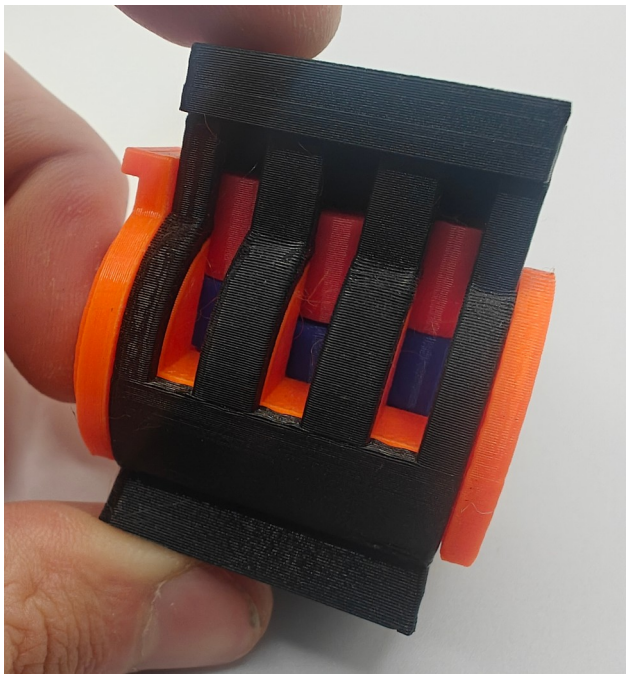
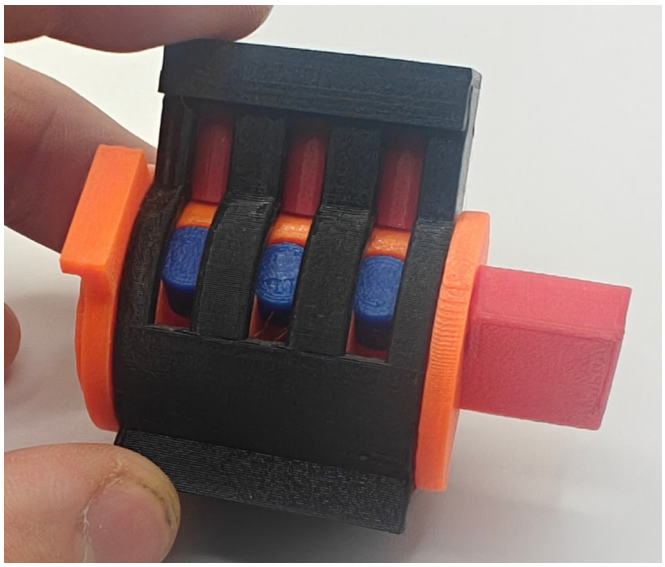
Single Pin Picking Guide

How a pin tumbler lock works

A lock works by way of a cylinder (called a plug) turning inside of a housing. Pin chambers are drilled along the top of the plug and has matching chambers in the housing. A lock will often have either 5 or 6 pin chambers. Each pin chamber has 2 pins in them called key pins (bottom) and driver pins (top). The bottom pins are always short enough to sit fully inside the plug. The top pins will rest on the bottom pins inside the plug and stick up into the housing with a spring at the top to keep everything pushed down. This prevents the plug from turning since any attempts to turn the plug will bind it against the top pins. The purpose of the bottom pins is so that if the pins are all lifted as high as they can go, then the bottom pin will stick up out of the plug and into the housing, preventing the plug from turning. In order for the plug to turn, each pin stack must be lifted to a specific height which pushes the top pin out of the plug but doesn't push the bottom pin out of the plug. This way there is nothing in the pin chamber which sits in both the plug and housing at the same time. The place at which the pins meet and allow the plug to rotate is called the shear line.





This is a 3D printed cutaway version of a lock. The plug is orange and located inside the housing, which is black. The first picture shows the lock in a locked state. The bottom pins (blue) are fully inside the plug and the top pins (red) are partway inside, keeping the plug from moving. The second picture shows a key inserted which lifts the bottom pins to the shear line (top of the plug) allowing the plug to rotate.

