

## Pfaffenhai Cutaway Cylinders

My name is Han Fey and as a collector of high security locks, I am interested in the technique behind the security. In locks for ordinary usage, these high security features are not clearly visible.

One of the reasons why manufacturers produce cutaway locks is to show potential buyers and entry level locksmiths the inner workings of a lock and to show the security features. Various cutaway locks make up an important part of my collection. Some of these locks are factory cut, while some I made myself because I could not get a factory cutaway or because factory cutaways were never made available.

I have at the moment about 85 different cutaways in cylinder shape, and another 50 pieces in padlock shape. In this second article I want to discuss some of the cutaway cylinders.

I will tell something about the security features and the technique, and if possible show an exploded view of the lock. I will also try to tell something about the way of cutting and if possible, I will show some specific individual parts. Most of the cutaways (CW's) in this article are Euro-profile cylinders or Swedish oval cylinders, as these are most prevalent in Europe.

The techniques I viewed in my collection locks I tried to write down in this article. I can therefore not be responsible for errors in the content; I however did my best to record it as accurately as possible.

For errors and corrections, see the end of the document for my contact details.

I intended to write this second cutaway article about several brands of cylinders, but because we did such great research concerning bumping in the Netherlands, some manufacturers wanted to improve their cylinders after this research. Pfaffenhai is one of them. They gave their full support during testing and also gave me the whole range of cylinders they had in their assortment to have a close look at. For Tooool of course, this was a great opportunity to increase the knowledge of the data-base.

### **In the first part I discussed the:**

- 1 Zeiss-Ikon Sperwellen, Europrofile (Type 1)
- 2 Abus EC 850, Europrofile (Type 2)
- 3 EVVA 3KS, Europrofile (Type 2)
- 4 Winkhaus Titan, Europrofile (Type 2)
- 5 ASSA 7-pin, Swedish Oval (Type 2)
- 6 EVVA DPI, Europrofile (Type 3)
- 7 Ikon ZSE, ZSV, 0-level. Europrofile (Type 3)
- 8 Alfa Vario Flex, Swedish Oval (Type 4)
- 9 Bi-Lock, Swedish Oval (Type 4)
- 10. Assa V10 / Assa Twin, Mortise Cylinder (Type 4)

In this part I will discuss the Pfaffenhai systems:

- Standard
- K14
- W14
- KW14
- V14
- KV14
- Integral (J)

In my view there is a progression line in these cylinders, which I want to make clear with this article.

In this article I am following the American protocol of calling the pin that contacts the key and is in the plug as the Bottom Pin.

The pin in the Cylinder housing I call the Top Pin. Americans place their cylinders this way (on top) because they want to prevent dirt from getting into the chambers.

## Pfaffenrain / Abus

Pfaffenrain is a former East German company, which was founded in 1946. In 1996 the lock factory existed 50 years and they released their slogan "50 Jahre im Dienst der Sicherheit" which means something like "50 years of Service in the Security industry". I first thought that there was a person named Mister Pfaffenrain who has started this company, but it seems that there is a village named Pfaffenrain in former East Germany where they started production of these locks. They therefore named it after the city where they started production. When I visited this factory I passed by the city of Gera also in former East Germany. I knew that Gera is also a company who makes locks, so I assume that it is common to give their product the name of the city they started production.

In 2003 Abus (August Bremicker Und Söhne) bought Pfaffenrain, and Pfaffenrain became a member of the "Abus group". I assume Abus bought this company to get more influence to the more advanced high security cylinders. The production and the product range of the original Abus cylinders and the Pfaffenrain cylinders are however kept separate as far as I could see during the writing of this article.

Pfaffenrain uses the following logo. It represents a Euro-profile cylinder with the character "S". The "S" stands for Schlossfabrik (in English Lockfactory). At the moment there are between 100 and 120 people working at the Pfaffenrain factory.



*The logo of Pfaffenrain*

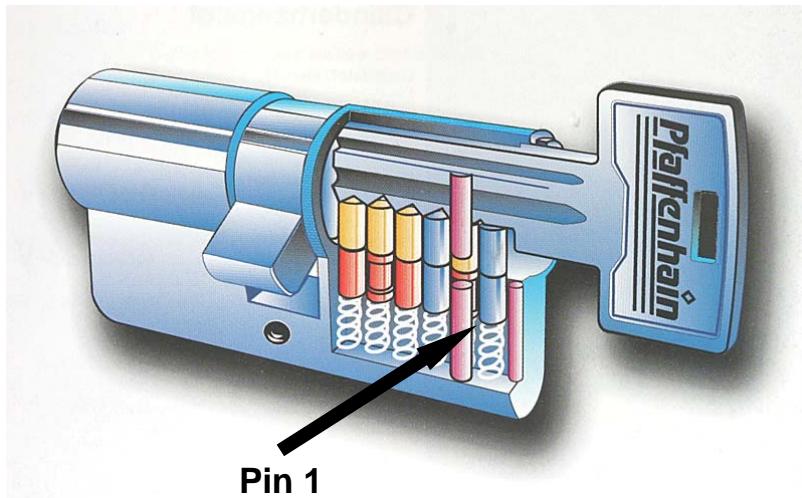
Concerning Abus, I also have cylinders with the brand name Abus on it, which are equal to cylinders of Bricard (a French manufacturer) or should I say that Bricard has some cylinders equal to Abus. Some of them I have in cutaway shape and they are certainly worth telling about. Some cylinders from the Abus range are even produced at CISA (an Italian company). Maybe that is something for another article.

When I saw this brand a few years ago at a big fair "Practical World 2006", in Köln, Germany, I noticed the different cutaways they had for each type of locking mechanism they had in their program. I did not at first clearly understand the workings of all these types but in my opinion as a lock collector it was nice because I had some new things to collect now. I assume the point of view from Pfaffenrain for these different cutaways was to show the different (developed) techniques they had in their assortment of cylinders. I must say they developed some very nice security features.

I received several cutaway cylinders from Pfaffenrain and I decided to write something about the progression in the used techniques. A nice feature of the cylinders is the tolerances. The key fits perfectly in the keyway and all of their new cylinders run smoothly and feel secure.

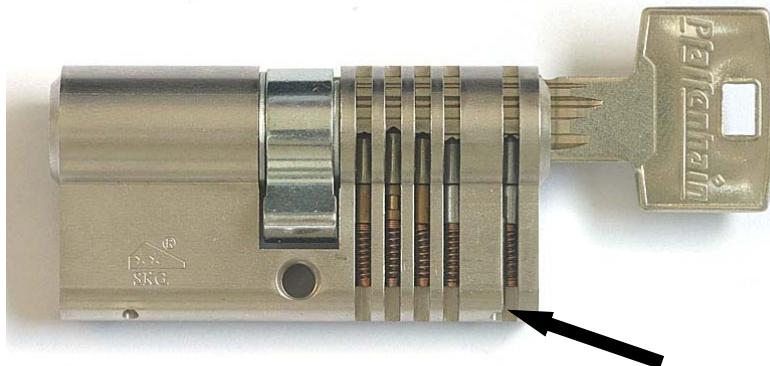
## **System Standard**

They started production with the simple 5-pin tumbler. A 6 pin-tumbler is optional for all systems. They also now call this system "Flat-profile", because the key is just flat. A special feature of their cylinders is that they can use a core diameter of 14 mm. A normal Euro-profile cylinder has a 12.8 mm core diameter. This small trick makes extensive systems possible. Pfaffenhai claims that keys and pins are made from nickel-silver. This guarantees a longer service life by reducing wear and tear effects.



### ***Pfaffenhai Drill protection in System Standard***

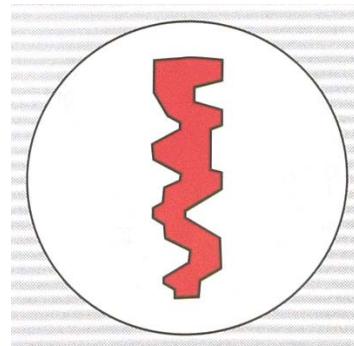
In every modern Pfaffenhai cylinder the first and third pair of pins is made from hardened special steel, for good drill protection. Normally I call the pin in the back of the cylinder as pin number one, but because Pfaffenhai starts counting from "bow till tip" I use their way of numbering the pins. The deeper the drill protection in the lock, the harder it is to drill / reach. I have seen cylinders with the drill protection on the last pin. A nice feature of Pfaffenhai is that they claim that all their key systems are compatible up and downwards, e.g. KV14 and V14, but more about this later in this article.



### ***Cutaway Standard 6 pin-tumbler, profile EA***

*Note: I wondered why they made the second chamber from the front not cutaway. I assume they did this to show the hardened drill protection pin which is in the housing on this position. Notice the small dent where the two hardened drill protection pins are mounted.*

Pfaffenhai claims that there are 7.800 different key differns in system Standard with mono keying. They also claim that they have about 500 key profiles in this standard system. This is the reason they use the slogan "Key systems with profile" They also use these different keyways in Grand Masterkey systems.

