



CCI Notes

10/9

Keying Out of Paintings

Introduction

Paintings on canvas have a tendency to become slack on their auxiliary supports (i.e., stretchers, strainers). In certain circumstances, a procedure called **keying out** can be performed to tighten the canvas on stretchers with expandable corner joints. However, if keying out is performed when it is not necessary, or if it is incorrectly executed, serious damage to the painting can result. Anyone undertaking keying out should be aware of the correct procedure and of its limitations.

Keying out is not a routine or basic procedure. If there is doubt concerning its application, seek advice from an experienced conservator before undertaking keying out.

Paintings and the Environment

Paintings respond to fluctuations in relative humidity (RH). It is important to realize that all components of a painting (i.e., wood, canvas, glue size, ground, and paint layers) respond to changes in RH. The overall response of a painting to its environment will vary from one painting to another, depending on the materials present and on the individual reactions of each material.

When RH drops, the paint, ground, and size layers lose moisture,

contract, and become increasingly stiff and brittle. In this condition, the layers are most highly stressed and their ability to accommodate dimensional change without cracking is reduced. With increasing RH, these layers gain moisture and become more flexible. However, above approximately 85% RH, the canvas may have a tendency to shrink. Expansion and contraction of the wood stretcher will also affect the painting's response to fluctuations in RH.

Is Keying Out Necessary?

A painting can have varying degrees of tension, from slack to taut to tight. Ideally, a painting should be "just taut" upon its stretcher; that is, the canvas should be held under minimal, even tension. Tautness in a painting will vary, depending on such factors as the materials present in the painting, the dimensions of the painting, and the environmental conditions surrounding the painting.

Slight slackening and tightening of the painted canvas in response to seasonal fluctuations is to be expected and allowed. These conditions should not be treated by keying out.

A painting that exhibits slackness in the canvas should be observed over a period of one year to determine if the slackness is a temporary response to climatic change, especially to fluctuations in RH.

Minimal keying out may be considered for paintings in which overall slackness is observed throughout an entire annual cycle.

When hanging vertically, a painting that is slack will usually bulge at its centre and may also sag slightly along its lower edge. The object of keying out is to remove slight overall bulging and to bring the painting back into plane.

While overall slackness can often be corrected by keying out, local distortions, such as isolated bulges or draws in the corners, require skilled conservation treatment and **should not be treated by keying out**.

Tight framing or warping of the stretcher or backing board can cause an overall out-of-plane distortion of the canvas. This distortion may be reduced simply by improving the framing method (see CCI Notes 10/8, *Framing a Painting*, and CCI Notes 10/10, *Backing Boards for Paintings on Canvas*).

When Should Keying Out be Undertaken?

Whether one should be concerned about slackness depends largely on the storage, display, and travel plans for the painting. Generally, slackness in a painting that is permanently stored or displayed in a museum will not result in immediate damage. Therefore, a slack canvas may be observed over a period of time without risk to the condition of the painting. However, if a painting is to travel, flapping of a loose canvas can result in damage to the painting.

The behaviour of a painting in response to its environment has tremendous implications for keying out. If keying out is necessary, it should be undertaken mid-way through the RH cycle to which the painting is exposed. For example, in an uncontrolled environment that fluctuates between 20% and 80% RH, keying out should be undertaken when the RH is between 50% and 60%.

Never undertake keying out during extremes of RH or temperature, particularly during periods of low RH. In low RH, components of the painting become stiff and brittle. Keying out at 30% RH is two to three times more stressful for the painting than keying out at 50% RH.

Precautions

Keying out is a potentially damaging procedure that must be undertaken with extreme caution.

Keying out of a rectangular stretcher is not an ideal procedure because it tends to put excessive stress on the painting at the corners and at the tack points where the canvas is fixed to the stretcher.

Over-keying can cause the canvas to tear along weak edges and can cause the paint and ground layers to crack.

If, during keying out, the corner areas become taut while the central area of the painting remains slack, stop the procedure and seek the advice of a conservator. In such a case, it may be necessary to modify the stretcher and re-stretch the canvas.

Avoid regular keying out with seasonal changes. Each time a painting is keyed out, it becomes slightly larger. The danger exists that the painting, unable to accommodate repeated stretching, will tear along its edges.

In most cases, it is safer to leave a painting slightly slack than to make it too taut by keying out.

Procedure for Keying Out

Examination of Painting and Auxiliary Support

Examine the painting to ensure that it is in stable condition and can be moved safely. Paintings with lifting, flaking, or curling paint should not be handled or keyed out. In these cases, contact a conservator for advice.

Carefully unframe the painting and remove the backing board (see CCI

Notes 10/12, *Removing a Painting from Its Frame*).

Examine the condition of the fabric support. An extremely brittle canvas with tears or splits along the edges or with threads that break or powder easily should not be keyed out.

