Is It Time to Switch to All-Vinyl Windows?

PVC extrusions offer low cost, low maintenance and thermal performance that rivals wood

BY SCOTT GIBSON

Ron Sandwith found it tough sledding when he went on the road to sell PVC extrusions for making vinyl windows in the mid-1980s. Already a supplier of weatherstripping to makers of aluminum windows, Sandwith wanted to begin selling an extruded vinyl that could be fashioned into window frames. Most of his customers weren't interested. One plant manager told him: "It will be a cold day in hell when I make a plastic window."

That day has arrived. In less than 20 years, all-vinyl windows have been transformed from a low-end commodity used mainly by bargain-hunting remodelers to a major player in the new-construction market. More than one-third of all windows going into new houses are vinyl. In remodeling, vinyl windows outsell everything else, and vinyl windows are now finding their way into high-end houses where their use was unthinkable just a few years ago (photo above). Not coincidentally, Sandwith's company, Mikron, is now the largest maker of vinyl-window extrusions in the country.



You can't tell from the street. *Vinyl windows have moved into the upper end of the residential market. In this new Los Angeles home, only the door is wood.*

Vinyl windows are less expensive than comparable primed-wood, vinyl-clad wood and aluminum-clad wood windows. They are made in a variety of styles—double- and single-hung, bow, casement, sliders and awning—and with nearly identical glazing options as wood or clad windows. Although color choices are limited, vinyl windows never need painting or any other kind of maintenance beyond an occasional scrub with soap and water. Manufacturers say that both materials and fabrication are better than ever and that vinyl windows should last just as long as any other type, even in harsh climates. As they like to say in the siding business, "Vinyl is final."

Vinyl offers lower prices and improved performance

Even in regions where all-wood or clad windows have traditionally held the upper hand, low prices have given vinyl windows a real boost. According to estimates from manufacturers, vinyl windows typically cost 30% less than aluminum-clad and vinyl-clad windows of the same size, type and relative quality. Substituting vinyl windows for clad or primed-wood windows in a 2000-sq. ft. house can save several thousand dollars. Savings grow as houses become bigger and windows more elaborate.

Jeff Jones, marketing vice president for Windsor Windows and Doors, cautions that comparing prices is difficult. "It's a little like grabbing smoke," he says. Vinyl windows, for example, need jamb extensions (photo 1, facing page), which may not be included in the unit price. Material and labor costs for extensions make the price difference less dramatic. Further, Jones says, standard glazing in some brands of vinyl windows may not be as good as that in typical primed-wood or wood-clad units. Although better glazing is available, it may be at additional cost. The bottom line: Builders should compare total installed and finished costs for windows of similar quality.

Jim Benney, education director for the National Fenestration Rating Council (NFRC), says wood is still a feel-good product that commands a higher price. But he adds that vinyl windows are shedding an early image of poor quality. "The first ones that came out were cheap," he says. "They had to get over that hurdle, and they've done that. They've improved the product." Additives and UV-inhibitors are more effective, making windows more fade-resistant and durable, he says, while better extrusion designs have improved both strength and thermal efficiency.

