55.500 SB

Thread M22

Angles 0°/15°

Details of application

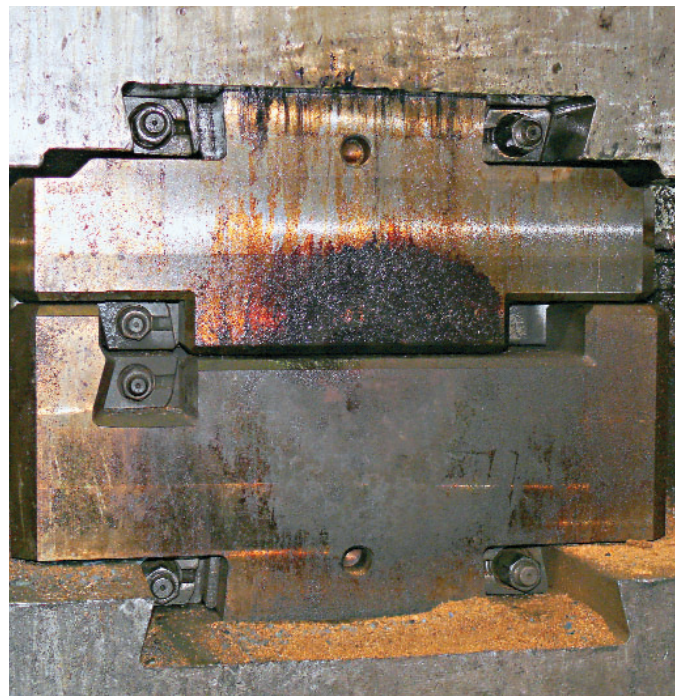
Insert holder for forging with one piece die insert (max. size 340 x 500 mm).

The parts of the holder are clamped by means of two **Feuerbacher tensioning keys**. Both keys are provided with a block insert to prevent longitudinal displacement.

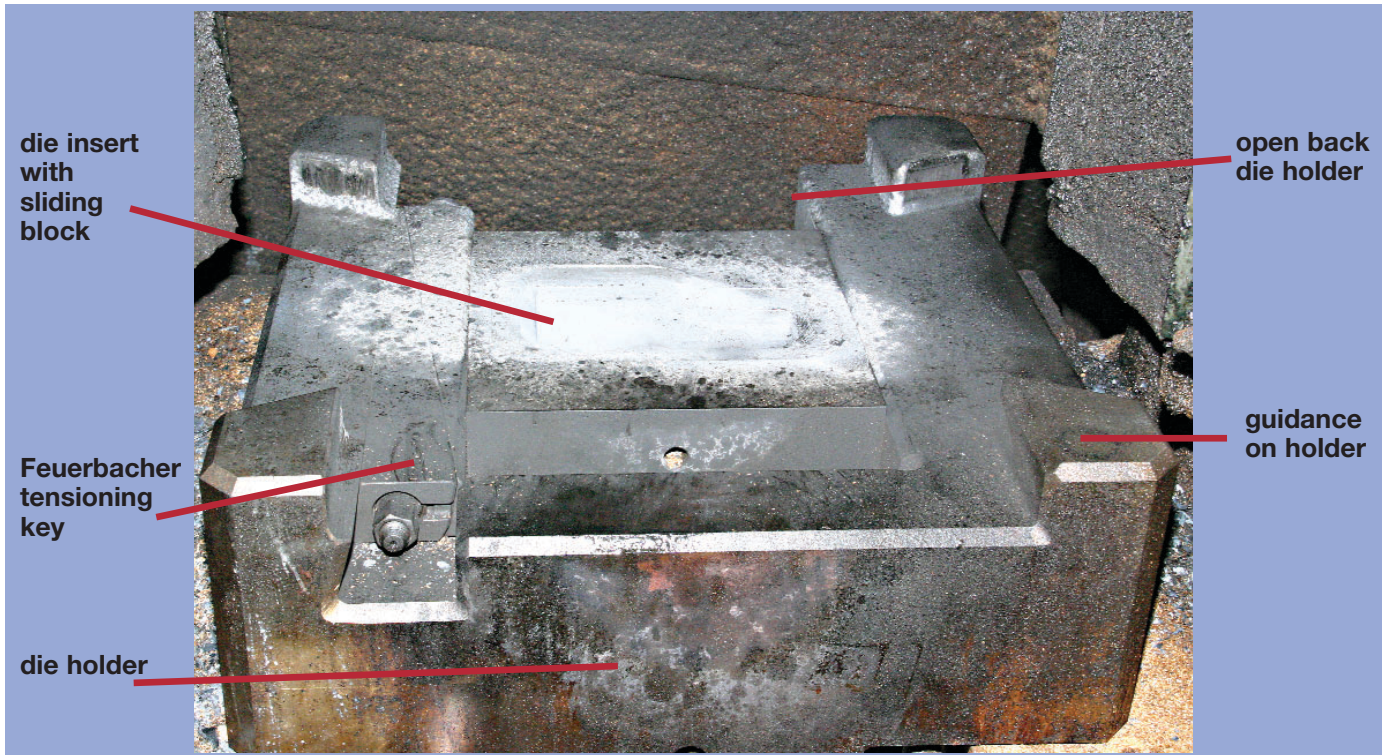
The inserts are fixed by means of two Feuerbacher tensioning keys.

When exchanging the die **only the die inserts need to be replaced**. The base holders remain in the hammer.

The offset in the die can be adjusted by using thin metal shims.



General

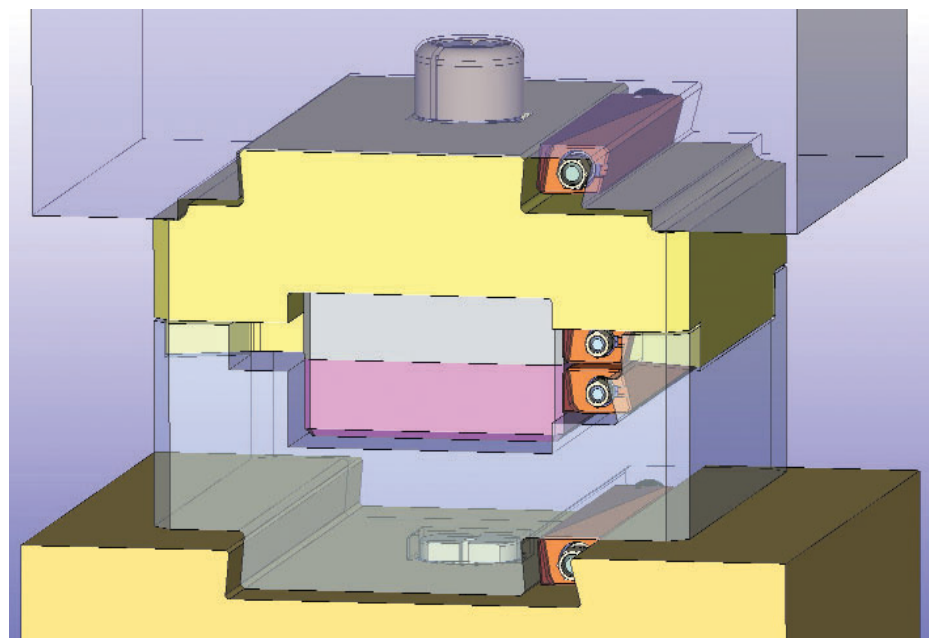


Alternative arrangement

As an alternative to the use of a second key, on one side die holders of modified design can be located directly against the recess on one side of the tup and anvil.

This resists any forces that would attempt to cause tilting.

The die insert can be designed to be accurately located in the die holder so that sliding blocks for adjustment in this area are not required.