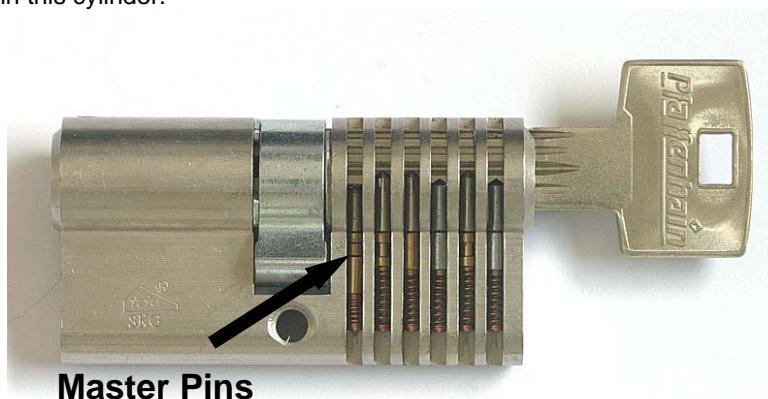


### Example of Standard Pfaffenrain keyway

*Note: The patented paracentric keyway, which offers good protection against pick-tools.*

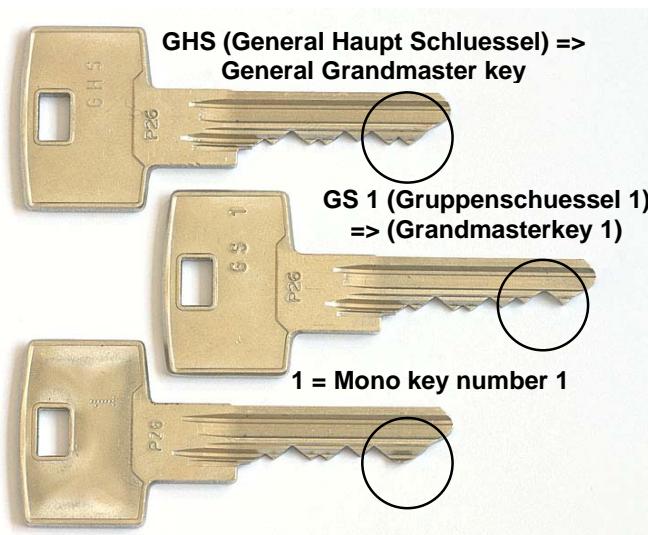
### System Standard & Masterkey system

In the cutaway below, Pfaffenrain shows the working of a Masterkey system. In the last chamber there are extra pins. These thinner pins, also called Master Pins make it possible that keys that are different cut will operate in this cylinder.



### Cutaway with Master Pins

In the picture below you see the key set which came with this cutaway.

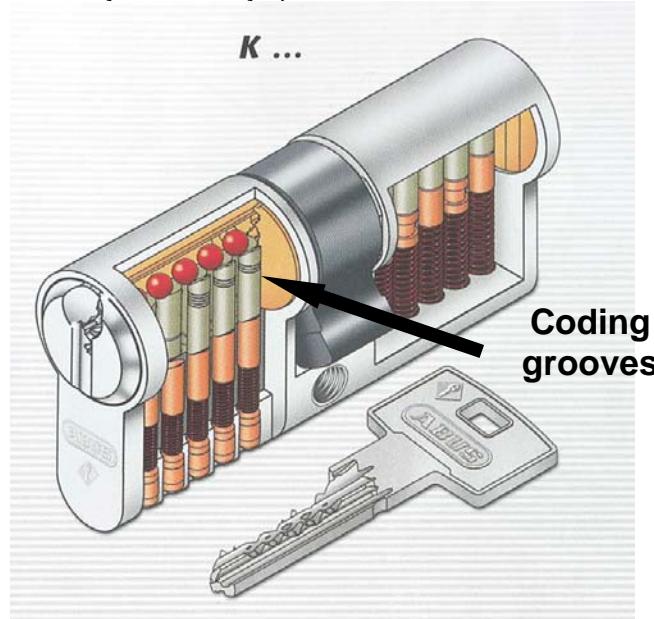


### Different keys from a Masterkey system

*Note: The different depths of cuts in the last pin position.*

## System K

A nice feature of Pfaffenhai is that their keyed systems can be upgraded and downgraded. In other words the security features are modular. In the system K, they introduced beside the 5 or 6 normal pin tumblers an extra row with ball-bearings, side bottom pins, side top pins and side springs. These 5 extra drilling holes are beside the normal drilling holes for the pins. This system does not have a sidebar. There are up to 5 active locking elements possible. The depth in the dimple holes can vary from 1 to 3, depending of the keyprofile. So there is a second line of active pins in this cylinder which are steered by the ball-bearings. These ball bearings take a horizontal movement and translate it into a vertical movement. This is very clever in my opinion.

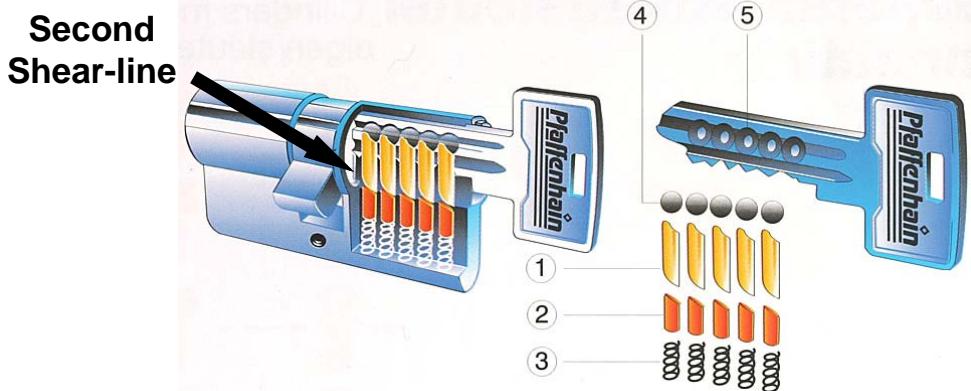


**Exploded view System K**

*Note: The row with the 5 dimple holes on one side of the key.*

*Note: The grooves on the Side Pins (see arrow). These grooves are not for anti-pick but they indicate the length of the pin for production.*

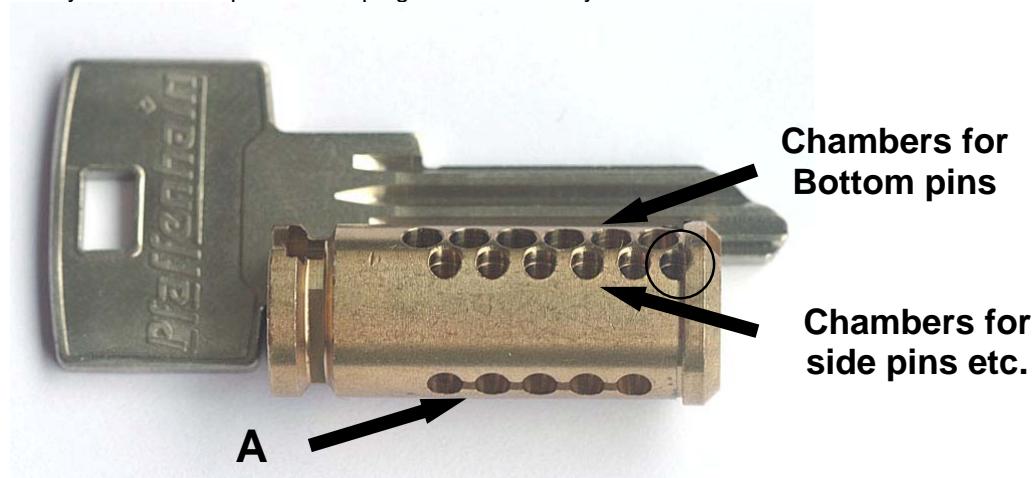
They call it system K, because K stands for Kugel, ball-bearing in English. Beside that is the diameter from the plug 14 mm and to show this they call this system K14. The highest number of active elements in the K14 system is 11 (6+5). With this system Pfaffenhai claims that they can make 78.000 key differs in a single cylinder and about 26.000 key differs in a Masterkey system.



**Exploded view System K and KV**

*Note: The specific parts used in the K-system. The ball-bearings (part 4) are pushed out of the plug and the side pins (part 1) are pushed downwards. With the correct key there is a second shear line created between part 1 and part 2 (see arrow).*

In the picture below you can see a picture of a plug used in the K-system.



### **Detail of plug from System K**

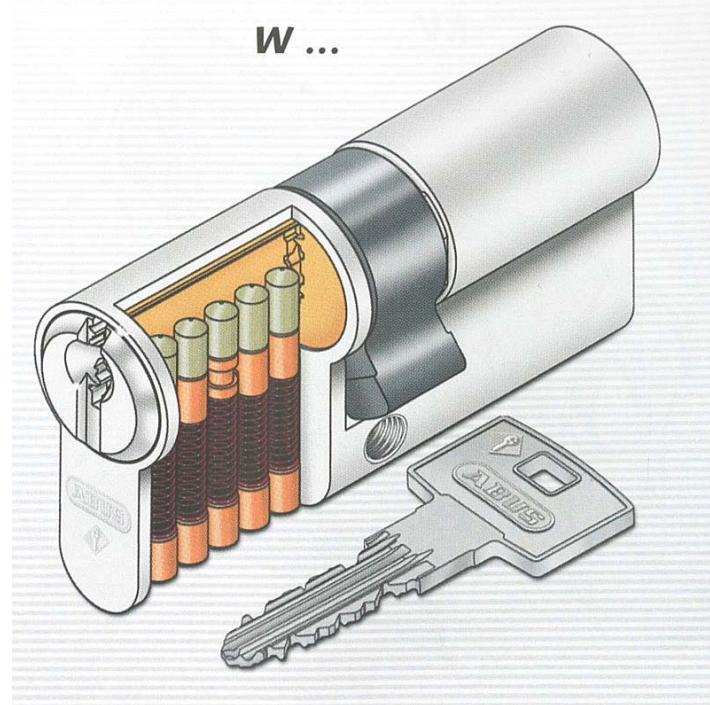
*Note: The circle marks the dimple hole where the drill protection pin goes in. Even this row is specially protected with a hardened pin. Then at last we have the row of dimple holes below where the ball-bearings goes in (arrow A). If the ball-bearings are installed a rod goes on the plug, to keep the ball-bearings in place.*



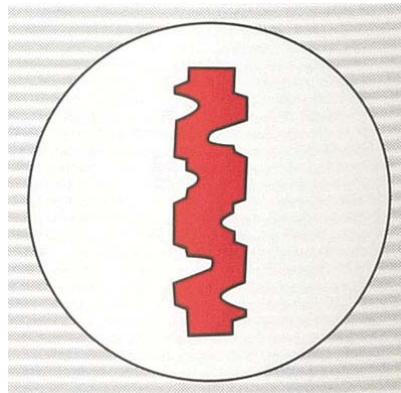
**Blank from system K (Flat profile) and KV14 (will be discussed later)**

## **System W14**

Pfaffenhai improved the ordinary pin-tumbler by making a symmetrical patented reversible key with lateral cuts, for high ease of use even in darkness because the key can be inserted two ways. This system comes with 5 or 6 pins. Pfaffenhai claims 1200 key differs in mono keying and 240 key differs in Master key systems. Besides the key cuts they also use complex keyway warding because of the few thousand different key profiles they can use in this system.



