

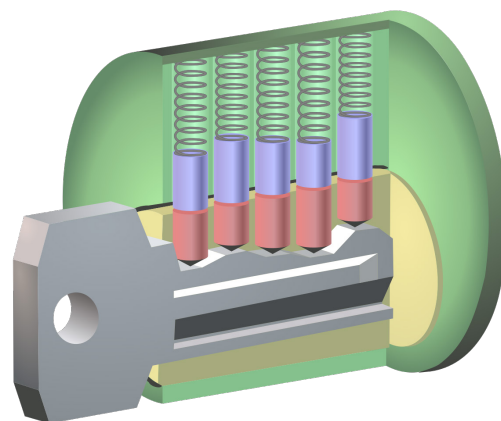
Pin Tumbler Lock Picking

A pin tumbler lock (standard home and most padlock's are pin tumbler locks) has a plug enclosed in a housing. When the plug rotates, it moves (or activates) something that controls a locking mechanism.

Pins, inside the plug and housing, block the plug from rotating unless the proper key is inserted in the keyway inside the plug. The key lifts each pin to the proper height (the shear line), which then allows the plug to rotate.

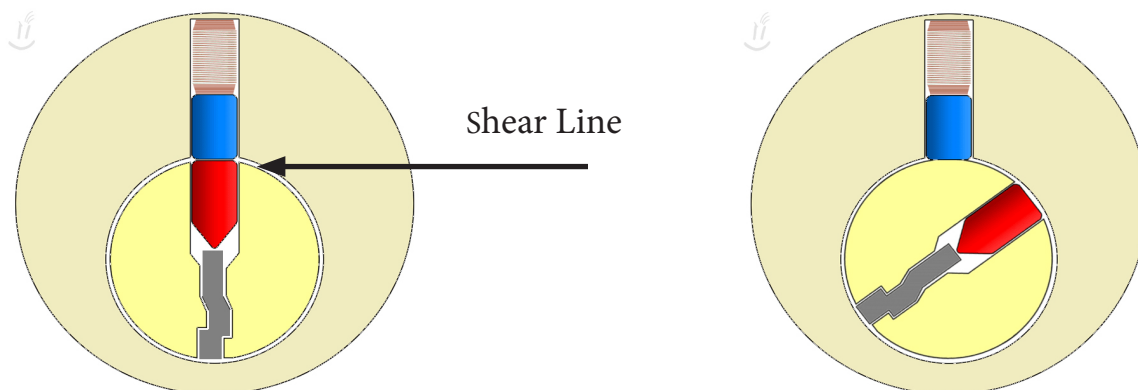
Parts of a pin tumbler lock:

- 1) Housing (in green)
- 2) Plug / Cylinder (in yellow)
- 3) Keyway (key is inserted in the keyway)
- 4) Springs
- 5) Top Pins / Drivers (in blue)
- 6) Bottom Pins / Key Pins (in red)
- 7) Master Pins (in some locks but not shown)
- 8) Shear Line (where the top of the plug and the bottom of the housing come together - the space between the top of the yellow plug and the green housing in our illustration)



When the pins are lifted to the proper height, as shown in the illustration above, the top pins (drivers) are all in the housing above the plug and the bottom pins are all resting in the plug. The break between the top and bottom pins is at the “shear line” and this allows the plug to rotate. Any other configuration will see either a top pin or bottom pin blocking the shear line, thus not allowing the plug to rotate.

Illustration below shows how the plug is able to rotate when the proper key is inserted (or when the lock is properly picked). The separation between the top pin and bottom pin is at the “shear line” allowing the plug to rotate.



With no key (or the wrong key) inserted, the bottom pins are in the plug with the top pins resting on them. The top pins are now half in the housing and half in the plug. In this configuration, the top pins are blocking the cylinder from turning.

With an improper key inserted, sometimes the bottom pins will be pushed up partially into the housing. In this configuration, the bottom pins are now blocking the cylinder from turning.

The illustration below shows the pins with the wrong key inserted. Lets examine each pin chamber, starting with chamber #1 closest to the “head” of the key (locksmiths call this part the “Bow”,) it’s where you hold the key.

