# Technical Bulletin #3
# Humidity Control

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Your piano is made primarily of wood, a versatile and beautiful material ideal for piano construction. However, being made of wood, your piano is greatly affected by humidity. Seasonal and even daily changes in humidity cause wood parts to swell and shrink, affecting tuning stability and touch. Extreme swings in humidity can eventually cause wood to crack and glue joints to fail.

Other materials in your piano also are affected by changes in moisture content in the air. The many felt and leather parts in your piano's action can change dimension, affecting regulation and friction, or stiffness of the touch. Very high humidity can even create condensation on metal parts such as strings, tuning pins and hardware, eventually causing them to rust.

## How does humidity level affect my piano's tuning?

Swelling and shrinking of the piano's soundboard is the most immediate and noticeable effect of humidity change. The soundboard, a sheet of wood approximately 3/8 of an inch thick, is made with a slightly crowned shape. The strings pass over the soundboard and are connected to it by a wooden piece called a bridge. The upward crown of the soundboard presses the bridge tightly against the strings.

As the moisture level in the soundboard increases during periods of high relative humidity, the crown expands and pushes the bridge harder against the strings. The strings are stretched tighter and the piano's pitch rises. Because this increase in crown is greater in the center of the soundboard than at the edges, the pitch rises more in the middle octaves than in the bass or treble registers.

During periods of low relative humidity the soundboard shrinks, reducing the crown and decreasing pressure against the strings. The pitch drops, again with the greatest effect noticeable in the center of the keyboard. When relative humidity returns to its previous level, the average pitch of all the strings will return to normal, although the exact pitch of individual strings will be slightly changed from their original settings. Thus, a piano only will stay in tune as long as the relative humidity level in the air surrounding the soundboard remains constant. Extreme humidity changes require making greater changes in string tension to bring the piano into tune. This upsets the equilibrium between the string tension and the piano frame, and the piano never becomes stable.

## What is relative humidity?

Wood swells and shrinks in response to changes in the relative humidity of the air around it. Relative humidity (RH) is the amount of moisture contained in the air, compared to the maximum amount of moisture that the air is capable of holding. The moisture content of air is affected by weather as well as conditions and activities within the home, while the moisture- holding capacity of air varies with temperature. One way of thinking about RH is that it is a measure of air's tendency to absorb or release moisture to its surroundings. Thus when the RH of air in a room increases, moisture will tend to transfer from the air to wood and other absorbent materials in the room. When the RH of air decreases, moisture will transfer from other materials back into the air. The RH of the atmosphere is always changing by the hour, and more dramatically, with the seasons. Consequently, the wood and felt parts in your piano are constantly changing dimension as they absorb and release moisture.

Since RH depends upon the temperature and moisture content of the air, it is not possible to maintain a constant RH by controlling room temperature alone. In fact, maintaining an even temperature while moisture content varies will cause RH to change.

## What can be done to minimize humidity problems?

Keeping the humidity level around your piano as constant as possible will help it stay in tune longer as well as slow such damage as soundboard cracks, loose tuning pins, and glue joint failures. The first and simplest precaution you can take is to position your piano away from areas where it would be exposed to extremes of temperature and humidity such as heating and cooling vents, stoves, doors and windows. Direct sunlight is especially damaging. If your home is not well insulated, an interior wall is preferable to an outside wall.

Controlling the humidity within the home is another step you can take to preserve your instrument. In most areas of the country the relative humidity is very low during the cold winter season, and very high during the spring and summer. In other areas these humidity cycles are reversed. Wherever you live, you have probably noticed the symptoms of low RH (shocks from static electricity when sliding out of a car or after walking across carpet), and the signs of high RH (limp, soggy feeling newspapers and sticking doors). To monitor RH changes in your home, you may wish to purchase a moderately priced wall hygrometer available from most instrument supply companies or electronics stores.

Use of a room humidifier during dry seasons will help somewhat. However, too much moisture added to a room during winter months can cause condensation to form on cold surfaces such as windows, eventually causing mildew, rot, and in extreme cases, damage to the building structure. During the humid season de- humidification is needed. If your humid season is winter, keeping the home evenly heated will help. However, humid summer situations require much more elaborate de- humidification systems. Unfortunately, it is seldom possible to adequately control the relative humidity of a piano by controlling the room environment alone.

A very practical and effective answer to humidity problems is to have a humidity control system installed in the piano itself. These systems consist of three parts: a humidifier for adding moisture to the air, a dehumidifier for eliminating excess moisture, and a humidistat or control unit which senses the RH of the air within the piano and activates the system to add or remove moisture as needed. These systems are designed to maintain the RH of the air within the piano at the ideal level of 42%. The components are installed out of sight, inside the case of a vertical piano or under the soundboard of a grand. They are easy to maintain, and can be installed by your piano technician.

## How will humidity control benefit my piano?

While not eliminating the need for regular piano maintenance, humidity control will allow more stable tunings by reducing the radical pitch changes your piano may experience through the seasons. When your piano stays closer to its correct pitch level of A440 (A-440 cycles per second), your technician does not have to perform a large pitch raising or lowering procedure prior to fine tuning. Thus, a balance of forces is maintained between the strings and the frame of the piano, allowing more accurate and stable tunings to be done.

In addition, a stable environment will help to preserve your piano through the years. Wood parts, glue joints, metal parts and your piano's finish will all last longer if not subjected to excessive humidity swings. Maintaining the correct environment will preserve your piano investment for a lifetime of enjoyment.