

Why do Strings Break?

Ever wonder why a string breaks in your piano? There are actually three main reasons why strings break: playing too loud, defective wire, or rust.

First, a piano tuner seldom breaks a string. Each string on the piano is stretched to between 137 and 170 pounds of tension, depending on the size and length of the string. But even at that tension, the string is at about 60% to 75% of its breaking point. A piano tuner would need to raise the pitch of a piano by almost 4 or 5 notes before it would break. So when a string breaks while the piano is being tuned, it usually because of other problems.

When a note is played, a string vibrates. As it vibrates, it moves across several different pressure points. As the string moves across these pressure points, it creates friction and the string heats up. (Try bending a paper clip a couple of times). When the string heats up, the molecular structure of the string breaks down and the tension of the string will become greater than the tensile strength of the string. And that results in a broken string.

Under normal playing conditions and the strings are “healthy“, the strings do not heat up enough to break. But when a piano is played loud, the conditions are right for strings to break. When a key is played, the hammer hits the string, and it vibrates up and down. When the string vibrates up and down, at some point it comes to an apex, the point where the string cannot go any higher or lower. When the hammer strikes the string again at exactly the same time the string is at the upper apex, there is no other place for the string to go, and it will be stretched beyond its tensile strength. When that is combined with the friction that has been created by the string vibrating, the string will snap. The best way to avoid breaking strings during heavy playing is to not keep the sustain pedal down all the time. The dampers actually hold the strings down, and it won't be over stretched.

Another reason a string will break is because it is defective. When a string is made at the foundry, a block of steel is pulled through a smaller and smaller hole. During that process, should there be a slight power surge in the plant where the string is being made, the string will become slightly thinner for a very small segment of the wire. In most cases, the difference is so minute, that it will never be a problem. But sometimes the “dimple” in the wire is enough to cause the string to break when it is pulled up to tension. Most of the time this is caught at the piano factory, but sometimes the defective wire will survive the manufacturing process, and decide, completely on its own, to break 1, 5, 10 or even 50 years later. Thus, when a string breaks for no apparent reason, blame it on the manufacturing process.

And last, the reason a string will break is when it is rusty or has become corroded with salt air. We have a big problem with rusty strings here in Hawaii, where the humidity is always high. Rust breaks down the molecular structure of a wire and it literally eats away at the steel. As was mentioned earlier, there are several pressure points on a string. It is at those pressure points where the rust causes a problem. When enough of the wire has been eaten, the tension of the string will become greater than the tensile strength of the wire,

and it breaks.

There are three ways to prevent rust on strings. On an upright, a damp chaser inside the piano, which creates heat, will keep away the moisture, and prevent a lot of rust. On a grand piano, a damp chaser under the piano will help, but the best way to keep moisture off the strings is with a string cover. A felt cover should not be used, because felt absorbs moisture, and then releases it onto the strings. That is why a string cover made of Ranch Hide is better.

In extreme circumstances, it might also be advised to put a cover over entire piano, especially in a large room or auditorium. That, along with the damp chaser, will really keep the moisture out. Unfortunately, those preventive measures can only do so much. Pianos in homes next to, or within 100 yards of the ocean, almost don't have a chance. The salt air will corrode the strings, and there is not much that can be done to stop it.

In addition to the damp chaser and covers, there is also a product called Rust Blocker that will help keep rust off the strings. Rust Blocker emits a vapor that settles on the strings and prevents moisture from adhering to the strings, thus preventing rust.

To reiterate, the three reasons a string breaks are: playing too loud, defective wire and rust. Knowing what causes a problem is the first step in prevention. Perhaps this information was helpful.

Replacing strings.

When strings break, or become corroded, they need to be replaced .

There are two kinds of strings on a piano: Bass string and treble strings. Bass strings are primarily found in the lower end of the piano, and are steel strings wrapped with copper. Replacing one of those strings is relatively easy. A measurement is made of the strings outside diameter, and a string of the same diameter is then cut to the same length, making sure the copper winding is the same length as on the string that broke. The bass string has a loop on one end that is attached to the hitch pin at the far end of the piano, if it's a grand, or in the bottom of the piano if it's an upright. The string is then wound around the tuning pin and brought up to pitch.

For information on replacing all the corroded bass strings, please look at this article on [bass string replacement](#)

Treble strings also come in different diameters. In order to determine the outside diameter of the string, a micrometer is used. It is extremely critical that a string of exactly the same diameter is used as a replacement.

Putting a new treble string on a piano can be tricky, especially on an upright. In order to

replace a string on an upright piano, the action has to be removed from the piano. In most instances, it is relatively easy to remove the action. But sometimes the keys also have to be removed to get the action out of a piano. Obviously when keys have to be removed to get the action out, the cost of replacing a string will be more expensive than replacing a bass string. Please look at the link on sticking keys for more information on removing an action.

In Hawaii it is not unusual for all the strings to become rusty. In that case is it sometimes necessary to replace all the strings. The cost of doing that can be quite expensive, so the only time replacing all the strings is when the piano is of good enough quality, and there are no other structural or mechanical problems.