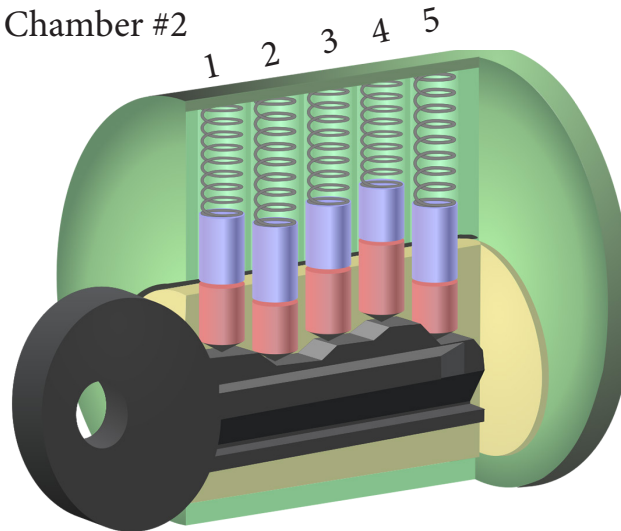
Chamber #1 - the top pin (driver) is completely in the housing with none of the pin inside the plug (cylinder). The bottom pin (key pin) is in the plug with none of the pin inside the housing. The plug would rotate if all the pin chambers looked like #1

Chamber #2 - the top pin is partially in the plug (cylinder) blocking the shear line. This is also what it looks like when no key is inserted. All the top pins (drivers) block the shear line, thus not allowing the plug to rotate. *In picking, this is also called an “Underset”, where you have not raised the binding top pin above the shear line, so it still blocks the cylinder from turning.*

Chamber #3 - Same as Chamber #1

Chamber #4 - With the improper key inserted, the bottom pin (key pin) is raised too high. In this case it is the bottom pin that now blocks the shear line not allowing the plug to rotate. *In picking, this is also called an “Overset”, where you have raised the bottom pin too high and it now binds and blocks the shear line.*

Chamber #5 - Same as Chamber #2



The majority of house locks have 5 pins, however some have 6, or more pins.

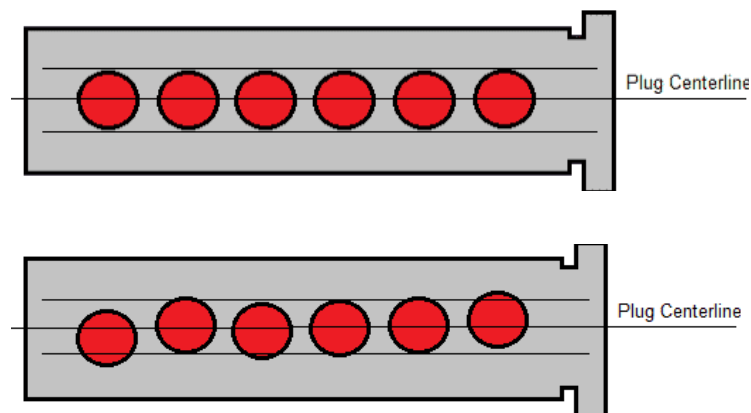
NOTE: The top pins, master pins (if installed), and bottom pins in each chamber is called the pin stack.

There are several ways to pick a lock:

- Pick Gun - A pick gun strikes the bottom pins with force, transferring the impact to the top pins, this causes the top pins to bounce into the housing while leaving the Bottom pins in the plug. Gentle turning pressure is applied via the tension wrench so when the top pins are in the housing and the bottom pins are in the plug, it will rotate.
- Bumping - Using a key with special cuts and a bump hammer. The idea is to mimic the action and force of a pick gun.
- Raking - Uses a special type of pick that randomly lifts the pins, in an effort to quickly raise the top pins to the shear line. This is a kind of “throw it all out there and see what sticks” type of approach but it does work very well on the more inexpensive locks with very sloppy tolerances. At times, raking will get some of the cylinders picked, leaving you only one or two that need to be “single pin picked”
- Single Pin Picking - The most skillful method in lock picking. With proper tension (discussed later) you find the “binding order” and lift each top pin (driver) to the shear line.

