Abloy Special products (Part 4)

My name is Han Fey and I am a (pad)lock collector from the Netherlands. I like to write and inform people about the workings and techniques used in different high security locking systems.

In my first article about Abloy I discussed the Classic and the (High) Profile. In part 2, I discussed the Disklock, Disklock Pro, and Exec. In the third article I discussed their newest system the Protec in detail. In this article I want to discuss variations of the Abloy system. I intended to write also something about Abloy padlocks in this article, but this I will save for my next article Abloy padlocks (part 5) otherwise will be perhaps, a bit lengthy.

I have about 175 different (pad)locks made by Abloy. This article is based upon my observations of these locks workings. As this is the case, I can therefore not be responsible for errors of content. I did however, attempt to convey this information in an accurate manner. For errors and omissions, please see the end of the document for my contact details.

Discussed systems:

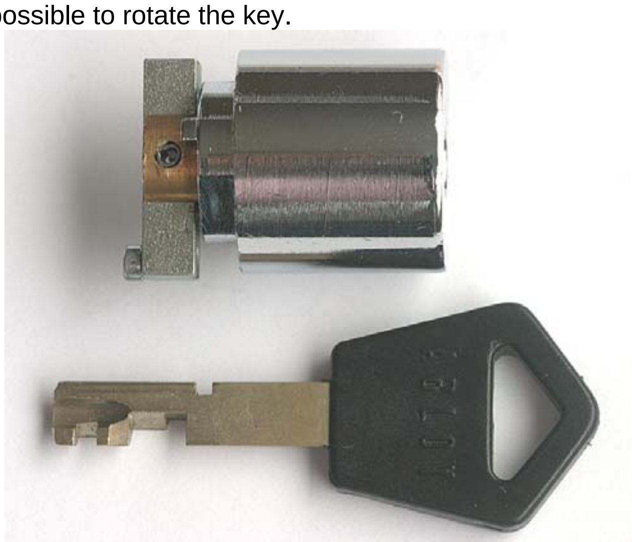
- Abloy locks with fixed (not rotating) discs
- Abloy locks with thick (1.35 mm) and thin (0.9 mm) variation discs
- The Abloy Ava system
- The SMARTDISC
- The safe lock Rosengrens RKL-10

Abloy locks with fixed (not rotating) discs

Most common in Abloy locks is that they contain rotating discs. There are however some exceptions on this rule. In this part I discuss three of these.

Abloy deposit locks.

This lock is designed that the key must be fully inserted before you can rotate the key. Abloy created a special mechanical design that contains a special fixed disc in front of the lock and an extra groove in the key. The second disc located from the front of the lock is a fixed disc with a notch on the outside of the keyway. The key has a matching radial groove on the back with this notch in the keyway. Near the bow is located a special radial cut on the key, where this notch can drop in when you rotate the key. This extra cut makes it possible to rotate the key.



Abloy Deposit lock with key

Note: look at the unique shape of the plastic bow of the key.

Besides the fixed disc this lock also contains two profile control discs. This lock contains from the back to the front the next parts:
- Steel profile control disc (1)
- Brass variation discs (7)
- Steel Fixed profile control disc (1)
- Steel Profile control disc (1)

Between each disc are of course, washers. The fixed profile control disc along with the special cut key, are the unique parts in this locking system.

The disc below is a specific disc used in deposit locks. The notch in the disc in combination with the fact that the disc is fixed, makes that you have to insert the correct key fully before you can rotate the key. Another function of this disc is separating the variation disc and the front profile plate.

Specific Fixed profile control disc, used in Deposit lock

The key below is a specific Abloy deposit key. The radial groove in the back provides that the key can only rotate in the lock when it's fully inserted.

Abloy Deposit lock key

Master key selection disc.

In the picture below you see some older Abloy door cylinders. The lock on the left is the oldest of the two pictured doorlocks. The round keyhole in the housing of the older Abloy lock is smaller than the newer Profile cylinder on the right. Simply because they did not think of a larger key when they released the first Classic system, I assume. If you should change the discs from both locks, you cannot insert the Profile key into the keyway of the older lock. This way you can recognize that you have an older type of Abloy lock.

Old Abloy cylinders with Classic and Profile keyway

Note: The key way profile of the Profile lock on the right is "AAA". It has the same "D" shaped keyway profile as the Classic it's only bigger. It is thus, logical that Abloy gave this profile plate the code "A". Later in this article I write more about the coding of profile plates for the Abloy High Profile system.

The cut-away lock below, is the lock on the left in the picture. Besides the issue of the smaller hole in the front, the discs in this lock also have different shaped false gates and notches as is the case with Abloy's modern locks. Perhaps this is not clearly visible on the picture, but believe me, they are here.

This lock comes from a master key system. The second disc from the back is fixed (see arrow). This means that this disc does not rotate. The keyway in the disc is just the "D" shaped profile. If there is a 6-cut on this position in the key you can rotate the key. If there is not a 6-cut on the key in this position you cannot rotate the key the full 90° in order to position all the discs in the correct position. Abloy introduced this fixed disc to indicate directly to a user, that he or she has inserted the wrong key in the lock. (A 6-cut means that the key is cut maximum).
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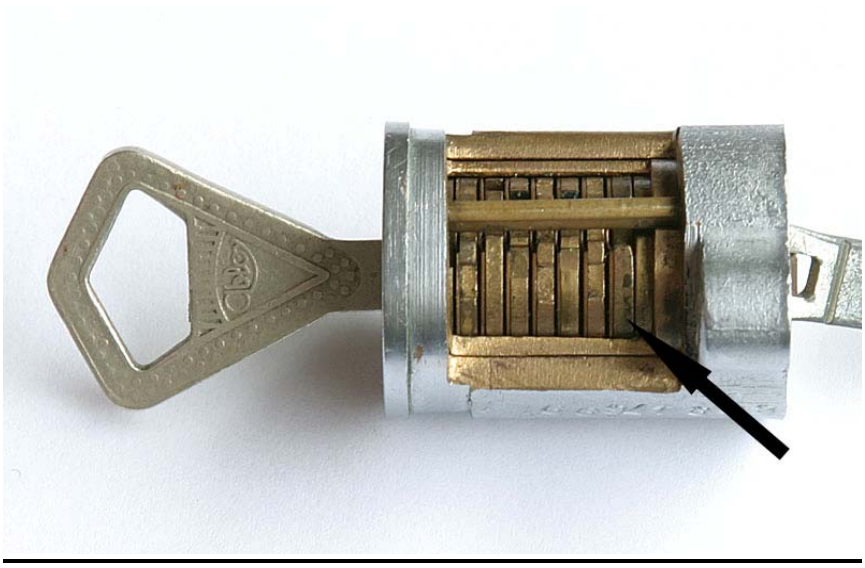


Abloy Classic Grand Master key lock with fixed disc.

Abloy Classic fixed disc.

Master key 1-6 disc.

There is not much to say about this type of disc, except that it is also used in master key systems. This disc accepts every degree of key cut. Thus, the cut on the key is not important. The specific "D" shaped keyway profile on the inside of the disc is therefore round. This disc is the opposite of the aforementioned disc. Just as short summary in the picture below, a Profile plate, a normal variation disc and the master key disc with number 1 till 6.