Example: Screw press



Screw press

Year of construction 2007

Rated press force 8 MN

Hard on hard blow force 18 MN

Gross energy 90kJ

Feuerbacher tensioning key 55.500 SB

Height 55 mm, width 93 mm, length 500 mm

Externally mounted cup spring washers

Fully supported vertical contact face

Supporting clamping screw

Thread M22

Angles 5°/15°

Details of application

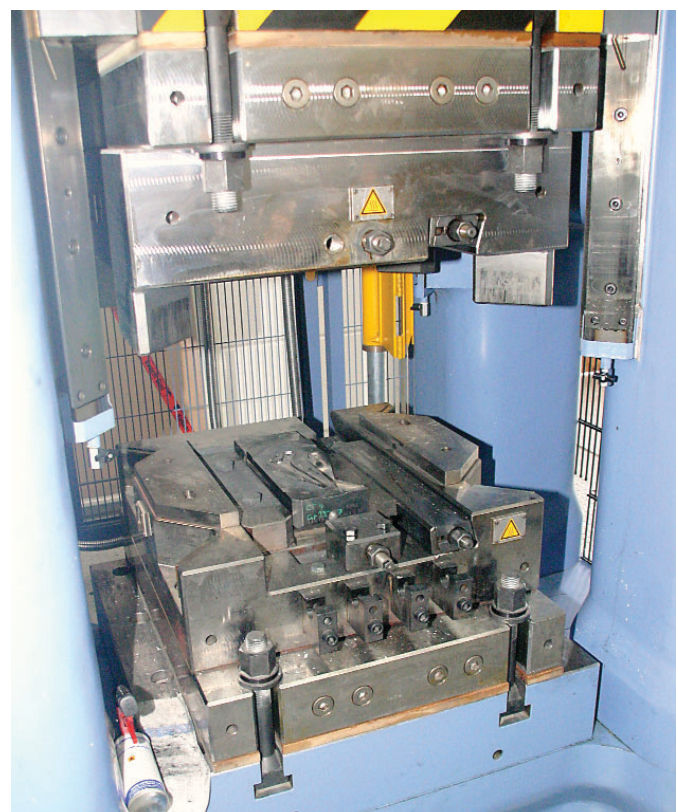
The holder is designed for use with a single piece die insert (max width 400 mm, length 500 mm, height 60 mm).

The upper and lower die holders are fixed to the press ram and press bed using fixing bolts. The holder is fitted with a heating system, a guide arrangement and additional impact faces.

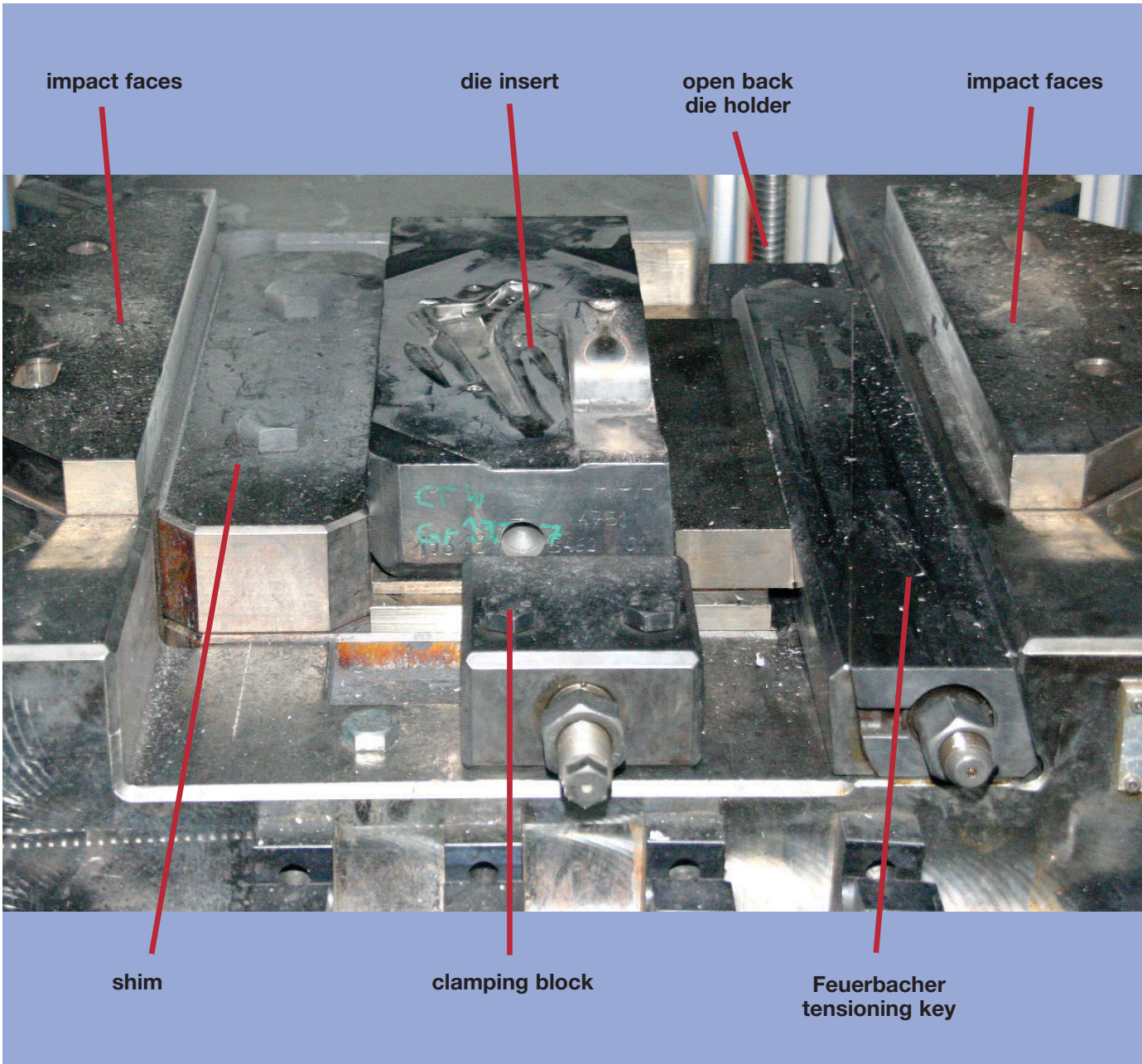
The die inserts are clamped to the die holders at the top and at the bottom using, in each case, one Feuerbacher tensioning key. For changeovers **only the inserts are replaced**. The die holders remain in the press.

Any offset of the dies can be corrected using shims at the clamping faces of the inserts.

Systems of this kind have been provided for presses with force ratings up to 6000 tons.



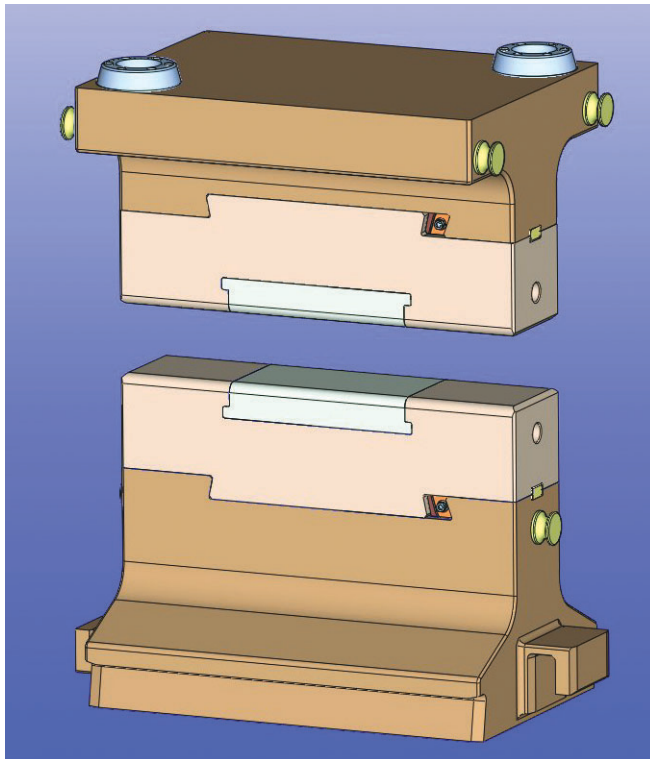
Example – A special set up



Mechanical and hydraulic presses

Feuerbacher tensioning keys can also be used in conjunction with holders of similar design used on mechanical or hydraulic presses.

