

ASSA Twin Systems (part 1)

The Unparalleled Security System

My name is Han Fey and I am a collector of high security locks. I have always been looking for the weak spots in locks and find ways and methods to actively exploit them. That is the reason I started collecting locks. The goal of this article is, as all of my articles have been, to provide information about both old and new locking mechanisms.

As a mechanical engineer I am interested in the many techniques used for security. I have a great admiration for ASSA locks because they belong in my opinion, to the category of the best locks in the world. Throughout this article I will try to detail the high security features in these locks which are normally not clearly visible. I will show cutaway locks and exploded views in order to better explain these features.

One of the reasons why many manufacturers produce cutaway locks is to show potential buyers and locksmiths the inner workings of a lock and its security features. Various cutaway locks make up an important part of my personal collection. Many of these cutaways are factory made, however sometimes I am unable to obtain a factory cutaway or factory cutaways may not have ever been made available. When this situation occurs, I frequently produce my own custom cutaways by hand.

I currently have about 100 different cylinder cutaways and another 75 padlock cutaways, for research and development purposes.

For each of the locks to follow I will talk about the security features and techniques used, and if possible show the internal workings of the lock. Many of the techniques I discuss in this article I derived from my own collection of locks. While I did my best to detail them as accurately as possible, I am not responsible for any errors made.

In this article I will follow the American standard of calling the pin that contacts the key, and is in the plug, the bottom pin. The pin in the cylinder housing I will call the top pin. Americans place their cylinders this way (on top) because they want to prevent dirt and ice from getting into the chambers. In addition there is the idea that you still can open the lock if some springs are very weak or broken.

Originally I was planning to have one article where I covered all the Twin systems. This article was more than 75 pages and was almost a book. For this reason I split the article in two parts.

In part 1, I discuss the following systems from ASSA:

- Twin 6000 ⇔ Twin 1 (systems Europe + USA) => **Introduced 1981 (100th anniversary) => page 3.**
- Twin 6800 ⇔ Twin Exclusive (up-grade Twin 6000) => 6 pins + 5 side pins => **Introduced 2000 => page 13**
- Twin 7000 ⇔ Twin 2 ⇔ Twin V10 ⇔ Twin Global => 6 pins + 5 side pins => **Introduced 1996 => page 15**
- Twin 6100 ⇔ Twin Pro => 6 pins + 5 side pins => **Introduced 2003 => Page 21**
- Twin 8800 ⇔ Twin Maximum => 6 pins + 5 side pins => **Introduced 2005 => Page 25**
- Twin 2800 => cheaper version of the Maximum. No hardened pins etc.

In part 2, I will discuss the following systems from ASSA:

- Twin 5800 ⇔ Max ⇔ Twin Combi ⇔ Twin Multi => 6 pins + 5 finger pins => **Introduced 1991**
- Twin 1800 => 6 pins + 3 finger pins (cheaper version Twin 5800 => **Introduced 1991**
- Twin 4800 => 6 pins + 3 finger pins.
- Twin DP Double Performance => **Introduced 2004**
- Twin IC Cylinders
- Twin Knob Cylinder
- Twin Pro Deadbolt with Geminy shield

Notes: - Side pins are pins which only move upwards and downwards.
 - Finger pins are pins which not only move upwards and downwards, but also rotate.

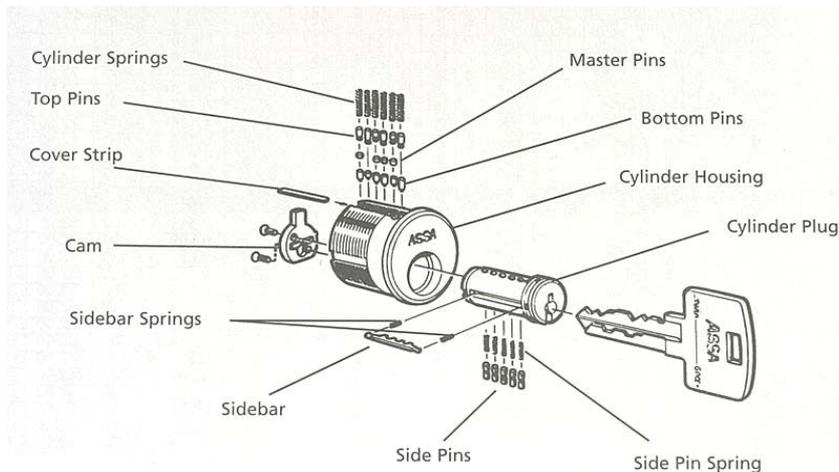
In this article I will NOT discuss the ASSA SCB, ASSA 600, ASSA 700, ASSA Flexcore, ASSA Guideline and ASSA Desmo locking systems. It is certainly unfortunate, because all of these systems have their own special features which make them unique, however for the sake of clarity I decided to focus on the Twin line. I will not discuss the levels of security and the ingenious ways the cylinders are connected in a door, again for the sake of clarity and length.

The parts in the ASSA “TWIN” SYSTEM

All ASSA Twin systems have two independent locking mechanisms, this means that two sets of bittings, or key cuts operate the **double locking mechanism**. They use a 6 pin tumbler mechanism incorporating mushroom drivers (**System code**), and a uniquely coded side bar system (**Side bar code**). The side bar provides additional protection against picking as well as offering dealer, end user, regionally exclusive key systems.

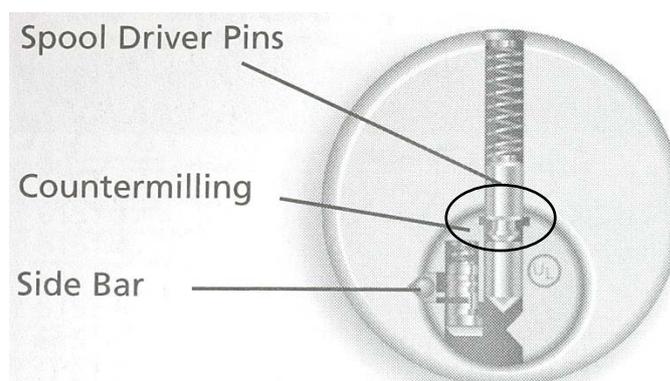
Because of the two independent locking mechanisms, the ASSA Twin system also has two independent shear lines that help assure optimum pick resistance. False grooves in the side pins catch the side bar when improperly positioned. When rotational force is applied, the spool driver pins are caught by counter millings in the chambers of the cylinder plug. These features make the Twin system superior above other normal pin-tumbler systems. ASSA tries to constantly improve their products as you will see in this article.

The slogan of ASSA is: ASSA Cylinders – security at the highest level.



Parts in ASSA Twin systems

Note: The two independent locking mechanism are called System code and Side bar code



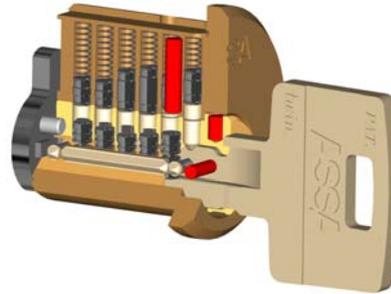
Working of the counter milling in the ASSA Twin 6000

Note: The counter milling in top of the chamber in combination with the specific ASSA mushroom pin (see oval). This is a very effective way to protect a cylinder against lock picking because the mushroom-shaped drivers are caught by this counter milling. In German they say Pol und Gegenpol. There are more details about the different counter millings and top pins later in the article.

The ASSA Twin cylinder is UL 437 rated, they have hardened pins inserted around the keyway and side bar to resist drilling etc. In most of the detailed pictures of the plug and the housing, you will see these hardened inserts.

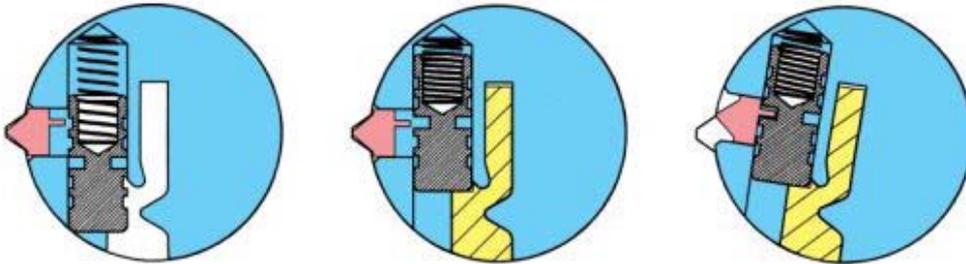
ASSA Twin 6000 (Europe)

In 1981, ASSA celebrated its 100th anniversary as a company with the release of the ASSA Twin 6000. It incorporated a new cylinder concept utilizing the dual locking mechanisms also found in modern ASSA cylinders. The ASSA Twin is one of ASSA's most successful products. It was patented in 1980 by Bo Widen and on most Twin keys you can find his logo (in Part 2 more details). The red pins below are drill-protection pins and as you can see, there is a special drill-protection pin for the side bar.



3-D view of the Twin 6000

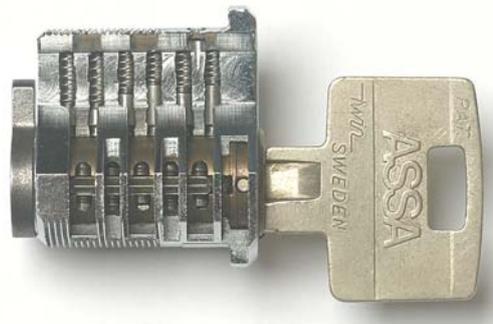
In the picture below you can see how the side pin works in combination with the key. In the left picture you can see that the side bar rests in the groove of the cylinder housing, blocking movement of the plug. The side bar code of the key (yellow) lifts the side pins into a position where the side bar can be received (picture in the middle). The side bar then “cams-out” into the plug as the key is turned.



Working of the Twin 6000 (locked, key inserted, side bar retracted)

Note: There are 5 side pins, with 5 possible depths. This makes theoretical 3.125 side bar variations.

In the picture below you can see a cutaway from this system. It was one of the first cutaways I obtained. For several hours I investigated this cutaway looking carefully at how they made the milling tracks so that you have a sturdy and reliable cutaway.



Cutaway rim cylinder of the Twin 6000 (Europe)

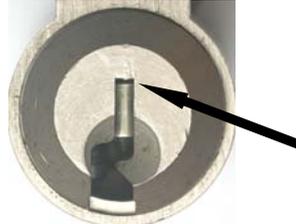
Note: The enlarged bow accommodates use by manually impaired people.

Note: The fonts they use for the brand name “ASSA” on the bows.