Windows start with hollow vinyl extrusions

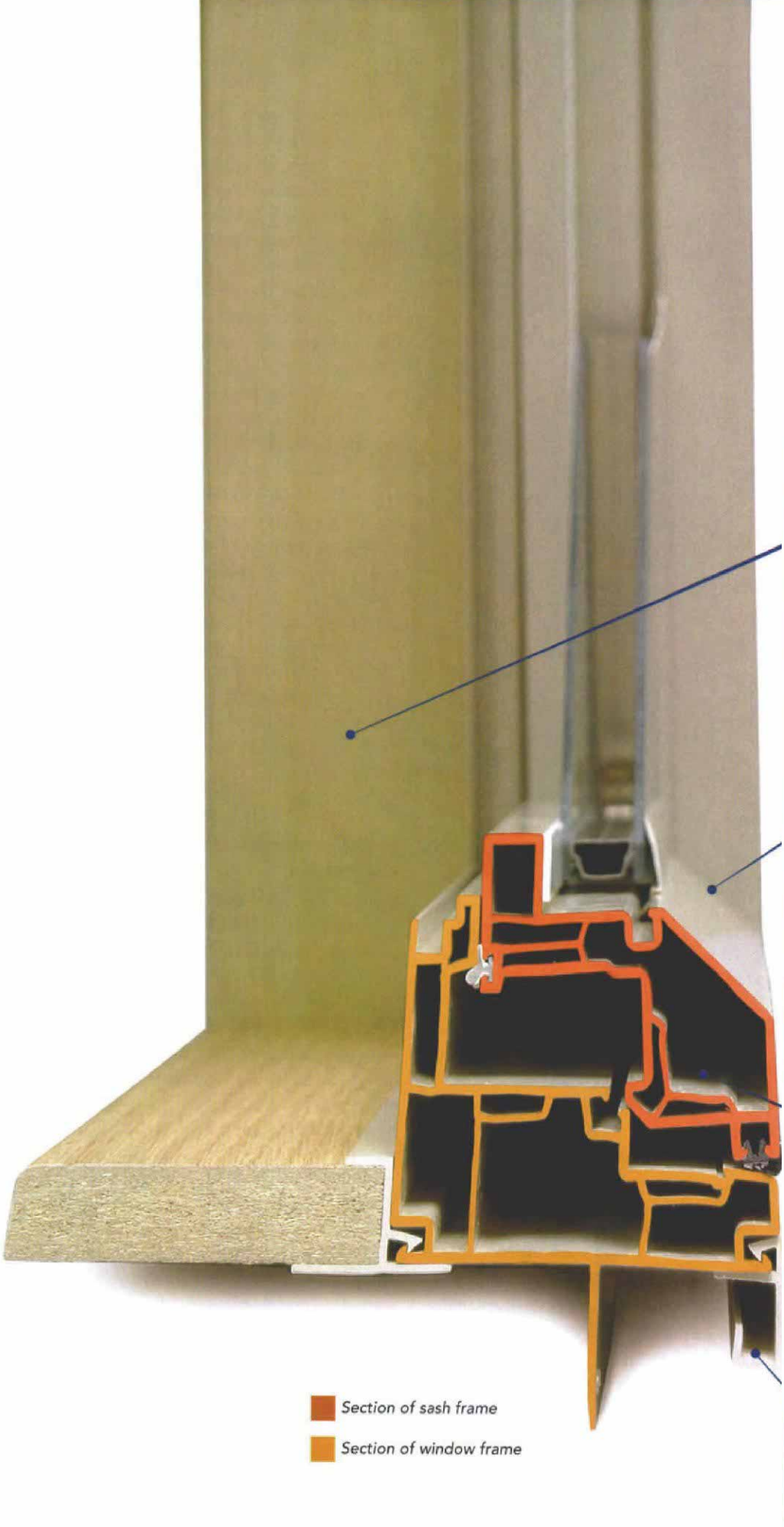
Unlike wood windows clad in a vinyl or aluminum skin (sidebar p. 67), almost all vinyl windows are made of hollow extrusions of polyvinyl chloride (PVC) (photo left, facing page). Some window manufacturers make their own extrusions; many others buy them. Window makers specify the profiles they want, then turn the lengths of thin-walled extrusions into finished window frames and add the sash.

Extruders start with powdered vinyl and mix it with resins, waxes, stabilizers and oth-

Photo this page: Gary M. Katz

A LOOK INSIDE A VINYL WINDOW

By itself, vinyl is a flimsy material. Extrude it in the right shape, though, with lots of chambers and angles, and vinyl stiffens to be strong enough for window components (photo left). The photos below show details of vinyl windows, both standard and optional.





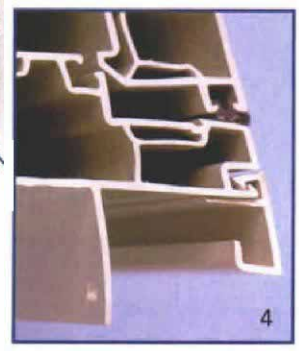
Factory-applied extensions. *Extrusions may include slots on inside jamb edges to receive wood or drywall returns, but factory-applied jamb extensions speed up finishing.*



No-leak corners. *Most vinyl-window manufacturers miter their extrusions and heat-weld the corners for a reliable seal.*