Open die forging press



Open die forging press

Year of construction 2007

Nominal pressing force 50 MN

Feuerbacher tensioning key 99.550 FF

Height 99 mm, width 115 mm, length 550 mm

Cup spring package inside

Fully supported vertical contact face

Thread W1"

Angles 12°/20°

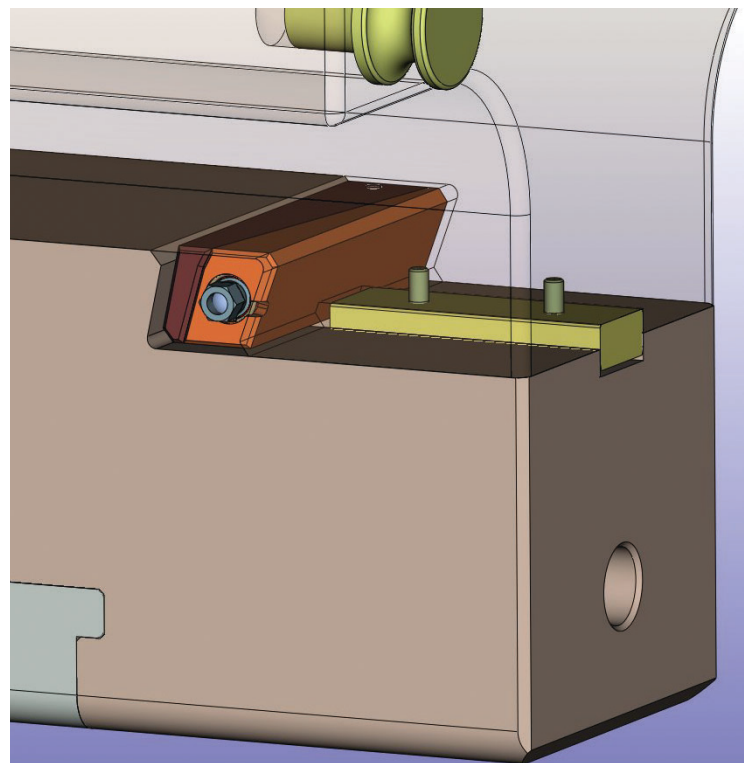
Details of application

For fixing die carriers ranging in depths from **450 to 800 mm**.

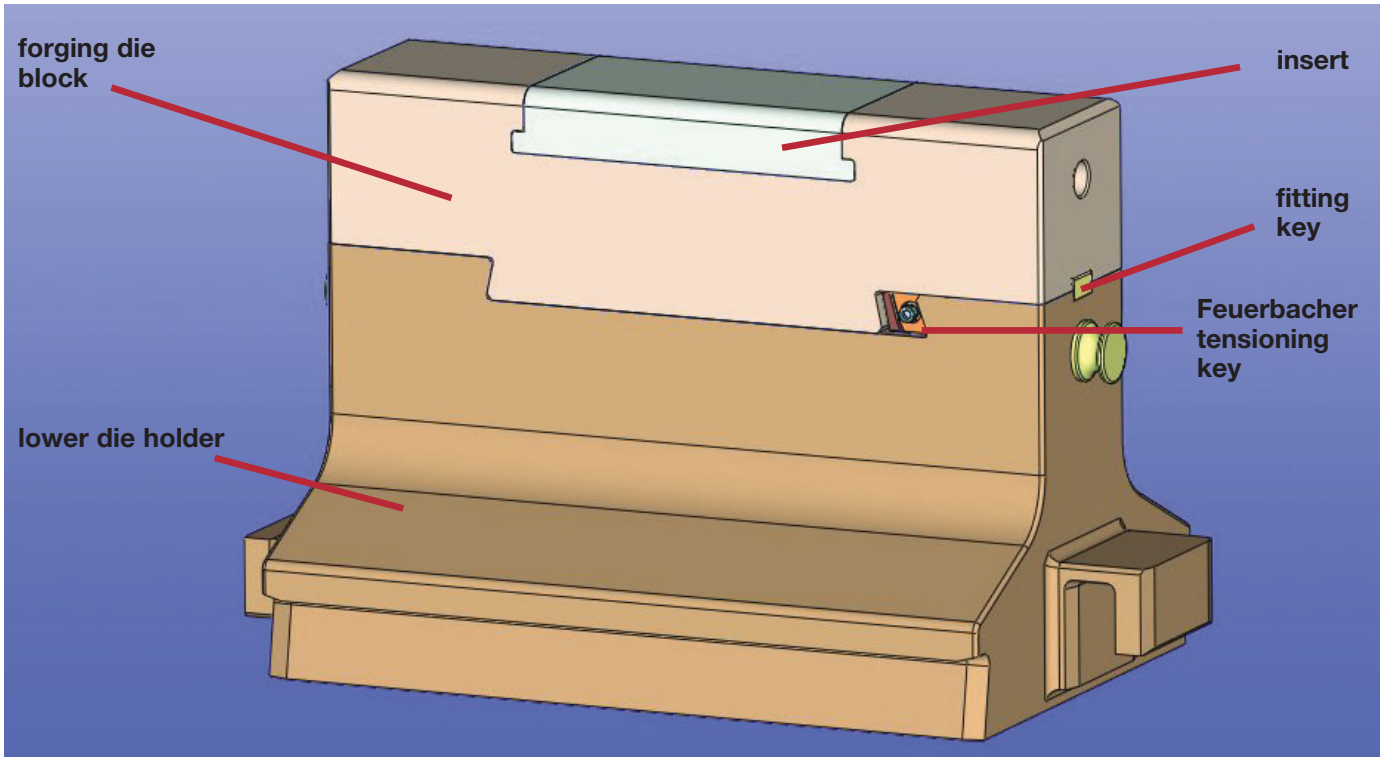
Weight of the dies depending on depth of die blocks **approx. 2.500 kg – 4.000 kg**.

In the event of one sided wear the carriers can be turned round through 180°.

The tensioning keys are completely covered by the die.



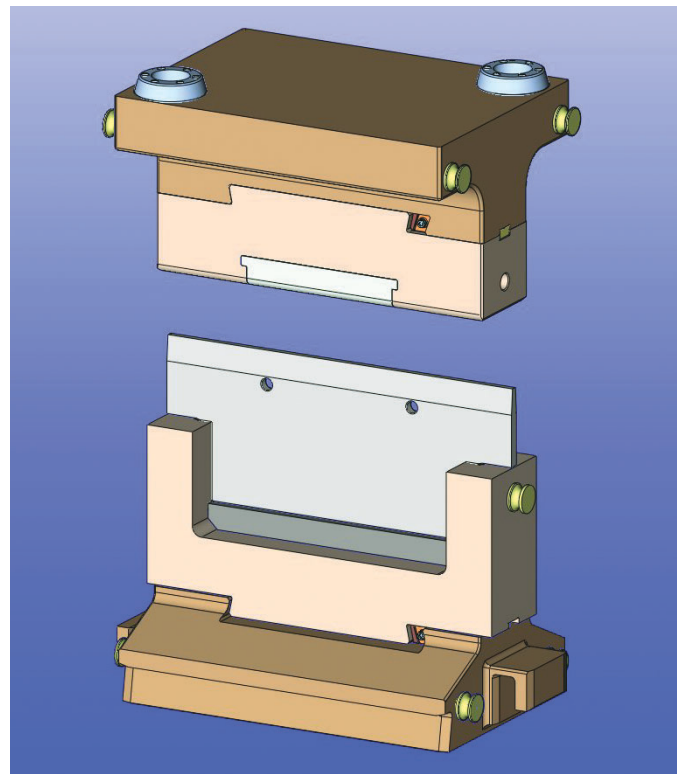
General



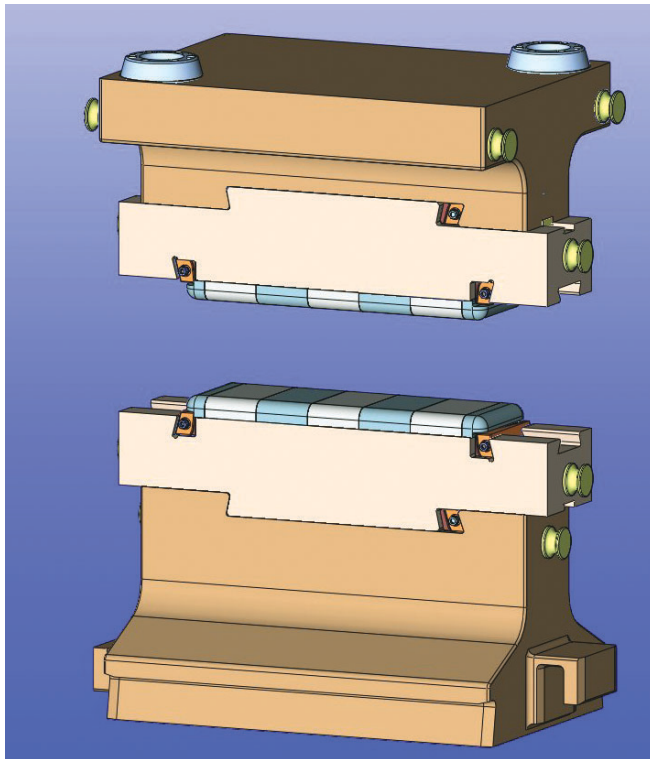
Alternative arrangement

Die set for cutting a massive steel slab.