Vulnerability

It is not possible to make any two pins the same exact diameter due to manufacturing tolerance. At a small scale there will always be variation. If you were apply a turning force, called tension, to a plug, it will not want to rotate because it will bind against the top pins and the housing. If the pins were all exactly the same diameter then they will all take equal binding force. But if one of the pins is thinner than the others it will remain loose, non-binding, in its chamber. The other (wider) pins stop the

plug from turning enough to bind the thinner pin. This is actually the case with all the pins. They all vary in diameter so the widest pin will take the binding force, leaving the other pins non-binding. If tension is kept on the plug and the binding pin is slowly lifted then once it reaches the shear line it will allow the plug to rotate, “setting” the pin. The plug rotates until the next widest pin stops it and becomes the new binding pin. This slight plug rotation keeps the set pin in place as the plug rotates underneath it and holds it up. By successively setting each binding pin as they occur, the lock will eventually have all pins at the shear line and the tension on the plug will rotate it open. The binding order of the pins is random and different in every lock. This is true even within the same lock with a different direction of rotation, as it depends on small imperfections in the sizes of the pins.

Choosing your tools

Each shape of lockpick has a purpose and it’s important that we choose the correct tool for the job.

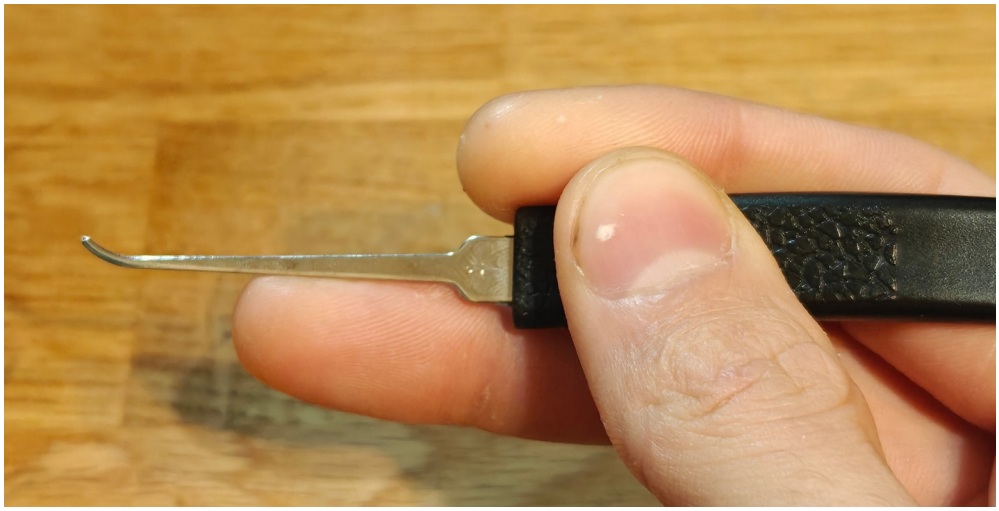
Hooks are designed to be able to lift a pin with minimal disturbance to the surrounding pins. This is because if we disturb a pin we are not trying to lift, we may end up over-setting it. The larger the hook and the more aggressive the curve on it, the higher you can lift a pin without disturbing nearby pins. But it also comes at a cost of being harder to navigate the hook through the lock. When using a hook we want to use the largest hook we can comfortably move around inside the lock.