Profile plate, variation disc and master key disc (discnumber 1 till 6).
Note: The fixed master key disc does not make contact with the key

Abloy locks with thick and thin variation discs

Most common in the Abloy Classic and Profile (pad)locks system is the use of 9 and 11 discs. In a lock with 11 discs there are two profile control discs (on top and on bottom). Between these discs are the other 9 variation discs. This makes 10,077,696 theoretical different keys possible. Sometimes there is an extra profile control disc in the middle in these systems. The standard thickness of the used discs is 1.35 mm.

The normal smaller padlocks from Abloy (type 3015, PL220 and PL320) claim to have 9 discs, again 7 variation discs and 2 profile control discs. This makes 279.936 theoretical different keys a possibility. The theoretical keys are without the use of profile control discs. Standard thickness of the discs is 1.35 mm. Both previously mentioned systems have a 10-digit key number.

There are more then 20 different profile plates, so you can calculate for yourself how many keyways are possible.

(High) Profile with thin discs.

For high security areas Abloy introduced thinner discs. These thinner discs made it possible to place more discs in the standard (pad)locks. The lock is then harder to pick and the number of different key permutations increases. These thinner discs are used where besides security, reliability is also important. In the field / outside for example airports and the Army tend to prefer these older systems above the newest Exec of Protec systems. The thickness of these discs is 0.9 mm.

In the High Profile 14-disc lock there are 12 variation discs; this makes 2.176.782.336 possible key combinations possible. In the small Profile PL220 padlocks with 12 discs, of which 10 are variation discs, there are 60,466,176 theoretical different possible keys.

Classic with thin discs.

I found one padlock in my collection, with the Classic system and a 12-digit key number. When I examined this lock closer, I noticed that there were 0.9 mm thick discs in this padlock. I expected then to count 12 discs in this lock because it had the size of a PL220. The first disc however was missing. The first disc is the disc which lays the deepest in the lock. In this small padlock I counted actually 11 discs. Ten of these discs were variation discs; disc number 11 was the hardened steel disc on the outside of the padlock. From this discovery, it is apparent that there are also Classic systems with thin discs.

I made a table were you can see how these Abloy cylinders are filled with these discs, so if you ever open a Classic or a High profile cylinder you know how the discs are placed in the lock. A washer has the thickness of 0.45 mm, a standard variation disc in an 11-disc cylinder is 1.35 mm. The variation discs in a 14-disc lock are 0.9 mm.

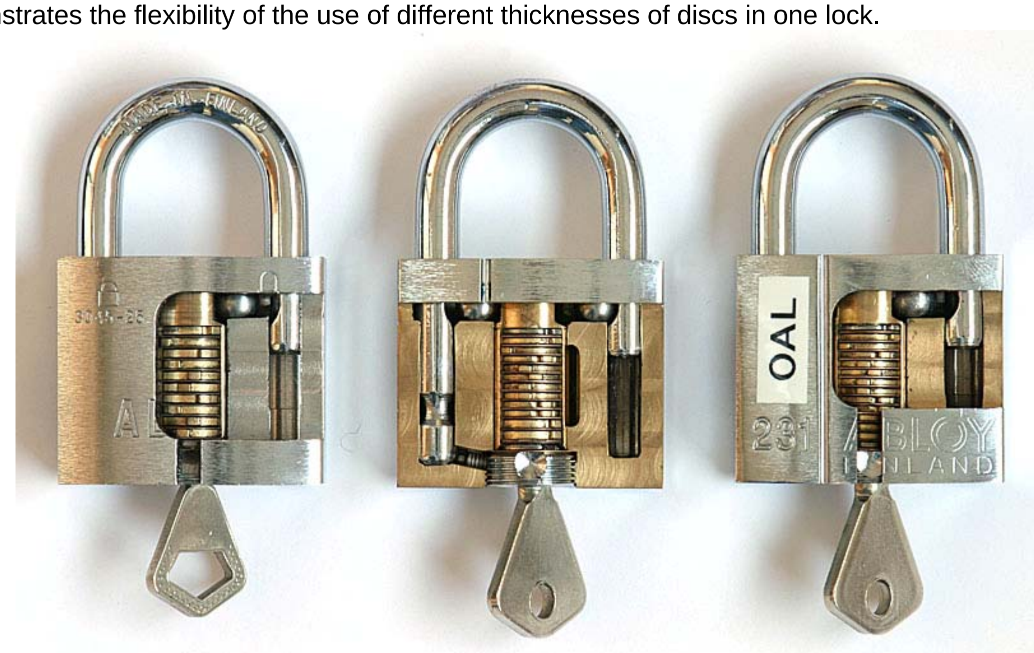
In all three aforementioned systems the key number exists of 12-digits. So you can recognize the system on the key number. If the key number has 12-digits there are 0.9 mm thick discs used and it’s a 14 or 11 disc system.

Overview of length units in the different Classic and Profile systems																													
Discnr.	0		1		2		3		4		5		6		7		8		9		10		11		12		13		Units
11-disc 1.35 mm (9+2) Standard	2	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	2	x	x	x	x	x	x	x	41
14-disc 0.9 mm (12+2) Profile	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	x	41
PL220 size																													
9-disc 1.35 mm (7+2) Standard	2	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	2	x	x	x	x	x	x	x	x	x	x	x	33
11-disc 0.9 mm (0+10+1) Classic	0	0	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	x	x	x	x	x	X	X	29
11-disc 0.9 mm (0+10+1) Profile	0	0	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	x	x	x	x	x	X	x	29

Note: 0 = nothing (no disc)
1 = Thickness of one washer is 0.45 mm, called 1 length unit.
2 = Thickness of a profile plate or thin disc is 0.9 mm, called 2 length units.
3 = Thickness of normal thick disc is 1.35 mm called 3 length units.

In this table I wanted to show and explain the wide variety of numbers of used discs in the wide range of different Abloy padlocks with the system Classic and Profile. The cam locks I did not discuss because the number of discs used here are the same as in the padlock range.

In the picture below you can see an overview of possible used discs in the standard Abloy padlocks. I assume that 99.9 % of the padlocks have 11-discs and 0.1% have 14-discs. The lock in the middle demonstrates the flexibility of the use of different thicknesses of discs in one lock.



Abloy cut-away padlock with 1.35 mm discs and 0.9 mm discs:
- PL3045-25 Classic with 11 discs
- PL231 High Profile with 13! (11+2-profile)discs
- PL231 High Profile with 14 (12+2-profile) discs

Note: The chosen thicknesses of discs and washers make it possible to use a combination of different thickness of discs in the lock. In the lock in the middle I demonstrated that the use of 1.35mm and 0.9 mm discs is possible in one lock. You would be correct to think that it’s very hard to pick this lock because of the different depths of the discs in the lock.

The key below on the left is the most common standard 11-disc Classic or Profile key. On the right you see the 14-disc key. The cuts 1-10 on the key in the 11-disc system you can find in the 10 digit keynumber. The cuts 1-12 in the 14-disc system you can find in the 12-digit keynumber.

Abloy 11-disc and 14- disc keys with numbering

Note: the 11-disc contains 1,35 mm thick discs, the 14-disc 0,9 mm thick discs.