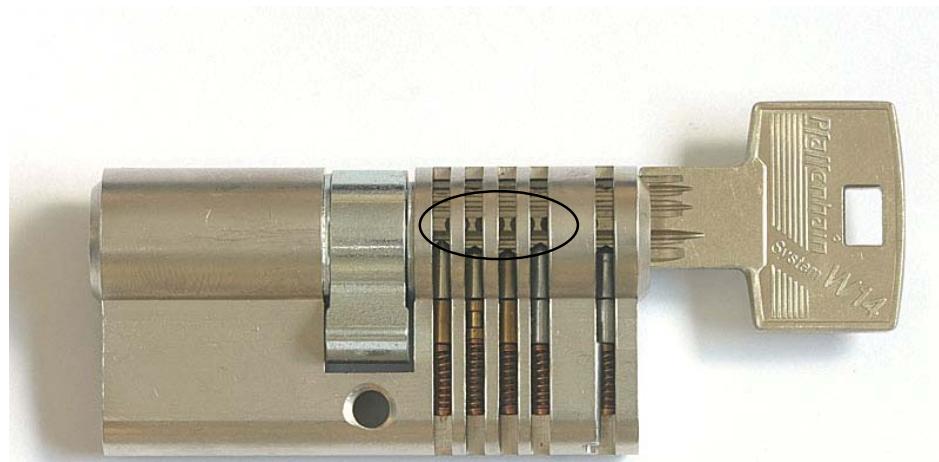
**Exploded view system W14**



**Example of keyway System W14 and KW14**

Note: That the keyway of this reversible system is vertical and not horizontal like the DOM-ix or the Mul-T-Lock. Also notice that the top pins are not in the round part of the housing like Keso and Kaba. The top pins are just in the housing as in an ordinary pin tumbler along the vertical centerline of the lock. Therefore they did not have to invest in expensive machines. They can simply use the ordinary cylinder house for this system.

They called this system W14. I assume the "W" stands for Wendeschluessel (Reversible key).

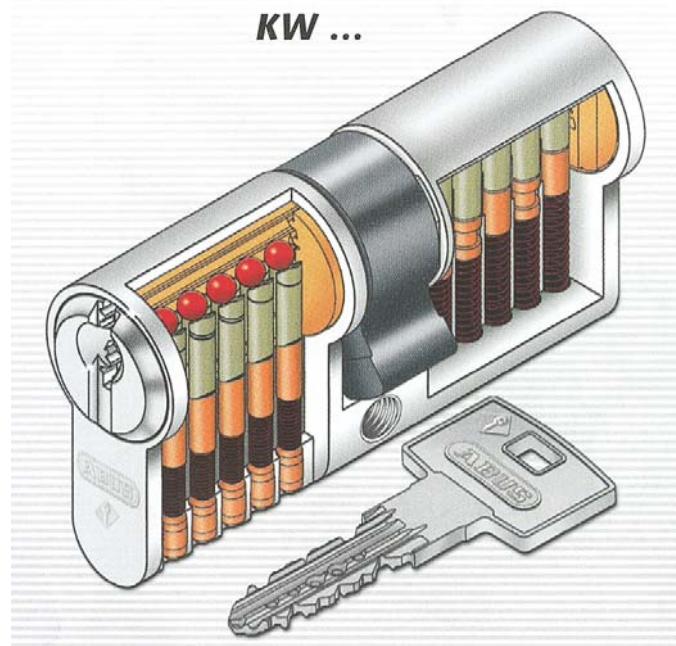


### Cutaway system W14

Note: When I took this picture I inserted the wrong key. I inserted a KW14 key which is discussed later. Nevertheless this key fit because the normal key cuts for the demo KW14 key were the same as for the demo W14 key. You can see the dimple holes in the key that are not necessary for the W14 in this picture. I find it clever to come up with the idea to make a reversible key from an ordinary pin-tumbler lock which also works that well. I assume the engineers had a lot of challenges in developing this system.

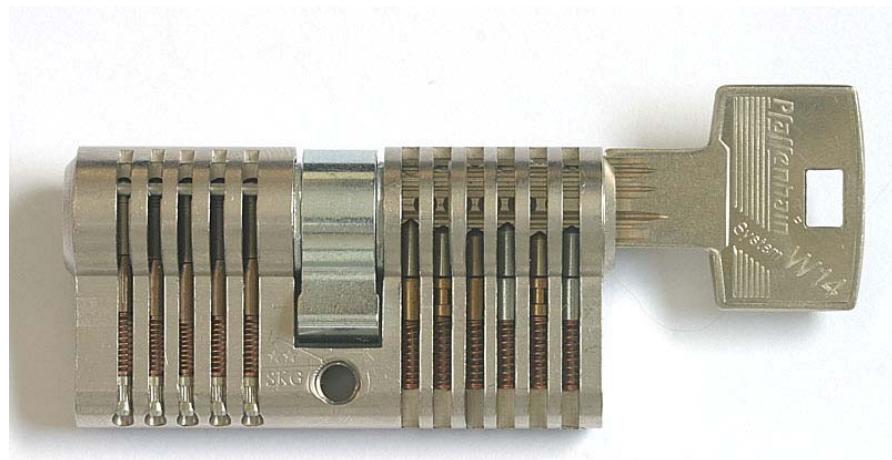
### System KW14

Pfaffenhai continued developing and improving their products, so they also incorporate the K-system in the W14 cylinder, thus allowing a second plane with up to 5 active locking elements. This way they had created the KW14-system. There are 3 different depths possible for the dimples in the side of the key. Pfaffenhai has coded these pins: c-b-a. This coding is used in all the K-systems from Pfaffenhai.



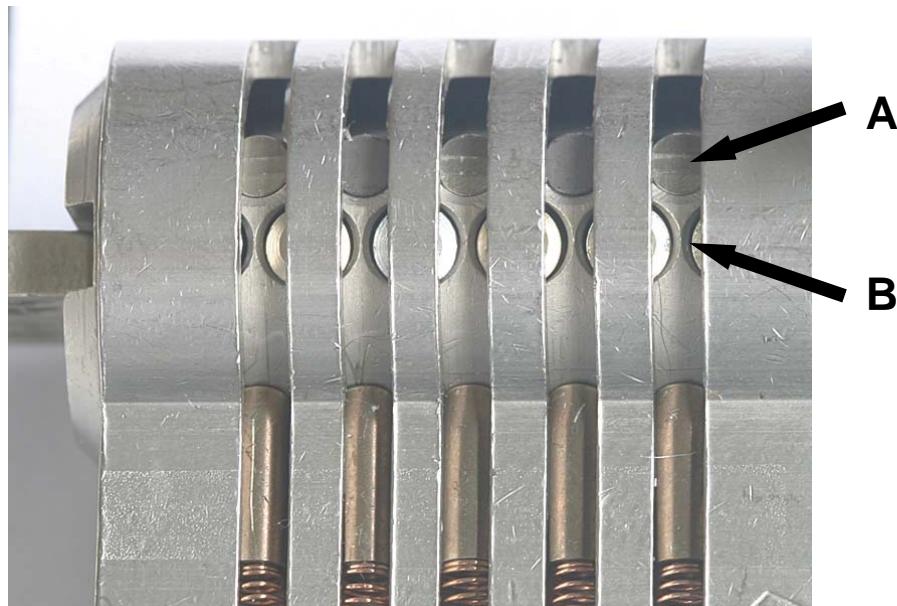
### **Exploded view system KW with front view keyway**

Note: The row with the 5 dimple holes on one side of the key. On the other side is of course the same row with dimple holes.



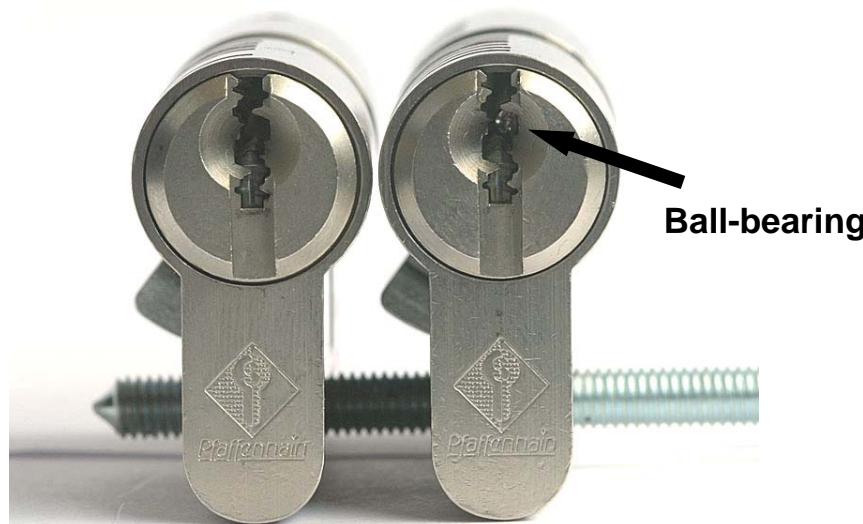
### Cutaway system KW14

Note: In a KW14 double cylinder are up to 117 parts.