Some ASSA terminology:

Profile is the shape of the key and the shape of the cavity in the cylinder that the key goes into. Some call this a keyway, ASSA calls it a profile.

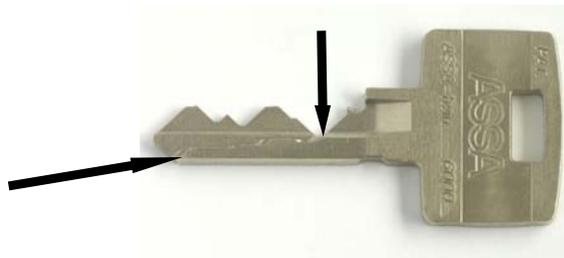
ASSA made several profiles in this system. In the following picture you can see the European profile. I call it "European" because in my opinion, it's the most frequently used profile in Europe. If you look carefully in the keyway you can see the side pin with its false grooves. All the side pins are physically the same so you cannot "read" anything from them. If you look at the first bottom pin below you will notice that you are able to see the top of it, this makes it possible to determine the first key cut depth.



Details of the European Twin 6000, Profile 50

Note: Later in this article is the "American" Twin 6000 profile, if you look carefully you can see the differences.

The left side of the key has a ramp at the tip that picks up the round edge of the side pins as the key is inserted (see arrow). The side bar and conventional pin-tumbler mechanism are totally independent.



Key of European Twin 6000

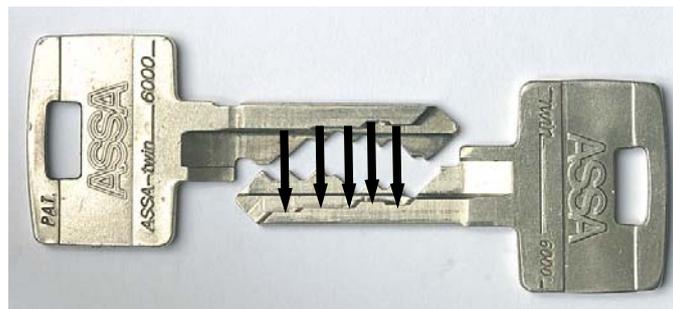
Note: The leftmost arrow marks the ramp for the rounded side pins.

Note: These are the cuts in a pin-tumbler key I like. The first cut is deep, then you get two high cuts and then again a deep cut. This combination of cuts makes the lock harder to pick.

Note: This picture shows that ASSA is not afraid to use a deep cut nearby the bow (rightmost arrow). Most manufacturers don't because it would weaken the key, potentially causing breaking.

ASSA Twin 6000 (Europe) side bar codes

I have a large collection of keys with different Twin 6000 side bar codes. I noticed that in Europe two keys with mirrored side bars have consecutive numbers. For example, if the side bar code is 954, the mirror in cuts is a key with side bar code 955. Just like 960 is dual with 961. In the United States they use another side bar coding as you will see later.

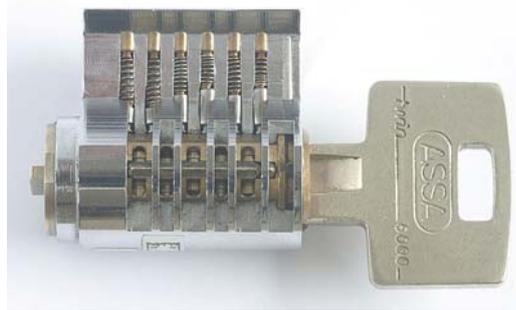


Key of European Twin 6000 with side bar code 956 (bottom) and 957 (top)

ASSA Twin 6000 (USA & Europe)

For some time ASSA produced the Twin system in the USA. As far as I know they have stopped production because they could not guarantee the quality of the product in the States. I once spoke to someone who had visited the ASSA factory and said the quality control of the locks was excessive. I will give a short example of a test they use for tolerances. First they take the housing for the cylinder and put it upright or vertical. Then they insert the plug in the housing. The lock passes the test if the plug stays stuck in the housing. If you push down the plug it should stop moving when you stop pushing (similar to a telescopic antenna). You can imagine that these tolerances do not allow the use of a shim or make picking easy.

To my knowledge and in my collection I only have American Twin 6000 cylinders with profile 51 and European cylinders with only profile 50. It seems that for American Twin systems, profile 50 was for dealers and profile 52, 61 and 62 were for end-users.



Cutaway oval cylinder from the Twin 6000 (USA)

Note: This cutaway is assembled from 37 parts. I am always curious out of how many parts a lock contains. For me it's an indication how secure the lock is.

In the picture below you can see the details of the American Twin 6000 profile. If you look closely you can not only see the top and bottom pin, but also what type of top pin is used.



Profile of an American Twin 6000 (profile 51)

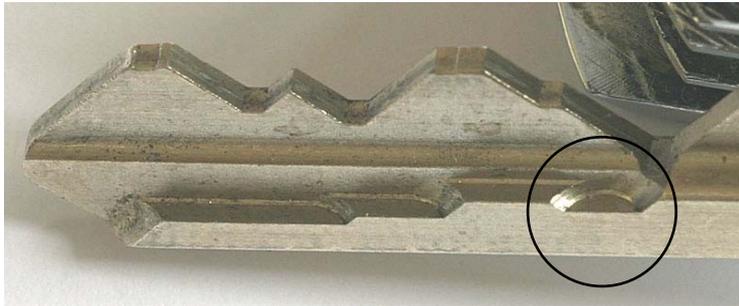
Note: The stamp of the UL-listing (Underwriters Laboratories Inc.) on the plug of this cylinder.



Key of a Twin 6000 (USA)

Note: The number 51545 on the bow denotes two separate details: 51 is the profile and the number 545 is the code number of the side bar.

On the next picture you can see a detail of the side bar cuts on the key. You can see the round shape of the side bar cut where the side pin drops in. In the other Twin systems the shape of the side pins is different, therefore there are different shapes of the side bar cuts in the keys of the other Twin systems.



Details of the side bar cuts in a key from the Twin 6000

Note: You can see rounded grooves in the side bar cuts, these match exactly with the diameter of the round side pins. In their new systems, like the Twin Pro, Twin Maximum, etc., ASSA made the contact point of the side pins more streamlined.

Twin 6000 side pins

Below a picture of the side pins used in the Twin 1 or Twin 6000. These pins were revolutionary in the time frame they were introduced. These side pins have inactive “dummy” grooves, which catch the side bar when improperly positioned.



Details of the side pins of the Twin 6000 with springs

Note: All the side pins are the same and they have four false grooves.

The side pin contact points and the side cuts on the key are critical contact points. These are the points which make it hard to illegally copy a key from the Twin system.

In the production process the side pins seem to be the most critical components. These parts are made in Sweden only, because only there they can make them with the precision required.

They tried at one point to make the side pins at LAB in the USA, but they couldn't maintain the tolerances and so they stopped production there.

A short joke about the notches in the side pins

In Sneek 2007, during the Dutch Open, there was a speaker who told something about different locking mechanisms. He also covered the ASSA Twin 6000. There were maybe 70 people speechless listening to his presentation.

When he presented the detailed picture of the side pins of the Twin 6000 on the screen he said:

- There are 3 types of grooves, or notches, that are found on side pins used in side bar locks.
- The first are the real notches where the side bar enters the pin.
- The second are the false grooves or false notches that traps the side bar legs.

And

- The third type of notches are usually found on Spanish cylinders.

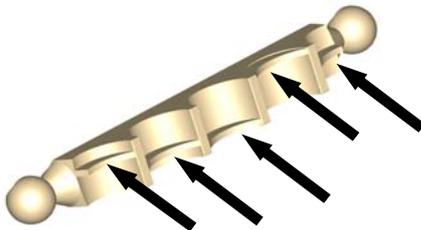
They are the ...

¡buenas noches!

I saw that it took some time before people understand that it was a joke. They believed this man was quite serious with all of his knowledge.

Twin 6000 (and Twin V10, Twin Pro and Twin Maximum) side bar

The side bar is pushed out of the plug by two small springs. If the side pins are lifted properly, the side bar can retract into the plug. If the side pins are not lifted properly, the side bar will not fit in the plug and this will prevent rotation.



Computer drawing and a picture of the side bar

Note: The theoretical number of side bar codes is 3,125 (5x5x5x5x5) because of the fact that there are 5 positions and 5 different heights. The actual number of side bar codes is 2,805, which can be produced using only 1,400 different side bars, because the side bar can be flipped around. For more information see www.tool.nl/cutaway1.pdf

Note: The design of the side bar used in the Twin 2, Twin V10, Twin Pro and Twin Maximum is the same. The side pins are unique for each system and all have therefore different shapes. Code variation is made by the different heights of the protrusions on the side bar (see arrows in the left picture).

Note: The numbering scheme from the side bar codes in the different Twin systems stays the same. For example if the side bar code in the Twin 6000 is 545, the side bar in the Twin Pro would have the same code. In part 2 I will show some keys from the different Twin systems, with the same side bar coding.

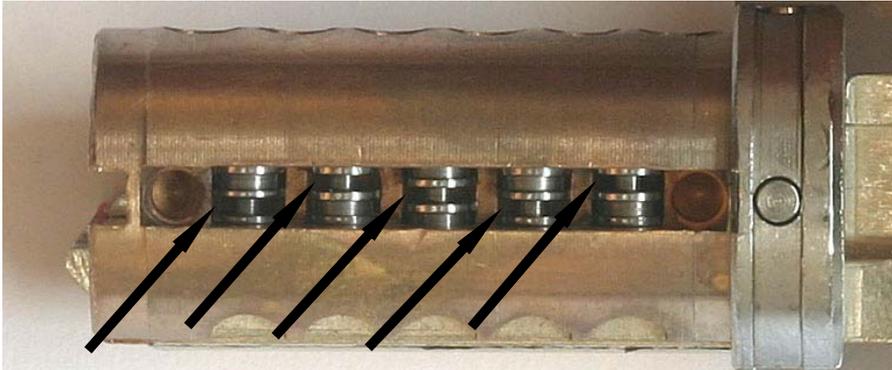
Note: The black arrows in the right picture mark the position of the springs, which push the side bar out of the plug.

The workings of the side pins and side bar

For each unique Twin system in my collection I have inserted the correct key and taken photos to show how the side pins work.

In the picture below you can see the side pins in the correct position. An important part of the Twin 6000 system is that the shear line for the side bar is not straight. If you take a closer look at the picture you will see the gates and the false notches on the side pins.

The arrows mark the different heights of the correct gates for this specific side bar.



Details of the groove in the plug of the Twin 6000 where the locking bar drops in

Note: You can see the drill protection pin in front of the side bar. All vital points in the UL-listed cylinders must be protected by case-hardened drill resistant inserts.