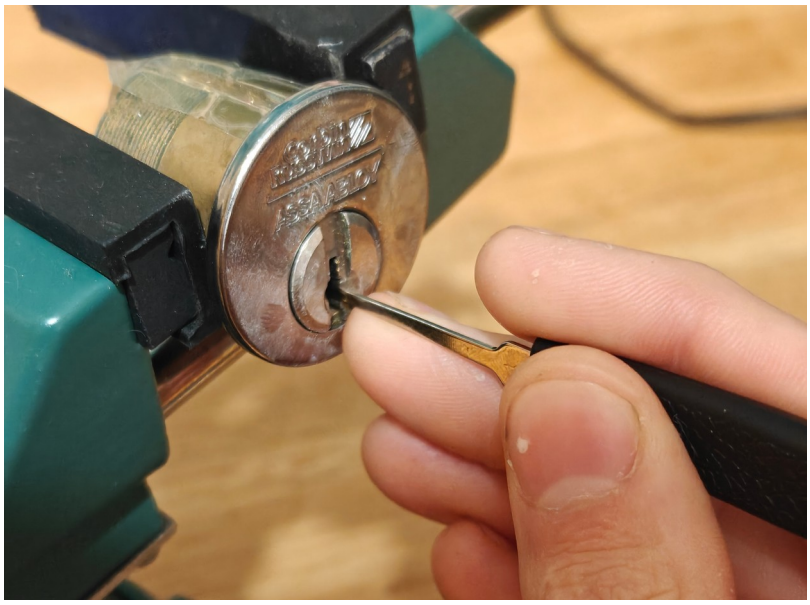
Half diamonds slide through a lock much easier than a hook but give less ability to lift a single pin without disturbing other pins. They are generally good for smaller padlocks which can be hard for hooks to navigate in due to their small keyway.

Rakes are used to jostle all the pins in the lock hoping that the pins set by chance and come in various shapes and sizes. A Bogota rake is often the most efficient. Each peak and valley is spaced apart the same distance as each pin in a lock. These rakes also come with varying amounts of peaks and can come in smaller sizes for smaller locks. City rakes and S rakes are commonly found in lockpick sets but may give the same results. You may also find snowman or half snowman rakes (which look like stacked balls/half balls) which are to be used on wafer locks. Rakes are used with quick, jittery motions. The movement should be in and out, and up and down. No side to side motion is recommended to avoid bending the pick. The tension should be pulsed throughout the process, gradually changing from lighter to harder tension and back again. I won't be covering raking in this guide as we will be focusing on single pin picking. Raking is more of a game of luck similar to bumping. It can be effective but not as much as single pin picking.

Holding a pick

The way you hold a pick is vital to getting useful feedback. The pick should be held similar to a pencil with your middle finger underneath the pick and your thumb and pointer finger pinching the sides. Thus your hand will remain under the pick while picking, never above. Your middle finger should also extend forwards and rest on the face of the plug while you pick, providing stability and a surface to leverage the pick off of. While picking you will always have the bottom of the pick resting on a surface, usually the warding (the shape of the keyway is called the warding), to provide stability to leverage the pick. But in cases where the warding is sloped and makes it hard to do so, your middle finger resting on the face of the plug will provide that surface to leverage the pick. Your pointer finger and thumb will move the pick in and out of the lock with your middle finger bending and straightening to remain on the face of the plug.





Tensioning a lock

When tensioning a lock it is very important what kind of tension wrench you use and where you place it. Tension wrenches usually come with a long, wide end to be inserted into the plug. You will also see some with shorter, thinner ends. Below is a double ended tension wrench with both.

There are 2 ways to tension a lock which is what each end is for. The longer end is for bottom of the keyway tensioning and the shorter end is for top of the keyway tensioning. I almost always recommend top of the keyway tensioning.

Bottom of the keyway pros:

- The tension wrench stays in the plug well, even without tension being applied

Bottom of the keyway cons:

- Uneven tension as you are turning from the edge of the plug instead of the center
- The tension wrench binds against the plug and housing keeping the pins from being tensioned
- Depending on the warding, the wrench can slid up into the keyway where your pick should be

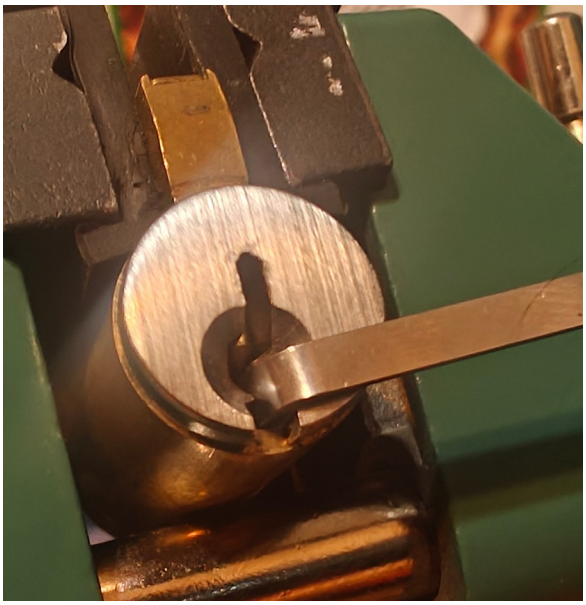
Top of the keyway pros:

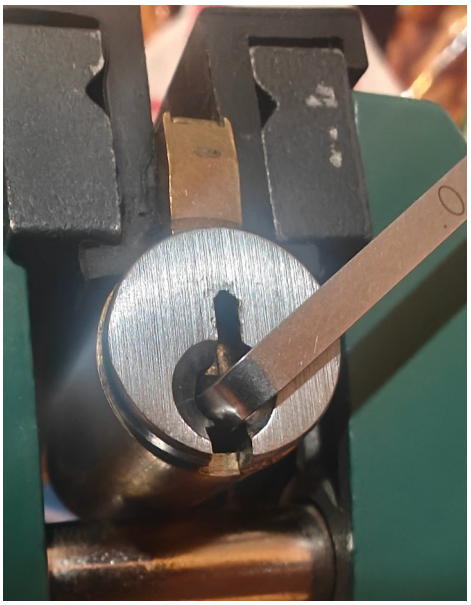
- Even tensioning throughout the plug
- Leaves the entire keyway available for your pick
- The tension wrench keeps the same position no matter which direction you turn

Top of the keyway cons:

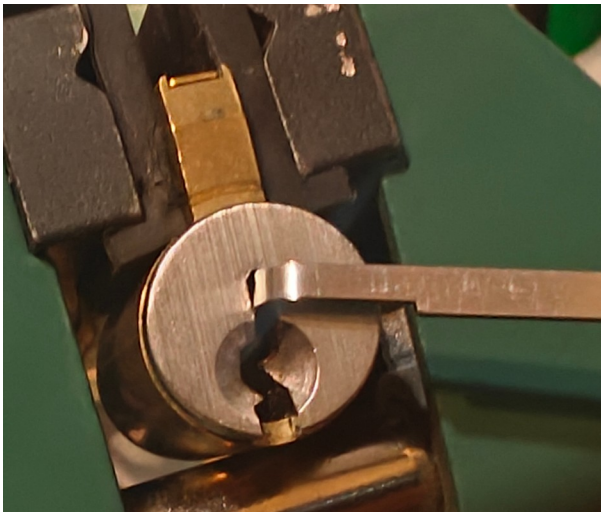
- Tension wrench may fall out if you completely let go of the tension wrench

The next two images show bottom of the keyway tensioning on a Schlage with the left picture having clockwise tension applied and the right picture having counterclockwise tension applied. You can see in the left picture how the plug is open on the bottom, causing the wrench to bind against the plug and housing. In the right picture you can see how turning the other direction causes the wrench to slid up on the warding and block the space for your pick.





Bottom of the keyway tensioning is suitable in some situations but there will be many more situations where it causes issues. Top of the keyway tensioning however will be suitable in just about every situation. Below is an example of top of the keyway tensioning.



You can see why the tension wrench needs to be shorter for top of the keyway. This is so that it doesn’t collide with the first pin and stick out of the plug. It also needs to be narrower so it doesn’t extend down into the keyway where your pick needs to be. If you only have bottom of the keyway tensioners then you can easily file/grind it thinner and cut it shorter.