Examine the auxiliary support for structural strength, general condition, and method of construction. Ensure that the stretcher is not warped and that long side-members are adequately supported by expandable cross-members. Determine whether stretcher members will expand evenly along their length and whether corner joints are mitred. Keying out of stretchers with squared mortise and tenon joints produces damaging distortions in the corners of the canvas (Figure 1). Such stretchers should not be keyed out unless they are modified by a conservator.

Examine the corner joints to determine how much they have been expanded previously. If the stretcher has been expanded to the point where the corner joints no longer have adequate strength, it should be replaced with a larger stretcher. In this case, contact a conservator for advice.

Expanding the Stretcher

To avoid over-keying, perform keying out in stages. First, expand all joints only slightly. If necessary, repeat the procedure, again with minimal expansion. Do not attempt to obtain the correct tension all at once.

The two most common expansion mechanisms for stretchers are wooden keys and turnbuckles.

Wooden Keys

Wooden keys are small wooden wedges that fit into slots on the inner corner joints and in cross-bars of the stretcher. Each corner usually has two keys. Tapping the keys further into their slots spreads the stretcher members (Figure 1). If keys are missing, it will be necessary to make new ones (see CCI Notes 10/8, *Framing a Painting*).

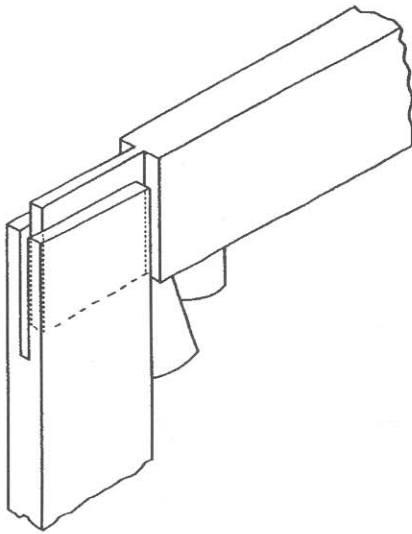


Figure 1. An expanded squared mortise and tenon joint.

Replace broken keys, keys that are too small to allow further expansion, and keys that protrude outside the stretcher edge. It will be difficult to remove keys that are tightly wedged into their slots. If keys cannot be removed by hand, leave them in place and contact a conservator for advice.

Hold small paintings upright on a table for keying out. Place larger paintings face down on padded blocks positioned diagonally under the corners of the painting (see CCI Notes 10/2, *Making Padded Blocks*). Cover the padded blocks with Mylar to permit the painting to move slightly without resistance.

Beginning in one corner, gently slide a thin, rigid card, such as 2- or 4-ply matboard, between the canvas and the stretcher to shield the back of the painting from accidental glancing blows of the hammer. Slide the card in only a few centimetres beyond the inner stretcher edge. Forcing the card further may place stress on the edge of the painting (Figure 2). Treat one corner at a time. Then, working either in a clockwise or a counter-clockwise direction, move to the adjacent corner. If the painting being treated is lying flat on padded blocks, treat both keys in each corner before moving to the next corner. However, the painting is held upright for

keying out, tap only the **vertical** keys in the two lower corners before rotating the painting to work on the **vertical** keys in the next two lower corners (Figures 3a to 3d).

Using a tack hammer, lightly tap the keys toward the corners, keeping the number of taps to a minimum. Avoid even brushing contact of the hammer with the protective card. Strike only the keys. As each key moves further into its slot, the stretcher members will expand. Move the rigid card from one corner to the next as the process progresses. Use the same pressure and the same number of taps on each key. After all the keys have been tapped, expand the cross-bars in the same manner. If the painting is still slightly slack, repeat the procedure, again using a minimum number of taps.

Avoid over-keying. Remember that the purpose of keying out is to remove slackness that has resulted in slight overall bulging. As soon as the painting is returned to plane, stop

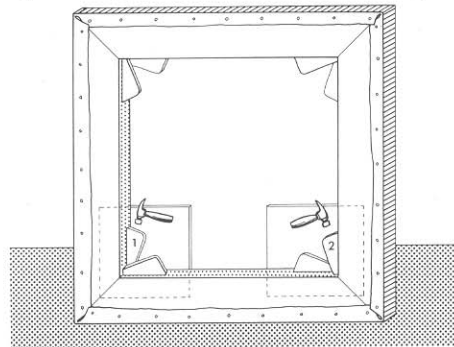
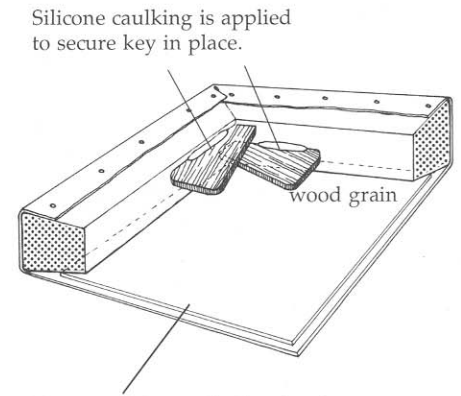


Figure 3a. Holding a small painting upright, tap lower vertical keys 1 and 2.



