



**P R E S E R V E
M O N T A N A**

Restoration Guide

Historic Wood Windows



Preserve Montana Restoration Guide

Historic Wood Windows

Written by Mary Webb, Restoration Director

December 2020



PRESERVE MONTANA

Protecting Montana's heritage today, for tomorrow.

Since 1987, Preserve Montana has worked to save and protect Montana's historic places, traditional landscapes, and cultural heritage, with an emphasis on at-risk properties. Based in Helena, Montana's capital city, Preserve Montana has provided individuals and communities with the leadership and knowledge to preserve our past for the future.

We work statewide and believe that saving landmark buildings and cultural places enhances our quality of life and makes our communities attractive and meaningful places to live, visit, and work.

Each year, our work joins together historians, architects, artists, authors, museums, tribal cultural leaders, business owners, government officials, economic development programs, traditional tradespeople, individuals and communities who all believe as we do in the power of historic places that hold the stories of our past and shape who we are as Montanans.

To share the legacy of Montana's historic places in all its richness, we have published award-winning books on barns and schoolhouses, hosted interpretive tours and our Montana Preservation Road Show, led more than 50 community workshops, helped to restore more than 30 buildings and structures, and shared perspectives on history and culture through our 46° North heritage podcast and on-line ethnic exhibits.

With the launch of our Preservation Toolkit program, we encourage all Montanans to join us in taking an active role in the stewardship and preservation of Montana's heritage. To learn more about how you can help, please visit us online, follow us on social media or contact us in our Helena offices:

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www.preservemontana.org

<https://www.facebook.com/PreserveMontana/>

On Instagram @preserve_montana

This guidebook was created by Preserve Montana as part of our efforts to bring preservation to a wider audience and give more people the ability to save and protect the historic buildings in our state.

In 2020, we compiled window restoration tool kits for lending in towns across Montana. The kits include all the tools necessary to completely restore historic wood windows, and they are available for check-out for both home and building owners. With this guidebook and the tool kits combined, we offer preservationists and do-it-yourselfers the chance to learn a valuable new skill on their own terms and save a little history in the process.

Preservation is often a team effort, and we could not have completed this project without the teamwork of our PMT board and staff and the generosity of our supporters. We thank Mary Webb, our Restoration Director and in-house preservation carpenter, for putting her expertise into an easy to follow format that anyone can pick up and use. We thank our staff Madie Westrom and Chere Jiusto for their contributions to this guide. And we thank Dustin Kalanick, who launched PMT's first window training workshops and laid the groundwork for the restoration outreach we now carry out in many parts of Montana. We are also grateful to have received grants from the Historic Preservation Education Foundation and the Montana Coronavirus Relief Fund, which made the production and printing of this guidebook possible.

Many people gave freely to help compile the window restoration kits. We are grateful to the individuals and businesses listed on the right who contributed tools and help finance the window restoration tool kits.



Helena's Power Townsend

Livingston's Ace Hardware

Owenhouse Ace Hardware

Carl Davis & Sara Scott

Alvaro Freyre

Lesley Gilmore & Bob Franzen

Janice & Cecil Goodman

Chere Jiusto & Jim Robbins

Kirby Lambert & Becca Kohl

Lucas Schad, LTS Architecture

Bob Valach

John Walden

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INTRODUCTION

Historic wood windows are one of the most prominent features on a historic building, lending beauty to the design while playing a character-defining role on the exterior façade and allowing natural light to flow into the interior spaces. Unfortunately, they are often one of the first features to be replaced as buildings age, altering the character and contributing to unnecessary waste. There are many misconceptions about historic windows that lead people to make poor choices about their replacement. This publication is meant to explain that with proper repairs and maintenance, wood windows can perform just as well as modern ones, while saving resources and the historic fabric of a building.

The truth is that traditional wood windows follow elegantly simple design principles that enable them to last for many decades, often with little maintenance. In fact, many wood windows have already lasted 100+ years, and in most cases can last another 100+ years if maintained. By contrast, their newer vinyl and fiberglass counterparts have a life span of about 30 years. While synthetic replacement windows are often touted for their energy efficiency and cost-savings, enlisting one or more energy saving techniques can improve the performance of wood windows to rival the efficiencies of their replacements.

Like all parts of a building, wood windows do require some maintenance. Using quality products can extend the maintenance cycle, and regular inspection of wood windows allows for deficiencies to be caught and addressed before too much damage has been done. For example, failing glazing putty can lead to air infiltration, while failing paint can trap moisture in the wood, leading to rot. However, catching these problems early can enable simple repairs to be made, and head off larger repairs down the road.





Overall, saving wood windows provides many benefits:

- Saves historic fabric and the historic value of a building
- Retains the appearance of the building
- Prevents more materials from going to the landfill
- Provides a higher return on investment than replacements
- Gives handy people the chance to learn a useful new skill set!

In 2012, the National Trust for Historic Preservation took on this question of whether historic wood windows really were inferior to modern windows being manufactured with synthetic materials, including vinyl and fiberglass. Their Preservation Green Lab (now the Research & Policy Lab) studied this problem in depth, and issued a report entitled, “*Saving Windows, Saving Money: Evaluating the Energy Performance of Window Retrofit and Replacement.*”

The Green Lab’s findings reinforced the viability of traditional wood windows, with the following takeaways:

- ***Retrofit Measures Can Achieve Performance Results Comparable to New Replacement Windows.*** When the performance for each upgrade option is taken into account, this study shows that there are readily available retrofit measures that can achieve energy savings close to new, high performance replacement windows.
- ***Almost Every Retrofit Option Offers a Better Return on Investment than Replacement Windows.*** Findings from the cost analysis showed that new, high performance windows are by far the most expensive measure, costing at least double that of common retrofit options when considering materials,

installation and general construction commonly required for an existing home. In all climate zones analyzed, cellular shades, interior storm panels and various exterior storm window configurations offer a higher average return on investment compared to new, efficient replacement windows.