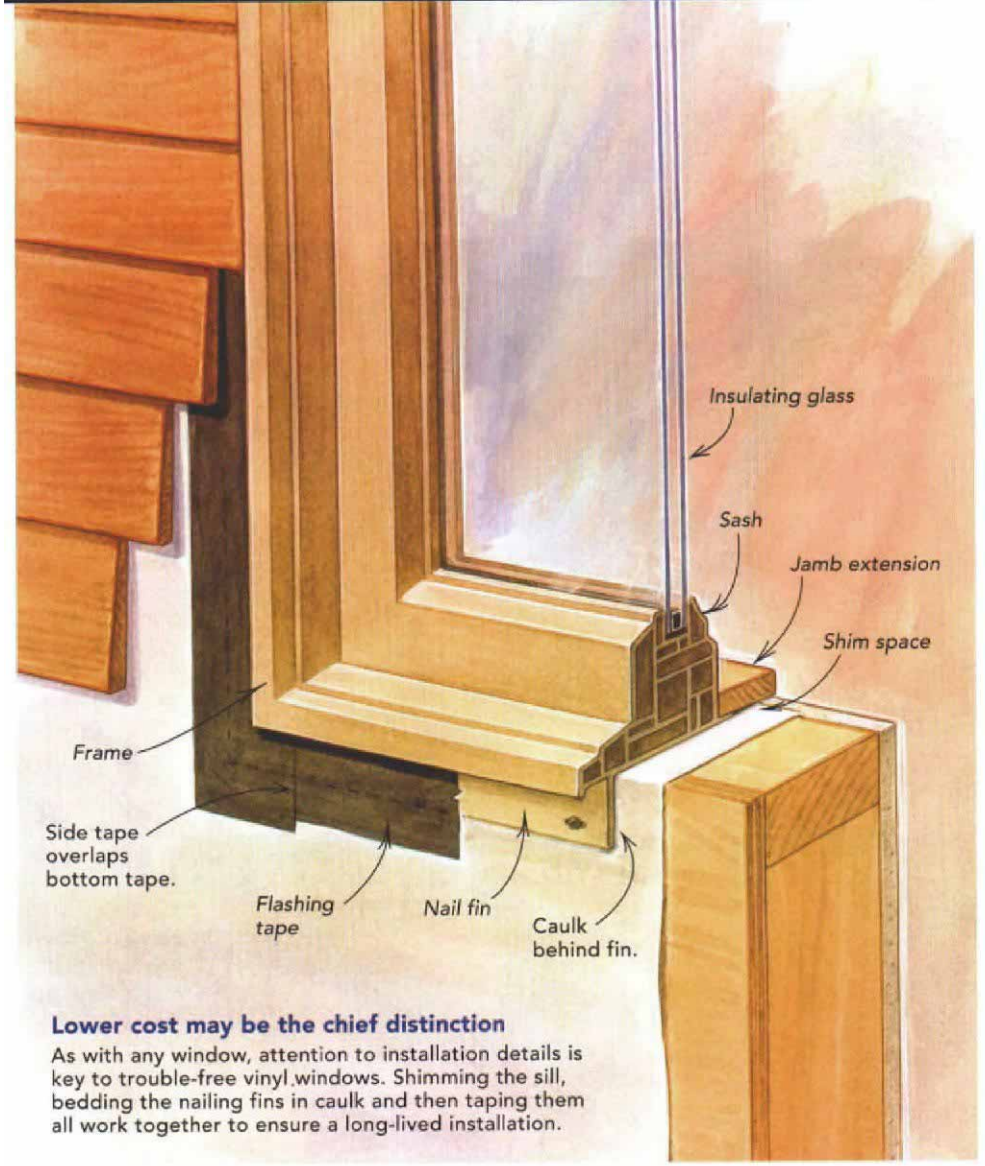


Chambers add more than strength. *Functioning much like the airspace between layers of insulating glass, the chambers inside the jambs and sash of vinyl windows resist heat transfer.*



Integral J-channel. *Because vinyl moves with temperature fluctuations, rigid siding shouldn't butt tightly to the window frame. J-channel hides the gap.*

Photos this page: Scott Phillips



Lower cost may be the chief distinction
As with any window, attention to installation details is key to trouble-free vinyl windows. Shimming the sill, bedding the nailing fins in caulk and then taping them all work together to ensure a long-lived installation.

er modifiers. The plastic dough is squeezed under high pressure through custom-designed dies. What comes out is a continuous length of PVC with a series of internal chambers that reinforce the relatively weak material and give it a thermal performance about the same as that of wood (photo 3, p. 63). Wall thickness is typically 0.065 in. to 0.08 in. Extrusions with wall thicknesses at the upper end of the range are likely to be stronger. But extrusion design—the frame's hidden multichamber construction—can be just as important to overall window strength, a number of manufacturers say.