The die set can be installed on any die holder by means of a Feuerbacher tensioning key.



Die holder with replaceable segments



Die holder with replaceable segments

Feuerbacher tensioning key 100.400 FF

Height 100mm, width 110mm, length 400mm

Cup spring package inside

Self-locking surface

Thread W1"

Angles 15°/0°

Details of application

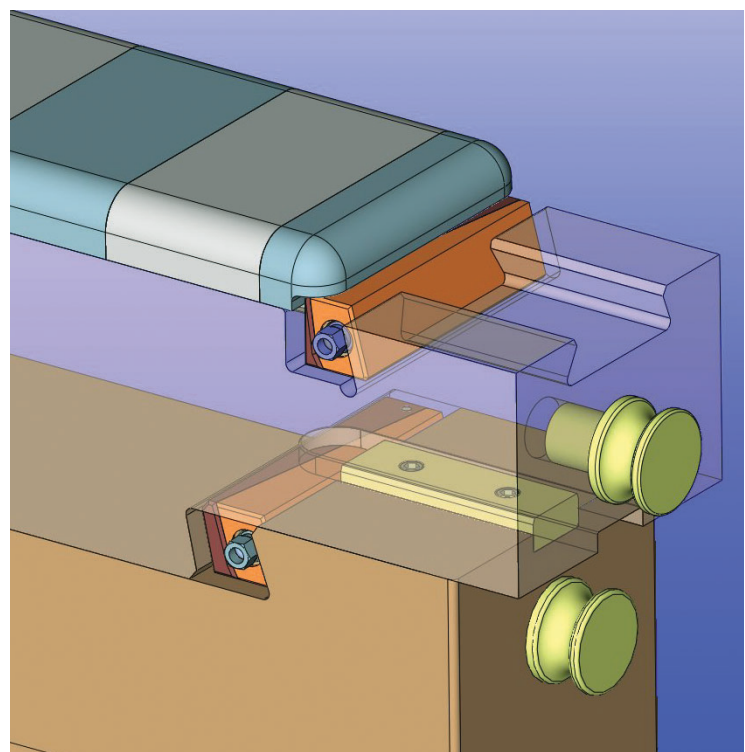
Field of application is the forging of **high-tensile material**.

Extensive welding of the complete die surface or shrinking of the holder inserts is not necessary.

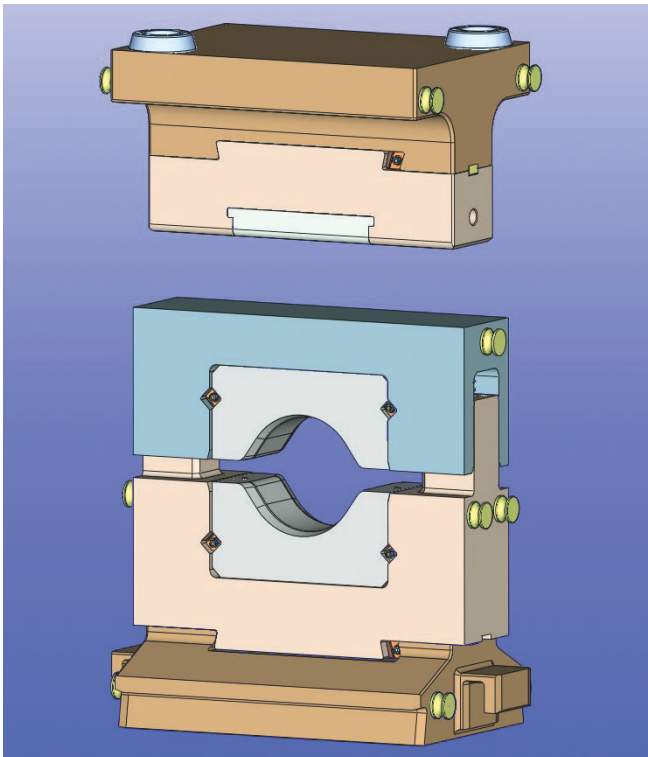
Depending on the degree of abrasion, it is possible to move a single segment to a different position or to replace it.

The segments will be inserted from the side and fixed with two Feuerbacher tensioning key.

The segment carrier can be installed on any segment holder.



Dies for round tools



Dies for round tools

Feuerbacher tensioning key 80.400

Height 80 mm, width 78 mm, length 400 mm

Cup spring package inside

Concave/convex contact face of key halves

Thread W1"

Angles 0°/0°

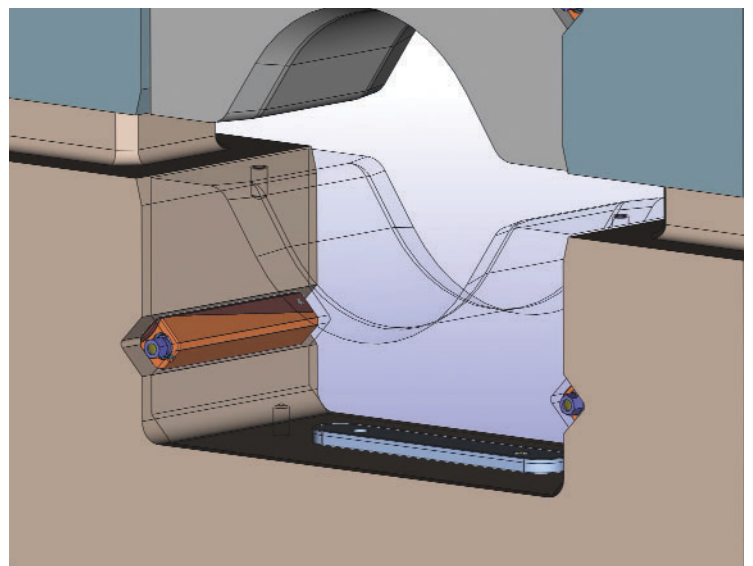
Details of application

Form and friction locking of the dies with Feuerbacher tensioning keys.

Weight of the dies
approx. 1.250 kg – 1.500 kg.

The die segments are installed from the top and fixed with two Feuerbacher tensioning keys each.

The holder for round tools can be installed on any die holder.



Example: Open die forging hammer



Open die forging hammer

Year of construction 1979

Weight of tup 3000 kg

Weight of dies approx. 1650 kg

Feuerbacher tensioning key 78.430 SB

Height 78 mm, width 93 mm, length 430 mm

Externally mounted cup spring washers

Form fit vertical contact face

Supporting clamping screw

Thread M27

Angles 5°/20°

Details of application

Die insert holder for forging on an open die forging hammer.

The die holder is clamped on the anvil bed using a Feuerbacher tensioning key.

