# 4 WINDOW FRAMES & REPLACEMENT UNITS

## ESSENTIAL KNOWLEDGE

Wood has historically been the primary window sash and frame material due to ease of manufacture, availability, and good thermal performance. The major disadvantage of wood has been its need for regular maintenance. Ease of maintenance has spurred competing materials such as steel in the early half of the 20th century and, more recently, aluminum and vinyl, which have now surpassed wood in combined sales. Recent improvements in glazing technology have made the thermal performance of aluminum and vinyl frames and the method of assembly significant issues. New frame technology employs thermal breaks in metal materials and insulated cavities in vinyl frames. New materials are being developed with greater dimensional stability, some of which are less dependent on natural resources.

This new generation of materials—wood composite, fiberglass, and reinforced or reformulated vinyl (CPVC)—are stronger, more durable, and have insulative values equal to or higher than wood. The increased strength of frames also allows for narrower profiles, resulting in more glazing area relative to the size of the unit. A manufacturer of wood composite frames claims this may result in a 20% increase in the glazing area. These new materials are generally impervious to water and therefore will not swell or distort when exposed. New engineered wood materials, either composite or laminated, do not have a tendency to twist along the grain, like wood. The thermal expansion of materials such as fiberglass, composed primarily of glass fibers, closely corresponds to that of glazing material, reducing stress to seals and frame as the materials move in tandem, preserving infiltration performance. The increased dimensional stability and resistance of fiberglass, long used as a marine product, provides for consistent operation under varying climatic conditions and corrosive exposures. Fiberglass, unlike conventional vinyl material, is available in dark colors that are not subject to fading. The solid or wide extrusion profiles of either a high or low density cellular vinyl (CPVC) product provide a greater surface area for the chemical welding of corners, resulting in a stronger connection. Fiberglass—with strength similar to that of aluminum—is now used as reinforcement for windows and doors with wood veneer to achieve a traditional appearance.

New materials not only provide benefits relative to wood in terms of maintenance, but can surpass its thermal resistance by up to a factor of two. Low density cellular vinyl incorporates a large proportion of air, as does wood, and achieves comparable R-values. Engineered wood products have solid profiles with essentially the same value as conventional wood frames. Fiberglass and high-density cellular vinyl that have cavities filled with foam insulation, result in the highest R-value products available. These materials are not without their drawbacks, which may include higher production costs, increased weight, and UV degradation.

In addition to providing higher overall R-value for a window assembly, frames that minimize heat loss at the glazing edge are more resistant to condensation. A center-of-glass R-value for insulated or low-e glazing is typically significantly reduced adjacent to the frame. This is because in conventional windows, the spacer between glazing layers is highly conductive. Thus, condensation on residential windows often

first appears at the pane edge. New low conductivity (warm edge) spacers significantly reduce these losses, resulting in higher overall U-values. When selecting a window it is important to note the overall window U-value (which includes the frame) as indicated by the NFRC label. The window frame alone may account for up to a third of the window area; thus the selection of frame material is an important influence on the overall window performance.

The method of assembly is also an important consideration in overall window performance. Historically, glass was only available in small panes and a window frame joined several panes to form the desired opening. This grid of frame material is referred to as a muntin. As glass technology evolved, windows increased the size of the grid, ultimately only being restricted by the operable weight of the sash. With no structural requirement for muntins and the advent of insulating glass the grid was preserved solely for aesthetic reasons (sense of enclosure, ability to define expanse of view, existing architecture). Today there are several options available dependent upon the degree of authenticity desired relative to convenience or performance. A window sash with individual lites (panes) is inherently more expensive and less efficient because of the increased length of the glazing perimeter. These window muntins are described as true or authentic divided lites as they serve their original structural purpose. The width of these true muntins, however, is typically larger to accommodate the insulating glass. Multiple individually sealed glazing units also increase the likelihood of seam failure.