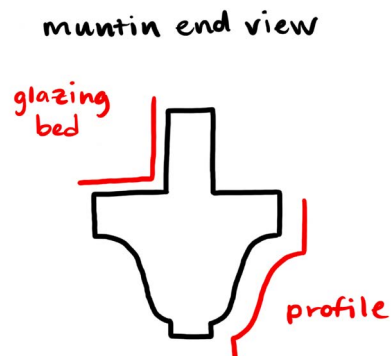
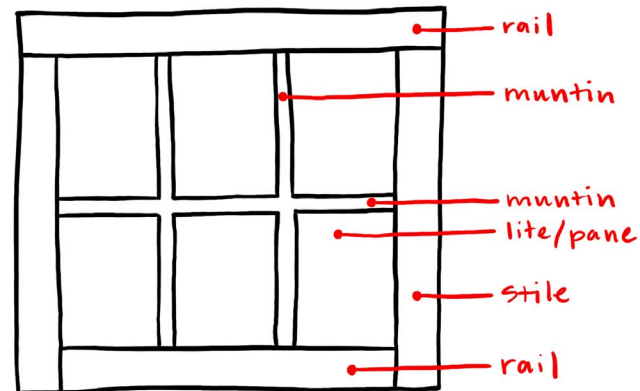
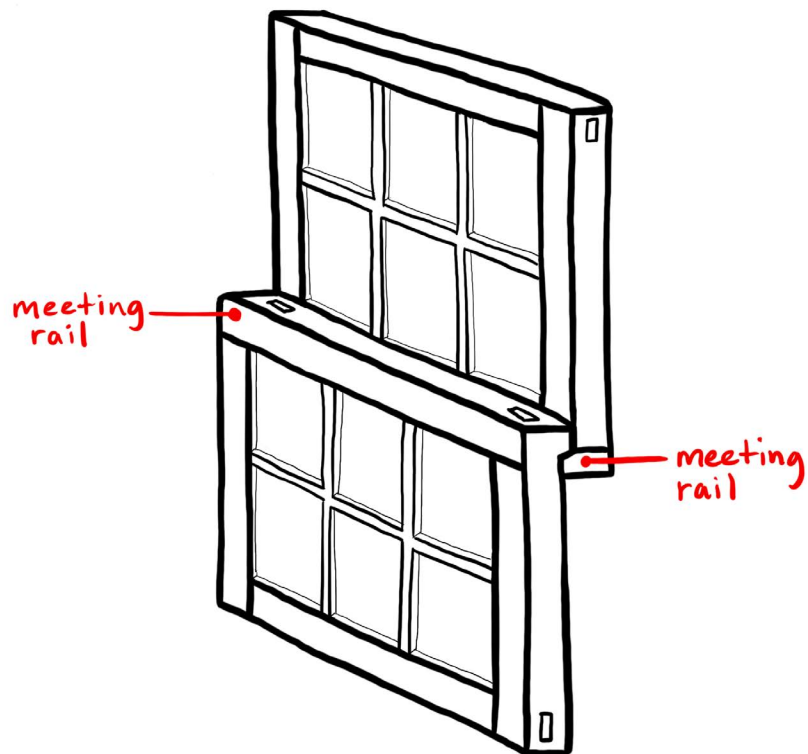
- **The Bottom Line.** *Retrofitting windows with high performance enhancements can result in substantial energy savings across a variety of climate zones. Selecting options that retain and retrofit existing windows are the most cost-effective way to achieve these energy savings and to lower a home's carbon footprint. Retrofits extend the life of existing windows, avoid production of new materials, reduce waste, and preserve a home's character.*

[National Trust for Historic Preservation. "Saving Windows, Saving Money: Evaluating the Energy Performance of Window Retrofit and Replacement". *Resource Library*. 11 March 2016. <https://forum.savingplaces.org/viewdocument/saving-windows-saving-money-evalu>]

This report compared the efficiency ratings of a range of window improvement options to be used in conjunction with original wood sashes against replacement windows, across multiple climate regions. They found that several simple retrofit strategies compare favorably with the energy efficiency of high-performance replacement windows, at a fraction of the cost. Great news for building owners and homeowners alike! No need to compromise the historical integrity and aesthetic appeal of your building's original architecture.

For more information, download the full report. Accessible at: https://living-future.org/wp-content/uploads/2016/11/Saving_Windows_Saving_Money.pdf





GLOSSARY

Dutchman: A wood repair technique for replacing damaged areas on a larger piece of work. The damaged area is cut out, and infilled with a new piece of wood, matching the species and grain.

Epoxy: A two-part system (resin + hardener) that is mixed together to create a wood filler, used for small, permanent repairs.

Glazing bed: (also referred to as rabbets) The ledge on a muntin in which the glass is placed.

Glazing putty: (often referred to as glazing compound or just “glazing”) Used to hold glass in place in a sash and to seal out weather. Traditionally made from linseed oil and whiting.

Glazing points: A small, flat piece of metal, usually triangular or diamond shaped, used to hold a pane of glass in a wooden sash. Found underneath the glazing putty. It will hold the pane in place even if the putty fails.

Infrared heater: A device used to scrape paint. It is particularly useful when scraping lead paint because it does not get hot enough to vaporize the lead, like many heat guns do.

Jamb: The wood that frames the window opening and which the sash(es) sits within.

Lite: Another term for a pane of glass.

Meeting rail: The rail of each sash that meets a rail of another sash when the window is closed. Also sometimes

referred to as *check rail*.

Muntin: A strip of wood between panes of glass. The interior side typically has a decorative profile made up of various curves and angles, while the exterior is in the shape of an ell, giving the glass a surface to rest on.

Orbital sander: A handheld sander with a head that vibrates in small circles. Specific round sanding discs are used.

Parting bead: A thin strip of wood used to separate multiple sashes in the same window opening.

Point driver: A tool used to insert glazing points. Very similar to a staple gun, when the handle is depressed, it shoots out a glazing point.

Profile: The decorative shape of the muntins and edges of stiles and rails on the interior of the sash.

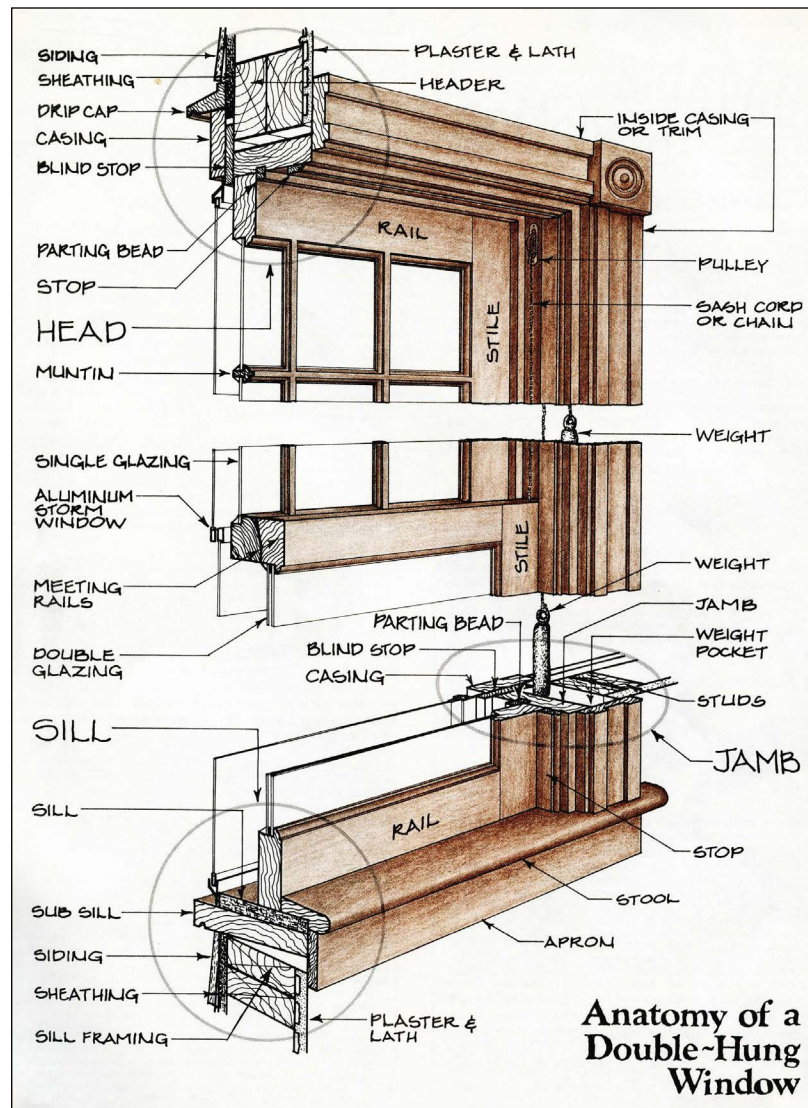
Rail: The horizontal members of the framework of a sash.