### Detail picture side pins in system KW14

Note: The arrow on top (A) marks the side pins which are steered by the ball bearings.  
The arrow below (B) marks the ordinary bottom pins.



### **Front view system W14 and KW14**

*Note: The keyways are both the same, only the right picture is from the KW14 system. You can see the ball-bearing on the right in the keyway.*

With this KW14 system Pfaffenrain claims that they can make 12.000 key differs in a single cylinder and about 2.400 key differs in a master key system. This is of course again, besides the variations in keyways.

I personally thought that Pfaffenrain had a great variety of techniques with the cylinders I discussed until now but this was not enough for Pfaffenrain. They continued developing and produced the System V.

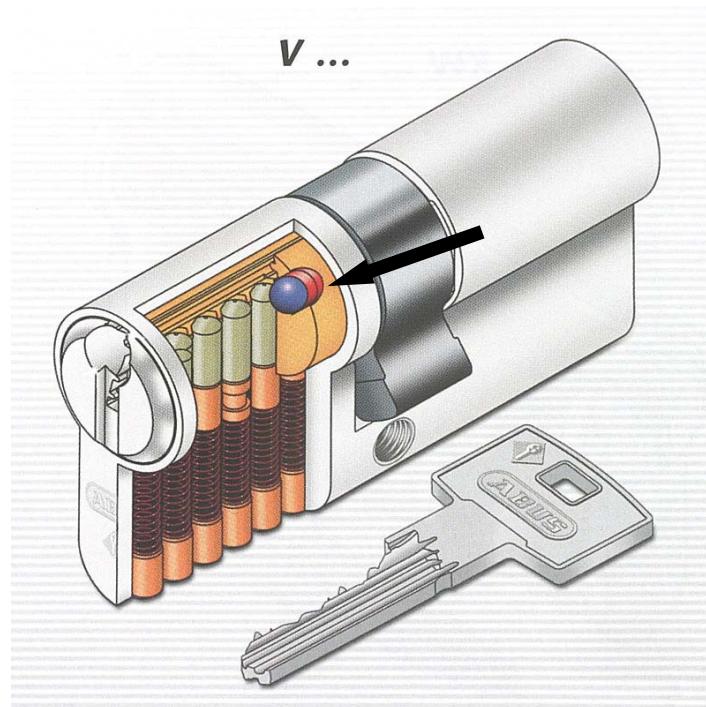
### **System V**

System V is an ordinary cylinder with in my opinion some special features. Feature one is the V-shape of the key and feature two is an inactive ball-bearing in the side of the plug. The V-shape is in combination with the ribs a protection against lock picking. The V-shape is also a protection against illegal key copying. The bent patented precision profile makes it hard to use pick tools. The V-profile looks a bit like the Kreisbogen profile from CES or Nemef. The CES / Nemef Profile is however rounded. The V-profile from Pfaffenrain is a 90° counter clockwise rotated "V".

Pfaffenrain claims tens of thousands of different profiles in this system. This is the reason why most dealers have their own profile or even multiple profiles. This way they also have some control of what that locksmith is doing. If they get a cylinder with that specific profile they can track the locksmith.

Beside the special profile, the plug of this cylinder contains a ball-bearing. When trying to manipulate this lock, a housing pin blocks the core after a 90° clockwise rotation or a 270° counterclockwise rotation.

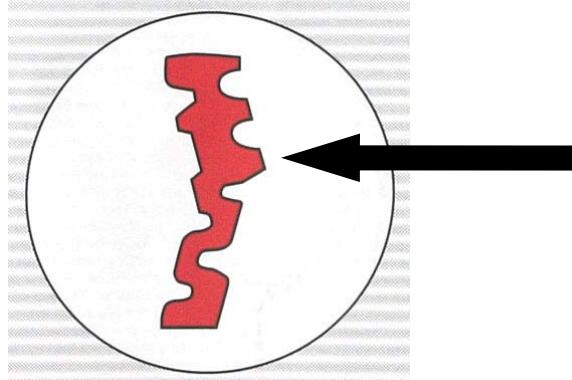
Pfaffenrain claims that the V-shape of the key is also a type of protection against the bumpkey. If you try to make a bumpkey by hand and you file down the cut too deep, the rib is damaged and the ball-bearing will be activated after a certain rotation.



### Exploded view system V14

*Note: The ball bearing on the right side in the core (see arrow). If the rib in the key is missing, the ball-bearing can be pushed in the plug and this will prevent further rotation.*

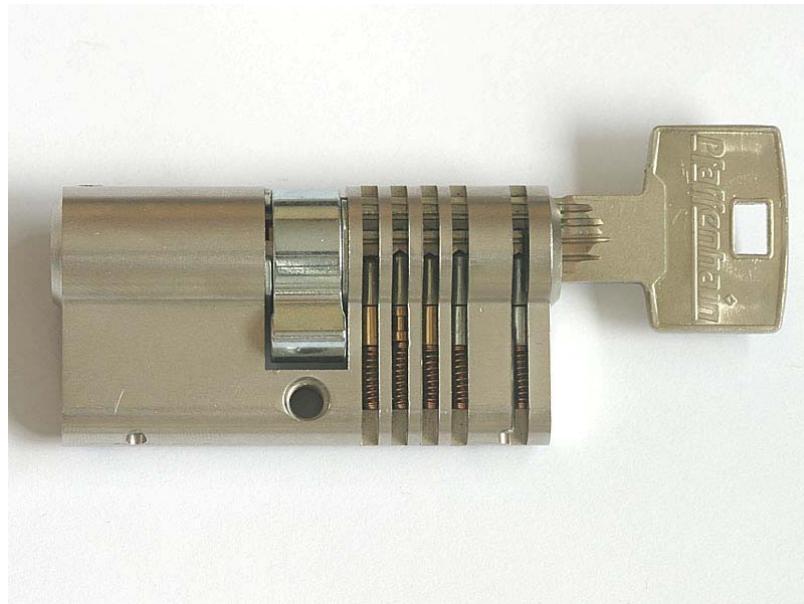
The arrow marks the place where the ball bearing rests on the key. Considering keycopying, the V-shape of the key requires you to need a very thick blank for use in the Easy Entrée. At the moment Easy Entrée does not have these blanks, but I assume that will be a matter of time. But in first instance this keyway shape is the first protection against the Easy Entrée, a key profile cutting machine.



### Example of keyway System V14 and KV14

*Note: The V-shape of the key makes it also difficult to clamp, in the vise of a key cutting machine.*

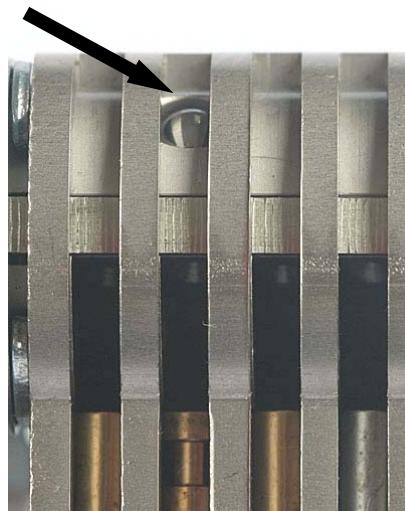
The cutaway below comes with two keys, the correct key and a key where the rib is filed down. This second key will block after a 90° or 270° rotation. In a normal cylinder this process is irreversible. In this cutaway you can reset this blocking by pushing down the housing pin.



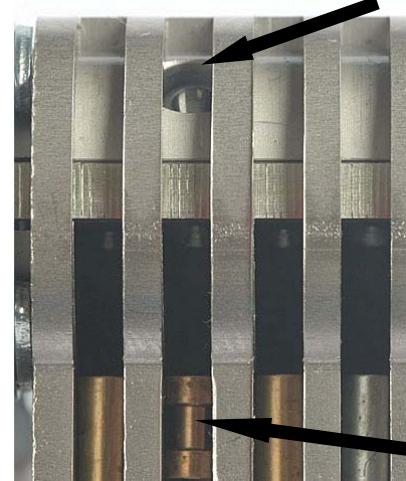
**Cut-away system V14**

Note: The cylinder looks similar to a normal Pfaffenrain cylinder. On the other side of the plug however is a drilling hole with the ball-bearing.

**Correct key**



**False key**



**Top pin  
which blocks  
the plug**

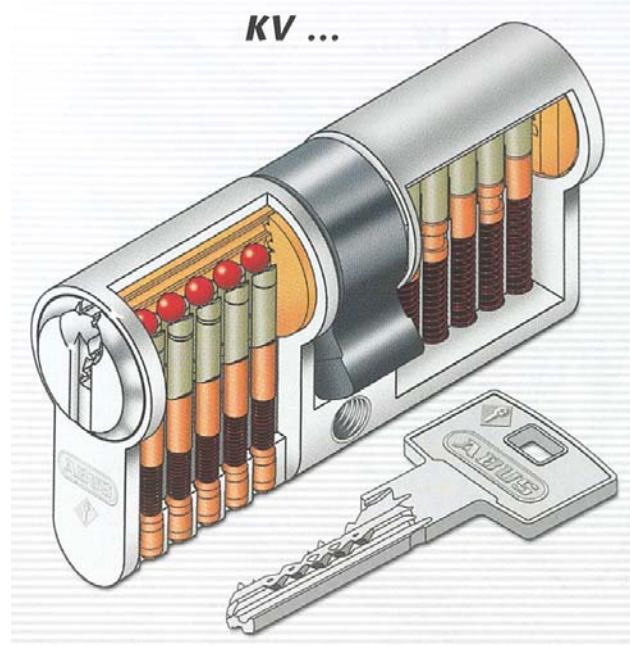
**Position of passive ball-bearing with the correct key and a false key**

Note: With the correct key, the ball-bearing is pushed out of the chamber. With the false key (without Rib) the ball-bearing drops in the plug. The top pin is pushed in the plug definitely after a certain rotation..