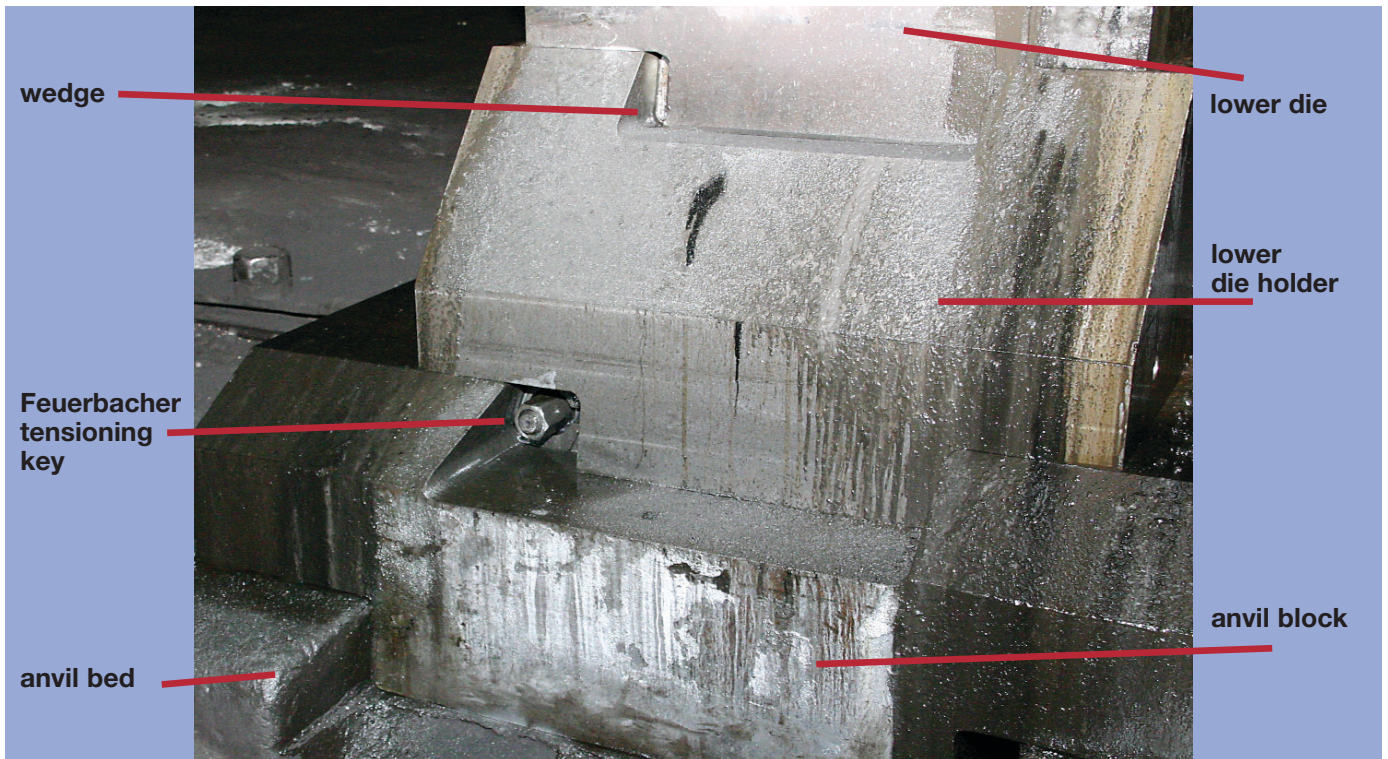
The die inserts are clamped into the die holder using wedges.

For changeovers the arrangement allows rapid replacement of the die insert or of the complete die holder.

To counter-act the tendency for the die to tilt the angles of the clamping key are in this case **20° on the die side and 5° on the die holder side.**



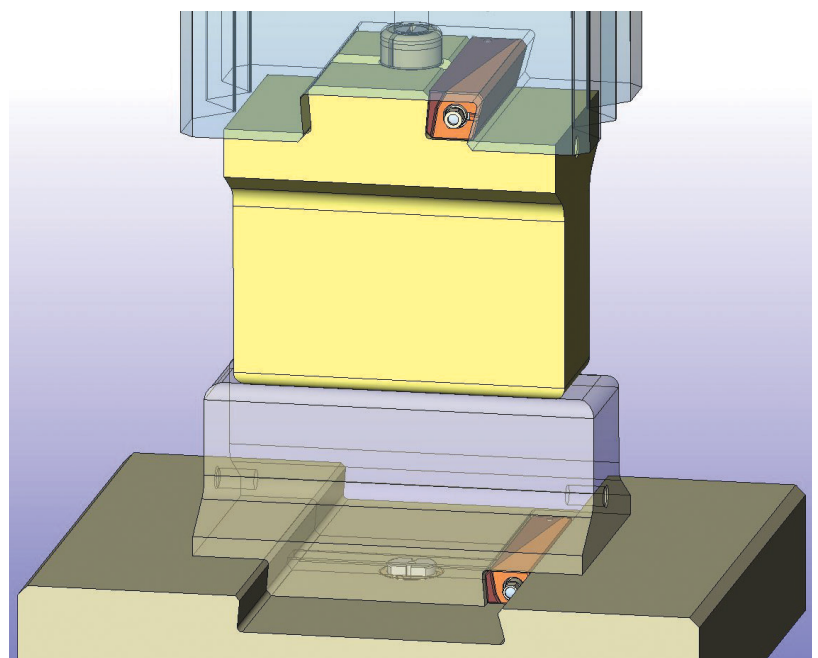
Detail of clamping configuration



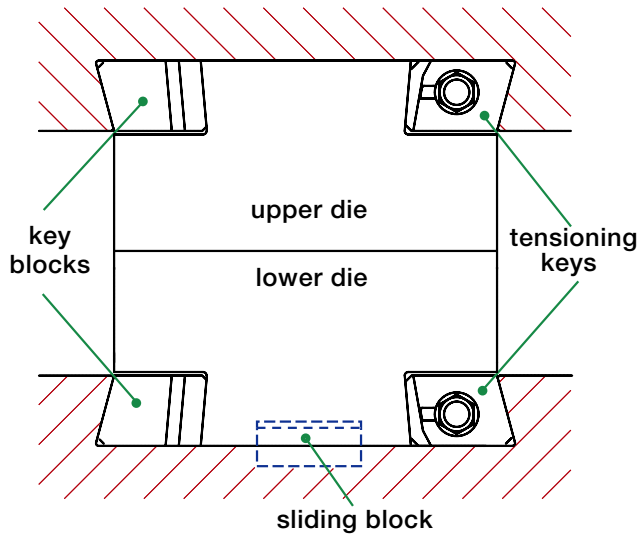
Alternative arrangement

As an alternative to using a wedge system for clamping the upper die holder a Feuerbacher tensioning key could be used.

To prevent collision between the Feuerbacher tensioning key and the bridge structure of the hammer the length of the Feuerbacher tensioning key used must **be such that it does not protrude beyond the side faces of the die holder.**



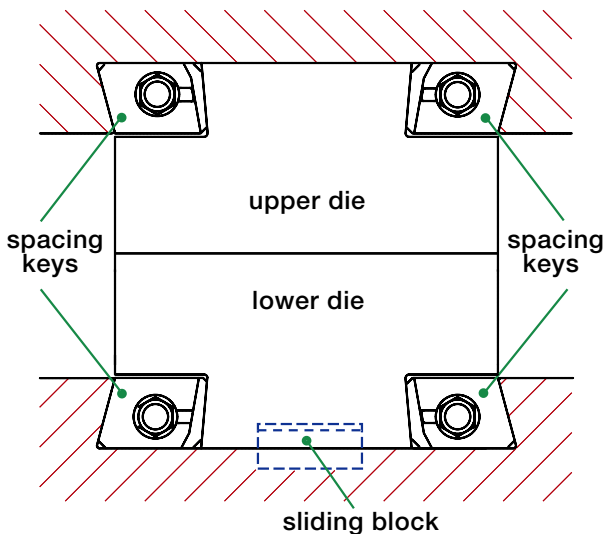
Possible clamping arrangements



Feuerbacher tensioning keys on one side

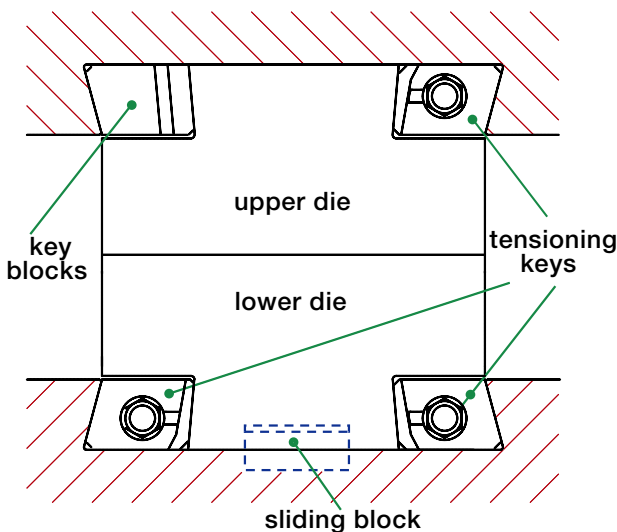
To correct positioning in the left to right direction additional spacing shims must be provided for either the upper or the lower die. The arrangement is suitable for anvils and rams of varying widths without dovetail configuration.