Although some manufacturers, especially small shops, still use mechanical fasteners at the corners of their window frames, most now heat-weld mitered corners (photo 2, p. 63). The process forms a weathertight seal that's less likely to work itself loose through repeated thermal cycling. The extrusion process creates an integral nailing fin used to hang the window in its rough opening (drawing above). When bedded in caulk, the nail fins also help to create a weatherproof seal between the window frame and the wall.

Colors are limited mostly to white, almond and light tans. The reason is heat. Vinyl begins to distort when temperatures reach about 165°F, and dark-colored vinyl can become far hotter than that out in the sun, even with the titanium dioxide manufacturers add to help PVC resist the effects of ultraviolet radiation. When it gets too hot, vinyl can sag.

Thermal performance is roughly the same as wood and clad units

When it comes to keeping out the hot and the cold, hollow vinyl extrusions perform about the same as wood window frames. They are a big improvement over aluminum window frames. Sealed chambers within the frame act something like the insulating air layer between the sheets of glass used in double-glazed windows.

Given vinyls thermal properties, most manufacturers don't pack the extrusions with additional insulation. As one product manager explained, extrusions designed to hold foam insulation tend to have larger cavities and fewer of them. That makes the frames less rigid. And because most of the window opening is taken up by glass, a little extra insulation in the frame gains only a marginal insulating value for the entire window.

Thermal performance in general varies widely, depending on what type of glazing is used and how the window is built. That's no different than it is for wood, clad or aluminum windows. Most types of glazing available in wood, aluminum or clad windows are available in vinyl windows. One exception is true divided-lite sash, windows in which the sash are made of a number of individual insulated-glass panes separated by muntins. Although that style is common on wood and clad windows, it's not an option on vinyl windows. Grids that create the look of a divided-lite window may be located between sheets of glass or applied to the glass surface.

Windows tested under a voluntary NFRC program bear labels showing their U-values as well as other performance data (301-589-6372; www.nfrc.org; see "Understanding Energy-Efficient Windows," *FHB* #114, pp. 68-73).

Metal reinforcement can take out the wobble

Structurally, vinyl is not as strong as aluminum or wood. "There are limits to the structural loads that a vinyl window can meet," says the NFRC's Benney. Extrusion design helps. Manufacturers also compensate by adding metal reinforcements to the extrusions on lock rails or in the mullions between ganged window units. Stiffeners reduce the annoying flex that turns off some potential buyers, and they allow vinyl windows to meet structural-load requirements all over the country—even in Dade County, Florida, where one infamous test subjects windows to 2x4s fired from cannons.

As is the case with other types of windows, vinyl windows may be tested for air and water infiltration and structural performance under a joint standard of the American Architectural Manufacturers Association (847-303-5664; www.aamanet.org) and the Window and Door Manufacturers Association (800-223-2301; www.nwwda.org). There's no special class of testing for vinyl windows. If, for instance, a vinyl window passes the DP (design pressure) 50 test—meaning it resists leaks under a force of 50 lb.

Drawing: Dan Thornton

per sq. ft.—it gets the same rating a wood, aluminum or clad window would get.

Unfortunately, however, there is no uniform labeling program for a window's structural performance. You have to ask. And although tests are standardized, criteria for how manufacturers select windows for testing are not, says Glenn Hause, an industry consultant. Directories of products that pass structural tests are at Web sites for the two trade groups.

No special installation procedures for vinyl

There's nothing special about installing a vinyl window: Bed the nail fin in caulk, level and square the unit, and nail it in (photos right; photos p. 66). The American Architectural Manufacturers Association (AAMA), which sponsors a training program for installers, makes no distinction between vinyl windows and any other kind. Larry Livermore, the AAMA's installation-program manager, says, however, that recommended shim spacing for vinyl windows may vary among window types or manufacturers. On a ganged window of two or more units, the manufacturer may recommend a shim at midspan so that the sill doesn't sag or, in some cases, a continuous shim. Livermore's best advice is to follow carefully the installation directions that come with the window.