Alternate methods have been developed to simulate the appearance of true divided lites and provide the ease of cleaning a single pane and/or to minimize the cost of fabrication. Simulated divided lites are muntins (grilles) adhered to the surface of the glazing and often available with an optional air space grille (spacer bar) simulate the appearance of true divided lites at lower cost and without significantly compromising energy performance. Single-lite insulating glass reduces the likelihood of seam failure. Another type, referred to by some manufacturers as "snap in" grilles, can be removed for cleaning but are considered to be the least convincing because of their thin profiles. They are also subject to damage with repeated use. A third option offers a combined strategy: a true divided lite sash with a single full size panel, which is set into the sash like an integral storm unit. This provides a single surface to clean from the interior while maintaining a historically authentic appearance with good thermal performance.


FIGURE 1 MUNTIN TYPES

Wood window frames not properly protected are subject to swelling and rot. The repair of these windows is often possible. However, the source of the problem should first be identified and corrected. Otherwise window repairs may be temporary at best and could potentially ruin the window if it is adjusted to accommodate for these abnormal conditions. A swollen window that has been planed to accommodate swelling will provide an insufficient barrier to infiltration when the sash shrinks. Window sashes that have been fixed in place address infiltration but compromise ventilation and safety.

The benefits provided by new materials may be retained by the use of a variety of partial replacement methods (Fig. 2). The primary benefit of partial window replacement is the preservation of the original materials including surrounding trim and surfaces, which can save labor and material costs. The preserved material's potential useful life and ability to be replicated are often the driving criteria.

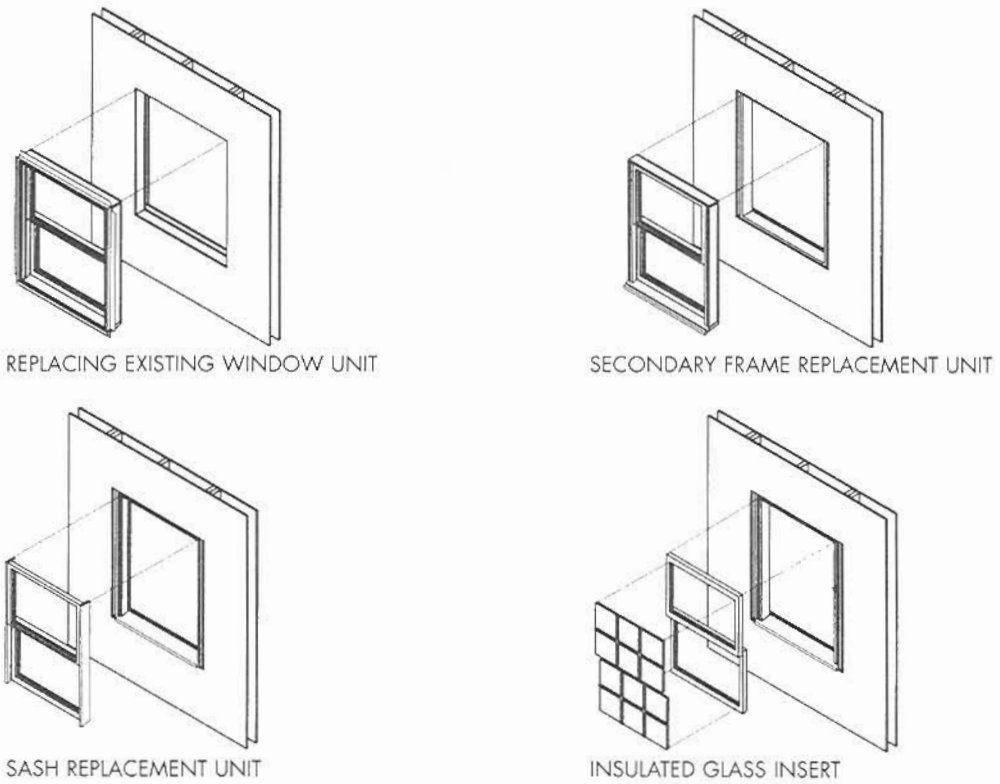



FIGURE 2 WINDOW REPLACEMENT UNIT TYPES

## TECHNIQUES, MATERIALS, TOOLS

### 1. REPLACE EXISTING WINDOW UNITS.

Replacement of existing window units with an entirely new unit will provide the best available performance and the opportunity to assure proper installation of the unit. Sources of damage to the unit being replaced may be corrected with the removal of the original window.