To compensate for differences in die width shims of different thicknesses are employed.



Arrangement with 2 Feuerbacher tensioning keys at the top and 2 at the bottom

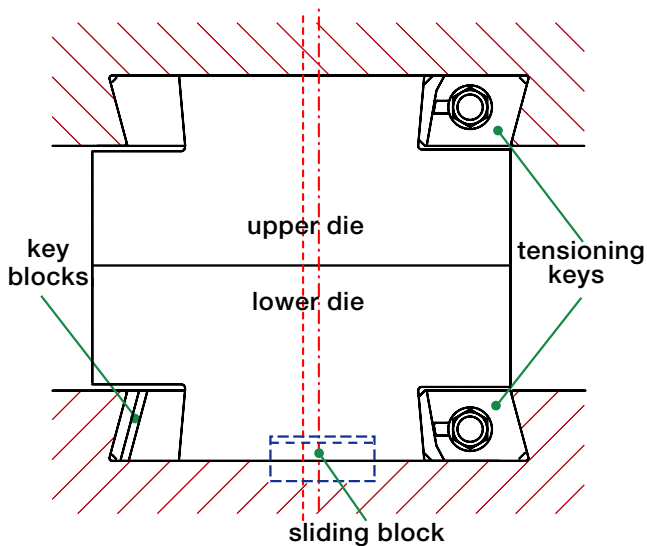
Either the upper or lower Feuerbacher tensioning keys can be used to correct for lateral offset



One Feuerbacher tensioning key at the top and two Feuerbacher tensioning keys at the bottom

This clamping system may be considered as the standard arrangement for hammer dies. The upper die is clamped using a clamping key on the one side and a parallel shim on the other. The bottom die is located by a sliding block and is then aligned in the length direction making use of the two Feuerbacher tensioning keys.

Applications

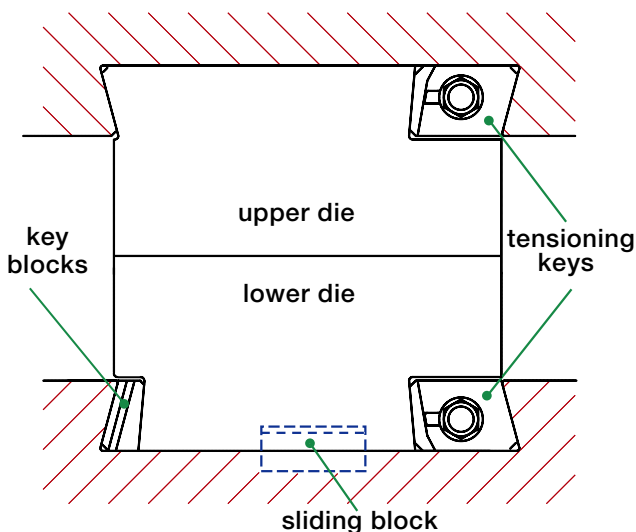


Arrangement with Feuerbacher tensioning keys on one side, with lateral offset of die insert

The die insert is set up off centre relative to the die space.

The position of the die cavity is such that it will then be central in the machine.

The shims may have to be narrower than the Feuerbacher tensioning keys.

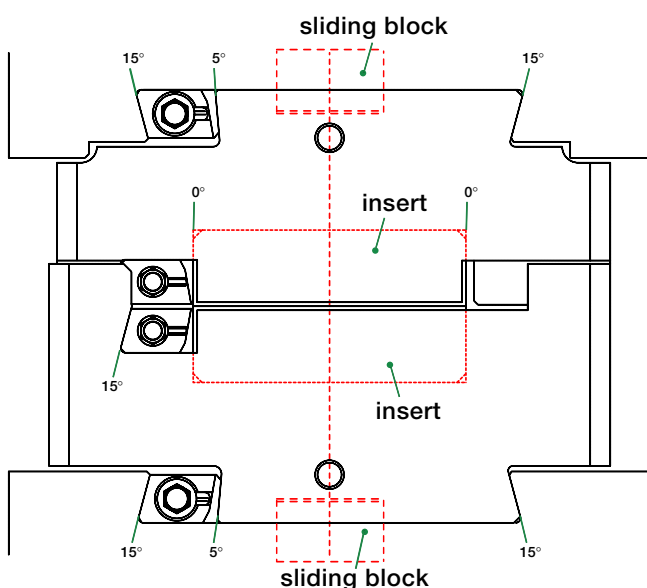


One sided clamping with direct location on the other side

The upper die is located on one side in the top dovetail.

To align the lower die spacing shims are employed on one side.

The shims are selected to correct for lateral offset.



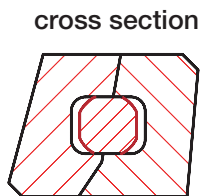
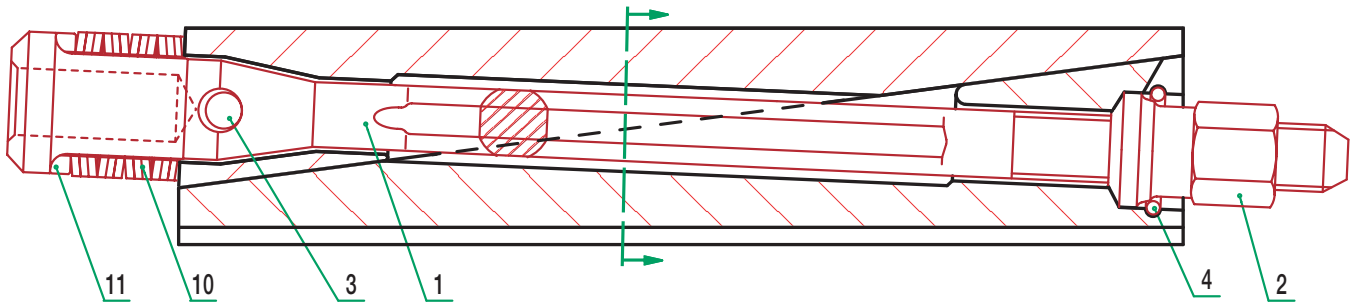
Die holder design

Die holder for forging using a one piece die insert.

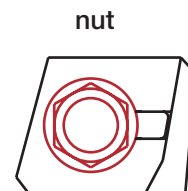
The parts of the die holder are in each case clamped with a Feuerbacher tensioning key. Sliding blocks are provided for both the upper and lower holder for alignment in the length direction.

Each of the 2 inserts are fixed using Feuerbacher tensioning keys. For changeovers only the die inserts have to be exchanged.

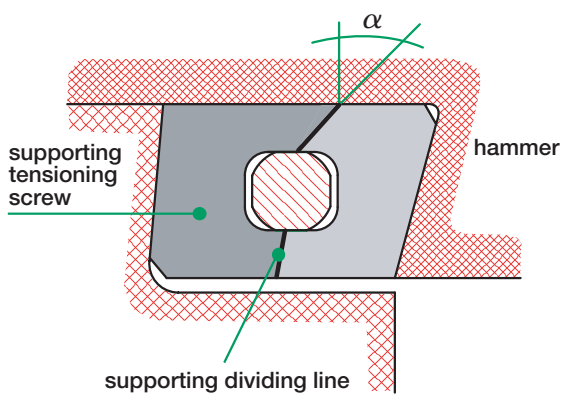
Feuerbacher tensioning key version "SB"



- 1 = tensioning screw
- 2 = nut
- 3 = taper pin
- 4 = retaining ring
- 10 = cup springs
- 11 = spacing ring



Field of application

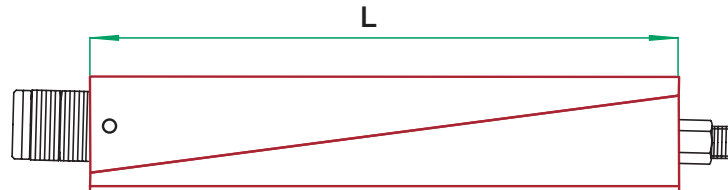


The Feuerbacher tensioning keys version "SB" have a fully supporting contact face and a supporting clamping screw providing a significantly improved clamping effect.

The angle alpha is significantly greater than the two external angles and as a result the two key halves will be securely held on the same level under load.