Sash: The (usually) moveable panel within a window jamb, comprised of the framework + glass. For example, a double-hung window is comprised of two sashes, the upper and the lower.

Stile: The vertical members of the framework of a sash.

Stop: A length of wood moulding attached to the window jamb that holds the bottom sash in place.

Poore, Jonathan. "Anatomy of a Double-Hung Window." *The Old-House Journal*. April 1982



STEP-BY-STEP WINDOW RESTORATION GUIDE

This guide includes steps to conduct a window restoration project in the most sustainable way we know. There are multiple ways to complete any of the tasks in this guide, but at Preserve Montana, we have developed this process based on best traditional building practices and environmentally-friendly products. We have chosen products that are naturally-based, rather than relying on solvents, chemicals, or petroleum products. From our experience, this means using purified linseed oil-based products throughout the entire process. If you have questions about why we do this, or just want more information on the various products, feel free to contact us.

The guide presents all the steps for a complete restoration, giving building and home owners a range of treatments depending on needs, time available, and condition of the windows. Before beginning your project, decide the level of restoration needed, and simply follow the steps from that point.

Preparation work:

Test window paint for lead: Use a 3M LeadCheck swab to test 3 different windows. Because your windows may have been repaired in the past, it is a good idea to take multiple tests, making sure that they all come back negative before assuming they do not contain lead.

- In a discreet location, scrape a small patch of paint to expose all the layers, for the most accurate test. This can be done with a utility knife, by making a wedge-shaped cut through all layers of paint.

CONSUMABLE ITEMS YOU MAY NEED:

- Lead test kit
- Asbestos test kit
- Plywood and 2x4s (if putting shutters up)
- Sandpaper
- Purified raw linseed oil
- Shellac flakes and denatured alcohol (or ready-made shellac)
- Glazing putty
- Paint
- Glass cleaner



1. Swabbing all layers of paint



2. The red tip shows that lead is present in the painted sash

- Follow the instructions on the lead check package. *[Photo 1]*
Results are immediate!
- If a test comes back positive (i.e. lead is present), make sure you know and follow the protocols for lead safety, especially knowing the difference between a contractor/business and homeowner completing the task. Also be aware of any local or state regulations for disposal. *[2] [3]*
- Go to <https://www.epa.gov/lead/renovation-repair-and-painting-program-do-it-yourselfers> for more information about lead safety, regulations, and equipment needed to work with lead paint.



Test window glazing putty for asbestos: Use an asbestos test kit or a certified asbestos inspector. Because your windows may have been repaired in the past, it is a good idea to test in at least three places, making sure that they all come back negative before assuming the putty does not contain asbestos. *[4]*

- Follow the instructions on the asbestos test package and mail the samples to the lab. Kits can be purchased with a turn-around from 1-5 business days.
- If there is asbestos present, make sure you know the regulations for working with asbestos and how to keep yourself protected.
- Go to <https://www.epa.gov/asbestos> for more information about asbestos and how to protect you and your household.



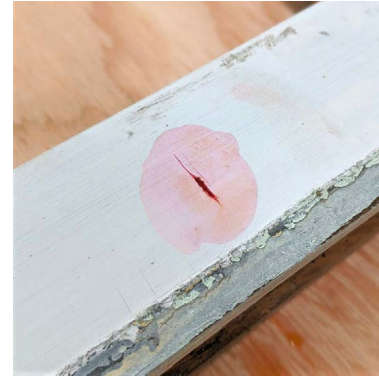
Documentation: To remember where each sash goes in the building, number each window opening, and make a diagram for your numbering system. *[5]*

- Recommendation: Start at the front door, and move clockwise around the building, starting the labeling with Window 101 (W101), W102, W103, etc. If there is a second floor, start at the same spot (but this time right above the front door) using W201, continuing clockwise with W202, W203, etc. The same labeling technique can be applied to storm windows, using S101, etc., or doors, using D101, etc.
- Skip this step if you are only fixing one window.

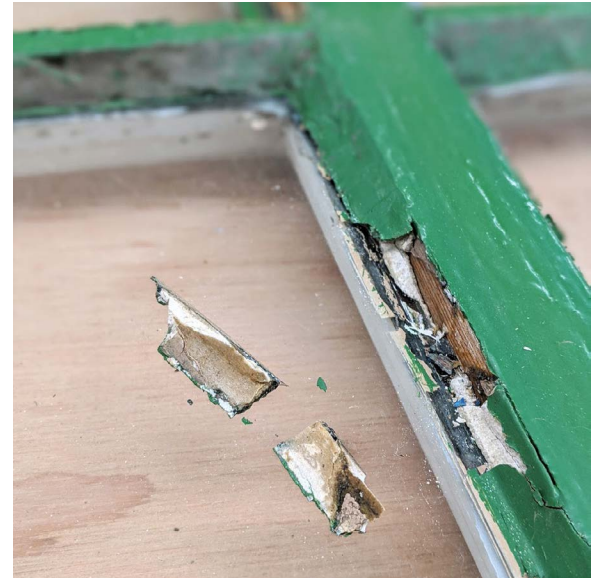
De-installation:

Remove window sash from building:

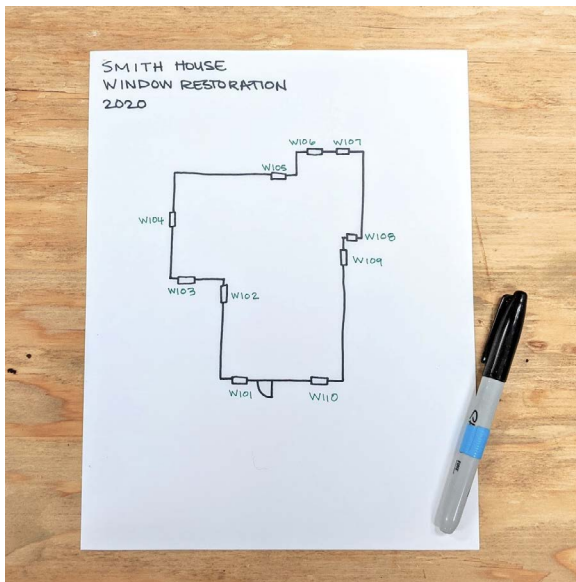
- Take pictures before you remove anything! If you are unfamiliar with the process, this will be helpful when reinstalling the sash after the restoration is complete.
- Carefully use a thin pry bar to remove any stops, trim or parting beads that are holding each sash in the frame. Avoid damaging these pieces, so there is less to repair or replace before putting the restored window back into place. Some pieces might be screwed in place, so make note of fasteners before diving in.
- Old windows are often painted shut, or the stops and parting beads have been painted to the jambs. If that is the case, run a utility knife over the seams, breaking the paint seal.
- Stops and trim are usually nailed in place with finish nails and will need to be pried up very gently. Parting beads are usually compression fit, and can be wiggled out with pliers, being mindful not to damage the wood.



3. The painted surface may also turn red/pink after being tested



4. An asbestos test kit will require you to pry loose a small chunk of glazing to send into a lab to be tested



5. Numbered plans for where each window is located in the building

- Label each stop or piece of trim (on the back) when you take it out – this will eliminate guesswork when you are putting everything back together.
- Label each window on their edge (where it will not be seen when you put it back in place). [7]
- If it is a double-hung window, or there are two sashes in the opening, label each window with Upper, Lower, Right, or Left. Label which way is “up” to avoid confusion when reinstalling each sash.
- Cover openings – we recommend using compression shutters. If the opening already has storm windows in place, there is no need for further coverings.

For more information about compression shutters, keep reading! There is a step-by-step guide later in the book for this process.

Documentation:

- Label each pane of glass with the window number, and where it sits in the sash so you know which opening it fits into. Tiny variations can be significant when trying to fit the glass back in later. [8]

Helpful hint: Label the glass using painter’s tape, instead of writing directly on the glass, so it does not wipe off as you clean the glass.

- This next step is optional, but ... it is always a good idea to keep a record of what work has been performed on a building. It will be a good reference for knowing when work was



7. Sash labeled on its side

completed over the years, as well as what was repaired/replaced, and what products were used.

- Print off or hand draw documentation sheets, complete with a diagram of the sash(es) to be restored. [9]
- Mark any repairs you need to make on the window, including replacement glass, epoxy repairs, and dutchmen repairs on the diagrams. You may need to come back to this documentation after the paint has been scraped and more deficiencies become apparent.

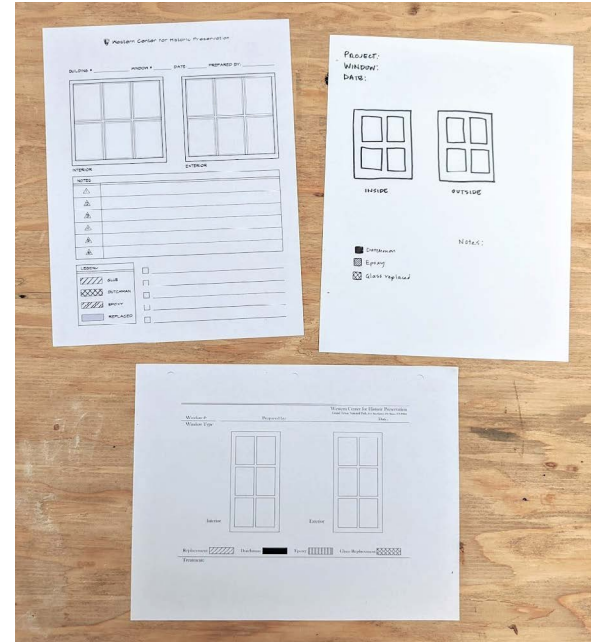
Restoration:

Paint scraping:

- There is a chance of accidentally breaking some glass during scraping. It is not ideal, especially if it is wavy, old glass, but glass can be replaced fairly easily and inexpensively (unless A LOT of glass breaks!).
- Remove any hardware on the sash (handles, locks, etc.). Make sure to label each item and what window they are from. [10]
- Scraping the hardware:
 - Exercise caution in choosing tools to scrape the paint off metal. A brass brush can be used to prevent scratching of the hardware. Nylon brushes or plastic putty knives can also be used.
 - There are some chemical-free options for cleaning paint off hardware:



8. Panes of glass labeled with window number and location of glass within the sash



9. Various types of documentation sheets



10. Handles and locking mechanism removed from sash



11. Many layers of paint removed from hardware via boiling water and baking soda



12. Heating paint to be scraped



13. Paint being scraped with infrared heater

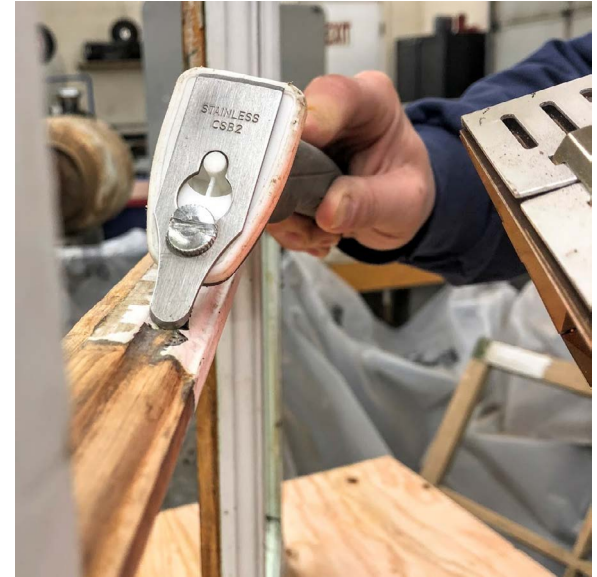
- Place hardware in a pot of boiling water with ¼ cup of baking soda for 20 minutes. This will loosen the paint, which can then be scraped off with a brass brush. It might take a few rounds of boiling to get all the paint loosened and scraped. [11]
- Place hardware in a crockpot filled with water and a few tablespoons of liquid laundry detergent or dish soap. Turn the crockpot on medium and let sit overnight. The paint will then be ready to be scraped with a brass brush.
- Helpful hint: Use an old pot or crockpot from a thrift store – After stripping paint in it, the pot will not be suitable for cooking.
- Scraping the sash:
 - Begin by scraping all of the old glazing and layers of paint, using an infrared heater. [12] [13] Scrape the glazing out first – this will allow for removal of the glass, and make scraping the rest of the paint easier.
 - The infrared heater softens the paint and glazing putty, allowing easier removal and reducing the dust when scraping. It also stays at a low enough temperature that it will not vaporize any lead contained in old paint layers.
 - Be careful not to break the glass! Overheating the glass will cause it to crack. To avoid this, be cognizant of how long the heater is held in one spot or create a heat shield/cover for the glass by wrapping a piece of cardboard in foil and placing it on top of the glass while heating that area.
 - Make sure you have a variety of scrapers, including ones

with carbide blades, a curved scraper [14] for scraping profiles, and a chisel for tight corners [15].