ADVANTAGES: A new unit provides the longest useful lifespan and significantly improves thermal performance.

DISADVANTAGES: Usually the most costly alternative, with the existing window discarded as waste.

### 2. REPLACE EXISTING WINDOW SASH AND TRACK.

Replacement sash units are a very popular choice for partial window replacement (Fig. 3) and are now produced by the majority of window manufacturers, including Caradco, Marvin, and Weather Shield, among others. These inserts come in a kit, which includes the sash and track (jamb liners) with a counterbalance mechanism and hardware. The units are available in a wide variety of stock sizes or can be custom fabricated with a choice of glazing.

ADVANTAGES: Low degree of effort and skill required for installation. Adjacent surfaces and trim are preserved. Elements replaced are those subject to the greatest wear, preserving as many components as pos-

sible and thus reducing waste.

DISADVANTAGES: Existing wood frame must be in good condition with no rot and relatively square with parallel jambs. Partial replacement does not address air infiltration at the perimeter of the existing frame or causes of damage that may be found within the wall cavity.

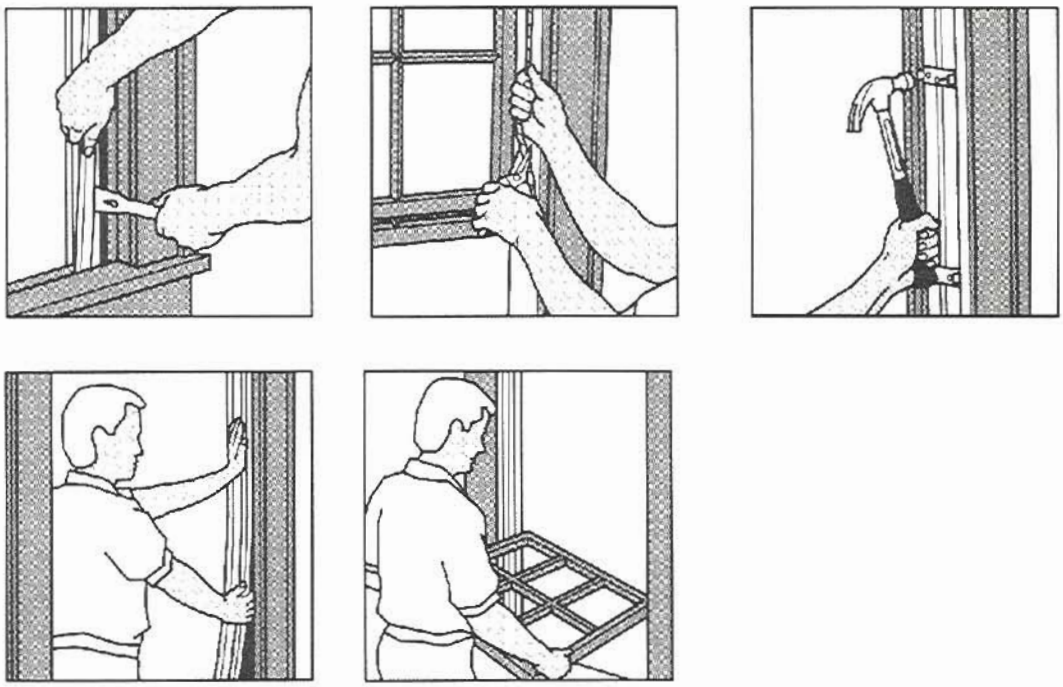


FIGURE 3 TYPICAL INSTALLATION OF A SASH REPLACEMENT WINDOW UNIT

### 3. INSTALL NEW (SECONDARY) WINDOW UNIT WITHIN EXISTING WINDOW FRAME.

The most popular form of replacement windows are vinyl units that fit within the existing window frame, although wood window units for this purpose are also available from Pella, and others. The secondary window unit is perceived as a unit within a unit, providing the sash and track with a pre-assembled narrow frame. These units are available in a wide variety of stock sizes or may be custom fabricated with a choice of glazing.