Note: The manipulation protection in the side pins are the horizontal inactive "dummy" grooves.

Each system has its own side pin design. All the side pins in one specific system are the same.

The code variation is made by the different heights of the protrusions on the side bar, so variation is made by the different side bar codes.

The key differences are made with the side bar itself.

On the next picture you can see the bottom of the plug, with the key inserted. The key is placed in the plug to prevent the side pins from jumping out. Each side pin can have 5 different positions.

What is most interesting about this picture is the tip of the key. In the circle you can see this strange tip. Every Twin system has its own special shape as you will see later.



Details of the Twin 6000 bottom of the keyway with the key inserted

Note: The specific tip of the key in this system. Later in the article you can compare the tip of the key with the other systems. The reason for the different shape of the tip is probably the ramp which makes first contact with the side pins.

Some Twin 6000 profiles

In first instance I thought there were only two different profiles in the twin 6000 system (USA and European profile). But coincidentally I also got this special profile in my collection.

If you look carefully on the keyway you see an undercut. Knowing that this system is from about 1981, I find it clever that they already used an undercut in these days. The ordinary profile 51 does not fit in the keyway of profile 851, but the key with the undercut (profile 851) fits in the ordinary keyway of profile 51. This way you can use the profile with the undercut in one GMK-system.

Sneaky profile of an ASSA Twin 6000

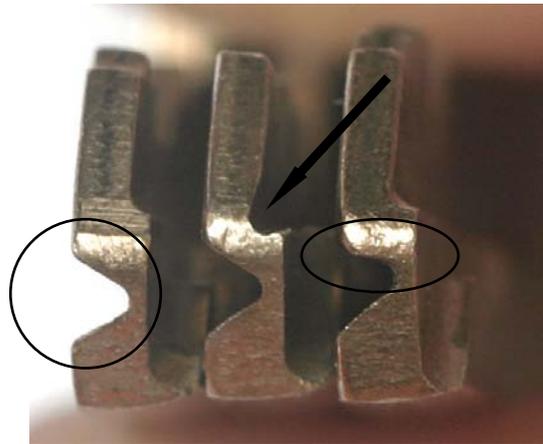


Sneaky key profile 851 of the Twin 6000 with “undercut”

I tried to make a clear picture of the Twin 6000 profiles which I have in my collection. On the next picture you can see profile 51 on the left. You recognize it by the V-shape on the key (see circle).

The profile 851 has the basic profile from the 51, but has an undercut on the key (see arrow). The key on the right is the key profile 50 and does not have the V-shape cut (see oval).

Only Profile 51 can be undercut. The other profiles 52, 61 or 62 cannot be undercut, because there is not enough room for the undercut. It would weaken the blank so that it couldn't be duplicated and key splitting would be the normal result of using it.



Front view of the different keys in the Twin 6000 (51-851-50)

Possibly the profile 851 is a Twin Exclusive profile. It has however the standard Twin 6000 side pins in it. As far as I know the Twin Exclusive uses also other side pins.

More ASSA Twin 6000 profiles

When I almost finished this article, I went to a locksmith in Germany who sold the ASSA Twin systems. I wanted to discuss with him the contents of this article. When I was walking around his shop, I suddenly saw an ASSA Twin 6000 demo kit. Of course as a collector I started playing with this cylinder. I was not familiar with the coding on the bow, so I tried to insert a random Twin 6000 key I had brought along with me. The standard 50 and 51 key profile did not fit and I did not see an undercut on the key. Now I was interested and I wanted to have this demo kit. A new profile I thought.

I traded the demo kit for an Ikon WSW cutaway, a lock that will stop being produced within a few years. Below you can see the demo kit and a detailed picture of the keyway.



ASSA Twin 6000 demo kit with special profile

Note: The surface of these cylinders have a different colour than the new ones. Because of the surface treatment they used in that period, you can see that you are dealing with an older cylinder.

This demo kit demonstrates again that ASSA has a lot of unknown keyways and tricks in their assortment, allowing them to upgrade certain locks with extra high security features.

On the next picture you can see that the keyway is not totally straight (see circle)



ASSA Twin 6000 keyway with special profile

I also took a picture of the key where you can see the extra groove clearly (arrow). I only have one key with this profile in my collection



ASSA Twin 6000 (unknown) profile

Note: The arrow shows the extra groove in the profile.

Finally I took a picture of all the Twin 6000 profiles I have in my collection, whether the last profile (on the right) is a Twin Exclusive I don't know. The side pins in this demo kit look similar to the side pins used in the other Twin 6000 systems.



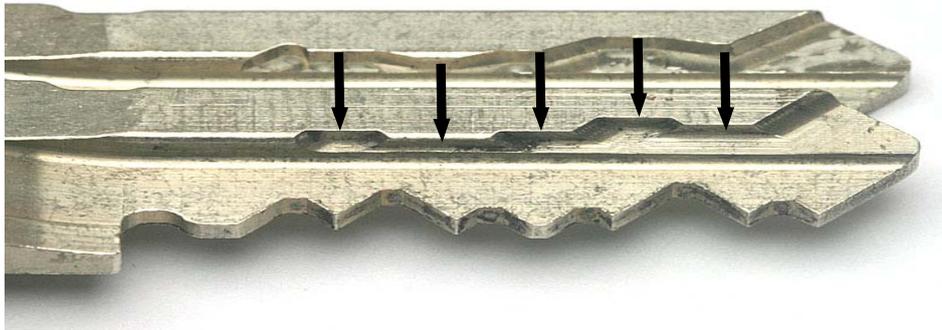
Profile 50, 51, 851 (undercut) and Profile "unknown"

Note: The ramp that supports the side pin on the right of each key.

ASSA Streamline side bar cuts

Julian Hardt, a German lock expert and picker, gave me a key set with a streamlined side bar profile. Later in the article I will show the other Twin systems, which all have a streamlined side bar profile on the key, but for the Twin 6000 system it's rare in my opinion. Julian gave me a key with the normal side bar cuts and a key with the streamlined side bar, and last but not least I got a matching side bar. The heights in this side bar are 32454. I build this side bar in a cylinder and I must admit, it worked with both keys. I must say that the streamlined side bar makes it much harder to read the depths of the side bar cuts.

It seems that the keys with the streamlined side bar cuts are produced on a side winder duplicator. Normally for big quantities they cut the side bar on a Giuliani machine. For small quantities of keys they use the Silca Quattro Code machine. The difference is that it takes over a minute to produce a key on this Quattro Code machine and it is only used when they need under 10 keys.



Keys with streamlined side bar cuts and “ordinary” side bar cuts



Note: During the photo shoot, I mixed up the side bars. I wanted to make a picture of the streamlined side bar with the matching side bar (cuts 32454). However, I took the wrong side bar and used the side bar with the side bar cuts 24324. The key has the side bar cuts 32454. For understanding how the cuts in the side bar profile work, this picture is fine.

During this whole article you will find this kind of anecdotes. It are the small details, which you normally do not see in common locks that are just a resume of the tricks I encountered during collecting. In my opinion there should be a lot more of these “special” security features.

ASSA claims that the ASSA Twin, high security systems that have been in use for the past 19 years, can be upgraded to each new patented system. The costs are relatively low with just the replacement of three components; the cylinder plug, the side pins and the keys.

ASSA Twin Exclusive

In 2000 ASSA introduced the Twin Exclusive, a patent-protected upgrade to the highly successful Twin 6000 series. While utilizing the same dual locking mechanism, the Twin Exclusive was built upon the original design and allowed for one key to work in both cylinders.

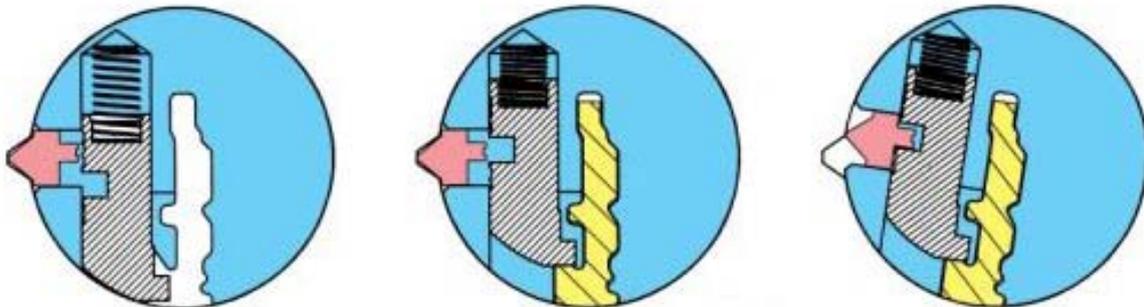
That same year ASSA opened its doors to a new 5,000 square foot facility in New Haven, CT increasing its production capabilities with state of the art machinery and assembly equipment.

The Twin Exclusive is an upgrade for Twin 6000 equipped facilities, offering patent protection for keys and is based on the Twin V10. ASSA divided their keyways in different sections: TER, TEL, TEE, etc. TER-keyways are designed for use by the locksmith and are available in national and regional keyway levels. The TEL keyway, also for locksmiths, is perfect for smaller geographical areas.

TEE means that the profile is factory controlled, this guarantees exclusive profiles. The first two characters in the "TE" coding stand for Twin Exclusive. Each side bar in this system can be operated by two different key blanks. The side bars are interchangeable between the Twin 6000, Twin V10, Twin Pro and Twin Maximum systems.

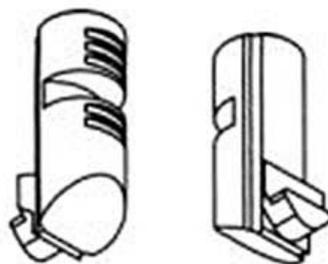
The Twin Exclusive is a true upgrade to the Twin 6000 product line and can be integrated into existing Twin 6000 profiles, like the 50, 51 and 62.

In the picture below you can see how the side pin works in combination with the key. In the left picture you can see that the side bar rests in the groove of the cylinder housing, blocking movement of the plug. The side bar code of the key (yellow) lifts the side pins into a position where the side bar can be received (picture in the middle). The side bar then "cams-out" into the plug as the key is turned.



Working of the Twin Exclusive (locked, key inserted, side bar retracted)

Note: There are 5 side pins, with 4 possible depths. This makes theoretical 1024 side bar variations.