- Do not dig in and gouge the wood as you are scraping – let the heat do the work.
- Scrape in the direction of the wood grain. Depending on how many layers of paint are on the sash and how hard the glazing it is, it can take multiple rounds of heating/scraping to remove everything.
- Be sure all old glazing points are out to avoid breaking the glass as you take it out.
 - Old glazing points can be stubborn to remove. Try using a putty knife or glazing tool on a point's side to push it out or needle nose pliers to pull them out.
- Sometimes heating the opposite side of the sash can help loosen the glazing under the glass enough to remove it from the glazing bed.
- Once the glass is out, scrape out any remaining glazing left in the glazing bed.
- Continue scraping until all of the paint is removed.

Sanding:

- Give the entire window a **light** sand, using an orbital sander for the flat surfaces [16] and hand sanding the profiles. Contour sanding grip sets are useful for the profiles [17]. Go easy - you don't want to sand so much that you affect the shape of the profile.



14. Using a curved scraper for the profiles



15. Using a chisel in tight corners



16. Giving the flat surfaces a light sand with an orbital sander



17. Sanding the profiles with a contour grip



18. Orbital sander hooked up to a shop vac

- On an orbital sander, you can use 80 grit sandpaper. Use your judgement – if you are getting marks on the wood, go to a higher grit. The orbital sander can also be hooked up to a shop vac to cut down on dust. [18]

Repairs:

- Holes and small repairs can be filled with epoxy [19], but do not go overboard using epoxy for large deficiencies. For those, a dutchman repair is more appropriate. Many types of epoxy exist; you want one that is not too hard to shape with a chisel or sandpaper but cures hard enough that it *can* later be sculpted by a chisel.
 - A recommended brand is Abatron WoodEpoxy, as is PC-7. [20]
 - Be careful with epoxies – some of them set quickly, so have a plan before you start!
- Dutchman repairs require a little bit more skill but can still be accomplished by beginners and with very few tools. They involve cutting out the damaged portion of wood and replacing it with new wood. Essentially, a wood patch. [21]
 - If you make dutchman repairs, be sure to use the same species of wood as the window. Also try to match the grain pattern.

Refinishing:

Cleaning: Clean the glass panes with glass cleaner and a razor blade in order to remove all old glazing and paint [22]. Be sure to change the razor blade frequently. If there is a lot of gunk on the glass, you

may have to use a new blade for each pane. A dull razor blade can scratch the glass.

Oiling: If you are using latex or alkyd paints, skip this step!

- After sanding, completely coat the window with purified RAW linseed oil, using a brush (an inexpensive brush or an old paint brush works just fine). [23]
- For new wood, 1 coat will probably do. End grain will soak up more, though.
- For old, dried out windows, you might need to apply more than once.
- After oiling, the window should sit overnight for optimum saturation. Any oil remaining on the surface the next day indicates that the wood is saturated. Wipe off excess oil with a rag.
- ****Oily rags are **FLAMMABLE**. YOU MUST SOAK used rags in a bucket of water and spread them flat to dry, or dispose of them in a metal safety can.*****

Shellacking: Coat glazing beds with shellac [24]. This provides a barrier, so that the wood does not leach the oil from the glazing putty. Leaching could cause the putty to dry out and fail.

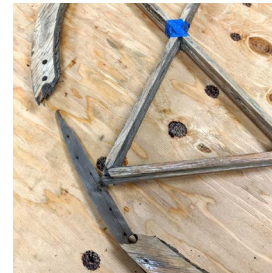
- Small, flat artist brushes are recommended for this step.
- Be careful to paint the shellac only in the glazing bed where it will be hidden by the putty. Shellac will stain wood and should not be left on the face or profiles of the sash, especially when those surfaces are to remain unpainted.



19. Small holes to be filled with epoxy



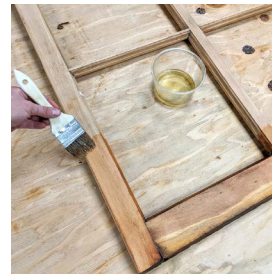
20. Holes filled with Abatron WoodEpoxy



21. A large deficiency that needs a dutchman repair rather than epoxy



22. Cleaning the glass with a razor blade and glass cleaner



23. Brushing raw linseed oil over the entire sash

PURIFIED LINSEED OIL:

There is a difference between linseed oil that can be purchased at your local hardware store and linseed oil that is purified and available online. In the past, linseed oil earned a negative reputation because of its ability to mildew, since mildew can feed on the natural proteins found in the oil. However, if the oil has been purified and the proteins removed, there is nothing to promote mildew. Check out the Products Source List for where to buy the right linseed oil.

There is also a difference between raw and boiled linseed oil. For most applications (hydrating wood), raw linseed oil is desirable because it penetrates into the wood deeper. Despite the name “raw,” it has still been purified if purchased from the right suppliers!

- Keep a rag or paper towel nearby to wipe up any drips on the face or profile.

- Complete this step even if you are not using linseed oil products. Chances are, the glazing you use will be oil based, so the shellac is helpful in any instance.

Cutting glass: We recommend safety glasses and work gloves for this step.

- Glass is sometimes broken in the scraping process, but replacement glass can easily be sourced from local glass companies.
- If the opening is rectangular, measure each dimension and transfer those dimensions to a sheet of replacement glass. [26]
 - Measure from edge to edge of the glazing bed. Take 1/16” – 1/8” off that measurement before cutting the piece of glass – you want the glass to slide in easily and have just a bit of wiggle room.
- Look for a glass cutter with a carbide cutter and refillable oil feed. Cheap glass cutters are often very difficult to cut with. [27]
- Using a cork-backed ruler or T-square, press firmly to cut along the straight edge with enough pressure to continuously score the glass one time. Do not go over your cut multiple times – this will often cause it to break unevenly. [28]
- Align the scored line to hang just over the edge of the table and pull down with a small amount of pressure. Many times, just doing this will cause the glass to separate at the score line, so make sure you are prepared for the break! [29] If it does not automatically break, tap the underside of the score line with the butt end of the glass cutter. [30]

MAKE YOUR OWN SHELLAC: [25]

Shellac is available at any hardware store, but you can also make your own.

Pros for making your own:

- You know exactly what ingredients are in it
- You can make it as thick/thin as you need
- It's fun!