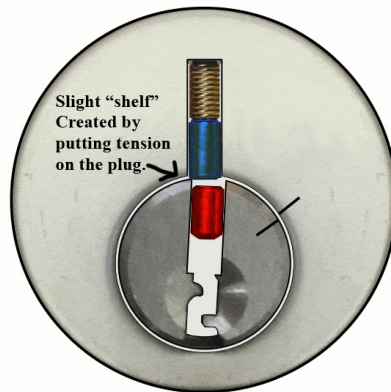
How does “Single Pin Picking” work?

Due to manufacturing tolerances, the holes in the cylinder and housing, that contain the pins, are not exactly aligned. The difference is microscopic, you probably can't see it, but with practice, you can feel it as well as see plug movement. Also due to manufacturing tolerances, the top pins are not all the same diameter.



While the above illustration is a major exaggeration, you can see how pin #6 would bind first if the plug was turned counter clockwise and pin #1 would bind first if the plug was turned clockwise.

The two issues mentioned above will cause a “binding order”, one pin at a time will bind against the lock housing when applying proper tension with your turning wrench. Once this first binding pin is picked, it will create a “shelf” above the plug for the top pins to rest on once they are picked. See illustration below:



Once the top pin is sitting on the “shelf”, the bottom pin will be floating freely in the plug and will come to rest at the bottom of the keyway where it normally sits when no key is inserted and the lock is not in use.

Some locks will pick easier in one direction than the other, however, to activate the lock (make it work), there is usually a particular direction that it will need to be picked. If a lock seems to only pick in the “wrong” direction, you will need a *Plug Spinner* to move the picked cylinder back across the shear line to the proper direction. A plug spinner uses heavy spring tension to rapidly spin the cylinder across the shear line. This is done so quickly that the picked pins do not drop back down and block the shear line. This process can not be done without the use of a plug spinner.

Tension Wrenches (sometimes called turning wrenches):

Tension wrenches (or turning wrenches) are used to put turning pressure on the cylinder to bind the pins during the picking or raking process. There are several types and ways to use tension wrenches.

- Bottom of the keyway
- Top of the Keyway
- Rigid
- Feather Touch
- Serrated / non-serrated
- And More.....

Most importantly, the tension wrench provides the “feedback” that you need to feel when each pinstack has been picked.

Similar to the vast amount of golf clubs available that have a particular and individual feel for each person and each situation, you need to find the tension wrenches that work for your picking needs for each situation (different type of lock).

Applying the Correct Tension:

- Too much tension will “over bind” the pins making raising the pins very difficult.
- Too little tension can not only cause the picked pins to fall back down into the cylinder, it also reduces the ability to feel the binding order, thus reduces the feedback feeling needed to properly pick each pin stack.

You need to find the “happy medium” that will give you the proper feedback without over tensioning the cylinder.



Correct tension is your key to success and is only developed after quite a bit of practice and “feel”.

Happy Medium

Simplified Picking Procedure:

- 1) Make sure the keyway is clear of obstructions (broken off keys and such), and the pinstack in each chamber is moving freely. With your pick (no tension wrench inserted yet), lift each pin stack to feel for freedom of movement and the spring pressure that keeps the pinstack in place when no key is inserted.
- 2) Position your tension wrench in the cylinder (bottom of keyway or top of keyway). Decide if you need to rotate the plug clockwise or counter clockwise, which may also effect your top or bottom of keyway decision. Apply the proper tension and *maintain tension* during the entire picking process. If you release tension, the top pins that you have already picked will now fall back into the plug and will need to be re-picked.
- 3) Use your pick (more information later on pick types) to locate the first “Binding Pin”. With the correct tension on your wrench, use your pick and lift each pin stack to see which stack binds the most (offers the most resistance when lifting).
- 4) Lift that first binding pin with your pick until you feel and/or hear a click and you feel and/or see a very slight rotation of the plug. These are the indicators that the top pin is now sitting on the shelf on top of the plug and the bottom pin is floating freely (without spring pressure) in the plug. This is called “setting the pin”.
- 5) Locate the next binding pin and repeat step 4 with each pin stack until they are all picked (Set). When all the pins are *set*, **the plug will rotate** and the picking process will now be complete.