Note: There are up to 67 parts in a V14 double cylinder.

## System KV

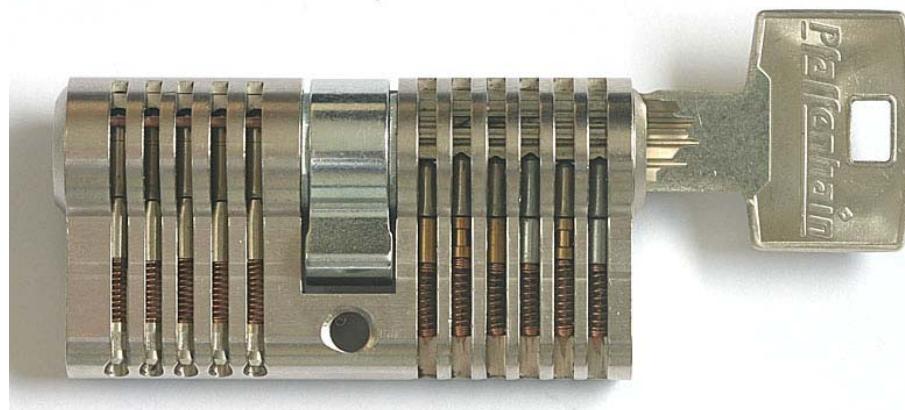
Like I said before the V14-system can be upgraded and downgraded, so this system can also be upgraded to the KV14-system. The inactive ball-bearing from the System V is missing then and is replaced with the 5 active pins from the K-system.



**Exploded view system KV14**

*Note: That the single ball-bearing is replaced by the K-system*

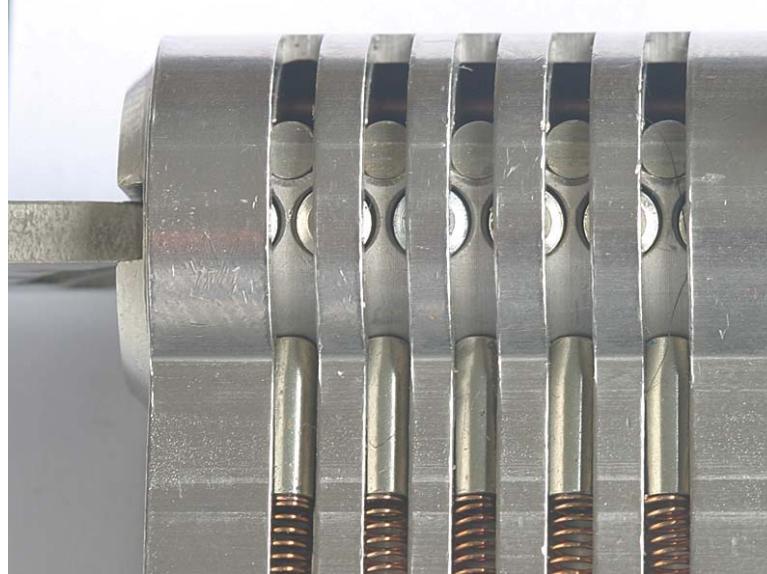
On the right side of this cutaway you can see the ordinary pin-tumbler side. The left side of the cutaway shows the K-part. Up to 5 ball-bearings are pushed out of the plug. By pushing out these ball-bearings, the side pins are pushed downwards. This way a second shear-line is created and the plug can rotate. There are 3 different depths for the dimple holes in this system. They are named b-a-w.



**Cutaway system KV14**

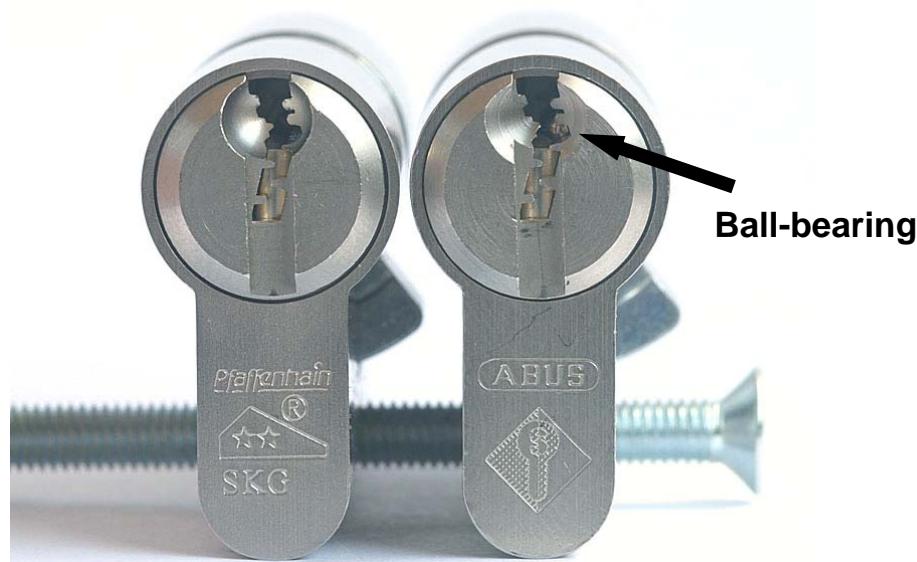
*Note: On the left side of this cylinder you see the K-system (side pins). On the right side of this cylinder you see the "normal" pin tumbler pins. If you have a close look at the side pins you can see that they are serrated. This is again, not for lock picking protection but for production.*

The picture below shows a detail picture of the two rows of pins in the plug. Later in this article I discuss the "Integral". Although there are also dimple holes on the side of the key, the system works differently than the System KV.



**Detail picture of the side pins in System KV14**

The cylinder below has the same keyway. The left one is from the V14-system, the right one is from the KV14-system. In GMK systems this option is used as a tandem function. For rooms where more security is required, the KV system is used. For the more standard rooms they can use the ordinary V-system. All of that in one GMK-system.



**Front view keyway system V14 and KV14**

**Note:**

- The cylinder on the left is sold on the Dutch and Belgian market, because of the SKG stamp in front of the cylinder.
- The cylinder on the right is sold in Germany because of the brand name Abus on the cylinder. It seems that Pfaffenrain also sold cylinders to Dubai, here they use another stamp again. On the picture of the "**Front view system W14 and KW14**" a few pages back, you can see the stamp they use in the other parts of Europe (except D. NL. B)

In the Netherlands we have the SKG test institute for locks, just like the Americans have the UL-grade in the States. The cylinder on the left has SKG\*\* (two star). This means that this cylinder offers 5 minutes of resistance to a normal burglary attack. SKG\* (one star) products must offer 3 minutes resistance and SKG\*\*\* (three star), the highest level must offer 10 minutes against a common burglary attack. To my knowledge lockpicking is included in this attack.

With the KV14 system Pfaffenhai claim that they can make 370.000 key differs in a single cylinder and about 46.000 key differs in a masterkey system. This is of course besides the variations in keyways.

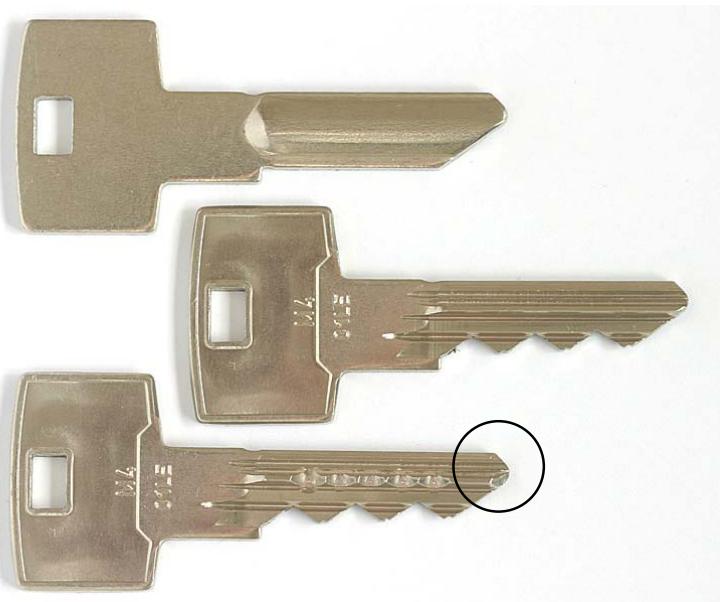
If you want to lockpick this cylinder you have in my opinion a nasty problem, because it's very hard to manipulate the row of ball bearings by the keyway. If you push out the ball-bearing you cannot make further contact with the side top pin and side bottom pin. They keep stuck in the chamber.

### **Grand master key systems**

Just in short, each before mentioned system can be upgraded or downgraded. What I find clever from Pfaffenhai is that they can vary:

- the length of the pin-tumblers
- key profiles (a few thousand)
- use of the K-system.

In the next picture you see a blank of a V-profile key. The grooves and ribs for the specific profile are not yet milled in this key blank. The next key is a V-profile key and the key below is a key from the System KV.