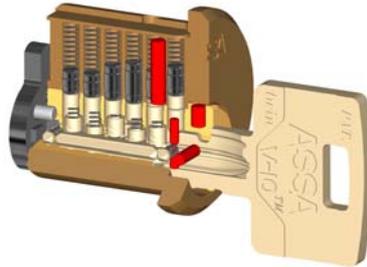


Detail picture of the Twin Exclusive side pin

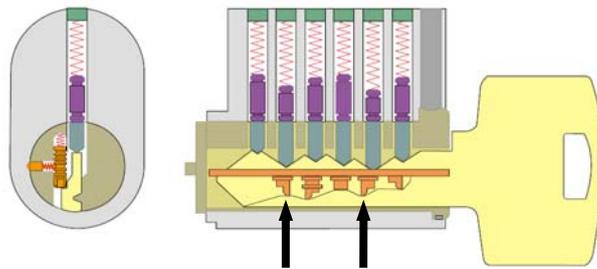
As far as I know, I do not have Twin Exclusive cylinders in my collection, so I am unfortunately unable to provide any additional details.

ASSA Twin 2 and Twin V10 (Extremely High Security according to ASSA)

With the introduction of the V-10 system in 1996, ASSA ushered in a new generation of lock technology. The V10 offers patent protected, unique and geographically exclusive profiles for ASSA authorized security centers and end users. The innovative V10 key design and cylinder helps to eliminate unauthorized duplicate keys, and to maintain a key control system that is unmatched in the industry. The Twin 2 and Twin V10 were introduced as an upgrade to the Twin 6000 program, and featured new patented key blanks and profiles. In comparison with the Twin 2, the V10 includes new side bar/side pin arrangements to expand master keying possibilities. Dealer and end user coded side bar assignments offer control over key duplication. Both side bars and key blanks are registered to specific contacts, and are only available to them. Regional and national exclusivity for side bars is available.



3-D view Twin 7000 / Twin 2 / Twin V10

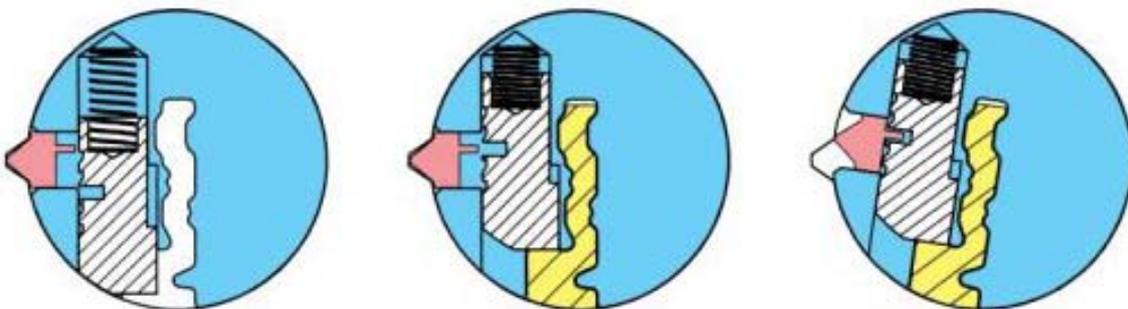


Cutaway view of the Twin V10

Note: The different contact points (For & Aft) on the key that the side pins can have

Note: It seems that there are 3 different side pins in the Twin V10 and Twin Pro. I do not have these different types of pins in my collection, so I am unfortunately unable to provide any additional details.

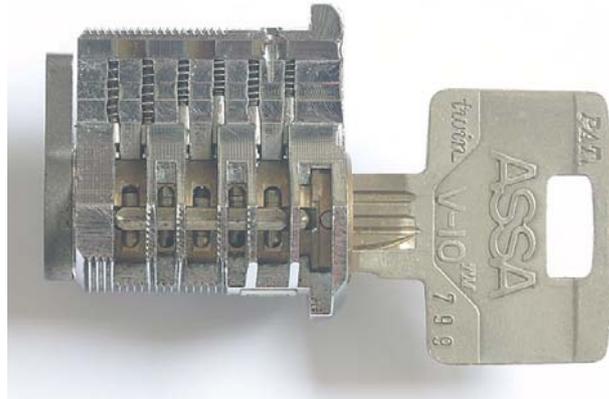
In the picture below you can see how the side pin works in combination with the key. In the left picture you can see that the side bar rests in the groove of the cylinder housing, blocking movement of the plug. The side bar code of the key (yellow) lifts the side pins into a position where the side bar can be received (picture in the middle). The side bar then “cams-out” into the plug as the key is turned.



Working of the Twin V10 (locked, key inserted, side bar retracted)

Note: There are 5 side pins, with 5 possible depths and 2 possible positions (For & Aft). The most common used side pin is the left pin (Aft). This pin is used in mono-keying. The other pins (right & Center) can be used in GMK-systems.

In one of my first articles about locks (May 2005), I wrote about the Twin V10. As this article is only an overview of the ASSA Twin systems, for more details about this lock see www.tool.nl/cutaway1.pdf.



Cutaway rim cylinder of the Twin V10

In the picture below you see a plug of the American V10. You can tell that this is the American version because of the UL-listing on the front side of the plug.

You can see the top of the first bottom pin and you can determine the first key cut. Most of the locks photographed in this article are demo locks, ASSA made all these demo locks with the first key cut shallower, maybe on purpose to make the key less likely to fracture, due to stress. Abus, a German company, does the same with their keys.



Profile of the Twin V10 USA (Profile nr. 95)

Note: the flat front side of the side pin and the shape of the top pin (arrows).
Note: Patent of this profile expires 31 December 2014.

On this American key, you can see the number “545” of the side bar code.



Key of an “American” Twin V10

A few years ago, I bought a European Twin cylinder in a shop. It is an example of the improvements ASSA makes with their product. The side bar coding and the key cuts cannot be determined directly from the numbers on the bow anymore. This is the type of improvement that makes ASSA a good company, they are innovative and they improve (when possible).



Keys of the (new) European Twin 2

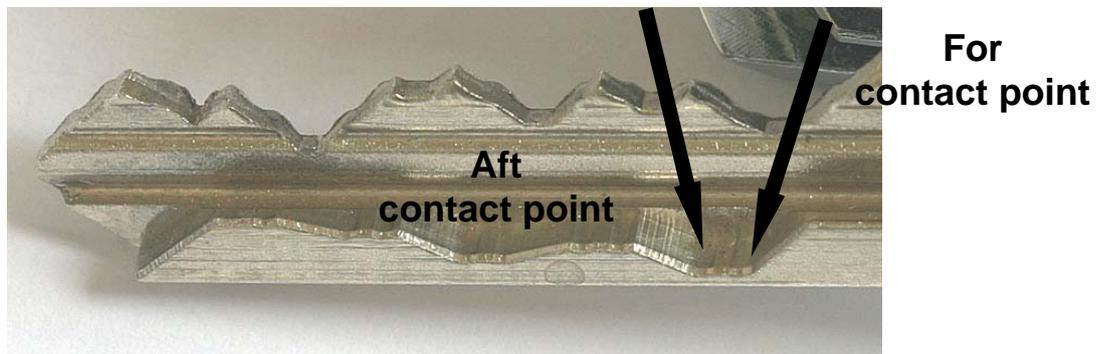
Note: The numbers on the Bow are TSA-14158 and TAA 000120, the key cuts and the side bar code are coded (in my opinion).

Details of parts in the side bar system of the Twin 2 & Twin V10

The side bars in the Twin V10, Twin 2, Twin Pro and the Twin Maximum are all the same. The fact that makes them unique is the specific coding, the height of the five edges, which engage in the gates of the side pins. If a locksmith is committed to ASSA, he can have his own unique side bar coding (or physically side bar code). The side pins for mono keying in the Twin V10 and Twin 2 system are all the same.

For master keying they have two different side pins. The contact point of the pin is then Aft or For (similar to Medeco). This means that there are two positions where the side pins can make contact with a specific key.

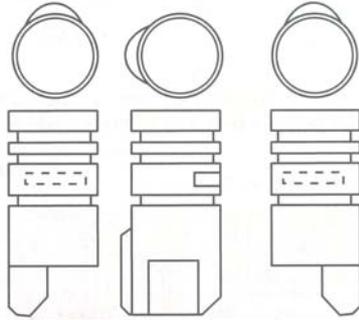
As far as I know each side pin may be positioned so that it contacts the front or the back on that specific side bar position on the key. The arrows mark the possible positions where the side pins can make contact with the key.



Details of the side bar profile on the Twin 2 / Twin V10

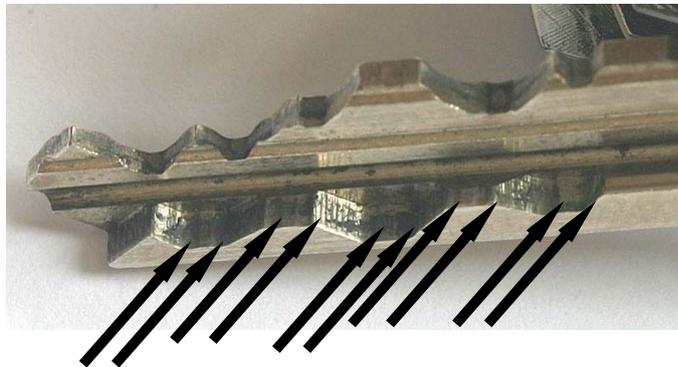
Detailed pictures of some Masterkey side pins

Originally I planned to take detailed pictures of these pins, but I did not have any side pins for master keyed systems available.



Details of side pins from the Twin 2

Note: On the picture you can see the gate where the locking bar drops in. In addition you can see that the false gates are horizontal. In part 2 you will see finger pins, which must be both lifted and rotated. In these pins the false gates are vertical.

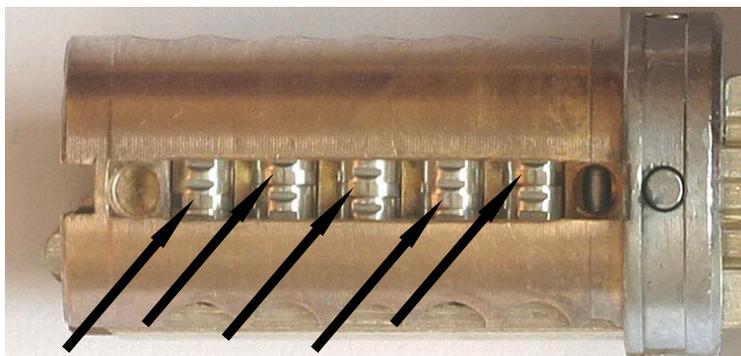


Details of the side bar profile in the Twin V10

*Note: If you look closely at the side bar profile on the key you can see 10 possible positions where the side pin can make contact with the side bar profile on the key.
Note: In GMK systems they can use the left (Aft), right (For) and Center side pins. They claim that they can make Master key systems that can exceed the 1,000,000 cylinders.*

Working of the side pins and side bar in the plug

On the picture below you can see a Twin V10 plug with the correct key inserted.