Abloy Classic standard 9-disc key, Classic 11-disc key and Profile 14-disc key

Note: the Classic 9-disc contains 1,35 mm thick discs, the 11-disc Classic and the 14-disc Profile contain 0,9 mm thick discs.

Notice that the cuts in the 0.9 mm disc locks are closer to each other.

Something about the Profile plates.

Each specific profile plate has a specific code. These are named from A to Z in the High Profile system. The first letter in the keyway profile code (for example the S, in the keyprofile SFI) refers to the disc which is the deepest in the cylinder. So the tip of the here mentioned key must match with the "S" profile plate. The last letter in the profile code is the letter which is on the outside of the lock, that will be the "I " in this key profile code. The letter in the middle refers to the profile plate on the seventh position in the lock, this is here an "F".

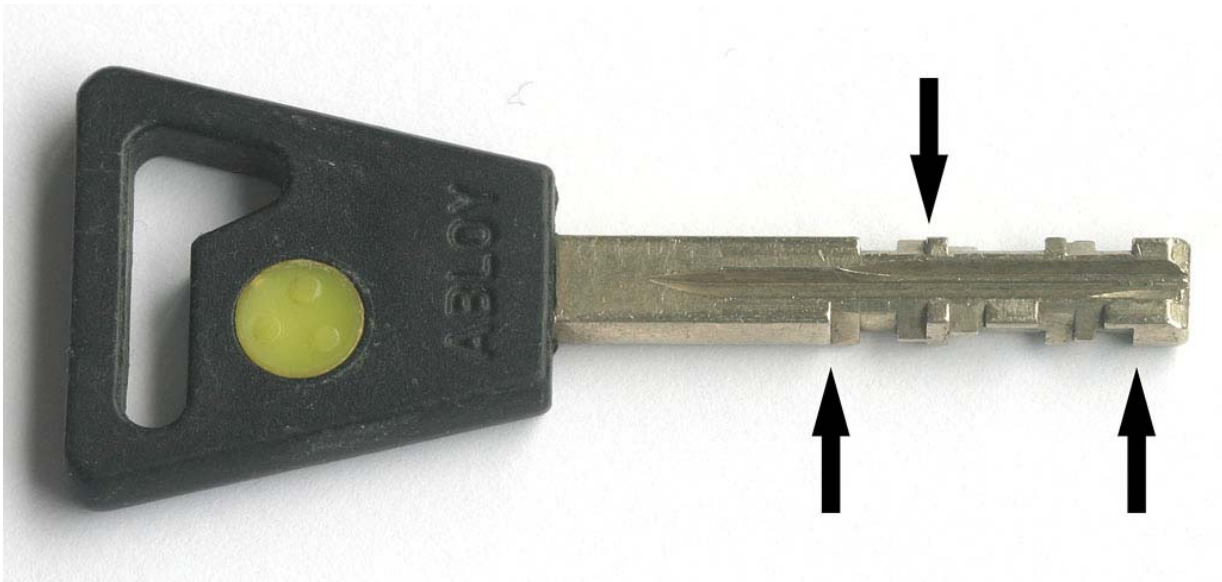
If a High profile lock has only two different profile plates (one in the back of the lock and on the outside of the lock) an example of the number can be OAC. The A in the middle in this code refers to a normal (half moon shaped) variation disc on the seventh position.
So if there is an A standing in the middle of the key profile code there are two different profile plates in the lock.

Some profile plates named :A-B-C-I-J-L-O-S-T

Note:
They start naming their profile plates with "A". This profile is just the Classic profile (D-shape) but then only bigger. The B-profile is the most common keyway in the Profile range. The profile is then coded BAA or BAB.
This knowledge was not yet present when I wrote my first article about Abloy, I hope to have explained it more clearly here.

The last thing I intend to write about the Profile plates.

This key from the Disklock system, I got a few weeks ago. What is special about this key is that there are 3 different profiles (means 3 different Profile Plates in the lock). In my opinion, this means that there will be also Disklock Pro, Exec and Protec cylinders for High Security use with 3 different profile plates. If you take a close look at the key, you see the change of keyprofile at the arrows.



High Security Disklock key with 3 different profiles

The SMARTDISC

The Abloy SMARTDISC is the newest system from Abloy, besides the mechanical security there is also an electronic security component. Therefore this locking mechanism exists of two independently working parts.

The SMARTDISC is a unique engineering and microelectronic data chip – it's the "key" to the next generation of lock systems. Keys and cylinders will fit each other not only mechanically, but electronically as well. The system is called CLIQ.

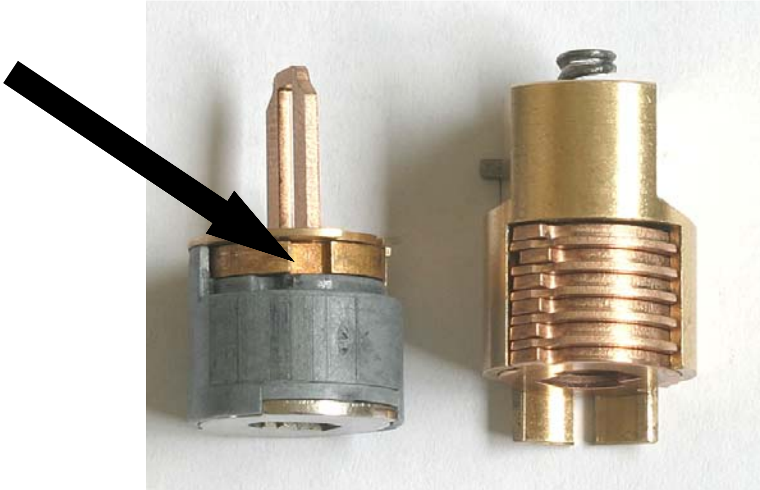
In a nutshell, each Twin CLIQ key contains a data chip that is validated by the cylinder's chip. A tiny battery in the key powers the exchange of data between the two chips. Since the cylinder does not require any power of its own, no wiring has to be done to install Twin CLIQ. "The system components are so small that there's room for all of them in the key and cylinder. Given that the Twin CLIQ cylinders are the same size as Abloy's previous models, upgrading to the new technology is a simple matter." The lock system is designed to maximize both user-friendliness and security.

The lock system is run by connecting a "setup key" to a computer and downloading data from the Abloy "Performer" program. The person in charge of the security system then goes to each lock in the corresponding system, inserts the key and transmits the data to the cylinder or padlock.

PL330 cut-away padlock with SMARTDISC system

Concerning the padlocks system, there are 6 discs in the mechanical part. I assume that the first disc (the disc the deepest in the lock) always is a Profile Control disc which also steers the disc-controller. So there remain the 5 variation discs, which make the number of key combinations 5x5x5x5x5 = 3125. Of course, adding to this, Abloy has several key profiles plus the addition of an electronic key which also must match, before the lock can be opened.

To open the lock the 6 gates from the mechanical Exec system must be aligned. Besides that, the disc which is controlled by the electronic part must also be aligned. On the picture below on the left (grey part) you can see the electronical part with the disc on top with the gate (see arrow). This disc prevents that the lockingbar comes down when the electronic key is not correct.