A bit more information on “tension wrenches”:

Tension wrenches (turning wrenches), as mentioned previously, do several things:

- 1) They put turning pressure on the cylinder so it rotates once the lock is picked. The action of rotating the cylinder will make the locking mechanism work in the same way as if a key were inserted.
- 2) The turning pressure applied (consistently) during the picking process will bind the pinstack you will be picking, one after the other.
- 3) The tension wrench will provide you feedback during the picking process so you (with practice) will “feel” when a pinstack is picked.

Top or bottom of the keyway for the tension wrench?

Either will normally work but there are advantages and disadvantages to each:

Bottom of keyway is the easiest to control, however if the keyway is short, the tension wrench in the bottom of the keyway can take up space on the bottom of the keyway and interfere with the pick, forcing it up too high and possibly giving you an “overset” on a long pin when reaching behind to pick a short pin. The advantage of bottom of the keyway tension wrench would come into play when you have a large keyway and you would like the pick to rest on the tension wrench to give the pick additional height.

Top of the keyway. This type of tension wrench is sometimes called a pry bar. The portion that enters the keyway is normally very short, so it does not bind against the first pinstack. It is a bit more difficult to control, especially for beginners since it can more easily slip out of the plug. Top of the keyway tension wrenches (pry bars) allow full use of the bottom of the keyway for your pick to work without any interference from the tension wrench.

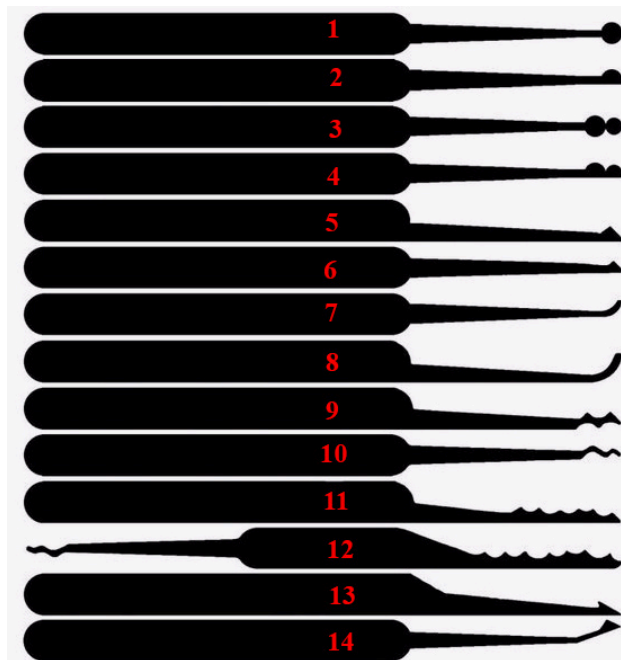
How much tension?

Light tension is what I use when “raking”, however when we talk about single pin Picking, you need the most tension possible without over-binding the pins. Too light tension will not give you the proper “feedback” to know when each pinstack is picked. Feedback is also why you use the most rigid tension wrench, it will transmit the feel of picking better than a “light touch” tension wrench when single pin picking.

Types of Lock Picks?

Rakes: Used for “raking” the pinstack as opposed to single pin picking. There are several shapes and styles of rakes. From double ball (snowman) to ones that look like the skyline of a city. The purpose is to randomly alter the pinstack in the hopes of “trapping” the top pins above the shearline while leaving the bottom pins below the shearline in the keyway. Photo below shows several types of rakes.

Picks: Used for “single pin picking” (although these can be used as rakes as well). A pick is designed to lift each pin individually until the top pin is above the shearline and the bottom pin is below in the keyway. Picks come in various shapes and sizes. They also come in different thicknesses, with a thinner pick designed to accommodate a thinner keyway. Some picks are straight with a diamond shape or hook on the end, some picks have more of an up-sweep with a hook or diamond shape on the end. There are many variations of each. The up-sweep allows you to get your pick behind a long pin to manipulate the pins behind it.