Place shellac flakes and denatured alcohol in a glass jar with a lid that closes tightly. Let it sit overnight, shaking a few times. After 24 hours, flakes should be completely dissolved in the alcohol. If you want a thicker mixture, add in more flakes, little by little. If you need a thinner mixture, add more alcohol.

- 1 ounce of flakes mixed with 1.5 – 2 ounces of denatured alcohol will be enough for several sashes.

Store leftover shellac flakes in a cool dry spot. They should stay “fresh” for a few years.

- If the mixture in the jar dries out, add some more denatured alcohol.



25. Ingredients to make your own shellac



24. Using a small paintbrush to apply shellac to glazing beds



26. Measuring for a new pane of glass



29. Breaking glass over the edge of the table



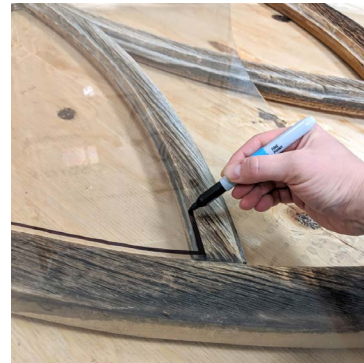
30. Tapping the underside of the glass to help it break



27. The glass cutter on the top is an inexpensive one that can be found at most hardware stores, though does not work as well as the one on the bottom with a carbide cutter and oil feed



28. Cutting glass against a ruler



31. Tracing a curved opening

- If the glass pane you are replacing is not rectangular, or the sash has racked over the years so the openings are no longer square, set the replacement glass over the opening and trace the shape onto the glass with a permanent marker. [31]
- Cut the shape, then dry fit the glass into its opening to make sure it fits before putting any putty in place.

Bedding the glass:

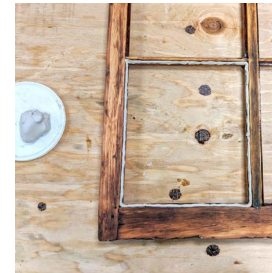
- Place the sash, glazing beds face up, on a flat surface.
- Spread a layer of glazing putty in the glazing bed of the sash, making sure not to leave any gaps.
 - Suggestion: Roll the putty into a snake and lay it in the glazing bed, making sure the snake goes all the way around the opening. [32]
- Place the pane of glass into its opening and press down evenly around the edges. [33] There should be a thin layer of glazing – no greater than 1/16” - between the wood and the glass
- Insert new glazing points, triangular tip pointing into the wood, on top of the glass. If the pane of glass measures less than 10”, only 1 point is needed on that side, placed in the center. If the measurement is more than 10” on a side, it is a good idea to add extra points, staying at least a few inches away from the corners.
 - There are multiple shapes for points – triangles, diamonds, arrows – and any of these work well [34]. There are also some sold in hardware stores with tabs sticking up. These are sometimes too long, and tend to stick out of the glazing putty.

MATCHING HISTORIC GLASS:

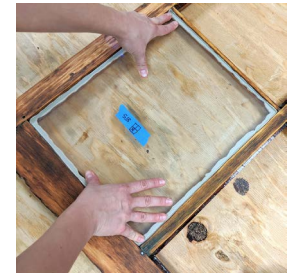
For windows that have broken panes of glass, it is possible to find replica wavy glass to achieve a more historically accurate look. However, it is a more expensive option and not usually found locally.

A few sources to get you started:

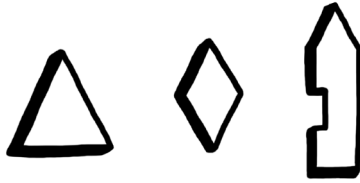
- Bendheim
- Pioneer Glass
- AGW Old Style Window Glass



32. A “snake” of glazing putty pressed into the glazing bed



33. Pressing the glass into place



34. Types of glazing points



35. A point not pushed into the sash far enough



36. A point properly pushed into the sash

- Make sure that the points are set far enough into the wood that the end is well within the edge of the profile on the other side of the glass. You don't want the points to get in the way while you are glazing. [35 & 36]
- To insert the points, you can either use a point driver [37] (helpful if you will be doing a lot of windows), or carefully tap them into place with a thick flathead screwdriver and hammer. Even if you use a point driver, you still might have to tap it in a little farther with a screwdriver.
- When using a screwdriver and hammer, place the tip of the screwdriver against the edge of the point and carefully tap the end of the screwdriver with the hammer to drive the point into the wood. [38]

Cleaning: Clean up the opposite side (the profile side) of the sash with your glazing tool – glazing will have oozed out while pressing the glass into place [39]. When scraping the excess off, make sure you are not pulling glazing out of the crease; it is important to angle the tool so that you leave a nice clean glazing line.

- You might have to adjust your tool a few times to find the right angle.

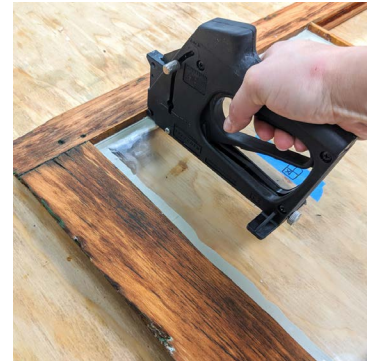
Glazing: If you have the time, wait a few days after bedding the glass to let the putty cure a little before you finish the glazing – otherwise, it might continue to ooze as you glaze the other side. If you don't have time, just flip your window and clean up the oozing putty as you go along.

- Place glazing putty around the perimeter of the pane of glass and up against the edge of the glazing bed. [40]

- Spread the putty [41], keeping clean, crisp corners [42], and a smooth line along the glass. Make sure to keep your line of glazing 1/16" inside of the profile edge you can see on the other side of the glass. [43] After glazing and painting, you do not want to be able to see either product when you look through the window from the interior.
- Set your glazing putty on a piece of glass or plastic when not in use – if you set it on a porous surface, the oil can leach out onto that surface, drying the putty out.
- Check the other side of the window – you might need to clean off oozing putty again.
- Follow manufacturers' recommendations for how long it takes for the glazing putty to skin over and how long to wait before painting.

Painting:

- If using linseed oil paint and a linseed oil putty, you can either paint immediately after glazing so the putty and paint can cure at the same time, or after the putty has cured. If you have the time, waiting is usually easier. When trying to paint it right away, the glazing can smear if you are not careful.
- If using latex or alkyd paint, do not paint immediately. Read manufacturers' instructions for the proper amount of time to wait.
- If using linseed oil paint, paint 2-3 coats on the exterior. Two coats will be sufficient for the interior (if it is to be painted). If using latex or alkyd, 2 thin coats are sufficient for interior and exterior.