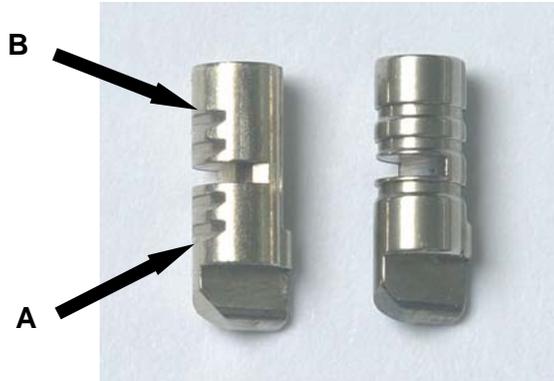


Details of the Twin V10 gates where the locking bar drops in

Note: The manipulation protection in the side pins are the horizontal "dummy" grooves.

Two types of the same side pin used in the Twin V10

I received a new V-10 cutaway from the manufacturer, and I saw some differences with the cutaway I already had. One difference were the side pins. On the next pictures you can see that the false grooves on the side pins are different and also have different positions, in comparison with the “older” version of the side pin.



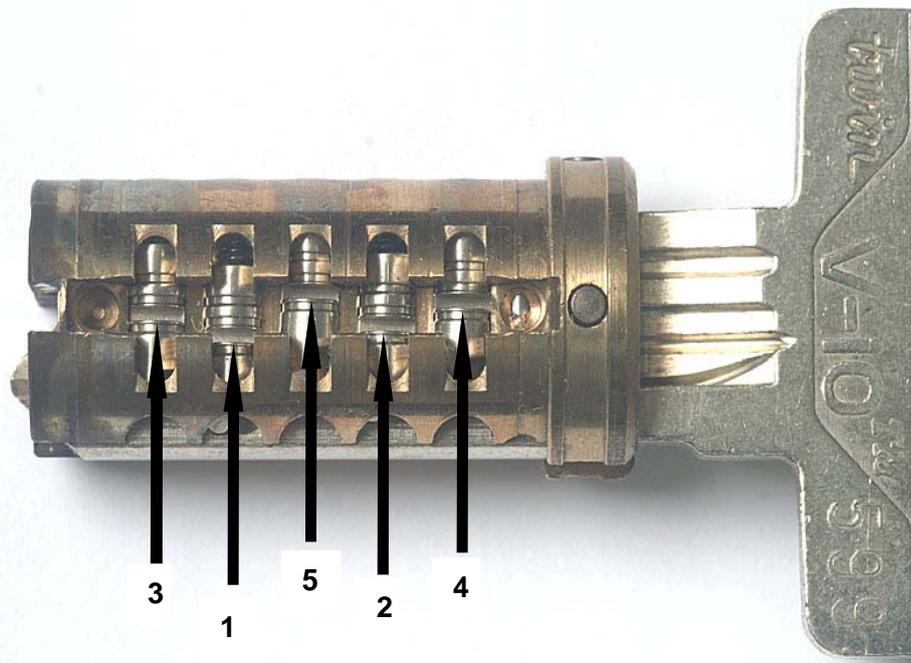
Details of the two types of Twin V10 side pins

Note: The side pin on the left is the older one.

Note: The angle in the false notch on the left side pin (arrow A). If you try to pick this pin, the angled part will slide over the side bar protrusion. The 90° angle on top (arrow B) of the groove prevents that the side pin will “fall” back. These details are some of the things I admire in ASSA locks, they are cleverly designed.

The different heights in the side bar

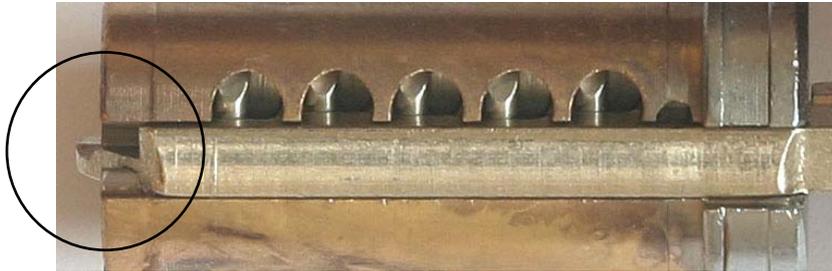
The side bar of this new V-10 cutaway has 5 different heights as you can see in the picture. Depth 1 is the deepest, depth 5 is the shallowest cut in the side bar profile.



Details of the gates of a Twin V10, with the new type of side pins

Note: This plug with the matching key is from an ASSA demo cylinder, therefore it has 5 different depths in the side bar code. As you can see on the key is the side bar code 599. This demo cylinder comes with two different side bar coded keys. The other key has side bar number 799. If you flip the side bar in this demo lock, you can use the key with side bar code 799.

On the next picture you can see the bottom of the plug of a Twin V10 with the key inserted. You can see the difference in the shape of the side pins in comparison with the Twin 6000 pins. The side pins in the V10-system can be positioned frontwards or backwards. In master key systems this variation of the side pins positions is used. In normal mono keying however, this feature is not used. On the next picture you see the normal configuration. Every side pin is "Aft" positioned.



Details of the bottom of the Twin V10 keyway with the key inserted

Note: The specific tip of the key in this system.

The side bar used in this system is the same as in the Twin 6000, Twin Pro, and Twin Maximum.

Twin V10 without side bar?

I intended to write something about the Twin Combi system later in the article. But when I was sorting my Twin cylinders I saw a V10 key without a coding on the bow. This was strange in my opinion and I searched, in my collection, for the matching cylinder. When I found it, I felt less resistance than normally by inserting the key. When I took a close look in the keyway, I noticed that there was no side bar in the plug. This means that ASSA used this cylinder in a GMK-system in a door with less importance.



Plug of the Twin V10, without side bar



Profile of the Twin V10, without side pins

Note: If you compare this picture with the other picture of the standard V10 profile, you will clearly see that the side pins are missing.

Note: Later I heard, they call this Profile V6, because you now have an ordinary ASSA 600 cylinder.

Note: With an active side bar in it, the ordinary Twin V10 has the Profile 95.

This possibly means that the side bar of this key is a fake and not used in other systems, except the cylinders where no side bar is active in.



“Fake” side bar profile of the Twin V10

Note: Side bar cut numbers are “12443”

It seems that you can compare this cylinder with a 600-series profile that interacts with the Twin V10 system. The profile number of this key, without working side bar is V6. These cylinders do not have drill-protection and a side bar. They are therefore not UL-listed.

The Twin 6000 and Twin Exclusive systems, also use this “tandem” function. Then they call the profile TL51, TL52, TL62. The abbreviation “TL” stands for **T**win **L**ow. These cylinders have no side bar and hardened pins. These cylinders are used to key locks into the building master key system but you do not need the heavy duty security of a side bar cylinder.

Vachette V10 or VIP

I found this key in my collection; it is from the Vachette V10 system. I do not know if this system is still in production, but the key looks a lot like the new system from Vachette, the VIP. It is a very nice cylinder with many passive side pins. I have little respect for passive side pins as they seem so easy to defeat through milling false notches in the keys. I like therefore the ASSA active system much better.

I may write about this in the future, for now only the keys of the French V10.

The only reason for mentioning this system is that it also has the name V10. This means that in AA (ASSA-Abloy) they have two different V10 systems.

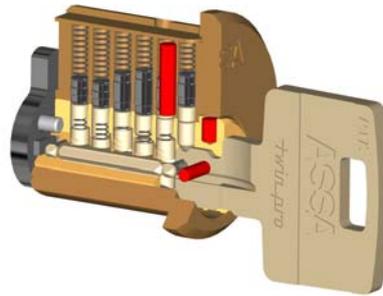


Vachette V10-system

ASSA Twin Pro

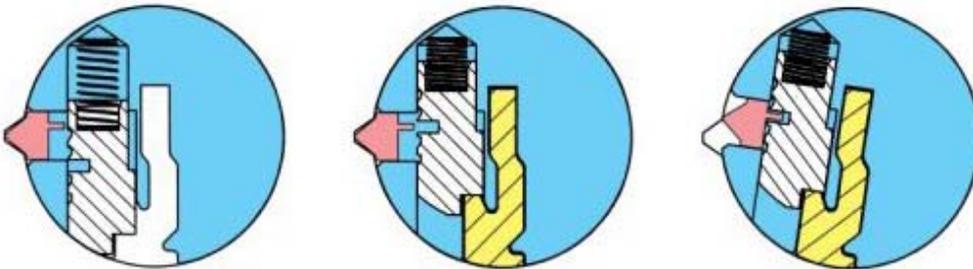
The Twin Pro system was introduced in 2003 as ASSA's highest level of controlled security concerning the delivery process. The Twin Pro lock is drop shipped only from the factory, and is available to end users and ASSA certified service centers. The Twin Pro was introduced after the Twin 7000. The most important improvement is that the key of the Twin Pro is thicker and therefore stronger than the V10 keys.

At the time it was released the Twin Pro was the most sophisticated key system being offered on the world market. Worldwide keyways could be obtained through a written agreement with ASSA for guaranteed exclusivity. The Twin Pro is not stocked by traditional distribution outlets eliminating this possibility of the system being compromised. ASSA trains facilities to service these locks in-house or to have them serviced by an ASSA certified service center.



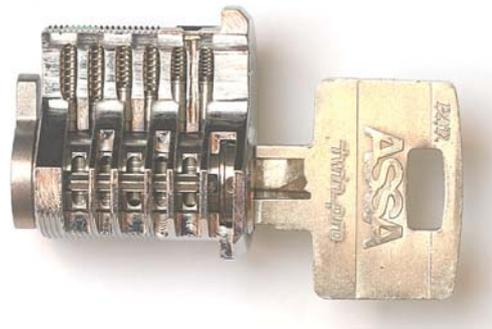
Cutaway view of the Twin Pro

In the picture below you can see how the side pin works in combination with the key. In the left picture you can see that the side bar rests in the groove of the cylinder housing, blocking movement of the plug. The side bar code of the key (yellow) lifts the side pins into a position where the side bar can be received (picture in the middle). The side bar then "cams-out" into the plug as the key is turned.