Livermore also says vinyl windows left leaning against a wall may develop a bow and take on a permanent set, just as a tall wood door can. If the manufacturer provides any specific instructions for job-site storage, they also should be followed carefully. Ideally, vinyl windows should be brought to the house just before installation, not left on the job site where they can be knocked around and damaged. The only special precaution is not to leave windows in enclosed metal containers, such as a truck trailer, in hot weather. Too much heat can distort vinyl frames.

Differences in extrusion design also can affect installation, especially when it comes to matching the siding with the window type. Some extrusions have integral J-channels designed to accommodate vinyl siding, fibercement siding or beveled-wood siding (photo 4, p. 63). Siding tucks neatly behind a lip that's about ½ in. wide. But the J-channel may not be deep enough to accommodate some kinds of siding. Several cedar shingles, for instance, are too thick to squeeze into the J-channel of some windows, leading to time-consuming detailing or field modifications to the extru-

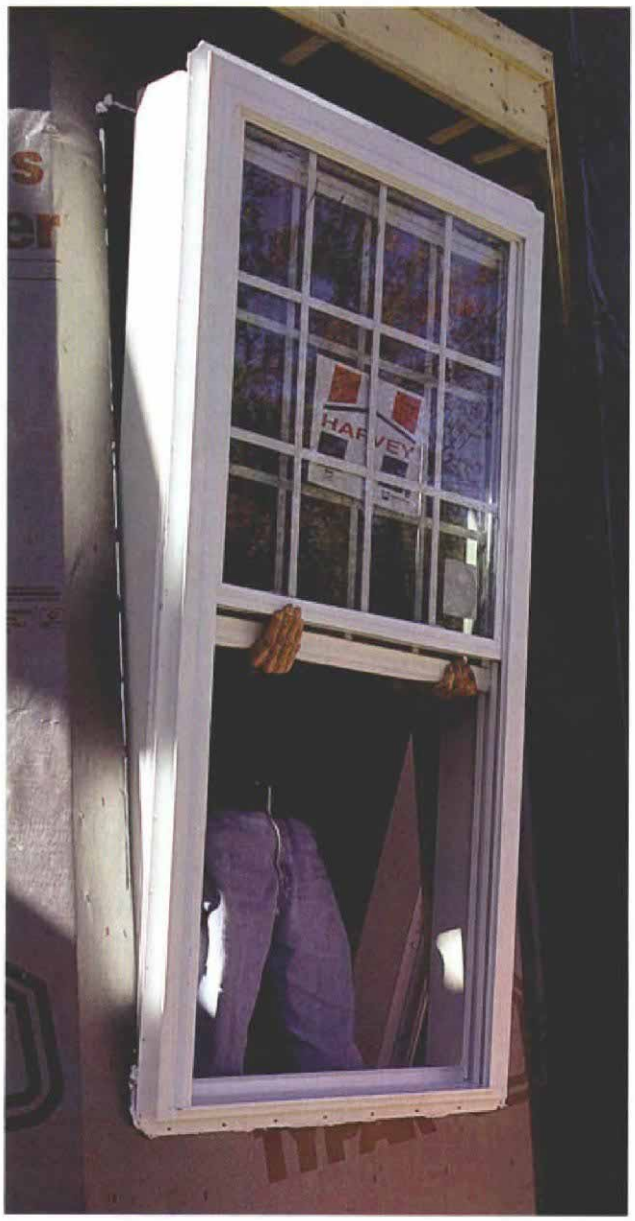
IF YOU'VE INSTALLED OTHER WINDOWS ...



Installing vinyl is the same as installing other flanged windows. *All window installations start with a level sill. One carpenter inside and another outside speed the task.*