37. Using a point driver to insert glazing points



38. Tapping glazing points into sash with a screwdriver and hammer



39. Cleaning off the oozing glazing on the underside of the glass



40. Pressing glazing putty in around the perimeter



41. Spreading the putty into a clean, smooth line



42. A crisp, clean corner



43. Glazing properly inside the edge on the left, while the right side needs to be pulled in a bit more

- Use a good quality paint brush (Wooster, Purdy) with an angled chisel tip, 1" to 2". [44] The angled tip is helpful for precision in corners and against the glass.
- When painting the glazing, use a steady hand and paint about 1/16" onto the glass to create a good seal between the glass and the glazing. Since your putty line was 1/16" inside of the glazing bed line on the other side, your paint line will now perfectly line up with the bed line or lie right inside of it. [45]
 - You can go back later to carefully clean up some minor errors with a razor blade but painting messy with the intention of cleaning it all up with a razor blade later is not advised – this can break the seal between the paint and the glass.
 - Masking tape on the glass may be used to create straight lines if your hand is unsteady. However, be careful when pulling up the tape and make sure you do not break the seal of the paint to the glass.
- Make sure you apply the linseed oil paint in VERY THIN coats [46] and that there is no pooling in the corners or where the glazing hits the glass. [47] Pooling linseed oil paint does not dry well and can wrinkle.
 - When painting with linseed oil paint, there should not be a thickness to the paint like there is with latex or alkyds. Spread the linseed oil paint as far as you can.
 - When dipping the brush into the paint can, there is no need to put very much paint on the brush. Wipe both sides of the brush off with the edge of the container – it might not seem like enough paint left on the brush, but it is. A little bit of linseed oil paint goes a long way.



44. High-quality brushes with an angled chisel tip



45. Paint properly applied 1/16" onto the glass



46. Painting a THIN coat of linseed oil paint



47. Too much paint in the corner that will not dry properly



48. Using fingers to rub whiting over the glass to pick up leftover oily residue



49. Gently using a brush against the putty to pick up oily residue



50. Wiping raw linseed oil over linseed oil paint that needs to be rehydrated [photo courtesy of the National Park Service]



51. Failing glazing putty that should be repaired

- Do not paint any of the edges of the sash that touch the jamb, head, or sill of the window, including the sides, top, and bottom. The only edge that should be painted is the meeting rail. Be aware of which edge of the meeting rail can be seen from the exterior and which meeting rail can be seen from the interior, painting accordingly (Usually, the meeting rail of the top sash will be on the exterior and the meeting rail of the lower sash will be on the interior).
- To speed up the dry time of linseed oil paint, it is helpful to put the painted sashes in a room where you can turn the heat up to 80-85 degrees.

Cleaning:

- Wait until the paint is completely dry before going back to clean the windows with glass cleaner. With linseed oil paint, this can be up to a week. Use a razor blade to carefully clean off any glazing residue on the glass.
- You can also clean windows immediately after glazing with whiting (chalk). Use your fingers [48] or a soft bristled brush [49] to spread the whiting around on the glass, which will pick up the oily residue. Be careful when brushing over the putty to not smear it.

Completion:

Re-installing the sash:

- Once the paint is COMPLETELY dry, the sashes can be re-installed back into their openings. Now is a good time to refer back to the photos you took at the very beginning.
- Place the upper (or outermost) sash in the opening, followed by the parting beads.
- The lower (innermost) sash can now be put back in its position, held in place by the window stops.

Maintenance:

- If linseed oil paint was used, the paint may start to look chalky after a few years. This is not paint failure. Simply rub a coat of purified raw linseed oil with a rag over the paint to re-hydrate the wood. [50]
- Monitor your windows every year, fixing any putty failures as you notice them. [51]

RAGS SOAKED IN LINSEED OIL ARE FLAMMIBLE

YOU MUST Soak used rags in a bucket of water and spread them flat to dry or dispose of them in a metal safety can.

LINSEED OIL PAINT

Prior to the 1940s, there were no latex or acrylic paints. Paint was made from natural materials, the most common base being linseed oil.

With a growing interest in more earth-friendly products and the well-being of the user, linseed oil paints are seeing a resurgence. There are several companies that now make traditional paints – mostly in Europe, though there are vendors in the United States for those products.

Linseed oil paint perform better than modern latex paints because it forms a breathable layer on the substrate, rather than a film. A film of latex paint is rarely impenetrable, and once water finds its way behind the film, it gets trapped, causing further paint failure and rotting wood. With linseed oil's breathable layer, water does not get trapped, keeping paint intact for longer.

PRODUCT SOURCE LIST

This list serves as a reference for those who wish to purchase some of their own window restoration products. They are by no means the only products on the market that can be used, but they are the ones that Preserve Montana has used and found effective.

Prices are accurate as of December 2020.

Lead Test

3m LeadCheck Swabs, Instant Lead Test
Most hardware stores, various online sites
\$10/2-pack, \$26/8-pack



Asbestos Test

Schneider Labs Asbestos Home Test Kit
Various online sites
\$35/5 business day response



Pro-Lab Asbestos Test Kit
Some hardware stores, various online sites
\$12/kit + \$40 lab fee



Paint Remover

Cobra SpeedHeater Infrared Paint Remover
eco-strip.com
\$499



Silent Paint Remover Model 1100
silentpaintremover.com
\$495



Paint Scrapers

Hyde Contour Scraper with 6 Changeable Blades
Some hardware stores, various online sites
\$16



Hyde 7/8" Triangular Carbide Scraper
Some hardware stores, various online sites
\$17



Hyde 2" Carbide Scraper
Some hardware stores, various online sites
\$20



Anza Triangular Scraper
earthandflax.com
\$24



Multi-Piece Stainless Steel Wax Carver's Set, various brands
Harbor Freight, various online sites
\$5-\$12



Sanding

Orbital Sander, various brands
Most hardware stores
\$80



Contour Sanding Grips
Various online sites
\$12/6-pack



Epoxy

Abatron WoodEpoxy
Some hardware stores, various online sites
\$24/12 oz.



PC-7
Some hardware stores, various online sites
\$13/16 oz.



Purified Raw Linseed Oil

Viking Purified Raw Linseed Oil
earthandflax.com
solventfreepaint.com
\$50/gallon



Shellac

Shellac Flakes
earthandflax.com
solventfreepaint.com
shellac.net
\$3-\$4/oz



Glass Cutter

TOYO Straight Head Oil Cutter
Various online sites
\$25



Glazing

Fletcher 07-900 GlazierMaster Driver
Fletcher 07-500 FrameMaster Point Driver
(comes with reversible head to also use glazier's points)
e-bay.com
\$80-\$100



Fletcher Glazier Points, 3/8" (08-980)
hardwareworld.com
amazon.com
\$25/pack of 5,000



DANA Linseed Oil Glazing Putty
earthandflax.com
solventfreepaint.com
\$50/11 lbs.



Crawford's Putty
Some hardware stores, various online sites
\$12/4 lbs.