Electronic part and Mechanical part

Topview Electronic part and mechanical part

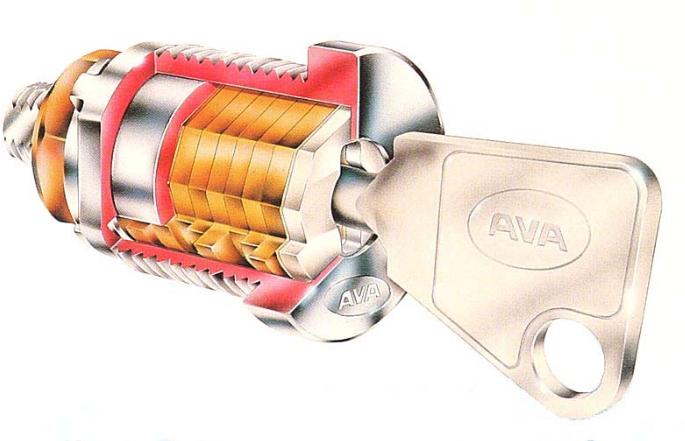
Bottom view PL330 with Exec system and SMARTDISC

Exec SMARTDISC key

Abloy Ava system
(not in production anymore)

Avalocks is part of Abloy. The Ava cylinder, has no springs or pins to fail, the construction is simple and reliable. The system does not contain the ordinary discs like the ordinary discs in the Abloy locks, but the lock contains wafers. This radial wafer mechanism gives the AVA cylinder an excellent protection against picking. The unique Ava key is made of cold forged nickel silver, which makes it very strong.

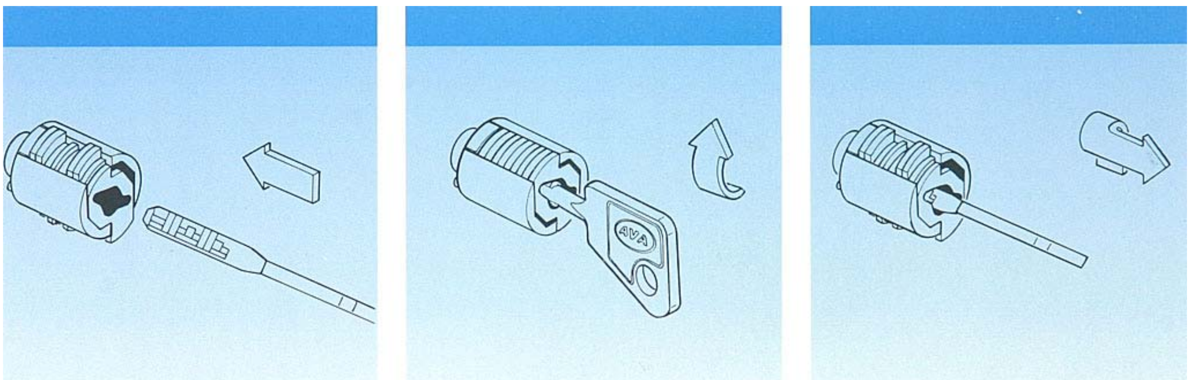
The companies Chubb and Miracle "borrowed" this principle from Abloy for their high security padlocks, more about this later in this article.



Exploded view Ava lock.

The Ava principle.

The operation of the Ava cylinder is based on radially moving wafers, instead of rotating discs. This system works with up to 10 of these wafers in a plug. If the wafers are properly aligned in the correct position in the plug, the plug can rotate in the housing and the lock can be opened. This mechanism makes the Ava lock reliable and convenient to use.



The three steps in the Ava system.

<u>Step 1.</u>
The correct Ava key turned 55° clockwise will align the brass wafers in the correct position.
<u>Step 2</u>
When the wafers are aligned on the shear line, the inner cylinder will be free to turn and the lock can be opened.
<u>Step 3</u>
To withdraw the key, turn in reverse direction until it stops. This scrambles the wafers and the inner cylinder engages in the cylinder housing again.

Abloy Avalock

On the picture below you can see a modern AVA lock. The brand name is Avalock. The Abloy version of this padlocks is marked, Abloy OY Finland. These locks come in a large variety of colors. These locks may look simple, but they are very hard to pick with their 9 sliders. There are 3 different keycuts possible on each position. I disassembled one lock from its plastic housing. What remained was its Zamac body. In this naked body you can see how efficiently this lock is produced. Just a housing for the locking mechanism and a part which holds the shackle, simply connected with each other.

One normal Avalock, one "naked" Avalock.

The lock on the left is an Ava padlock and in turn, it has a specific Ava keyway. The lock on the right, in the picture below is an Abloy Ava padlock and has a typical Abloy keyway. Type number of these locks is 0890. Just to make it clear, these locks come from the same factory, only the profile plate on the front of the lock is different.

Front view of an Ava padlock and a Abloy Ava padlock

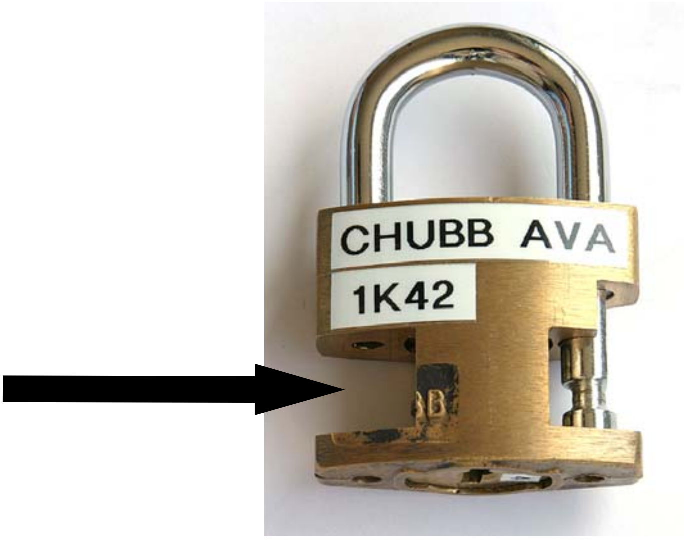
Ava key and Abloy Ava key

Note: Only difference between these locks / keys is the keyway.

Chubb Ava

When I first saw this lock I did not have a clue as to how it worked or how it could be picked and so, I made a cut-away from this Chubb padlock. In the modern Chubb Ava locks there are up to 10 wafers, these wafers have to be lifted properly in the correct height, so that they fit exactly in the plug. Only then can the plug be rotated. There are 5 different heights possible in the Chubb Ava key, but there are only three different wafers in the lock. The wafers can be used in reverse, meaning that wafer number 1 becomes rotated wafer number 5, Wafer number 2 becomes rotated wafer number 4 and wafer 3 can theoretically be rotated, but it remains the same.

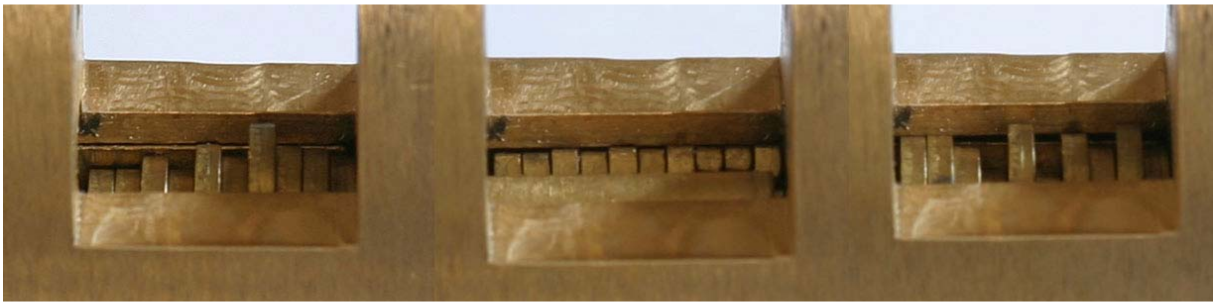
On the picture below you can see the Chubb Ava cut-away padlock that I modified. In this cut-away you can see the plug with the wafers from both sides.