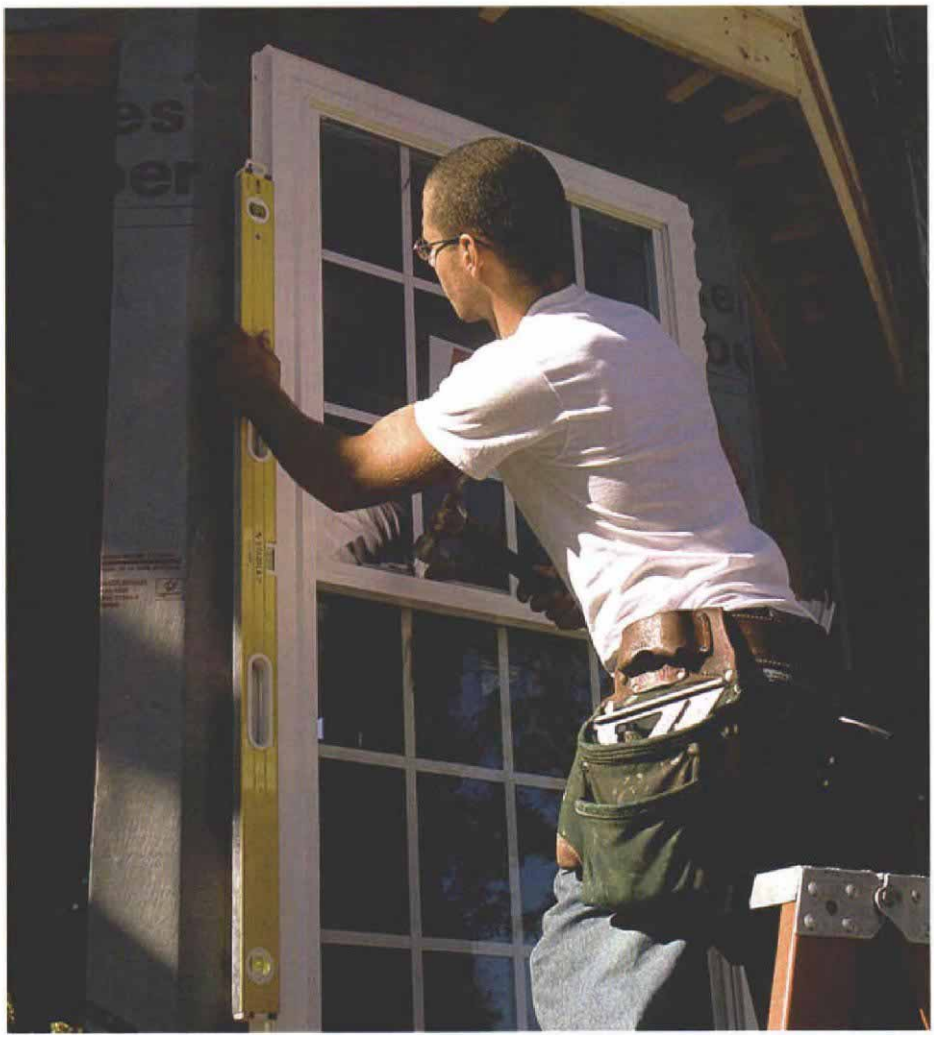


A bead of caulk on the backside of the nail fin is common sense. *It reduces air infiltration and minimizes the chance of wind-driven rain getting behind the window.*

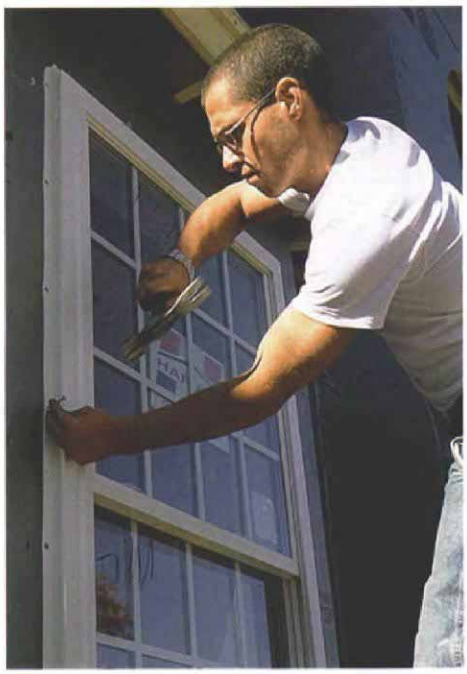


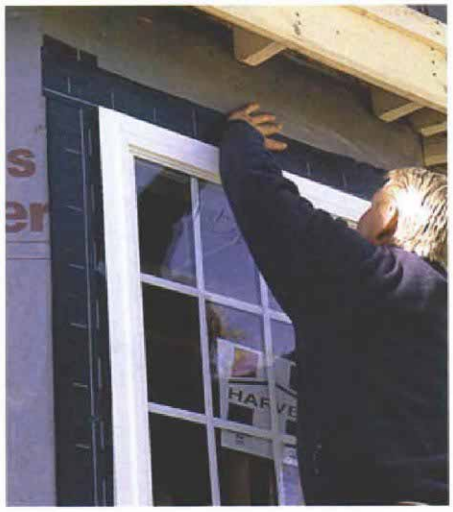


Pop in the window. *As you would set a wood window, the bottom of a vinyl unit is rested on the rough sill; then the unit is pulled into the rough opening. A carefully wielded pry bar is used to center the window.*