Pin Length: The deeper cuts in your key, the longer the bottom pin in the lock. This is important to know since a longer pin (deeper key cut) in front of a shorter pin (shallow key cut) will make the picking more difficult as once the longer pinstack is picked, it can be difficult to get your pick behind the longer pin to manipulate the short pin behind without disturbing the longer pinstack. For this reason, a pick such as the Deforest, or one with more of an up-sweep can be beneficial. On the flip side, the more up-swept picks can be more difficult to control in a shorter keyway due to the lack of room needed to manipulate a more up-swept pick. A good illustration is the photo above #5 vs #14 - both are diamond picks but #14 (a diamond hook) is designed to reach behind a longer pin as is #8.

Side Note #1: *Not critical to your picking, however good to know...* Some lock manufacturers use different length top pins in their pinstack. For example if you had a longer bottom pin, the manufacturer will call for a shorter top pin, also, if you had a shorter bottom pin, they would call for a longer top pin. This keeps more uniformity in the pinstacks and more consistent spring pressure on the springs above the top pins, as well as not allowing the complete pinstack to be pushed up above the shear line (short top and bottom pin) which would make picking easier. Some manufacturers call for only one size top pin regardless of the length of the bottom pin.

Side Note #2: *Not critical to your picking, however good to know...* Lock manufacturers use something called “MACS” Maximum Adjacent Cut Specifications. The MACS determine the maximum difference in pin length that can be next to one another. For example the longest pin (key cut) may not be able to be placed next to the shortest pin (key cut). This is done so the key will operate more smoothly going in and out of the keyway. This also assures the picker that they will not be having to manipulate the shortest pin behind the longest pin, however, the shortest pin may be two places behind the longest pin, since they are not directly adjacent to one another.

Side Note #3: *Not critical to your picking, however good to know...* As you can see from the information above, the most difficult locks to pick will be the ones with the longest pins next to the shortest pins (allowed by MACS). Take a look at your house key, if it looks like a major roller coaster ride, it will be harder to pick than a key that looks like a flat country road with a small speed bump on the way.

Side Note #4: *High Security Locks.* While, considerably more difficult to bypass, High Security locks can be bypassed, some by advanced picking procedures and some by other methods. This is something you may want to tackle once you are proficient at single pin picking standard pin tumbler locks. There are many different types of locks that provide higher security than pin tumbler locks. You may want to join a lock picking club or take more advanced classes (along with a lot of practice) to learn how to bypass High Security locks.

Side Note #5: *Factors that change binding order.* As discussed above, the binding order of the pins are the critical factor when single pin picking. There are factors that will effect the binding order. In addition to the manufacturer tolerances of the holes drilled in the plug, other factors will be: Direction you are applying tension (already discussed on page 3), the manufacturing tolerances of the lock plug vs the cylinder it sits in, and the placement of the tension wrench (bottom of the keyway vs top of keyway). All things considered, the binding order will be the same each time if you apply the tension in the same direction with the tension wrench in the same place. Change any of those factors and the binding order can change.

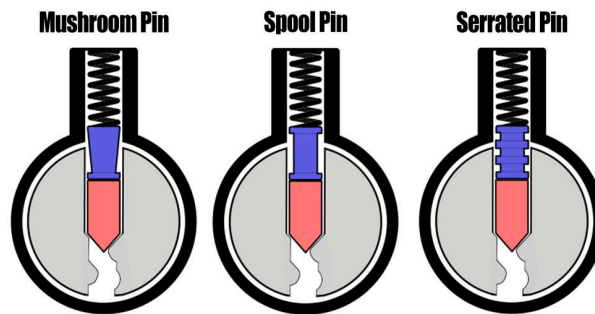
Side Note #5a: *How the position of the tension wrench affects binding order.* If you position your tension wrench in the bottom of the keyway and give clockwise tension, you are slightly pulling the front of the plug to your left, which in turn, moves the back of the plug to your right. The movement will change how close the back pins are to cylinder housing, thus changing the binding order. The opposite would be true if you were putting counter-clockwise tension on the bottom of the keyway. Alternatively, If you position your tension wrench (pry-bar) in the top of the keyway and give clockwise tension, you are essentially pushing the front of the plug to the right, which in turn, moves the back of the plug to the left. This will now move the front pins closer to the cylinder housing, thus changing the binding order. Again, the opposite will be true if you put counter-clockwise tension on the top of the keyway.