Chubb Ava cut-away padlock

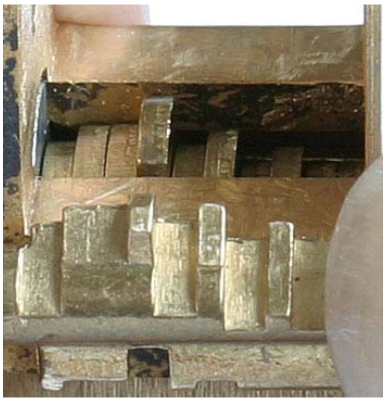
If you look on the side of the lock (see Arrow) you can see the wafers. I tried to take some pictures of the wafers in different situations.

On the picture below on the left you can see the lock in the locked position. You can see the different heights from the sliders. Most specific about these heights is that they match with the cuts in the key. In a following picture I will explain it in more detail.
The picture in the middle is the lock in the open position with the correct key inserted. The wafers are aligned and the plug can rotate.
On the picture on the right you can see how a plug is blocked if a false key is inserted.



Sliders in locked position, open position and false key position

Most tricky about these locks is that the wafers always slide back in their start position (locking position). In the picture below you can see a close-up of the start positions. If you can determine the numbers of the wafers, you have decoded the lock and you can make a key for the lock. When I tried to insert a wrong key in the lock, the wafers were then lifted as shown in the picture before. If however, I removed the false key the sliders still came back to the position as shown below.



Ava wafers in the locked position, in combination with the correct key

Some Chubb Ava keyways

In past days, Chubb produced Ava padlocks of different sizes. The smallest padlock from Chubb with the Ava system is the 1K60, still this lock has 9-sliders. There are 3 different cuts possible on the key, that makes about 19.000 (3^9) possible keys. This padlock is the smallest padlock with the AVA key I have seen and I think it’s also my most secure small padlock.

The next padlock in line is the 1K61 padlock from Chubb. This lock has a bigger keyway and has also 9 discs. I counted the different cuts on several keys I had and came also to 3 different cut heights.

Then at last we have the 1K42 older version which has 10 discs, there are 5 different cuts possible in the key, which makes 9.765.625 (5^10) theoretical key combinations.

The keyways of the first three locks have the same shape, only the size is different.

The modern Chubb Ava keyway is slightly different from the three older ones. If you have a close look at the keyways you can see that the older ones are narrower on one side of the keyway.
Currently, Chubb produces only one keyway in the Ava system, this is the one on the right in the picture.

4 different Chubb Ava keyways, 1K60, 1K61, 1K42 (old), 1K42 (new)

Some different Chubb Ava keys fitting to the locks before mentioned.

Note:
The most modern Chubb Ava key has a longer shaft because of the modern security features, where the lock mechanism is deeper in the lock.

Some very heavy Chubb padlocks

On the picture below you can see some modern Chubb padlocks with the Ava system. The modern Ava system has several million key variations and it has an exceptional resistance to picking and manipulation.

Some very heavy Chubb padlocks with the modern Ava system,
- ***Hercules 1971 with Close shackle***
- ***Older Hercules Concealed Shackle (1K57A),***
- ***Conquest with Close shackle (1K12A)***

-Modern Conquest Open shackle 1K22A

Note:
- The Conquest padlock (1K12)also is made in the 6-pin tumbler and the Chubb Biaxial variation.
- Chubb continuously improves their products, from the Hercules, 1K57A I have for example 4 different versions
- The Conquest padlocks are in my opinion one of the strongest padlocks in the world.

Miracle

The American company Miracle also uses the Ava system in their Ingersoll shaped padlocks. Because this is an American lock I assume most American lock collectors are familiar with this lock and I will therefore not discuss it here. Maybe in a next article I will write something about Ingersoll padlocks, because this company makes very nice High Security (pad)locks, with all kinds of different locking systems.

Miracle High security padlock with Ava system

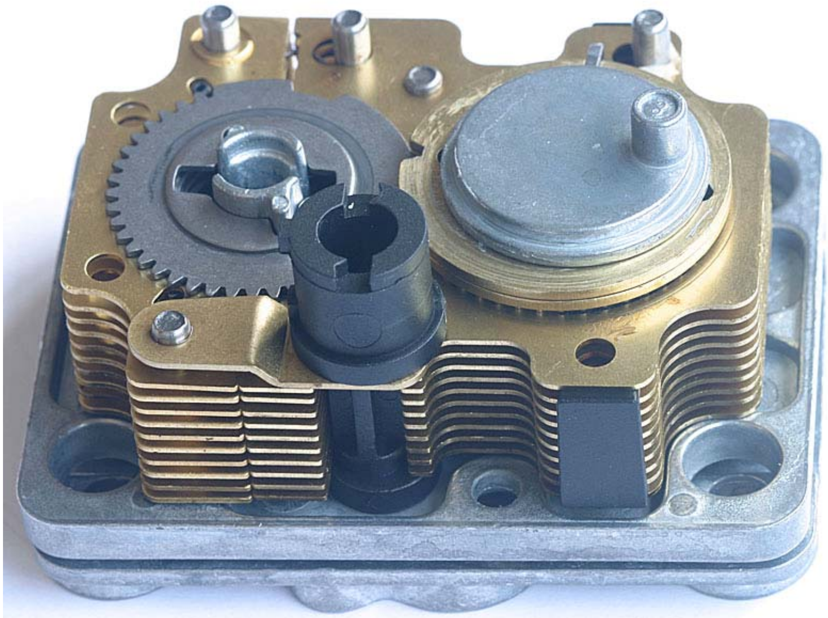
Miracle keys with 9 sliders

Safe lock Rosengrens RKL-10

The Rosengrens RKL-10 is a Swedish unique resetable key lock with a double bitted key. The key has different cuts on each side and the cuts are under different angles The predecessors of this lock are the also rekeyable ABN-1 and ABN-2 safe locks. These locks have also double bitted keys, but the cuts in the keys miss the angles, in comparison with the RKL-10 key. There are only 8 levers in these older types of locks.

The RKL-10 is an improvement of these previously mentioned locks and in my opinion is one of the most secure safe locks in the world. There is for example also a narrow curtain in the lock, which makes it hard to use pick tools. To my knowledge, there is not yet a pick tool in the market for this lock.

When I first opened this lock I only removed the top plate and then I quickly screwed it back because of the many unknown components that I saw in the lock. Later on I got curious about the working principle of this lock, so much so that I dared to open it again. The first time I disassembled this lock it took me 2,5 hours to assemble the lock again. Upon examination, I then understood how this locking system worked. In this part of the article I will try to explain the working of this lock as I find it fairly sophisticated and possibly interesting for people who like a lot of technique in a lock.