2-in-1 Glazing Tool
Most hardware stores
\$8



Painting

Ottoson Linseed Oil Paint
[photo courtesy of Earth+Flax]
earthandflax.com
solventfreepaint.com
\$170/3 liter



Linseed Oil Soap Concentrate
[photo courtesy of Earth+Flax]
earthandflax.com
\$25/10 oz.



Viking Linseed Oil Paint
earthandflax.com
solventfreepaint.com
\$155/gallon



Whiting (Chalk)
solventfreepaint.com
earthpigments.com
\$7-\$12/2 lbs.



Wooster 1 1/2" – 2" Ultra/Pro Extra Firm
Angle Sash Brush
Most hardware stores
\$12-\$15



Cleaning

Razor Blade Scraper, various brands
Most hardware stores
\$5-\$10



Ottoson Linseed Oil Soap
earthandflax.com
solventfreepaint.com
\$16/quart



COMPRESSION SHUTTERS

There are several ways to board up a window opening. This guide presents a method to cover window openings with plywood “shutters” that prevents damage from screw and nail holes and ensures security by not having any exposed fasteners. A person must have access to the interior to take them off.

To shutter each opening, you will need:

- 1 piece of plywood
- 1 2x4
- 2 carriage bolts (length determined by the depth of the opening)
- 2 washers
- 2 nuts

Preparation work:

What size to cut the plywood will depend on what the window frame looks like and whether there is a stop/ledge within the frame for the plywood to rest against.

- The bottom edge of the plywood should rest on the window sill.
- If there are window stops to rest the plywood against inside of the jamb, cut the plywood to fit inside (we suggest you cut the wood $\frac{1}{4}$ " to $\frac{1}{2}$ " smaller than the opening to allow for easier install and wiggle room).



Exterior



Interior



- If there is nothing to rest the plywood against besides the actual building or window trim, cut the plywood so it overlaps each edge by at least 6".
 - In this case, you may decide to not cut the plywood at all.

Cut one 2x4 to span the height of the window opening. It should be cut a total of 12" taller than the actual opening, so it will overlap the opening by 6" on either end.

Once the plywood shutter and 2x4 are cut to size, lay the plywood over sawhorses or on the ground so you can drill holes for the bolts that will secure the plywood and 2x4 together. If you lay the plywood on the ground, prop it up so you can drill through the wood without hitting anything (dirt, concrete, rocks, a deck, etc.).

- Lay the 2x4 on top of the plywood in the position that will span the window opening. In most cases, this will be right down the center.
- Drill 2 holes in the 2x4 and through the plywood underneath. Since the 2x4 was cut to overlap the opening 6" on either end, the holes should be drilled 18-24" from either end.
 - Helpful hint: Clamp the 2x4 to the plywood to keep things from moving around while drilling.

Installation:

Grab a friend – this is a two-person job!

Insert the bolts through each of the holes in the plywood, from the exterior.

Lift the plywood into place to cover the window opening.

- The head of the bolt should be on the exterior, while the threads extend into the building.
- The bottom of the plywood should rest on the window sill.

With one person holding up the plywood on the exterior, another person should be on the interior, fitting the 2x4 onto the bolts.

Once the 2x4 is in place on the bolts, place a washer and nut on each bolt and tighten each until the plywood starts to bend inwards.

The opening should now be weather tight and pest-proof.



MAKING YOUR WINDOWS MORE ENERGY EFFICIENT

Contrary to what we have been led to believe in recent years by proponents of replacement windows, wood windows can be made to perform to high efficiency standards right alongside new vinyl or fiberglass windows. There are multiple options of varying costs when it comes to making single-pane wood sash windows more energy efficient. These options can be used singularly or in combination, depending on the desired level of efficiency.

Weather Stripping:

Weather stripping is a key component to keeping a window sash sealed tightly in its opening. There are many different options on the market, and it is important to consider one that will be concealed in the window opening. It is a low-cost option, with a high return on investment, and one that homeowners can perform themselves.

Types of weather stripping:

- Spring bronze or V-shape bronze: This is an easy-to-install option using basic hand tools and is a long-lasting choice – up to 100 years. It can be used on many types of windows, including single/double-hung and casement.
- Bulb type: This can also be installed by a homeowner, but takes a little more skill than the bronze, along with a router.

Cellular Shades:

Cellular shades provide improved thermal performance of a window, minimize drafts, and replace standard window blinds.

This is another low-cost option that homeowners can easily install themselves.



Exterior storm window

In cold climates, Preservation Green Lab's *Saving Windows, Saving Money: Evaluating the Energy Performance of Window Retrofit and Replacement* indicates that cellular shades offer the highest return on investment out of all the options studied.

Exterior Storm Windows:

Exterior storm windows are mounted outside of the primary sash to provide added thermal insulation. They create an airspace between the storm unit and the window sash that keeps the sash warmer than outside temperatures. Storm windows can be temporarily/seasonally added to an opening or permanently fixed in place.

If storm windows still exist on a building, they can be restored with the same methods as the primary window sashes. If the storms are no longer present, replicas can be made that match the style of the sashes and the rest of the building. More ambitious homeowners can even build a set themselves.

Interior Storm Windows:

If exterior storms do not already exist, or further efficiency is desired, interior storm windows are an option. From the exterior, the product is invisible, and from the interior, they can blend into the existing window frame.

Interior storms can be compression fit into each opening, so no hardware is needed and no damage is done to the opening's woodwork or finish.

Many interior storms are made with acrylic rather than glass, making them lightweight and easy to install and remove as the seasons change.

MORE TRAINING OPPORTUNITIES



**PRESERVE
MONTANA**

Preserve Montana

Every year Preserve Montana hosts training workshops on restoration trades, including window restoration, stone masonry and more. We invite people to check our website for a schedule of upcoming workshops, that give the opportunity to learn these skills while helping to preserve a historic building of Montana.

Preserve Montana has also created a series of how-to videos for various preservation topics. New videos will be posted on our website as projects and production allow, so keep checking back!

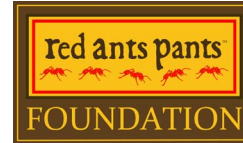
www.preservemontana.org
mary@preservemontana.org
406-457-2822



Western Center for Historic Preservation

Located in Grand Teton National Park, the Western Center for Historic Preservation provides a variety of preservation related trainings, both classroom- and field-based. Their BEST Preservation Workshop series is open to everyone – not just National Park Service employees.

go.nps.gov/wchp
erin_gibbs@nps.gov
307-739-3571



Red Ants Pants Foundation

The Foundation's Timber Skills Course is designed to empower and educate women of all skill levels on the basic understanding, maintenance, and operation of hand and power tools. Every year they offer Carpentry 101 and Chainsaw 101 programs in White Sulphur Springs, Montana.

<https://redantspantsfoundation.org>
info@redantspantsfoundation.org

More books about window restoration:

Old Windows in Depth, Scott Austin Sidler
Save America's Windows, John Leeke