The Feuerbacher tensioning keys of the "SB" type are particularly suitable for use on modern forging hammers.

Dimensions and weights

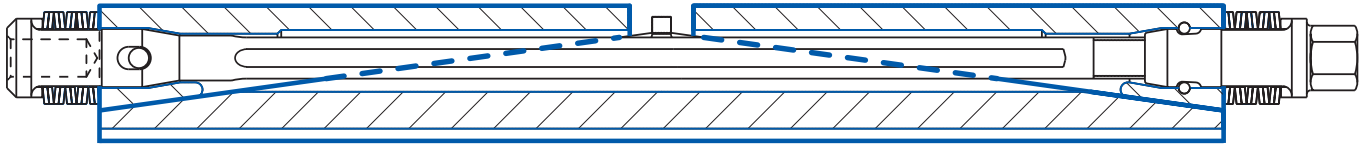


Maximum Forging Energy kJ	Tensioning key Dimension mm			Tensioning key Version "SB" type number	Max. die length mm	Thread size	Tightening torque Nm	Tensioning key weight approx. kg
	h Height	b Width	L Length					
32	50	64	300	50.300 SB	- 420	M20	360-380	7
32	50	72	400	50.400 SB	- 520	M20	360-380	11
40	55	72	400	55.400 SB	- 520	M22	450-480	12
40	55	93	500	55.500 SB	- 650	M24	530-560	18
80	60	93	500	60.500 SB	- 700	M27	570-600	20
100	60	95	600	60.600 SB	- 800	M27	570-600	25
100	60	96	700	60.700 SB	- 900	M27	570-600	30
130	70	96	500	70.500 SB	- 700	M27	570-600	24
130	70	100	550	70.550 SB	- 750	M27	570-600	30
130	70	104	600	70.600 SB	- 800	M27	570-600	34
130	70	112	700	70.700 SB	- 900	M27	570-600	37
130	70	120	800	70.800 SB	- 1000	M27	570-600	52
>160	80	112	700	80.700 SB	- 900	M30	600	39
>160	80	122	800	80.800 SB	- 1000	M30	600	60
>160	90	128	700	90.700 SB	- 1000	M30	600	60
>160	90	128	800	90.800 SB	- 1100	M30	600	67
>160	90	128	900	90.900 SB	- 1200	M30	600	80
>300	100	150	1000	100.1000 SB	- 1400	M36	600	100
>400	100	160	1200	100.1200 SB	- 1600	M36	600	140
>400	100	180	1400	100.1400 SB	- 1800	M36	600	170

Feuerbacher tensioning keys are also available in other sizes. Please contact us for further information.

Information on other versions of clamping keys and possible installation configurations can be found together with full technical documentation on our website www.th-broer.de.

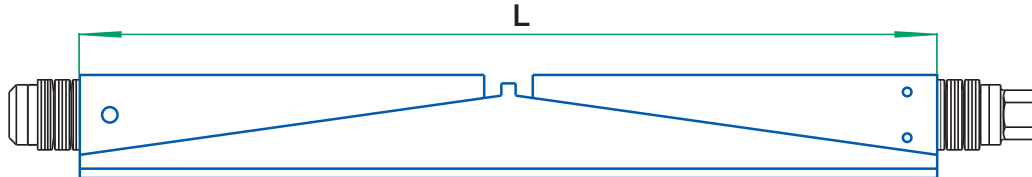
Feuerbacher tensioning key version "DK"



The Feuerbacher tensioning keys in the "DK" range feature a continuous contact face, and an end-to-end supporting clamping screw resulting in a significantly improved clamping effect. The 3 component clamping wedge is made up of 2 counter-acting clamping halves each with its associated external cup washer set.

3 component Feuerbacher tensioning keys in the "DK" range more than 600 mm long are narrower than the 2 component Feuerbacher tensioning key from the "SB" range of similar length. These Feuerbacher tensioning keys are available from 600 up to 1300 or more mm long. The keys are particularly suitable for applications on forging hammers.

Dimensions and weights

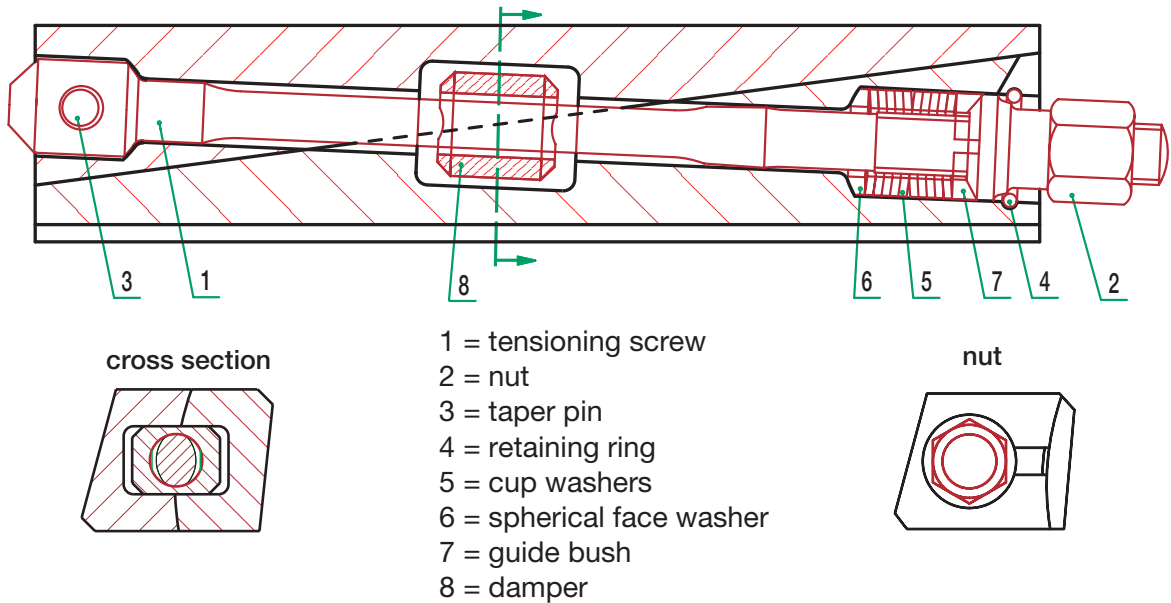


Maximum Forging Energy kJ	Tensioning key Dimension mm			Tensioning key Version "DK" type number	Max. die length mm	Thread size	Tightening torque Nm	Tensioning key weight approx. kg
	h Height	b Width	L Length					
100	60	72	600	60.600 DK	- 1000	M22	360	20
>160	70	88	800	70.800 DK	- 1200	M27	560	38
>160	80	104	1000	80.1000 DK	- 1500	M30	800	65
>160	90	128	1300	90.1300 DK	- 2000	M33	1170	117

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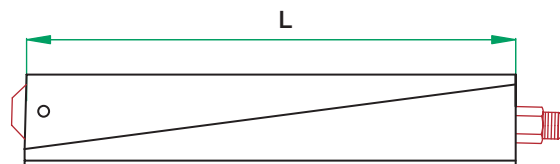
Feuerbacher tensioning key version "D"



On the Feuerbacher tensioning keys "D" the tendency for vertical offsetting of the Feuerbacher tensioning key halves is taken up by a damping block. This is particularly valuable when clamping upper dies.

The arrangement for accommodating the cup washer pack internally makes this Feuerbacher tensioning key type particularly suitable for use on presses.