Picking

The process for picking a lock is as follows:

1. Apply tension
2. Feel for the binding pin
3. Set the binding pin
4. Repeat steps 2 and 3 until the lock opens

If you remember from the “Vulnerability” section when we apply tension to the plug and try to turn it, the plug will bind up one of the pins instead of all of them since one pin will be larger in diameter than the rest. This is called the binding pin. Every lock is different and you will not have the same pin binding at the start. To find it, apply hard tension. This will make that pin feel very solid while the other pins remain springy. Once it’s found then to lift the pin you need to lighten up on the tension otherwise you will bend your pick instead of lifting the pin. Don’t release tension completely, just lightly lift on the pin while softening the tension until the pin starts moving. Keep lifting the pin until you hear/feel it click into place on the shear line. This can be heard and felt because once the pin is at the shear line the plug will rotate a tiny bit until it hits the next pin, with the plug holding up the set pin. You must not lift this pin any more otherwise you will overset it. Oversetting is when the bottom pin moves out of the plug and binds there. You can only push pins up not pull them down so if a pin becomes overset you must release all tension and start over.

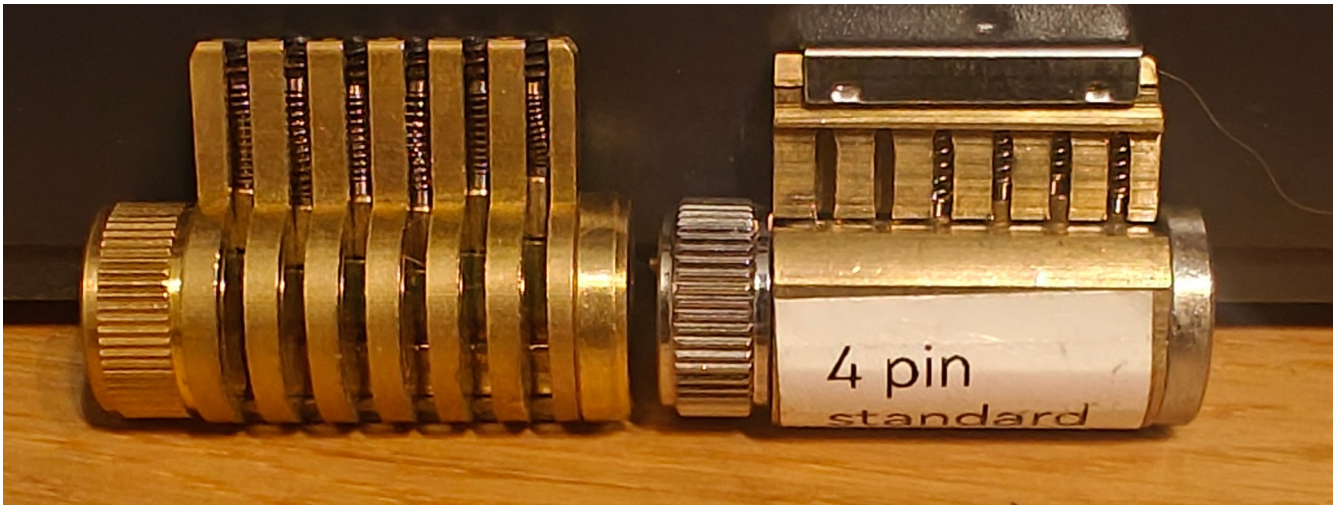
Once the first binding pin is set, the plug will rotate to create the next binding pin. Repeat the process of using hard tension to find it, softening up the tension until the pin can be lifted, and set the binding pin. Once the last pin has been set then the plug should rotate from the force of the tension wrench and the lock will be open.

A common issue is that you will have no more binding pins but lock doesn’t open. Here are some possibilities as to why:

1) An overset pin
    a) The bottom pin may be binding above the shear line. Since it’s not possible to set this pin anymore, nothing else can bind. You must release all tension and restart.
2) A binding pin has been lifted but is not set at the shear line
    a) If you lift a binding pin, but not enough to set it at the shear line, then it will remain binding and no other pin will bind and the lock won’t open. Just go through each pin stack and lightly tap each pin to make sure they are fully set. Don’t lift too hard or you may overset a pin.
3) The lock has been picked.
    a) Spring tension can keep the plug from turning. A common issue when picking American Lock padlocks is the spring tension on the plug. The spring engages right when the plug starts to rotate past the shear line so it’s not noticeable when picking, only when all pins are set. Simply apply stronger tension to test if the plug can rotate.
4) There are serrated pins inside. Continue reading to learn how to deal with this.