Plumb and square don't care what the material is. *As the outside carpenter checks for plumb, the inside carpenter shims as directed.*





Roofing nails hold in vinyl windows. *Here's about the only difference in installation: Vinyl is easily cracked by an errant hammer blow, particularly in the cold. Once the window is in, self-adhering flashing tape seals out water.*

sions that manufacturers don't like to recommend (that is, cutting off the J-channel). It's easier to specify the right kind of window to start with.

What if you don't like the trim profiles on the vinyl windows carried by your supplier? Profiles vary, so check with other manufacturers to see whether other profiles are available. Vinyl frames also can be supplemented with extra trim to help them match existing units or simply to give the windows a different look. In that case, manufacturers say, butt the supplemental trim to the vinyl and leave only a small gap—⅛ in. or less—to be filled with a flexible exterior caulk.

Because there is no seam between a vinyl-window frame and the nail fin, there is no path for water to find its way inside. Metal head flashing isn't necessary, but manufacturers often recommend that all four nail fins be sealed with a strip of self-adhering flashing after the window has been installed.

Jambs on vinyl windows typically do not run the full depth of the wall—many are only 3¼ in. deep—so a jamb extension is added at the factory or on the job site. Extrusions can be designed to catch the edge of a drywall or wood return, making for a clean transition between the vinyl jamb and the window well. Factory-applied jamb extensions can be especially helpful on large arch-top windows.

Overcoming a bias against plastic where wood is king

Joseph B. Lanza, a designer-builder in Massachusetts, used vinyl windows on two houses he built recently on Cape Cod, a bastion of white cedar and other natural materials. Vinyl windows were less expensive than some of the other options, Lanza says, and using them saved time because they don't have to be painted. Just as important, people don't seem to be bothered by plastic.

"You see tons of them," he says. "It depends on what market you're in, but there are more and more high-end vinyl products. It's not that tough a sell because people are used to vinyl-clad windows. Not only do you save money on the window, but you save on (not painting) the sash. You put it in, and it's done."

Mike Guertin, a Rhode Island builder, has been using vinyl windows in new construction for nearly a decade. "Until somebody tries it, there's no way they'll feel comfortable using them," he says. "That's the way it was for me for years. I didn't want to use them. Then one customer came to me and said, 'I

Clad and composite windows: low maintenance without the vinyl look

Andersen Windows was among companies that took an early interest in building windows from vinyl extrusions. But put off by the structural limitations of the material, the Bayport, Minnesota, company took a different fork in the road. Engineers combined vinyl and wood, and in 1966, Andersen launched its Perma-Shield line, the first-ever clad window. Exterior parts were protected by a skin of vinyl, and interior parts were wood, which could be painted or stained. Stiffer than vinyl, wood also offered good thermal and sound insulation. As important, people liked the way it looked.

A number of companies now make windows clad in vinyl or aluminum. They are typically more expensive than vinyl-extrusion windows, but they solve an aesthetic problem: Lots of people just don't like the look of plastic, especially inside.