Working of the twin Pro (locked, key inserted, side bar retracted)

*Note: There are 5 side pins, with 5 possible depths. This makes theoretical 3.125 side bar variations.
Note: It seems that there are 3 different side pins in the Twin V10 and Twin Pro. I do not have these different types of pins in my collection, so I am unfortunately unable to provide any additional details.*



Cutaway rim cylinder of the Twin Pro

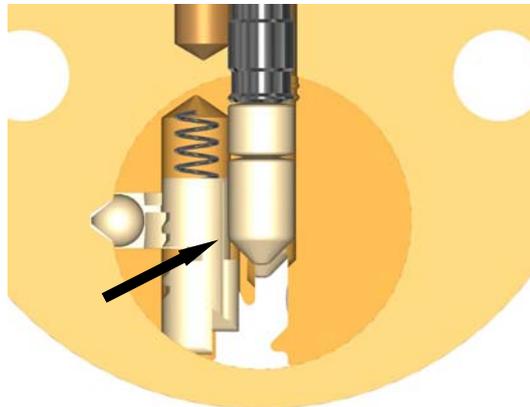
The Twin Pro has an undercut in the profile for protection against the Easy Entry. In the next picture you can also see the top of the bottom pin.



Profile of the American Twin Pro

Note: You can see the UL-listing logo on the front of the plug.

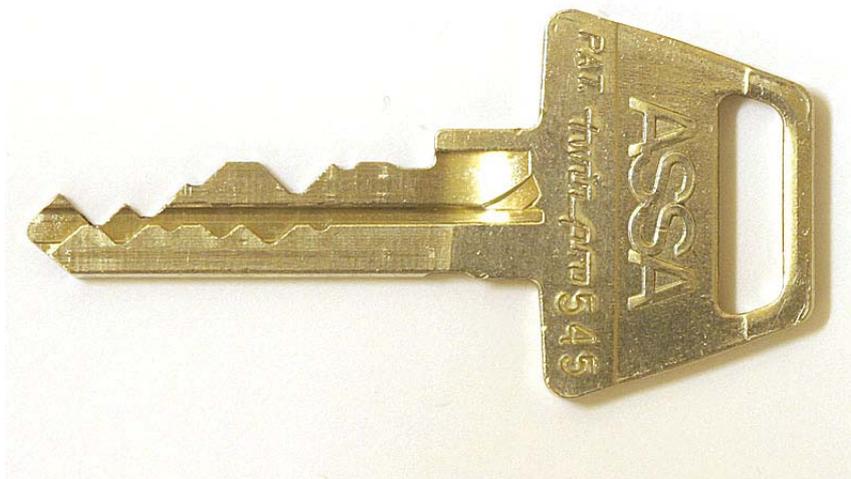
Note: Patent of this profile expires 31 December 2014.



Computer drawing of the front of the Twin Pro

Note: Notice the specific shape of the false grooves in the side pin (see arrow).

In the picture below you can see the key of the Twin Pro. You can see the V-shaped cuts where the side pins exactly fit in.



Key of the Twin Pro

Note: the shape of the side bar cuts.

I always thought you could recognize a specific ASSA system by the bow of the key, however I have found two keys from the same system but with different bows in my collection.

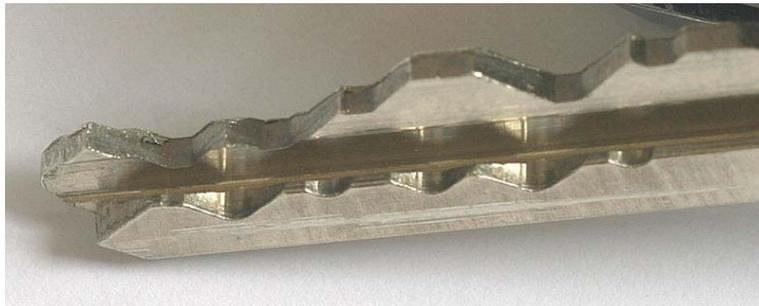


Some key bows of the Twin Pro

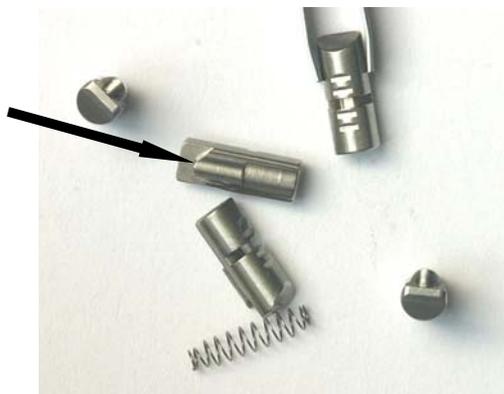
The Twin Pro system has 5 side pins which must only be lifted (only vertical movement). There are 5 different depth positions for each side bar cut. The contact surface of the side pins is a triangle which matches the triangle groove of the side bar track of the key. Small horizontal movements of the key, will lift up the side pins so that the side bar will block rotation. ASSA claims that this is a protection against bumping.

Details of the parts of the side bar system of the Twin Pro.

The side bar in the Twin Pro is unique, however the side pins are all the same.



Detail of side bar profile in a Twin Pro key



Details of the side pins in the Twin Pro

Note: The top of this chisel shaped contact point on the side pin fits perfectly in the V-shape cut in the side bar. With all these different shaped contact points from the side pins and the side bar profile on the key, ASSA has tried to make the pins more streamlined. The more streamlined pins help the insertion of the key so that it goes more smoothly.

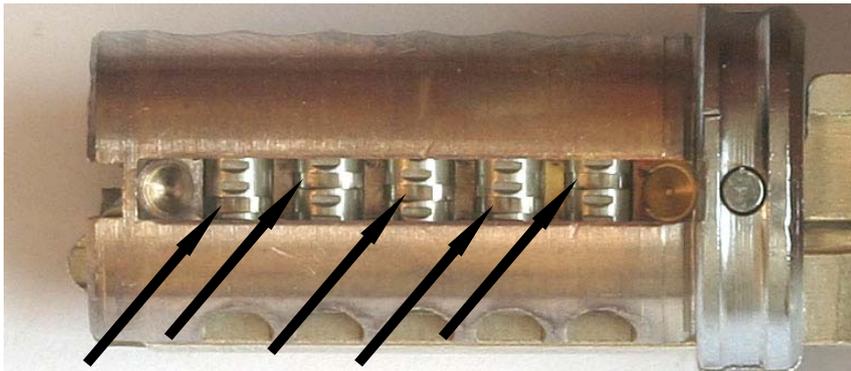
The side bar used in this system is, as written before, the same as in the Twin 6000, Twin 2, V10 and Twin Maximum (see page 7). This means that the size and design make them exchangeable within these systems. Of course you need a key from that specific system, where the side bar profile matches the different heights in the side bar.



Details of the working of the side pins in combination with the side bar.

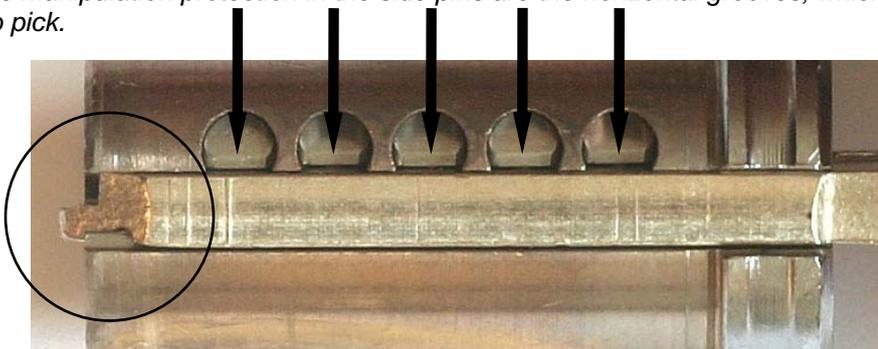
Combination of working of the side pins and side bar in the plug

On the picture below you can see a Twin Pro plug with the correct key inserted.



Details of the Twin Pro gates where the locking bar drops in

Note: The manipulation protection in the side pins are the horizontal grooves, which make the lock harder to pick.



Detail of the bottom of the plug from a Twin Pro, with the key inserted

Note: The specific tip of the key in this system, for the specific side pins in this system

Note: You can see that the side pins are lifted on different heights.

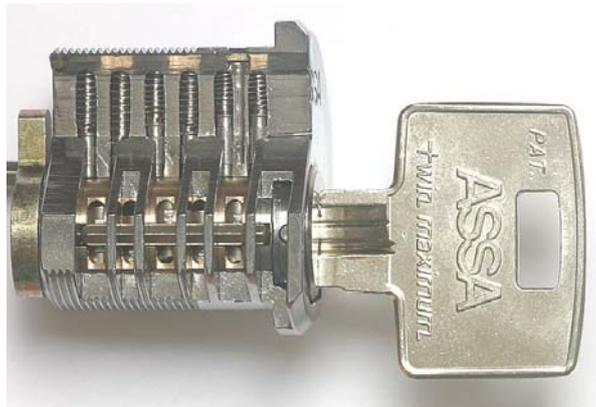
Note: The contact point from the side pin and the key is in the middle (vertical arrows).

ASSA Twin Maximum

I did not find an exploded view of this system because the V10 and Twin Pro all have the same design and look the same. The side pins are the only major difference. This requires a different level of cutting and positioning. These differences are apparently not noticeable to the eye.

The 6 normal pin tumblers are the same in all the Twin systems. Assa calls these different cuts the "System Code".

The Twin Maximum looks a lot like the ASSA V10, only the key is thicker and more sturdy. The side bar of the Twin 6000, Twin-2, Twin V10, and Twin Pro can all be used interchangeably in these locks.



Cutaway of the Twin Maximum system



Profile of the Twin Maximum

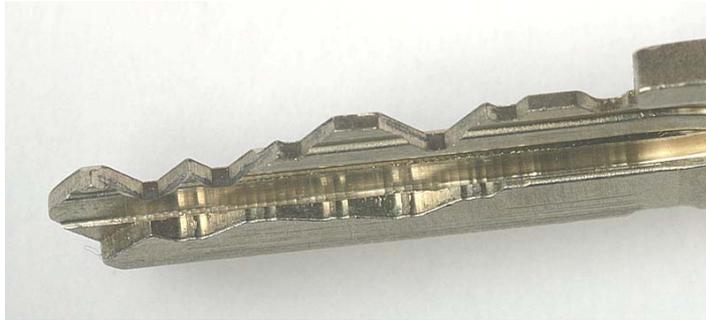
Note: Patent of this profile expires 31 December 2014.



Key of the Twin Maximum

Details of the parts of the side bar system of the Twin Maximum.

The side bar used in the Twin Maximum is, as written before, the same as in the Twin 6000, Twin 2, Twin V10 and Twin Pro (see page 7).



Detail of the side bar profile on the key of a Twin Maximum

Note: The Twin Maximum side pins, have two possible contact points on the key (just like the ASSA V10). One in the front (For) and one in the back (Aft). If you look at the side bar profile on the key you can see these contacts points. You can also see that the side pin is shaped this way.