***Key from V-system and KV system***

*Note: The tip of the KV key has an extra edge (see circle), which allows the key to be inserted in the keyway in the KV14 system.*

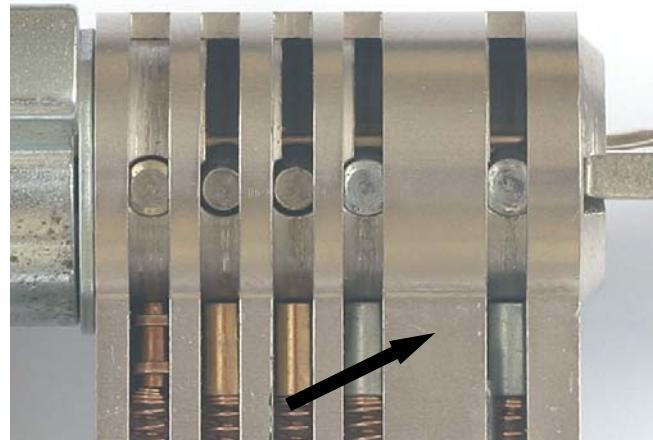
### Protection against Bumping

Pfaffenhai recognizes bumping as a real threat and therefore protects their cylinders against this kind of attack with special shaped pins, called Anti-Schlagstiften (Anti-Bump pins). In the cutaway below you can see these AS-pins.



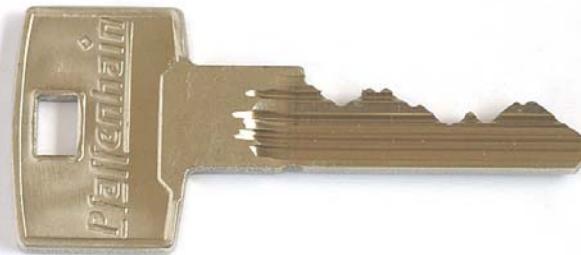
### **Cutaway system V14 with Bump key protection**

*Note: This is the first standard production cutaway I have seen with Bump key protection.*



### **Detail picture of these AS-pins (Bump key protection pins)**

*Note: In the second chamber (see arrow) there will be also an AS-pin. Because this chamber is not cut it is not visible.*



### **Matching key of this cutaway**

*Note: The second and sixth position in this cylinder have a short bottom pin. That means they have an AS top pin in the housing. The fourth and fifth pin have a long (Anti bump) bottom pin in the housing. The first and third pin in this cylinder are the standard anti-drill pins.*

### How do these AS-pins work?

They modified the top pins (housing pins) and the bottom pins (core pins) to make the lock harder to bump. Toool did several tests to bump open these new locks and we noticed that it is indeed harder to bump open cylinders with these special pins in comparison with a cylinder with ordinary pins.

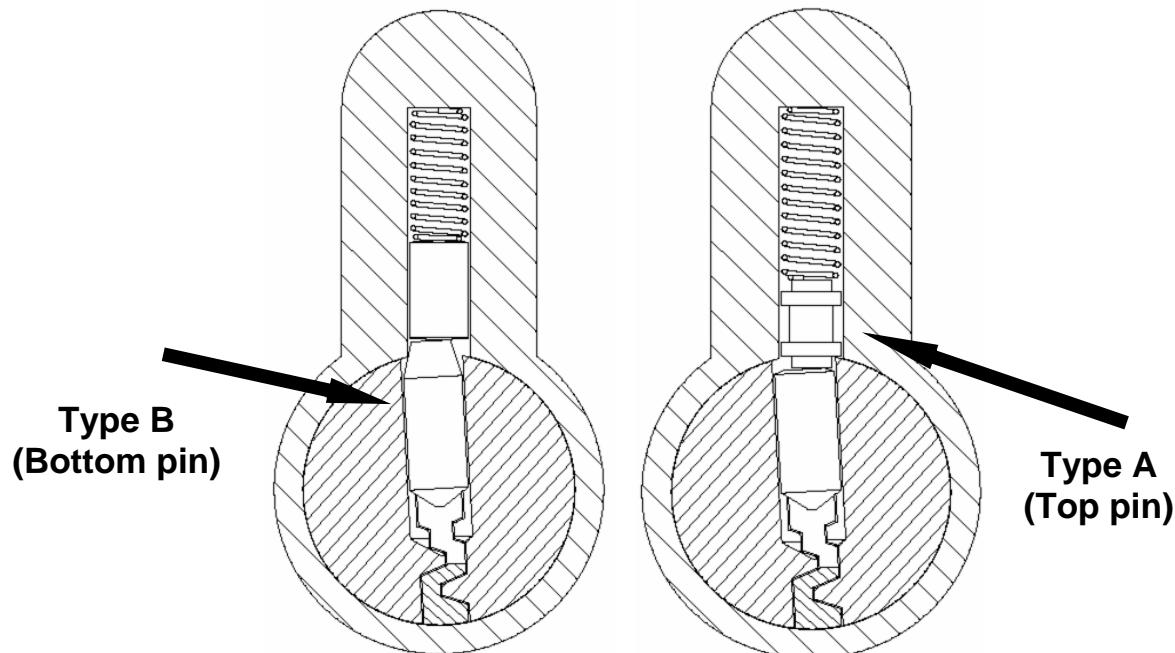


#### ***Detail of special shaped pins for Bump key protection***

*Note: The pins of type A are only used in combination with short bottom pins.*

The housing pin/top pin looks like a normal mushroom pin (Type A), but has two extra edges on the top and the bottom. If the plug after bumping is rotated only a few degrees this special shaped pin can still catch the plug and prevent rotation. This pin is used in combination with a short bottom pin. You can imagine that if you use this pin with a long bottom pin the effect is less.

Pfaffenhai also uses special shaped bottom pins (type B) against bumping and lock picking. These pins are narrow on top. The purpose of this shape is that this pin blocks rotation of the core, even if the core has already made a small rotation. This special pin creates a greater tolerance in rotation of the plug so that the lock is harder to bump in combination with the special top pin



#### ***Detail picture of working of the AS-pins, type A and type B***

## The optimum pinning configuration against bumping

We received from Pfaffenhai (before the before mentioned AS-cutaway was there) the next pinning configuration in a cylinder and we did not manage to bump this lock open. You can see that they used different tricks to elevate the effect of the AS-pins and make the time of rotation after bumping more critical. I made a detail picture of the plug with the specific pins.



**Core / Plug with top pins and without top pins**

*Note: This is one of the most nasty pinning configuration against bumping I have ever seen.*

### **Chamber 1 (bow to tip),**

Hardened steel pair of pins, concerning bumping it does not have a function.

### **Chamber 2,**

This chamber contains a very short core pin, with length 1, and has a AS-bottom pin type A on top. Again this pin has to travel a long way, before it gets above the shear-line and beside that if you bump the lock, the spring can get stuck between the side of the chamber and this housing pin.

### **Chamber 3,**

Hardened steel pair of pins, concerning bumping it does not have a function.

### **Chamber 4,**

Contains a bottom pin, type B with length 9. This means that if we insert a 999 bump key and we move this key a little bit forward, this pin will come out of the core and block rotation.

### **Chamber 5,**

Contains a bottom pin, type B with length 8. The top of this pin is narrow as you can possibly see in the right picture (see arrow). If you make a small rotation of the plug, this pin can still jump up, but it blocks the plug right away.

### **Chamber 6,**

This chamber contains the AS-pin type A. The pin has to travel a long way before it comes above the shear-line. If it then finally comes above the shear-line, the extra edge on the bottom of this pin can hook in the core and prevent rotation.

## **The coding of the pins**

Pfaffenhai is fairly unique concerning the use of 14 mm diameter core. This bigger core makes it possible to build in all kind of techniques that I will explain later.

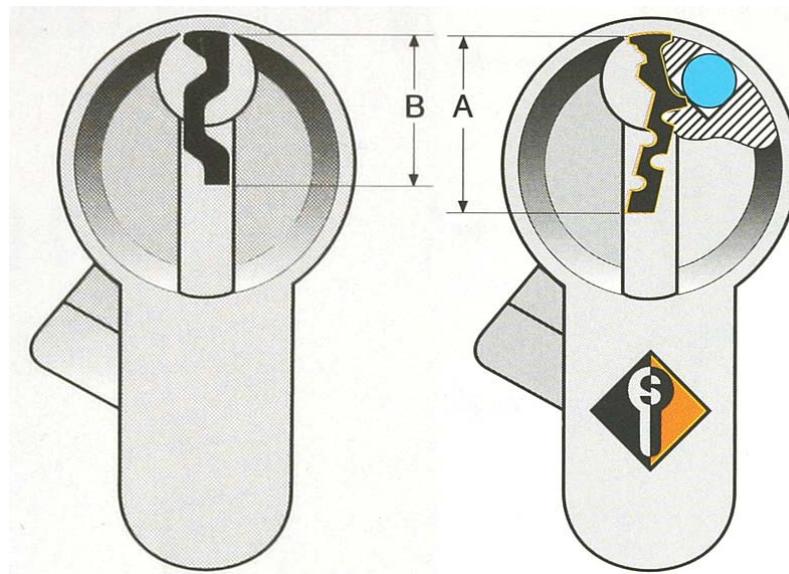
The big diameter also makes it possible to use a great variety of pin lengths. There are 13 different lengths of pins, coded Z – Y – X – 0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9.

The “Z” is the shortest pin (5,06 mm), the “9” the longest pin (9,26 mm). This pin coding with all their fixed length is used in all of their systems. In the system V14 and KV14 they can use the range from “Z” till 9. In the system W14, KW14 and Integral they can use the range coded “Z” till 3 and in the system Standard and K14 they can use the range 0 till 9 for the pin tumblers.

If you think over this coding with the corresponding pin length you will notice that it is well thought.

### What does the number 14 in the system name mean?

In the next chapters you will notice that all types have the system name and then the numbers 14. This 14 refers to the diameter of the plug which is 14 mm. In the picture below you can see the differences in pin length you can use.



**12,8 mm plug (B) and 14 mm plug (A)**

*Note: The cylinder on the left is a Standard, the cylinder on the right is a V-profile (more about that later)*

### Something about the keydiffers.

I got several key differs from each system Pfaffenrain produces. I thought, what a low number of possible keys. The reason for this is that two different keys must have at least two key pin height in difference. This means for example, if I have a key with cuts 12345**6**, there will not be a key with cuts, 12345**5** or 12345**7** in rotation. The jump of the key pin must be at least 2 cuts. So the next key will be 12345**8** and the previous key will be 12345**4**.