Dimensions and weights

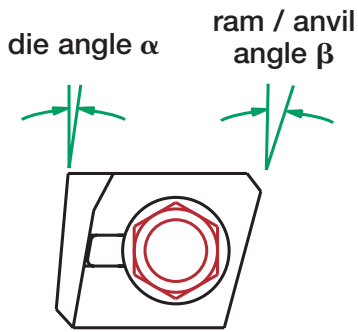


Maximum Forging Energy kJ*	Tensioning key Dimension mm			Tensioning key Version "D" type number	Max. die length mm	Thread size	Tightening torque Nm	Tensioning key weight approx. kg
	h Height	b Width	L Length**					
32	50	64	300	50.300 D	- 420	M18	270	7
40	55	72	360	55.360 D	- 500	M20	360	11
80	60	93	500	60.500 D	- 700	W1"	600	21
100	60	100	550	60.550 D	- 800	W1"	600	25
100	70	96	500	70.500 D	- 700	W1"	600	25
130	70	103	550	70.550 D	- 800	W1"	600	30
160	90	122	500	90.500 D	- 700	M30	600	41
160	90	128	550	90.550 D	- 800	M30	600	47

* suitable for presses up to 6000 tons

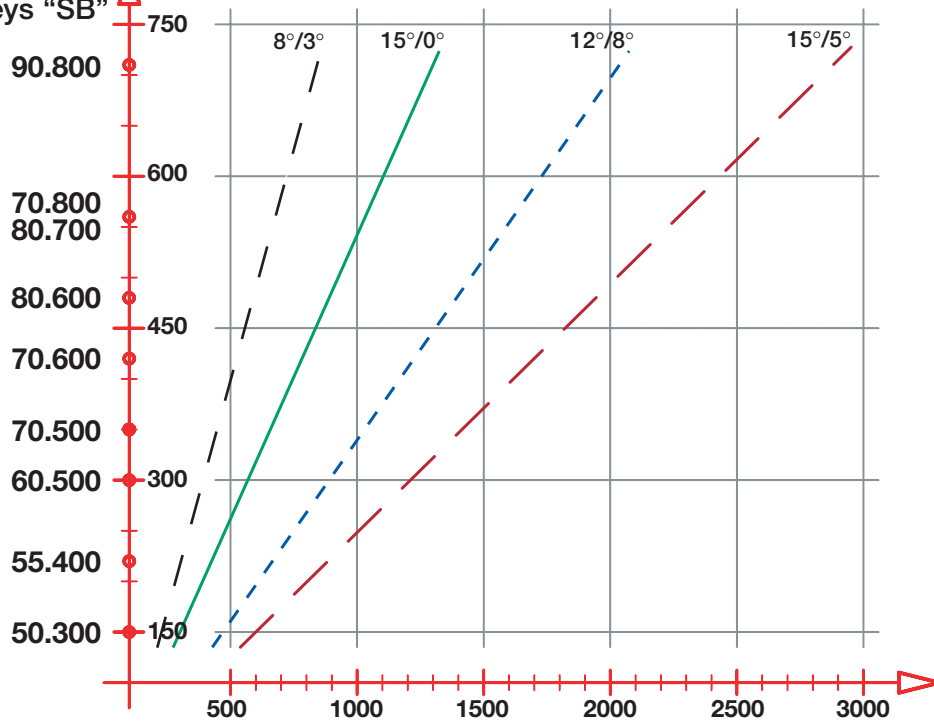
** also greater lengths up to 800 mm

Guidance values for Feuerbacher tensioning key sizes and forging die weights applicable to Feuerbacher tensioning key range "SB"



line code	die angle α	ram / anvil angle β	clamping force kg per cm ²
--- --- ---	3°	8°	ca. 1,2 kg
—————	0°	15°	ca. 1,8 kg
- - - - -	8°	12°	ca. 2,8 kg
- . - . -	5°	15°	ca. 4,0 kg

size of Feuerbacher tensioning keys "SB" Δ clamping surface cm²



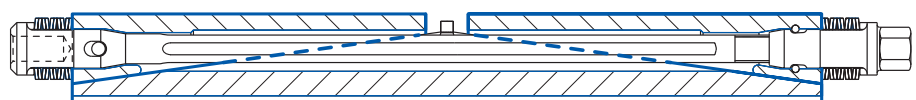
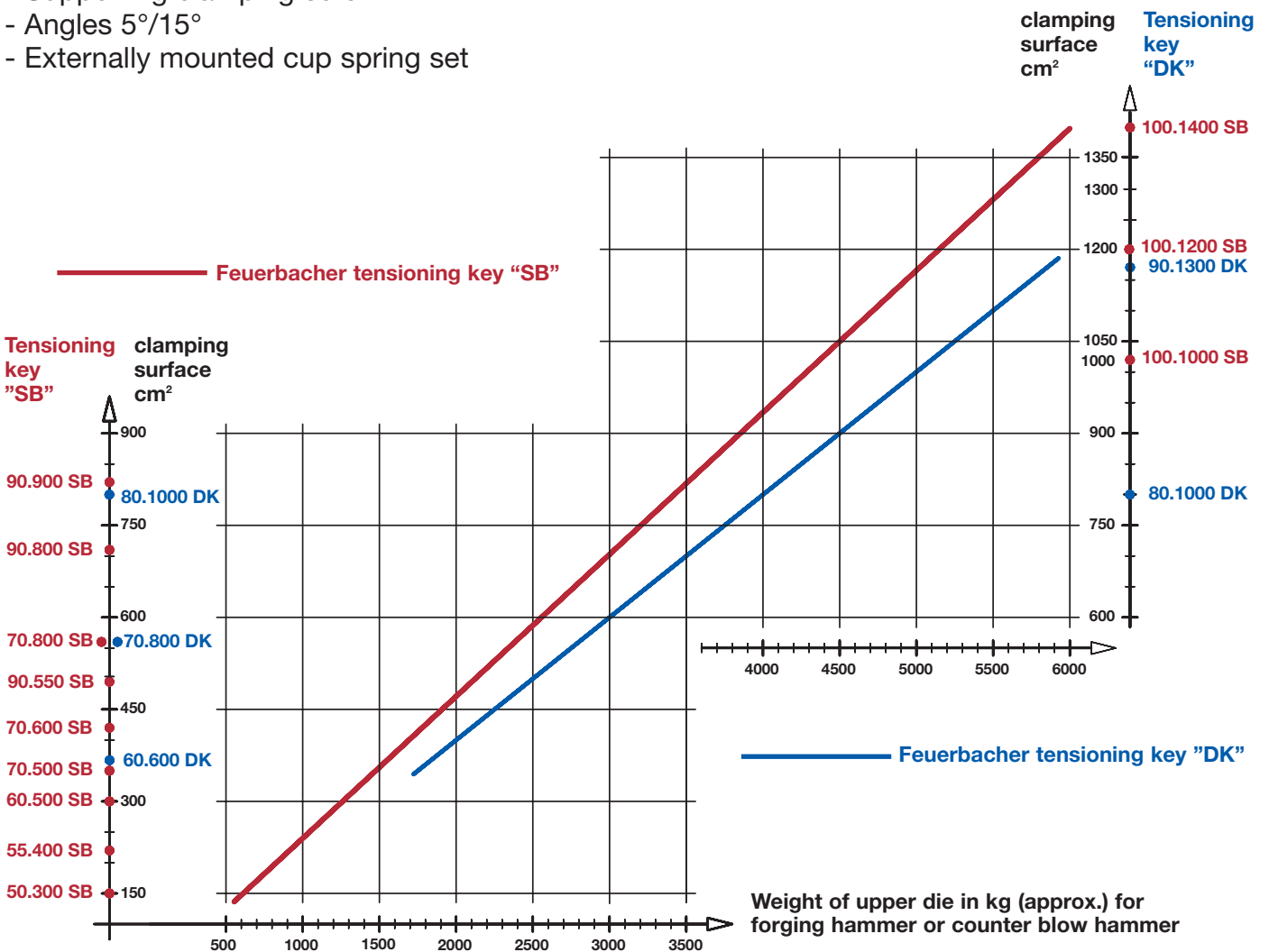
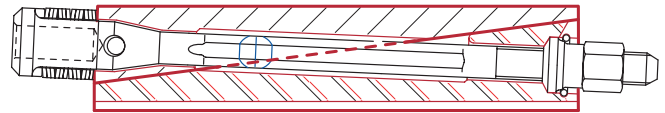
upper die weight in kg (approx.) for forging hammers or counter blow hammers

Guidance values for tensioning key sizes and forging die weights applicable to tensioning keys in the range "SB and "DK"

Feuerbacher tensioning key "SB"

Clamping force approx. 4,0 kg per cm² of contact face

- Full contact between surfaces of key halves
- Supporting clamping screw
- Angles 5°/15°
- Externally mounted cup spring set



Feuerbacher tensioning key "DK"

Clamping force approx. 5.0 kg per cm² contact surface

- 2 counter acting clamping key halves each with externally mounted cup spring set
- Fully supported contact faces of key halves
- Through going tensioning screw with support function
- Angles 5°/15°

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