The side pins look similar to the side pins in the Twin Pro, but in the Twin Pro the chisel point is in the middle. If you compare the side bar profile cuts from the Twin Maximum with the Twin Pro, you can see that the chisel shape is caught in the side bar cut in the Twin Pro system.



Detail of the side pins in the Twin Maximum

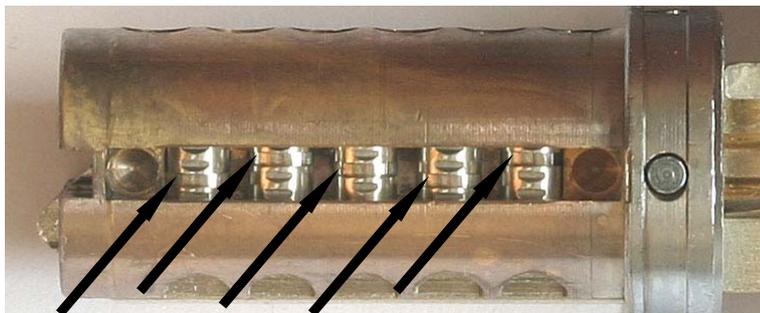
Note: The chisel shape can come in the front or come in the back of the side pin

Note: The side pins look similar to the side pins in the Twin Pro.

Note: I assume that there are also 3 different side pins in the Twin Maximum (left, right and center) but I am not sure of that.

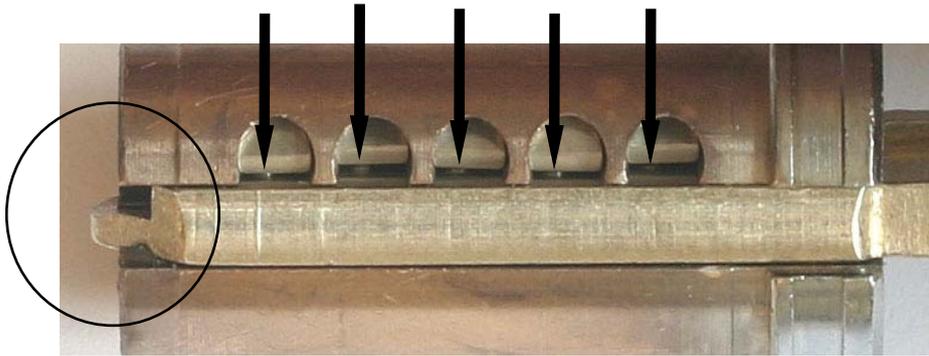
Combination of working of the side pins and side bar in the plug

On the picture below you can see a Twin Maximum plug with the correct key inserted.



Detail of Twin Maximum gates where the locking bar drops in

Note: The manipulation protection in the side pins are the horizontal “dummy” grooves.



Detail of the bottom of the plug from the Twin Maximum with the key inserted

Note: The specific tip of the key of this system.

Note: The different heights the side pins are lifted. The bottom of the side pin is angled. In the locking position the side pin rests on the inner shell of the housing.

Some side bar calculations.

I disassembled a demo cylinder with side bar code 545. When I assembled the cylinder, I noticed that I could flip the side bar and see that the side bar still was functional when I inserted the key. Clever for a demo model to make the side bar cuts that way as it does not matter how you insert it.



Detail picture of the heights of side bar number "545"

Note: As you can see if you flip the side bar the heights stay the same.

I investigated this and came to the next conclusion:

Side bar cuts are: 2-4-3-2-4 if you flip the side bar the number (3) in the middle stays the same. So height 3 in the middle is also with a reversed (or flipped) side bar height 3. This is logical.

Cut position 2, with height 4, comes on position 4 when I reverse the side bar. The height changes then from height 4 to height 2.

Cut position 1, with height 2, comes on position 5 when I reverse the side bar. The height changes then from height 2 in to height 4.

So another example:

Side bar code 599 with the cuts 3-1-5-2-4.

Because the number in the middle is not 3, this side bar is not reversible. The height from cut position 3, height 5, will become height 1 if you reverse the side bar.

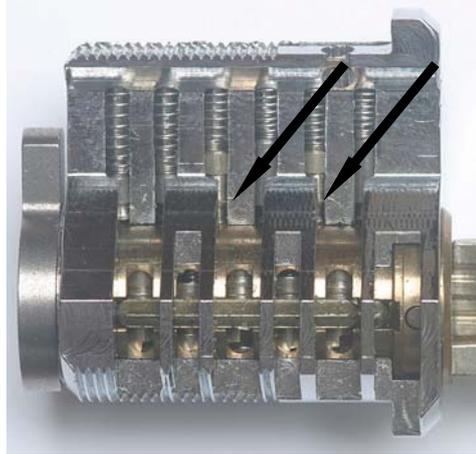
Cut position 1 has height 3, with reversed side bar, you get a cut 3 on position 5, etc.

You can determine now that the reversed side bar code of 3-1-5-2-4 will become 2-4-1-5-3.

Protection against lock picking

During the ALOA fair in Las Vegas in 2006, I met Tom Demont, the Director from Sales and Marketing of ASSA USA. I asked him if he could send me cutaways for a possible article about the Twin system. He was able to send me several cutaways from various Twin systems, however the most interesting cutaway he sent to me was of the ASSA V10.

I thought I had seen all the features of the V10 system, but ASSA surprised me again. The V10 cutaway I received had, in my first opinion, highly bump-resistant pins. The double step in the top pins makes the timing of the rotation of the plug during bumping much more crucial I believe. While we did no specific testing of these pins, given their shape I assume they are able to offer protection against bumping.



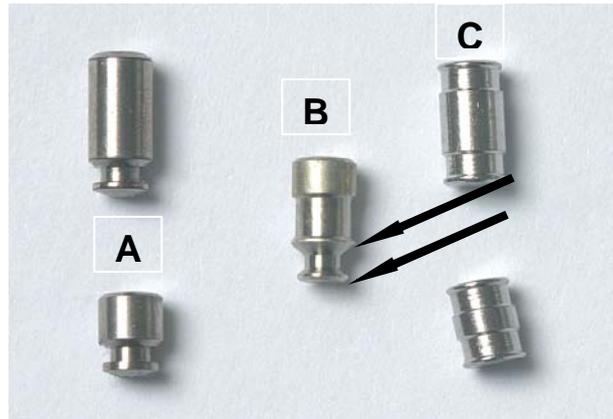
Cutaway of the Twin V10 with possible bump protection pins



Detailed view of the double step Twin V10 top pin

Note: ASSA may also use these pins in their other new systems, like the Maximum, the Twin Combi etc., however I have only seen these pins in the ASSA V10.

In my first article (www.tool.nl/cutaway.pdf) I described two different ASSA V10 cutaways, one an Instruction version and the other a Demonstration version. The top pins in these cylinders are different. This means, in my opinion, that ASSA uses three different kinds of top pins in their cylinders. An important feature about these pins is that they all hook the extra edge of the chamber in each plug. This is very effective against lock picking. In short I made a picture of all the different pins as a comparison.



Details of the three different top pins used in the Twin V10

Note: The top pins match with the counter milling in the top of the plug. I have opened several Twin V10 cylinders and have noticed that ASSA uses these different top pins randomly. The top pin of type C, they use the most currently.

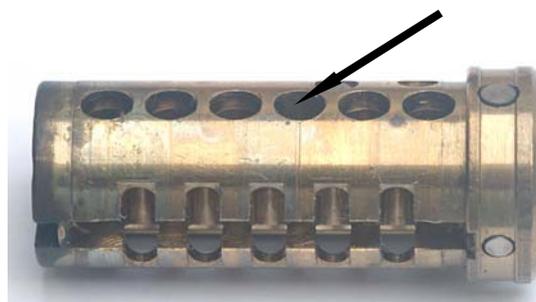
The pin in the middle (pin B) is, in my opinion the most expensive and effective pin against lock picking. With its two edges (see arrows) which can engage with the counter milling in the top of the chamber it adds picking resistance. Especially as the two edges also have two different diameters.

Pin A is also very effective against lock picking because if torque is applied to the plug they let the plug rotate a little bit and then the pins and plug will block. This because of the smaller diameter on the bottom of the pin. The mushroom shaped driver is then perfectly caught by the counter milling in the cylinder plug. The top pin is really fixed in the extra milling in the chamber if you try to pick a Twin cylinder.

I assume pin C is the newest pin they use in the different Twin systems and the most economical to produce. In addition, pin C can also be used easily in the modern cylinder filling machines. This type of top pin possibly requires another type of groove in top of the chamber. In the Twin Combi part I will show a plug with different counter millings in top of the chamber.

Some variations in the countermillings in top of the chamber

Like I said before, the ASSA Twin systems resist picking by any commonly known method. The two independent locking mechanisms ensure optimum pick resistance. I studied the countermeasures ASSA had implemented in their cylinders against picking. I have seen several plugs from different ASSA systems. Most people have probably seen the picture in my cutaway article with the extra counter milling in top of the chamber. In a conventional picking attempt, when rotational force is applied, the mushroom shaped drivers are caught by this counter milling in the cylinder plug. Here is a picture of an ASSA V10 where not all the chambers have this counter milling. Another example of improvement ASSA made, to make the lock harder to manipulate.



Plug of a standard Twin V10

Note: This V10 plug has “only” 5 chambers with an extra counter milling in the top of the chamber. The arrow marks the chamber without the extra counter milling. I have opened several Twin V10’s and noticed that ASSA varies these extra counter millings in top of the chambers.

Note: The required drill-protection pins for the UL-listing.

Top pin A in combination with the counter milling

On the next picture, you can see how the mushroom shaped bottom, from the bottom pin, is grabbed by the counter milling in the chamber



Top pin A in the “locked” position in a counter mill

Note: When picking to release the “locked” top pin you have to rotate the plug back most likely causing all the other top pins to fall back too.

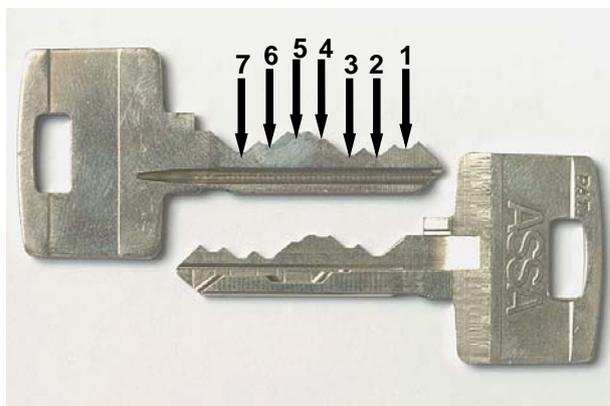
Fake or Fraud

Quite a while ago I bought some ASSA cylinders on Ebay, some with key, some without key. The seller put a picture in the auction with the stuff he was selling. When I looked carefully at the pictures in the auction I saw something strange with the keys and it was reason enough for me to win this auction. When I received the keys I had a look at them and then I could clearly see that this Twin 6000 key had 7 cuts. I put a standard Twin key aside this key, and the cuts matched with the cuts of a standard key, except for the extra 7th cut. Because this 7th cut was missing in the standard key. I held this key beside to an ASSA 7-pin cylinder and here the cuts did not match either.