**This gives the following different keys for each system:**

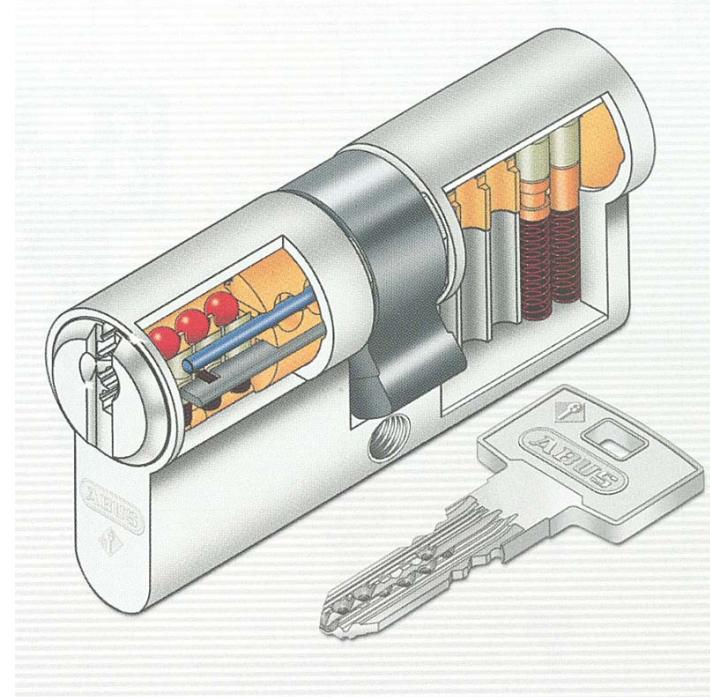
Standard	7.800 key differs
K14	78.000 key differs
V14	37.500 key differs
KV14	370.000 key differs
W14	1.200 key differs
KW14	12.000 key differs
Integral	35.000.000 key differs

In the reversible key systems (Wendeschluessel), there are only 7 depths of key cuttings possible, because of the interference with the dimple holes in the side of the key. The result is the low number of key differs.

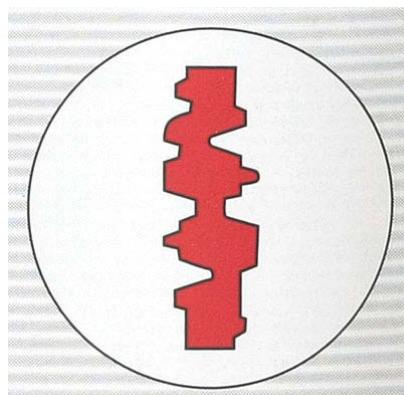
## **System Integral**

Top of the range of Pfaffenrain at the moment is the system "Integral". It is called the system "J" and not "I" which I had expected. This was likely done because the "J" is a character that can be read easily and you cannot mix it up with 1, like the character "I".

This system has it all. It has the normal pin tumbler system a reversible key and two locking bars that prevent the plug from rotating. The locking bars are each controlled by 5 spring driven tumblers. You can compare the sidebar system a little bit with EVVA 3 KS, but in the EVVA there are not spring driven sliders in the plug and in the Integral these are pins which only must be lifted to the correct position to let the sidebars drop in the plug.



***Exploded view system Integral***



***Example of keyway Integral***

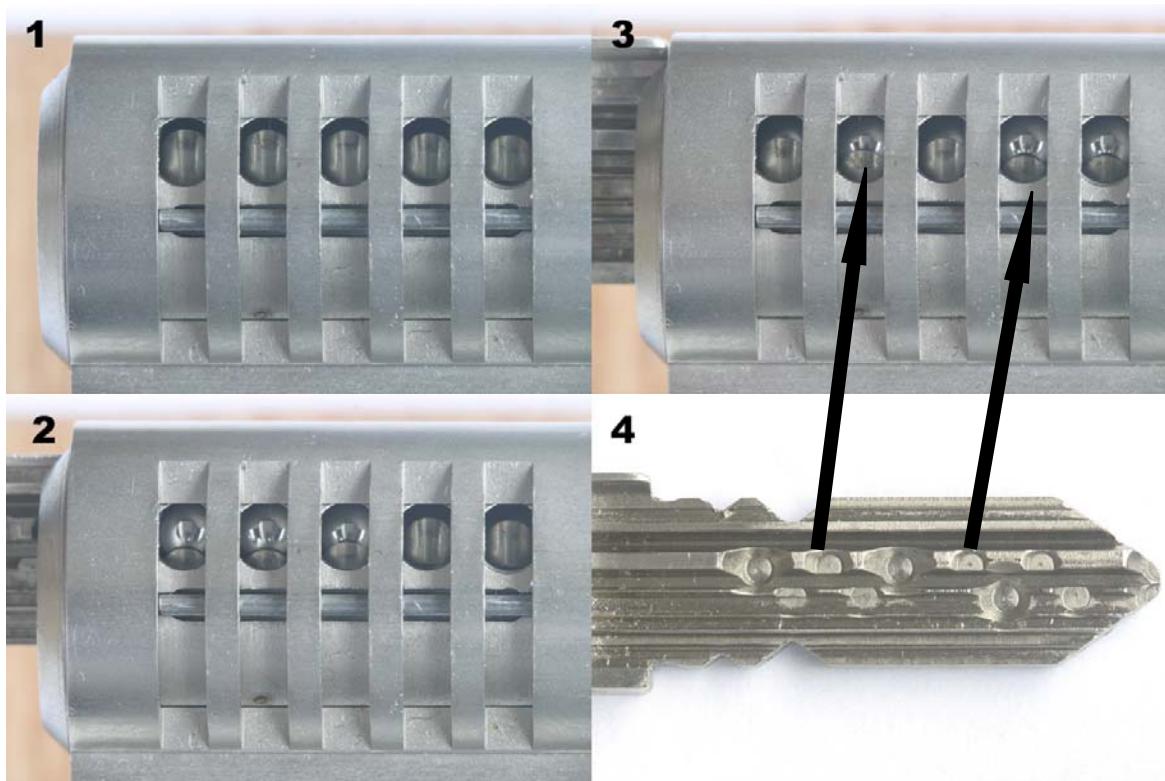


### ***Cutaway system “Integral 14”***

Do not mix up this system with the K14 system from Pfaffenrain like I did at first. In the system K14 there are 11 drilling holes for the chambers and there are two separate shear lines. If the 11 pins have created the two shear lines the KV14 / KW14 plug can rotate.

In the “Integral 14” there are the 6 pins that block the rotation of the plug and the two separate sidebars on each side of the plug. If the 5 ball bearings are properly pushed out on each side of the plug, the sidebar pins are moved properly downwards so that a shear line is created. This way the sidebars can drop in the plug.

In the next picture you can see the exact workings.



#### **Detail picture of working sidebar pins**

Note: Picture 4, the less deep the dimple hole is in the key, the more the ball-bearing is pushed out of the plug, the deeper the sidebar pin is pushed into the housing.

#### **Picture 1.**

The cylinder is in the locked position. The sidebar pins are pushed up by a spring and the 5 sidebar pins push the ball-bearings in the plug.

#### **Picture 2.**

A key is inserted halfway. You can see that the ball-bearings are pushed out of the plug and that some sidebar pins are pushed downwards in the housing.

#### **Picture 3.**

The correct key is inserted fully. All the ball-bearings are pushed out of the plug properly so that all of the sidebar pins are properly pushed downwards. Now there is a shear line created for the sidebar. The sidebar can now drop in the plug and the plug can rotate.

#### **Picture 4.**

Detailed picture of the key, notice the relation between depth of drilling hole and movement of the sidebar pin.

The row of dimple holes on each side of the key is different so there are two different lines of dimple holes on each side of the key. This is very clever in my opinion. I tried to pick this lock without the normal pin tumblers in it but the ball-bearings got stuck and they did not jump back. It's very nasty to lockpick this lock, I did not succeed. To say this lock is bump-proof is useless because it obviously is.

#### **Something about the plug.**

I have been to the factory and I saw the CNC operated machine that produces these cores. It took the machine 6 minutes to produce one core. Why that long I wondered. Then I saw why.

As far as I can see there are 26 drilling holes. Beside that there are 6 grooves and a lot more other gates/grooves that must be made, for example the hole for the drill protection in front of the plug. More about that later.



**Left view, top view and right view of an Integral plug**

Note: One single Integral plug can consist of 47 parts. One Europrofile double cylinder of this system can contain 143 parts.

In the Integral there are up to 16 active locking elements (5+6+5). There are up to 7 different lengths for the ordinary pin tumbler pins and 5 different depths for the drilling holes on each side of the key. These pins are numbered c-b-a-w-u. With this Integral system Pfaffenrain claim that they can make 35.000.000 key differs in an individual cylinder and about 550.000 key differs in a masterkey system. This is course besides the variations in keyways.

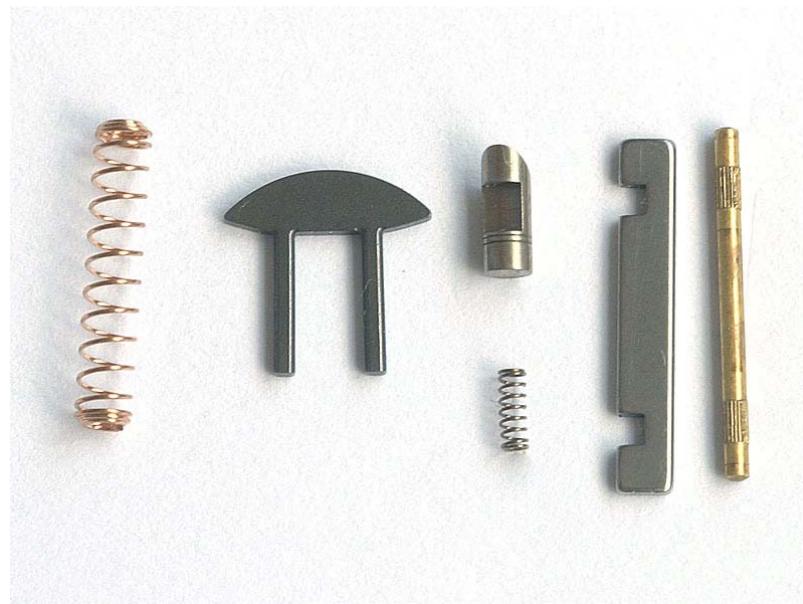
### Something about the dimple holes.