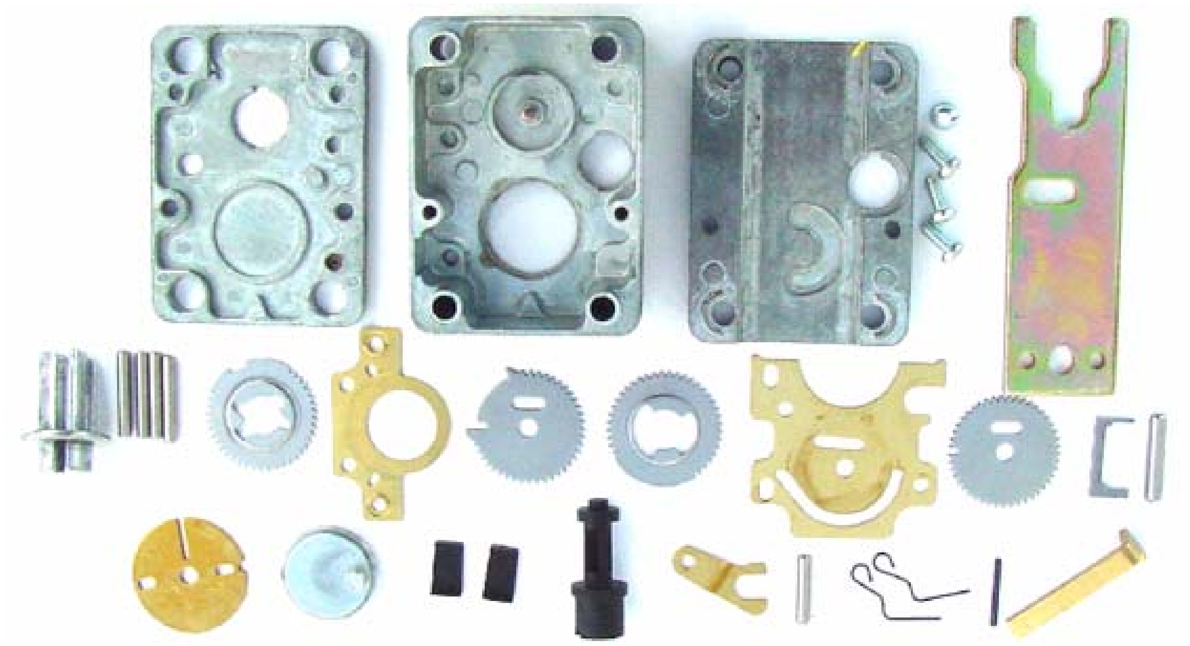


Back view Rosengrens RKL-10 with housing removed

The RKL-10 has no springs and works on the same principle as the Abloy disc-cylinder or do I have to say the Abloy works conform to the principle of the Rosengrens. However because this lock uses discs instead of normal levers and pins it has much similarity with Abloy and therefore I will write something about it in this Abloy article. There is one big difference with the normal Abloy cylinder, because in the RKL-10, there are two different lever packs / wheel packs. Each of these has a specific function. The levers in an ordinary safe lock are replaced with gear driven wheels in this lock. The use of two wheel packs is necessary for the change key function. The wheel packs are gear driven with each other.

Abloy locks have only 1 lever pack. Just like the discs in the Abloy, the discs in the RKL-10 also are separated by spacers. These are washers in the Abloy locks. The spacers (washers or plates) guarantee an independent rotation of the discs / wheels.

The RKL-10 contains a total of 70 parts if you fully disassemble it.



Different parts in the Rosengrens RKL-10.
Note: picture by courtesy of Owe Bengtsson

How it works:

Parts in first wheel package

Because this safe lock is changeable, there are two sets of wheels in this lock. The first package of wheels makes contact with the key. Therefore, these discs have a keyway hole in the center of these discs. Most important parts in the first package are:

- Curtain (1)
- Drive wheels (2)
- Lever wheels (9).

Parts in first wheel package, Curtain, Drive wheel, Lever wheel.

The purpose of the curtain is to let the key glide in the lock and to shield the levers for the use of pick tools.

Key in curtain

In the first 64° rotation the levers are engaged by the key, just like the ordinary Abloy. The contact point of the key with the inside of the levers can vary, just like with the Abloy Protec. The cuts on one side of the key move their respective wheel lever from positions 1 - 4, and on the other side of the double bitted key for wheel lever positions 5 - 8. So there are 8 different positions for the wheel lever.

Rosengrens optimalised the keys that way, so that reading the angles or height of the cuts is nearly impossible. I assume however, if you have a decoding tool for the key just like I showed in the Abloy Protec article, you can read the key number. It will be then something like 123456781. This means 9 numbers (because of the 9 wheel levers) variated from 1 till 8. It is clever that Rosengrens masquerades this number by using the angles and the use of the double bitted keys. Later more about that in "*Keyreading Rosengrens RKL-10*"

Parts in second wheel package

Most important parts in the second package are:

- Fence (1)
- Fence Drive wheel (2)
- Blocking wheel (10)

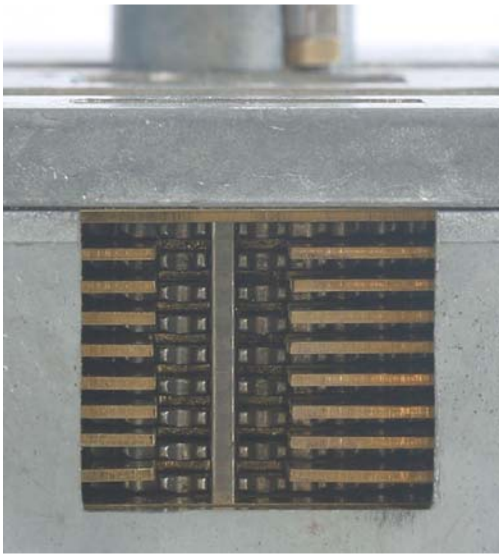
Parts in second wheel package: Fence, Fence drive wheel, Blocking wheel,

note:

If you look carefully at the teeth counterclockwise from the gate (ellipsis) in the blocking wheel, you will see a variation of the depth of the teeth. This is done to make the lock harder to pick.

The wheel on the right is called the blocking wheel, because it blocks the rotation if an incorrect key is used. Simply said, the fence does not go into the different gates, and thus, this wheel cannot rotate.

The second package of wheels is indirect gear driven by the wheels in the first package. The moment of these discs starting rotation is made by the first package of discs, which is again decided by the different cuts of the used key. This package contains 11 rotating parts, 9 of these are blocking wheels (in the Abloy system they are called variation discs) and two fence drive wheels which control the fence (lockingbar). These blocking wheels contain a gate just like in the Abloy discs. By rotating the blocking wheels in the right position there is a line of gates were the fence (lockingbar) drops in. The fence fits very tight in the gates as you can see on the following picture.