ADVANTAGES: The secondary frame is similar in concept to the replacement of sash and track in that only those parts subject to wear are replaced while providing benefits of new technology. The secondary frame may accommodate slightly out-of-square conditions.

DISADVANTAGES: Secondary frames reduce the amount of egress and glazing area, which may be in conflict with applicable building code egress requirements. As with other partial replacement methods, does not address air infiltration at the existing frame's perimeter.

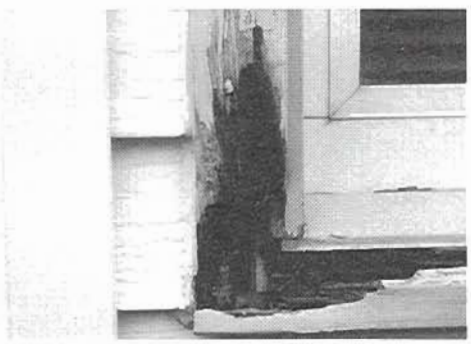
### 4. INSTALL REPLACEMENT SILLS.

A wood window sill is often the most vulnerable component of a window frame because it is possible for standing water to accumulate on this surface and form rot. This common condition may ultimately compromise the entire wall assembly by providing the means of entry for water. Replacement sills have been developed expressly for this purpose. There are essentially two means of correcting this condition. The first is to use a sheet metal material as a cap over the existing seal to function as flashing. The second is a new generation of replacement sills made from such materials as wood composites and vinyl, as manu-

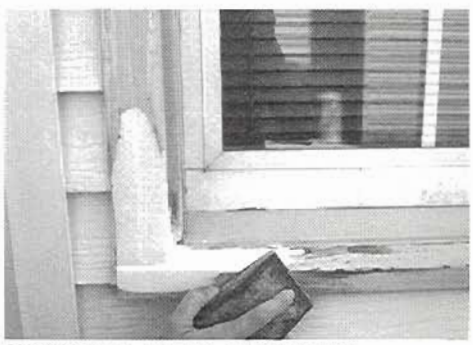
factured by Wenco, which are solid in profile and may be worked with conventional carpentry tools.
ADVANTAGES: A necessity for preserving the weather-tightness of the building envelope. The most economical means of addressing a common problem.
DISADVANTAGES: Both methods may serve to hide a more critical problem in which rot goes unaddressed and continues to erode surrounding materials. The metal flashing caps are considered unsightly by some and are subject to denting.

## 5. REPLACE EXISTING DAMAGED WOOD WITH EPOXY CONSOLIDANTS AND FILLERS.

Rotted or damaged wood frames can often be repaired with epoxy products. There are essentially two types of epoxy repairs: consolidants for use where the wood is intact; and a putty-like filler material for areas that are missing or require removal because they are beyond repair (Fig. 4). Epoxy consolidants will penetrate and bind with the wood fibers while preventing further deterioration. Consolidants, which are either poured or brushed on the surface in liquid form, bond with the wood fibers to create a surface with greater strength than wood and water resistant. The material cures in a matter of minutes or hours (depending on the amount used) and may then be worked as wood. Consolidants may be used as a primer for the application of an epoxy filler material, to fill voids or achieve intricate profiles that would otherwise be difficult and expensive to replicate in wood on a small scale. The increased strength of the epoxy material is suitable for structural elements such as an operable window frame when applied as per manufacturer's instructions. Consolidants are available from numerous sources (manufacturers and distributors) including Abatron, Conservation Services, Gougeon Bros. Inc., and Repair Care Systems USA, among others.
ADVANTAGES: Epoxy filler provides an alternative to solvent-based wood fillers, which may shrink as they cure or work themselves loose as materials expand and contract at different rates. Repair of existing wood members is often the most cost-effective solution with the least disruption. Epoxy can be worked like wood, maintaining the original appearance.
DISADVANTAGES: A degree of skill is required for proper application. The repair of damaged wood will not address the cause or progressive deterioration of adjacent materials.