How to practice

I highly recommend staying away from the clear acrylic locks. They are only useful in demonstrating how a lock works. The feeling of acrylic vs metal is entirely different and will not transfer. The acrylic locks also have more wear-and-tear from the metal pins and so the feeling of these locks will change over time. The best way is to use a cutaway lock and utilize a technique known as progressive pinning. A cutaway lock is a lock which has been cut to show the insides while remaining functional. There are two types of ways that locks are commonly cut away. One is where just the housing is cut and another is both the housing and the plug.



The fully cutaway version allows you to see your pick and is easier to know where you are in the lock. However, when learning how to pick locks with security pins it can cause issues with the security pins becoming stuck on the edges of the cuts. The partially cutaway version avoids this issue. You can still know where you are in the lock by seeing while pins move when you move your pick.

The purpose of a cutaway lock is NOT so you can open it easier. Your goal with a cutaway should not be to open it. You should use a cutaway lock to be able to identify different pin states. The four pins states are:

1. Binding
2. Non-binding
3. Set
4. Overset

If you do not know what these feels like then it will be very hard to open a lock. Start by applying tension to the lock and gently feel each pin. The binding pin will feel solid and will not want to move, while a non-binding pin will feel springy and you will see it move both up and down. You should aim for minimal lifting of pins to feel their state as lifting an already set pin too much will overset it. Associate the feeling you have in your pick with the state of the pin you are lifting. You should practice and be able to feel a springy, non-binding pin with minimal movement without looking.

Once you identify the binding pin, set it. Then before moving onto the next pin, gently lift the set pin. You should both see and feel that it starts out slightly springy and lifting it more will result in a hard stop. It will not want to lift higher as the bottom pin will hit the housing. You should do this until

you are able to identify this pin state without looking. From here you can purposefully overset the pin to be able to identify this pin state. An overset pin will just feel solid and not want to lift any higher.

Progressive pinning is where you start with fewer pins and add more pins as you improve. I recommend using a 3 or 4 pin cutaway lock to identify different pin states and then using progressive pinning on a non-cutaway lock to practice. A 1 or 2 pin lock will not be a challenge for most, nor will it have enough pins to truly practice finding the binding pin. Starting with 3 pins is a great way to test if you are able to accurately feel the different pin states. Knowing where you are in the lock is learned throughout the entire process of feeling pin states in a cutaway, as well as during progressive pinning practice. Starting with 3 pins makes it significantly easier to know which pin you are on, and adding 1 more pin each time only increases the complexity of this by a tiny bit at a time. You can always pull your pick out and feel the pins as you reinsert to know where you are.

Security pins

Security pins are specially shaped pins that make picking more difficult, although this does not slow down a skilled picker by much. Below are the two most common types of security pins, spool (left) and serrated (right).

A spool pin looks like a spool. The middle is significantly thinner. A serrated pin has serrations along it’s length. There are other types of security pins such as mushroom pins (used in Medeco locks) and t-pins (which look like spools but one end does not expand back out so it looks like a capital “T” instead of a capital “I”). These are not as common and are usually picked in a similar way to spool pins.

Picking spools:

Any spool pins in a lock will always bind last as they are thinner than the rest of the pins. When all standard pins are set, then the plug will rotate a noticeable amount in order to bind the spool pins. This is known as being in a “false set”. You can see in the image how the plug has rotated much more than normal. To pick these pins, gently lift each pin until you feel the plug start trying to spin back. This is known as counter rotation. When you lift a spool pin, it will try to counter rotate the plug. You should keep constant tension but allow the plug to rotate as you lift the spool pin until it sets in place. Sometimes this will drop other pins and that’s completely normal, you will just have to reset those pins. You may need to repeat this process depending on how many spool pins are in the lock.

Picking serrated pins:

Serrated pins will “set” at the shear line in each serration. Simply pick as normal and if the lock does not open and there are no binding pins, gently push each pin up to test if it’s in a serration. A serrated pin will “click” up a serration easier than a pin will overset. Only lift each pin one “click” at a time so you don’t overset it, as it can be hard to know if it set or simply went to the next serration.