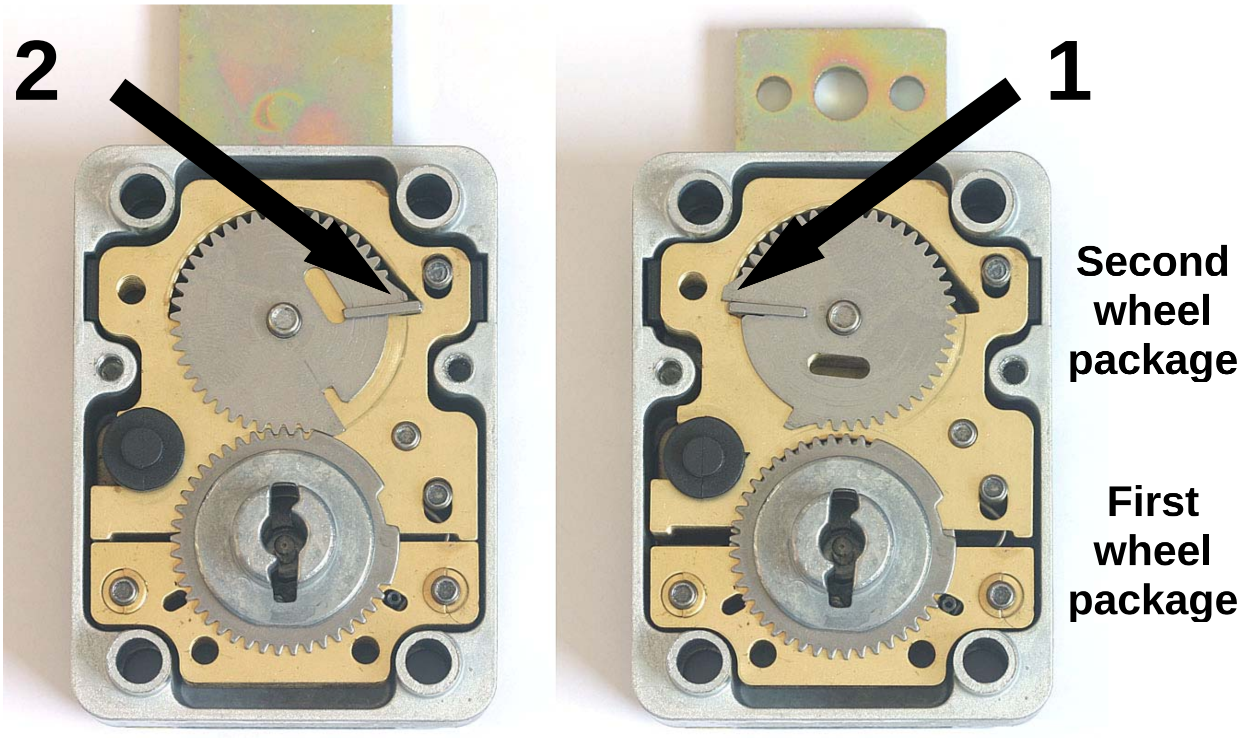
Fence properly aligned in the gates

Rekey function:

The lock / safes comes with a blank and the new owner receives a sealed package which contains new cut keys. Purpose is that these keys must be made fitted to the lock. I will call the blank, key 1, and the new key, key 2.

1. Insert key 1 in the lock and rotate it 225° clockwise, the lock is now open.
2. Turn the black change cam on the back of the lock with the tip of key 2 to the square sign. (the two gear driven wheel packs are now released from each other)
3. Turn back key 1 and remove it from the lock. (the lock is now in the neutral position, the fence is now blocked in the locking wheels as you can see in the picture on the right. The fence is pushed into the blocking wheels (see Arrow 1). The wheels from the first wheelpackage (drive wheel and wheel lever) can now rotate freely
4. Insert key 2 in the lock and rotate it 225°. You hear the lock during this rotation clicking. (the lever wheels in the first package are now rotated conform the specification of the new key 2).
5. Turn back the black change cam on the back of the lock, to the circle sign on the lock. (the two wheel packages are now engaging in each other).
6. Turn key 2, counterclockwise and remove the key. During this rotation both wheel packages are rotating to their start position as you can see in the picture below on the right.
7. The lock is now ready for use for key 2. Note that the fence is now on the right side in the lock. In the spacers is some place created so that the fence can come out the blocking wheels (Arrow 2).

The 2 drive wheels in the first wheel package engage with the 2 fence drive wheels in the second wheel package in the normal locking mode. There is a drive wheel in front of the lock and in the back of the lock. The 9 lever wheel in the first wheel package engage with the 9 blocking wheels in the second package. All these rotating parts are separated by spacers.



RKL-10 in normal locked position (left) and rekey / neutral position (right)

Note:
The picture on the right is the lock in the neutral position, waiting for the specific key. If this key is inserted and 225° rotated, the wheel levers are each rotated in a different position.

Something about the keys

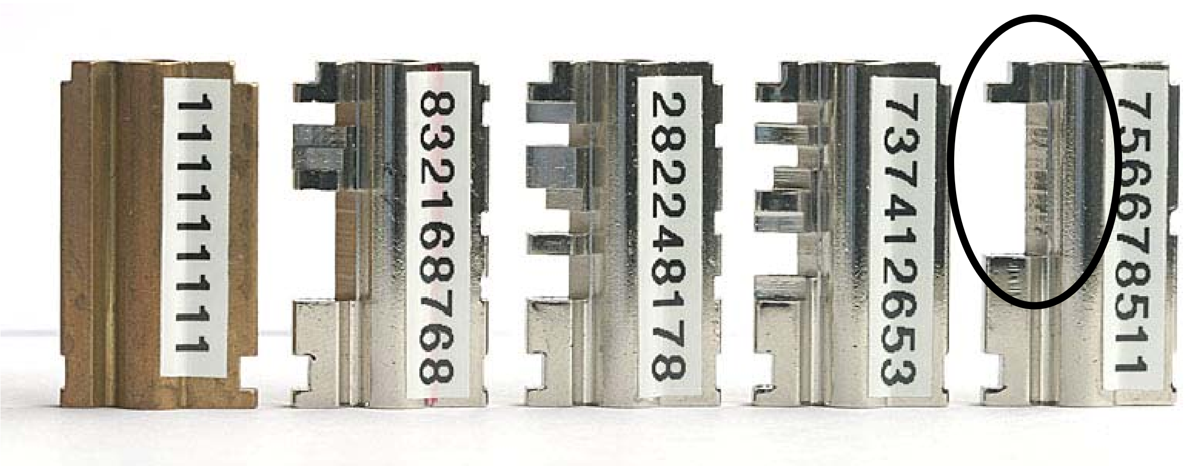
There is a profile on the key. The key is also not reversible. The key can only be inserted one way in the keyway. The keys of the RKL-10 must be screwed on a stem, these stems come in different lengths. If you buy a new safe with this lock build in, you will find a blank on the outside of the safe. The new keys are in the safe.

Rosengrens claims that the lock has more then 90.000.000 different keys. I noticed 45 teeth on the blocking wheel. That means that every 8° there is a tooth. With the 8 possible cut variations in the key does that mean that in a 64 ° rotation the gates must be aligned. If you insert a false key in the lock you will notice that indeed, the key is blocked after a 64° rotation. Every 8°, a disc can start rotating, so on 8°,16°,24°,32°,40°,48°,56° and 64° there is a gate. If the gates are properly aligned you can rotate the key further and open the lock.

The reason why these small angles in gates are possible is the bigger diameter of the wheel in comparison with the small discs in an Abloy cylinder and the fact that the fence (read locking bar) is only 1.5 mm wide.