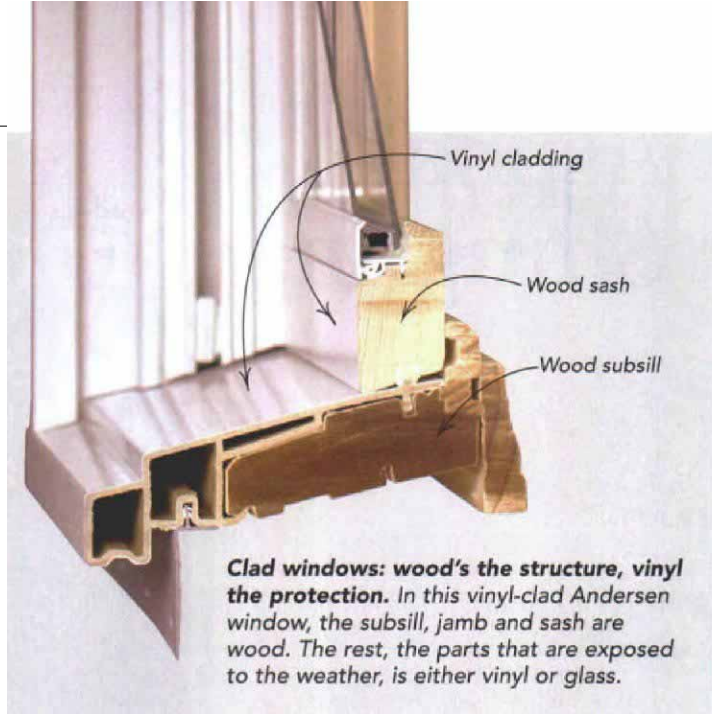
Vinyl-window makers are looking for ways to make window interiors more attractive and adaptable. CertainTeed (800-782-8777; www.certainteed.com) offers New Haven, a window line in which wood fiber is bonded to the interior surfaces of hollow-vinyl extrusions. The interior surface then can be stained or painted with water-based finishes.

In a different approach to the same end, Marley Mouldings, a Marion, Virginia, manufacturer (www.marleymouldings.com; 800-368-3117), developed a trademarked material it calls Cellular Vinyl, a solid product intended to offer the no-maintenance benefits of vinyl and the look of wood. Although Marley doesn't make finished windows itself, it sells the extrusions to companies such as Windsor Windows (800-887-0111; www.windsorwindows), which makes its Legend Series entirely of the material.

Unlike conventional vinyl windows, these units have solid sills and jambs, which can be handled and worked like wood. Also, the material can be painted and doesn't have the glossy skin of plain vinyl extrusions.

As successful as vinyl extrusions have been, many companies are looking ahead to composites as the next generation of high-performance windows. Like cellular PVC, composites are impervious to water and insect damage, but they are similar to wood in appearance. Silverline (www.silverlinewindow.com; 800-234-4228), which is already a major manufacturer of hollow-extrusion windows, is tinkering with a composite it hopes to market later this year. And a subsidiary of Andersen (www.andersenwindows.com; 800-426-4261) now uses a composite of wood and vinyl for a replacement window.

—*S. G.*



Clad windows: wood's the structure, vinyl the protection. *In this vinyl-clad Andersen window, the subsill, jamb and sash are wood. The rest, the parts that are exposed to the weather, is either vinyl or glass.*

want to use these windows.' I was reluctant, and I used them, and I said, 'Boy, you know these things are a lot better than I thought.'

"There is some junk out there, but as long as you're buying some decently manufactured ones, I'd put them up there with a vinyl-clad wood window or an aluminum-clad wood window," Guertin says. "They're great."

Guertin stays away from large sizes—anything more than 5½ ft. tall and 3 ft. wide—because he thinks vinyl frames may expand too much in summer's heat and make the sash difficult to operate. Other than that, he likes details such as tilt-in sash and high energy efficiency as well as lower cost. He hasn't had any trouble selling the benefits to customers, and he says he hasn't had any callbacks on the vinyl windows he has used.

With more vinyl windows than ever on the market, choosing the right one can seem daunting. It's impossible to tell by looking at a window how the extrusion will hold up in a hurricane or whether the unit will leak in a downpour. "The design is more the chassis of the windows, the stuff you don't see," says the product manager at one company.

Checking for heat-welded corners, adequate weatherstripping, ease of operation and sturdy hardware is an obvious first step. Beyond that, the best advice may come from John McFee, director of certification for the Window and Door Manufacturers Association. First, he suggests buying windows that have passed industry tests for air and water infiltration and structural integrity appropriate to the area (code requirements often are tougher in coastal locations). Second, McFee says that glazing, as certified by the NFRC, should meet energy-efficiency recommendations for the region in which the windows are installed. More information on energy efficiency and ratings is available at the NFRC's Web site or from the Efficient Windows Collaborative (www.efficientwindows.org).

Guertin advises talking with other builders about vinyl windows they may have used. "One problem with vinyl windows is that unless you know what you're looking at, you can buy some junk and not realize it," he says. "Talk around. That's how I found out." □

Scott Gibson, a contributing editor to *Fine Homebuilding*, lives in Steep Falls, ME.
Photos by the author, except where noted.

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