I was confused did there exist a Twin 6000 with 7-pins and side bar profile?

I also looked at the grooves made during milling of the cuts, and I compared it with a factory cut key. I could not see a difference.

If anyone has an idea about this key, please contact me. Maybe it's from a high security system for the government or something similar.



ASSA Twin 6000 key with 7 normal cuts and 5 side bar cuts

Key copy tricks

During a trip to Germany I visited a locksmith named Michael Burde. I knew he had a patent to make a key harder to copy. I was interested in obtaining some keys with his techniques. I have known this man for a long time, as twelve years ago I went to his shop in Germany for the first time with a Hi-Shear LK1200 padlock with a Medeco Biaxial 6-pin in it.

I showed it to him and he was impressed by the padlock and the Medeco system in it. He was not familiar with Medeco. I demonstrated to him how to disassemble the lock. He asked if he could keep the lock for a while and I had no problems with that. Few months later I visited his shop again and Michael had come up with the “brilliant” idea to rotate the mill of his key-cutting machine to a certain angle. When he now copied a normal key he got out a copy key with angled cuts.

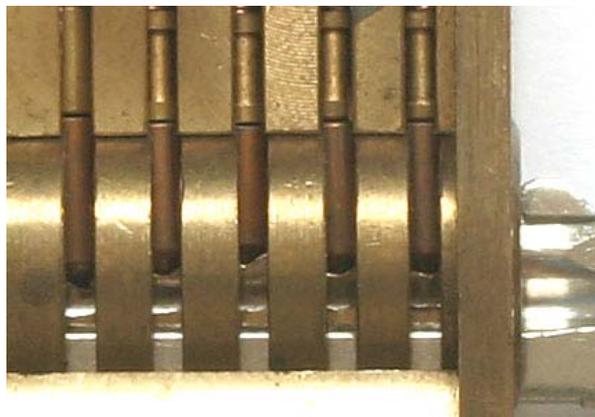
On the next picture you can see two different Abus keys, which are copied this way. The key on the left is the original key.



Original key (left), copied key with angled cut, which fits (middle), straight cut key from angled cut key, does not fit (right)

Of course these cuts had all the same direction. He demonstrated it to me proudly and I really liked the idea. He also said there was less wear in the lock now as the pins now rotated in their chambers. Then he said that was not even the best part, the primary advantage is key control. If a customer with this angled cut key goes to another locksmith and that locksmith makes a copy of this key with an ordinary key machine, this key will not fit the lock. This because the angles on the key cause you read the cuts higher. In short it was a smart and cheap form of key copy protection. Of course this locksmith was nice and he did not copy every key this way ;-). With this example I want to say that sometimes with a simple trick you can improve your security.

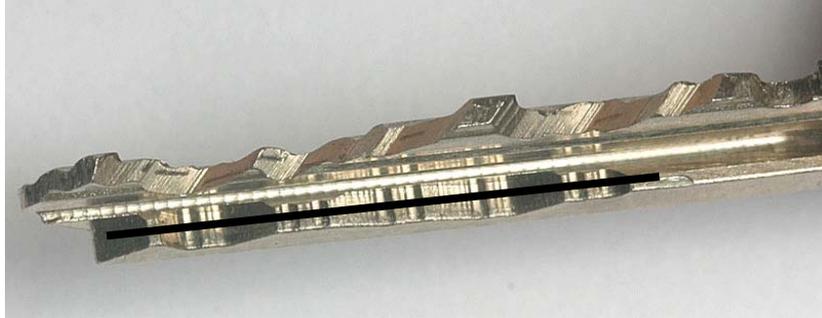
In the Abus cutaway padlock below you can see what exactly happens in the lock with the third key inserted. The bottom pins are now over lifted.



Abus cutaway with “straight cut key from angled cut key”

Michael also sold ASSA locks and I asked him if he also could cut an ASSA V10 blank for me with the angled cuts. On the next picture you can see these special cuts.

I draw a black line over the side bar profile in each key, so that you are not distracted by the side bar profile.



ASSA V10 key with angled cuts like Medeco

Note: On this picture you can also see clearly the top of the side bar profile.

Note: Of course these angled cuts are not a specific ASSA feature. Possibly this key will not work over time because the Assa pins would cut into the angles to the point of jamming the key. I did not investigate this, but it could be a flaw. The same could be possible for keys with the "crater" cuts.

During our conversation he also mentioned that he had another patent. It was a way to copy a key with a vertical mill. The angle of the mill had the same angle as the bottom of the bottom pin. The mill milled away the material in the blank.

This way you get a key as you can see on the next picture. The bottom of the bottom pin fits exactly in the groove. You can imagine that if you try to copy this key with an ordinary key duplication machine it would fail. The part which measures the height of the cut would measure the side of the "crater" which is higher than the actually cut. Once again the duplicated key would not work in the original lock.



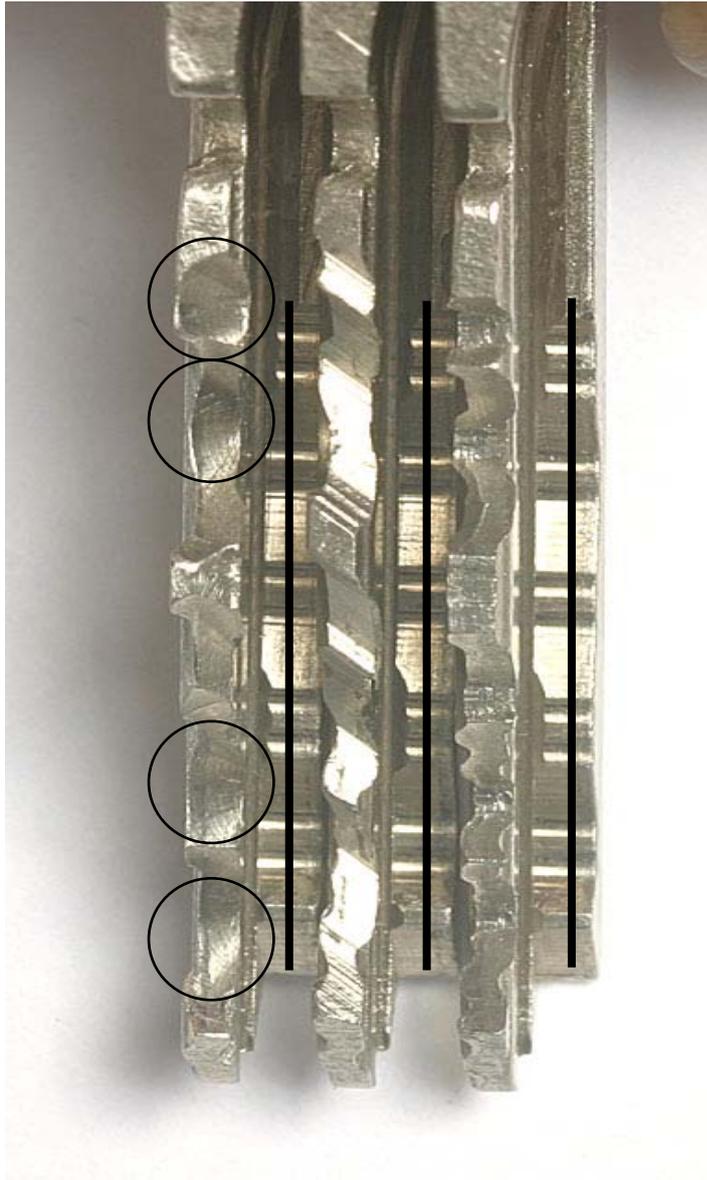
ASSA V10 key with "crater" cuts (picture 1)

Because it's hard to see, I include a second picture.



ASSA V10 key with "crater" cuts (picture 2)

To show the difference between all these cuts I made this picture.



Top view of all three different key cuts together.

Note: On the left you see the “crater” cuts, in the middle you can see the angled cuts. On the right you can see the normal key cuts of a V10 key.

Note: you can imagine that the bottom of the bottom pins perfectly fit in the “crater” (see circles)

Closing comments

This is part 1 of the ASSA Twin systems. All the systems covered in this part have side pins. These are pins which only move upwards and downwards. Each system explained in part 1 has its own side pin design (5 different side pin designs in five different Twin systems). Only within each system are the side pins all the same with the code variation being made by the different heights of the protrusions on the side bar. Variation is made by the different side bar codes.

In the next 40 pages of part 2, I will discuss the systems mentioned on page 1 of this document. In part 2 the Twin systems have finger pins. This means that a pin must be lifted and rotated. These finger pins are the important difference and make more permutations. The side bar in all these Twin systems is the same. So the side bar is not coded but just a straight bar. In the next part I will also explain about the pins and bows and relatives of the different Twin systems. I will bring some additional anecdotes including a special way of cutting a cylinder. In my articles I intend not to write about manipulation techniques however I will try to give an answer whether ASSA Twin systems are bumpable or not.

In the beginning all these ASSA systems were dazzling me. At one point an ASSA employee gave me the hint that you can recognize some systems by looking at the keyway and at the shape of the side pins / finger pins. This technique can certainly help to identify the different Twin systems.

The last anecdote in this article is about the ASSA Twin language. They use the next codes internally to the different systems:

T6	=> Twin 6000
TE	=> Twin Exclusive
TV10	=> Twin V10
V6	=> Twin V10, 95 profile only no side bar
TP	=> Twin Pro
TM	=> Twin Maximum
TL	=> Twin Low 51, 62 profile only no side bar

I want to thank Julian Hardt (Germany) and Mitch Capper (USA) for editing this article.

You can download this file with the next link www.toool.nl/assa-twin-part1.pdf where you can see the pictures in this article more clearly and in color.

If you want to know more about High Security locks or want to order some of these, you can look at my website www.HanFeyLockTechnologies.com. I already sold locks to several countries for example: Belgium, Canada, Denmark, France, Finland, Germany, Israel, Italy, the Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom and the USA.

If you have a question or discovered incorrect things in this article, you can contact me at: info@HanFeyLockTechnologies.com

I hope you have enjoyed reading this article.

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