There are 8 different keycuts possible, this makes with 9 wheel levers (8^9)134.000.000 theoretical combinations. The practical combinations are by Rosengrens restricted to 90.000.000 combinations. I assume therefore that every key is unique.

A security feature of the key is that it cannot be read and that it is hard to copy because of the angles and the different depths. This is only masqueraded because somebody who knows exactly how the cuts/angles work in combination with the wheel lever can in my opinion read the key. However you need to know exactly how the system works.



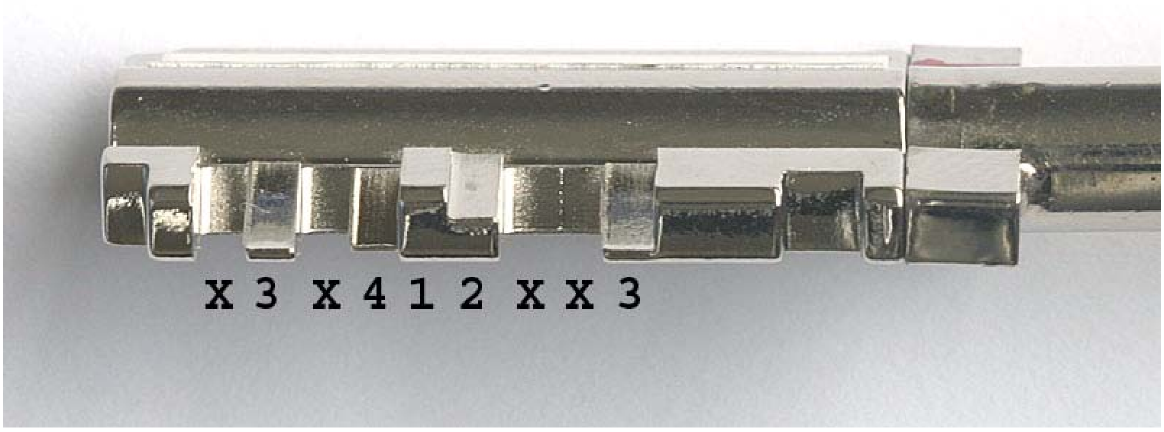
A Blank and some different keybit's of the RKL-10

Note:
A good safe key must be made random, I assume RKL-10 keys from Rosengrens are also made this way widnessing the "7" same cuts beside each other on one key (see ellipsis). This shows that Rosengrens knows what security is.

Keyreading Rosengrens RKL-10

Although Rosengrens made it hard to read a key, I have made the following list of steps to read it.

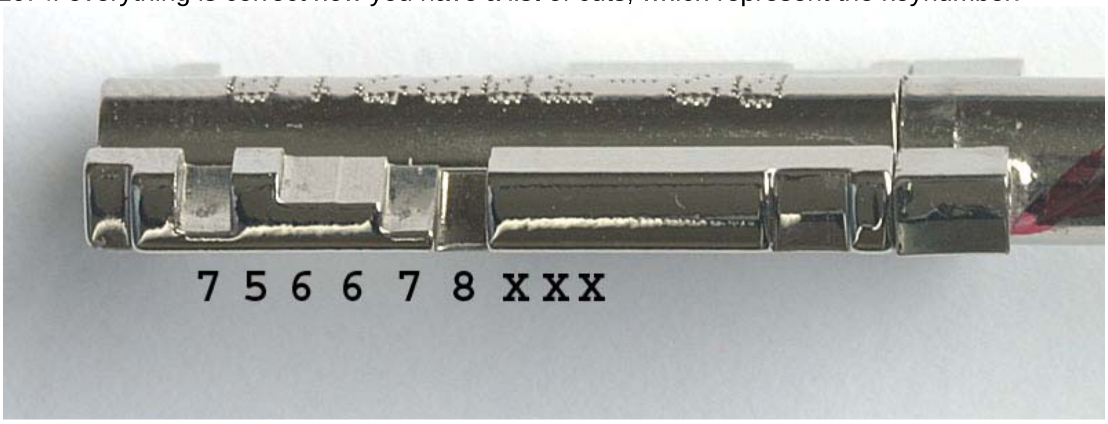
1. Put the key in front of you with the number down on the table (you do not see the number then)
2. Rotate the keytip, so that the screw hole for the sten is on your right side.
3. There are 9 positions in the key, so write down 9 dots on a paper
4. There is a fixed not cut position on the right of the key. This position is not cut and therefore high.
5. Determine the position of the different cuts. Every 1,8 mm there is a possible cut and 3.6 mm from the tip of the key starts the first cut.
6. Every position on the top of the key which is not cut, is a number 1 cut.
7. The cut something deeper under the 8° from cut 1, is a number 2 cut.
8. The cut something deeper under the 8° from cut 2, is a number 3 cut.
9. The cut something deeper under the 8° from cut 3, is a number 4 cut
10. Then there remains the deepest cut on top of the key, and that means this is a possible 5 till 8 cut (see picture).
11. If everything is correct you have filled in the numbers 1 till 4 on some dots, and some dots are still blank



Keycuts 1, 2, 3 and 4.

Note:
The X in the code stand for the cuts, 5,6,7 and 8 and must be read from the other side of the key.

12. Turn the keytip around, you now see the engraved number on the key
13. Take care that the screwhole for the sten is on the right side again.
14. Look at the dots which do not have a cut-number.
15. Every position on the top of the key which is not cut, is a number 5 cut.
    If there is a 5 cut on a certain position and you already gave this position a number 1 till 4, this older number remains. This because during rotation the cut number 1 rotates first, then 2, etc. The cuts 5 till 8 rotate always later then the cutnumbers 1 till 4.
16. The cut something deeper under the 8° from cut 5, is a number 6 cut.
17. The cut something deeper under the 8° from cut 6, is a number 7 cut.
18. The cut something deeper under the 8° from cut 7, is a number 8 cut
    The number 8-cut is the deepest cut, and the wheel starts rotating latest.
19. If everything is correct now you have a list of cuts, which represent the keynumber.



Keycuts 5, 6, 7 and 8.

Note:
The X in the code stand for the cuts 1,2,3 and 4 and must be read from the other side of the key.

Rosengrens deposit locks

As an extra I included some pictures of the Rosengrens deposit lock. This lock also works with discs. As you can see on the text in the picture you can read that there are 8 variation discs and 2 control discs in this lock. Maybe something for the next time to explain how this lock works.

Old and new Rosengrens Depositlocks

Closing comments

I hope you have enjoyed this article about Abloy and similar technology locks. The subjects are wider then in my previous articles. I personally found that some of the discussed locks had connections with the disc system. I hope to write more about Abloy padlocks in part 5, in which I will discus some special Abloy padlocks (shapes) like the government padlock, the horseshoe, the hockey puck, Trioving and some other different locking techniques they have in the program Beside that I will then also discuss the Sargent & Greenleaf Environmental padlocks 881 and 883.

If you have special Abloy locks or key profiles which are not mentioned in this article or in the previous articles, I will be interested, because I am a real Abloy fan.
You can contact me at: han.fey@12move.nl.

You can download this file with the next link "www.toool.nl/Abloypart4.pdf" where you can see the pictures in this article in more detail and in color.

I hope you have enjoyed reading this article.

Han Fey
The Netherlands