ROTTED WINDOW FRAME CLEANED



EPOXY FILLER APPLIED AND SANDED

EPOXY FILLER PAINTED

FIGURE 4 EPOXY FILLER

### 6. ADJUST WINDOW OR DOOR FRAME WITH SHIM SCREWS.

Shim screws, available from GRK Canada Ltd. and Resource Conservation Technology, Inc. are often an effective means of correcting an out-of-square condition. The screw functions as two different screws attached by a single length so as to allow sufficient anchorage while being able to fine tune the position of the frame without having to use shims.

ADVANTAGES: This method requires minimal effort to correct an out-of-square condition at minimal cost.

DISADVANTAGES: An out-of-square condition may be the result of a much more serious condition such as a rough opening which is too small to allow for the deflection of a header or an improperly sized or deteriorated structural member.

## FURTHER READING


*Repairing Old and Historic Windows: A Manual for Architects and Homeowners*, New York Landmarks Conservancy, New York: John Wiley and Sons, 1992.

*Residential Windows*, John Carmody, Stephen Selkowitz & Lisa Heschong, New York: W.W. Norton, 1996.

*Wood Preservation*, Barry Richardson, 2nd Edition, Chapman to Hall, 1993.

*Wood Protection Guidelines: Protecting Wood From Decay Fungi & Termites*, Wood Protection Council National Institute of Building Science, 1993.


## PRODUCT INFORMATION

Abatron, Inc., 5501 95th Ave, Kenosha, WI 53144; 800-445-1754 (wood repair products).

Alumax Building Products; P.O. Box 5350; Riverside, CA 92517; 800-626-3223 (vinyl replacement units).

Bird Vinyl Division, 1010 Withrow Court, Bardstown, KY 40004; 800-626-1524 (vinyl replacement units).

Caradco, P.O. Box 920, Rantoul, IL 61866; 217-893-4444 (wood sash only kits).

CertainTeed Corporation, P.O. Box 860, Valley Forge, PA 19482; 800-233-8990; www.certainteed.com (vinyl replacement units).

Chelsea Building Products, Customer Service, 565 Cedar Way, Oakmount, PA 15139; 412-826-8077 (vinyl replacement units).

Conservation Services, 8 Lakeside Trail, Kinnelon, NJ 07045; 201-838-6412 (wood repair products).

Easy Sills, P.O. Box 1454, Orem, UT 84059-1454; 801-785-4060 (retrofit vinyl window sills).

Gougeon Bros. Inc., P.O. Box 908, Bay City, MI 48707; 517-684-7286 (wood repair products).

Harvey Industries, 35 Commonwealth Avenue, Woburn, MA 01801; 800-882-8945 (vinyl replacement units).

Kolbe and Kolbe, 1323 S. Eleventh Avenue, Wausau, WI 54401-5998; 800-955-8177; www.kolbe-kolbe.com (wood sash only kits).

Marvin Windows, P.O. Box 100, Warroad, MN 56763; 800-346-5128; www.marvin.com (wood sash only kits).

Milgard Windows, 1010 54th Ave. E., Tacoma, WA 98424; 800-645-4273 (vinyl replacement units).

Pella Corporation, 102 Main Street, Pella, IA 50219; 800-847-3552; www.pella.com (wood replacement units).

Preservation Resource Group, Inc., P.O. Box 1768, Rockville, MD 20849-1768; 301-309-2222 (wood repair products).

Repair Care Systems USA, 300 Oak Street #155, Pembroke, MA 02359; 617-829-4555 (wood repair products).

Weather Shield Manufacturing, Inc., P.O. Box 309, Medford, WI 54451; 800-222-2995; www.weather-shield.com (wood sash only kits).