Problems encountered while picking:

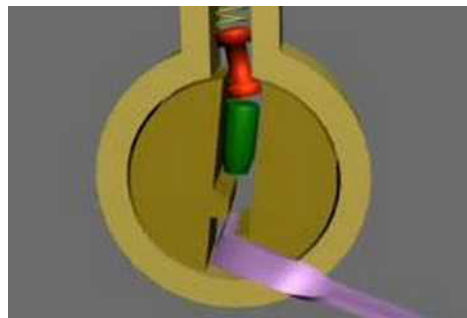
- 1) **Under-set:** This occurs when the top pin is not fully set above the shear line. Remember, when the binding pin is set, the top pin (driver) will be above the shear line and the bottom pin (key pin) will no longer have spring pressure and feel loose and floating in the keyway. The “under set” top pin is not fully above the shear line but because it is wedged against the plug, the bottom pin will no longer have the spring pressure so the bottom pin will have the same feeling as if the top pin is set.
*How can you tell if you have an Under-Set.....*There will be no next binding pin because the current binding pin in the under-set is still wedged and not above the shear line. You will also realize that every other pin is either already set (bottom pin floating in the keyway) or, not yet set (spring pressure still on the bottom pin).
*How to fix the Under-Set.....*Keep the same tension (no more, no less) and gently lift the last pin you were picking and it should set. Making sure you get full feedback (either a click or visual slight plug rotation) from each pin picked is the best way to avoid an under-set.
- 2) **Over-set:** This occurs when the bottom pin is pushed up too far and is partially above the shear line and binding against the cylinder.
*How can you tell if you have an Over-Set.....*There will be no next binding pin because the current binding pin (this time the bottom pin) is wedged at the shear line. Again, probe each pin. They will either have spring pressure (if not set) or will have the bottom pin floating in the keyway with no pressure. The over-set pin will have neither spring pressure or will have the bottom pin floating.
*How to fix the Over-Set.....*Try to, very minimally reduce tension and wiggle your pick on the over-set pin. With skill (and luck) only that pinstack may drop back down so you can re-pick that stack. In most cases, you may have to drop all the pins you have picked and start over. Avoid an over-set by trying to be more gentle with your single pin picking. You can also create an over-set by trying to reach that short pin behind a long pin because your pick accidentally pushes the long pin up while trying to reach the shorter pin behind.

3) **Specialty (Security) Top Pins:** There are special top pins such as “Spool” pins, “Serrated” Pins and “Mushroom” Pins, (see photo below).

All are designed to make picking more difficult by wedging against the cylinder and essentially creating an Under-Set, however, when we discuss things such as spool pins, the under-set is now called a “False Set” because the idea behind the security pin, is to falsely make the picker think the pin stack is set. The feel and look of the lock while picking a pinstack with a security pin is different than the feel and look while picking a pinstack with a standard top pin. The ability to notice this feel and look can only come with a lot of practice picking locks with standard pin stacks. You will get familiar with the “normal” feel and look enough that you will be able to tell when you have encountered security top pins.



The first thing you will notice when picking a lock with security pins is an “over rotation” when lifting the pinstack. This “over rotation” is what puts you into the “false set”. The cylinder will rotate more than it would if you had a standard top pin. See why the over rotation occurs in the photo below.



Once you feel and see the “over rotation”, the top pin will be in a “false set” which is actually an under-set. If you now lift the pinstack further you will see and feel a “counter rotation” on the plug as the security pin starts to lift to the shear line.

The above falls more into the “advanced” category of lock picking. This should be practiced once you are very familiar with the feel and look of picking locks with standard top pins, using the “single pin” picking method.