There are 7 different depths of dimple holes, these are used in all their systems.  
They coded these depths, e-d-c-b-a-w-u. In short they use the next depths in the following systems.

System K14, Profilserie A, P, G	e-d-c
Syst. K14, Profilserie C, S, T	c-b
System KV14	b-a-w
System KW14	c-b-a
System Integral	c-b-a-w-u

### Something about the parts.

In the picture below you can see some parts used in the Integral. The part on the left is a normal spring for the pin tumbler. On the right you find the hardened steel plate, which comes in front of the plug (drill-protection). You can see the groove for that in the picture from the Integral plugs. The two parts in the middle are the sidepin combined with the matching spring. The next part is one of the sidebar and the part most right is a rod to keep the ball-bearings in place (in the plug).



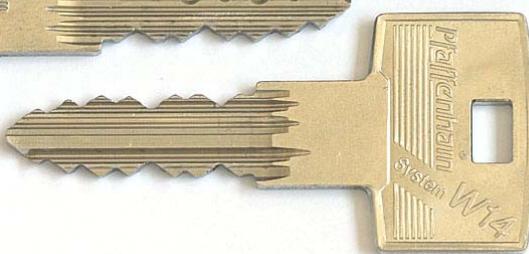
**Some parts in the system Integral**

Note: See the special shape of the drill protection plate.

**KW14**



**Integral**



**W14**

**The reversible keys from Pfaffenrain**

Note: The two different rows of dimple holes in the Integral key in comparison with the KW14 key  
Note: I received these keys during a factory visit. That is the reason why my name is engraved in some keys and cylinders.

### **Modular System**

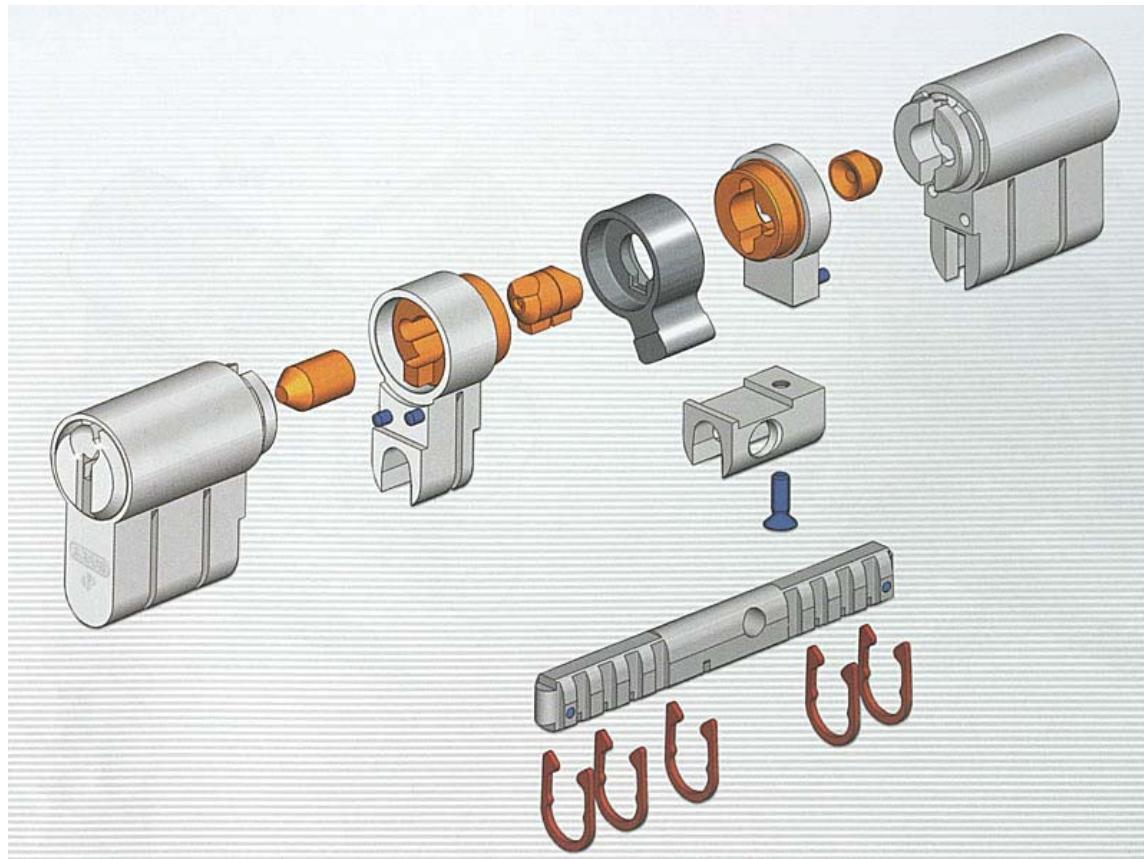
At the moment the most complete cylinder from

Pfaffenrain is the Integral with SKG 3 and Modular option. The fact that the cylinder is SKG 3 means that it is protected against pulling and will resist a hostile attack for 10 minutes with normal burglar tools.

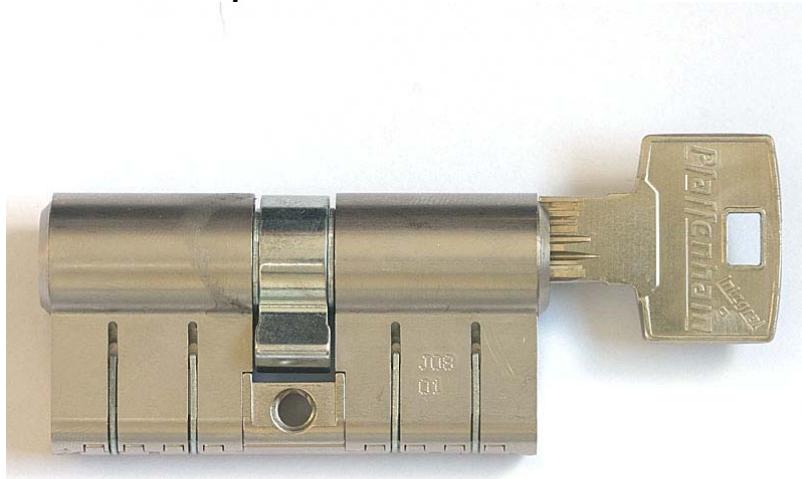
### **Mod-U-lar**

Modular means that you can vary the length of the cylinder. In Europe most cylinders have the length 30/30. This means if you measure from the middle of the cylinder to the front, the distance is 30 mm. A 40/50 cylinder has a total length of 90 mm and from the middle of this cylinder to the front you will

measure 40 or 50 mm. This depends upon the thickness of the door. With most European cylinders this length is fixed. Pfaffenhai introduces here the Modular cylinder so that you can extend the cylinder to any desired length. EVVA, Abloy, Dom, etc have similar systems.



**Exploded view Modular SKG3**



### **Modular Integral cylinder (SKG3)**

*Note: The bridge in the system Modular is tested to 15.000 N pulling force and made from CuBe2 (Beryllium Bronze)*

## Closing comments

So far my second article about cylinder cutaways. This time I discussed only the products of one manufacturer because it had that many locking techniques (cut-aways). There are a lot more locking systems in cutaway versions which I find personally worth writing about—for example, the Zeiss-Ikon Magnet system, the Kaba Quattro, Kaba Penta, EVVA Dual, BKS Multipin, Zeiss-Ikon Sperrissen, Wilka ZL-pro with the magnetic inserts in the plug, the DOM Diamant, Mottura with magnetic pins, etc. All of these locks have in common special security features which make them hard to manipulate.

Maybe something for the next time?

I want to thank Erik Mol from Metafa, the Netherlands and Jörg Hertel from Pfaffenhai, that they gave me the possibility to visit the factory and allowed me to write about the things I have seen. Especially I want to thank them for the nice cutaways they gave me. Nick Zakowski (USA), I want to thank for editing this article.

You can download this file with the next link "[www.tool.nl/Pfaffenhai\\_Cutaway\\_Cylinders.pdf](http://www.tool.nl/Pfaffenhai_Cutaway_Cylinders.pdf)" where you can see the pictures in this article more clearly and in color.

More info about High Security locks you can find on my website [www.hanfeylocktechnologies.com](http://www.hanfeylocktechnologies.com).

In the next parts, I intend to make a selection of the next cutaways I will discuss:

- Abus D8
- Alfa
- ASSA Desmo
- BKS SL
- BKS Multipin
- DOM SV
- DOM SC
- DOM Diamant
- Emhart / Corbin / VSB Interlocking
- EVVA MCS
- Gera 4000
- Ikon WSW
- Mottura Champion, C38 / C48
- Nemeef Cirkelboog
- Wilka ZL-pro
- .....

In the Kaba part I intend to discuss the cutaways:

- Gege AP2000
- Gege AP3000
- Gege Pekstra
- Kaba 8
- Kaba Star
- Kaba Gemini S
- Kaba Gemini T
- Kaba Quattro
- Kaba Quattro S
- Kaba Penta

I hope you have enjoyed reading this article.

Han Fey  
The Netherlands