Use protective card when keying out and when applying caulking.

Figure 2. Insert keys into stretcher and secure with silicone caulking (cross-section view).

keying out. There may be a difference in tension between the corners and the centre of the painting, but this difference should not be great. The painting should be "just taut" at its centre point. The corners will be more taut, but should never be "drum-tight." Secure the keys to the stretcher using the method described in CCI Notes 10/8, *Framing a Painting*.

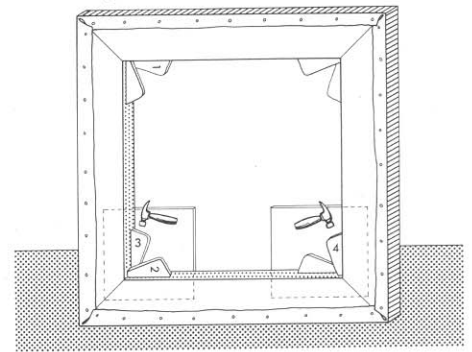


Figure 3b. Rotate painting and tap keys 3 and 4.

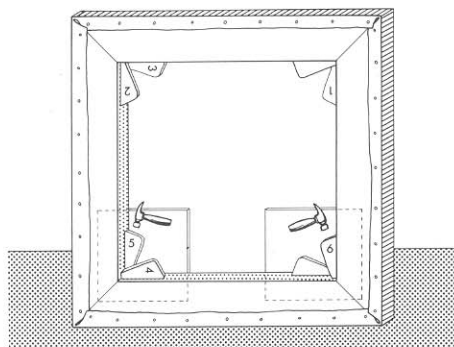


Figure 3c. Rotate painting and tap keys 5 and 6.

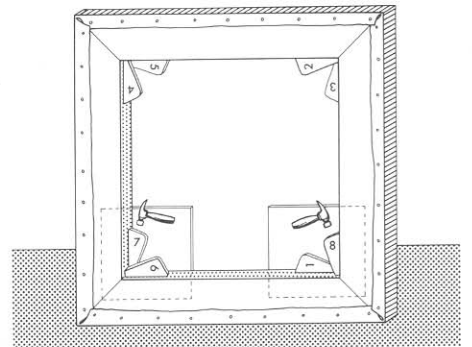


Figure 3d. Rotate painting and tap keys 7 and 8.

Turnbuckles

Turnbuckles, most commonly found in the Lebron stretcher, are designed to permit both expansion and contraction of the stretcher corners. Place a nail or metal dowel in a hole on the turnbuckle and turn it to rotate the mechanism (Figure 4).

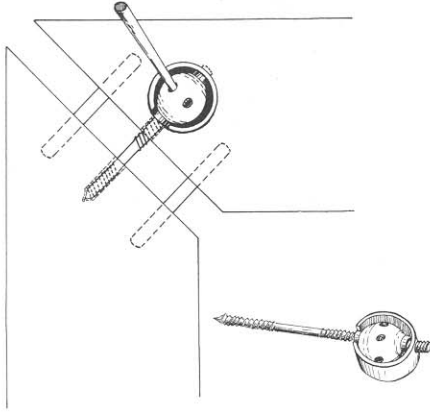


Figure 4. A turnbuckle expansion mechanism.

It is best to expand this type of stretcher with the painting lying face down on Mylar-covered padded blocks, as described above.

To expand the stretcher, follow the same general method as that for wooden keys described above. Work in one direction around the painting, expanding each turnbuckle with a minimum and consistent number of turns.

Reframing the Painting

Replace backing boards after keying out is completed. A painting that has been keyed out may fit too snugly in its original frame. It may be necessary to modify the frame prior to reframing (see CCI Notes 10/8, *Framing a Painting*).

Further Reading

Canadian Conservation Institute.
Backing Boards for Paintings on Canvas. CCI Notes 10/10. Ottawa: Canadian Conservation Institute, 1993.

Canadian Conservation Institute.
Framing a Painting. CCI Notes 10/8. Ottawa: Canadian Conservation Institute, 1993.

Canadian Conservation Institute.
Making Padded Blocks. CCI Notes 10/2. Ottawa: Canadian Conservation Institute, 1986.

Canadian Conservation Institute.
Removing a Painting from Its Frame. CCI Notes 10/12. Ottawa: Canadian Conservation Institute, 1993.

Copies are also available in French.

Texte également publié en version française.

© Government of Canada, 1993
Cat. No. NM95-57/10-9-1987E
ISSN 0714-6221