HURRICANE-RATED Windows

They cost more and are harder to install. But if you build near the Atlantic Ocean, you better get used to them.

HURD

by Charles Wardell

Some East Coast builders are in for an expensive surprise: They may have to install storm-resistant windows on coastal-area homes. The windows are supposed to reduce property damage from major hurricanes, but they can add thousands of dollars to the cost of a home.

Dade County, Fla., has required these products for years. When Hurricane Andrew caused $25 billion in damage in 1992, Florida building officials blamed much of the destruction on wind pressurizing the homes, then blowing off roofs and collapsing walls. To minimize loss during future big blows, the code was changed to fortify buildings against wind penetration. This included a requirement for storm-resistant windows and doors.

The window requirement headed north in January, when the new *International Residential Code* began

SIMONTON

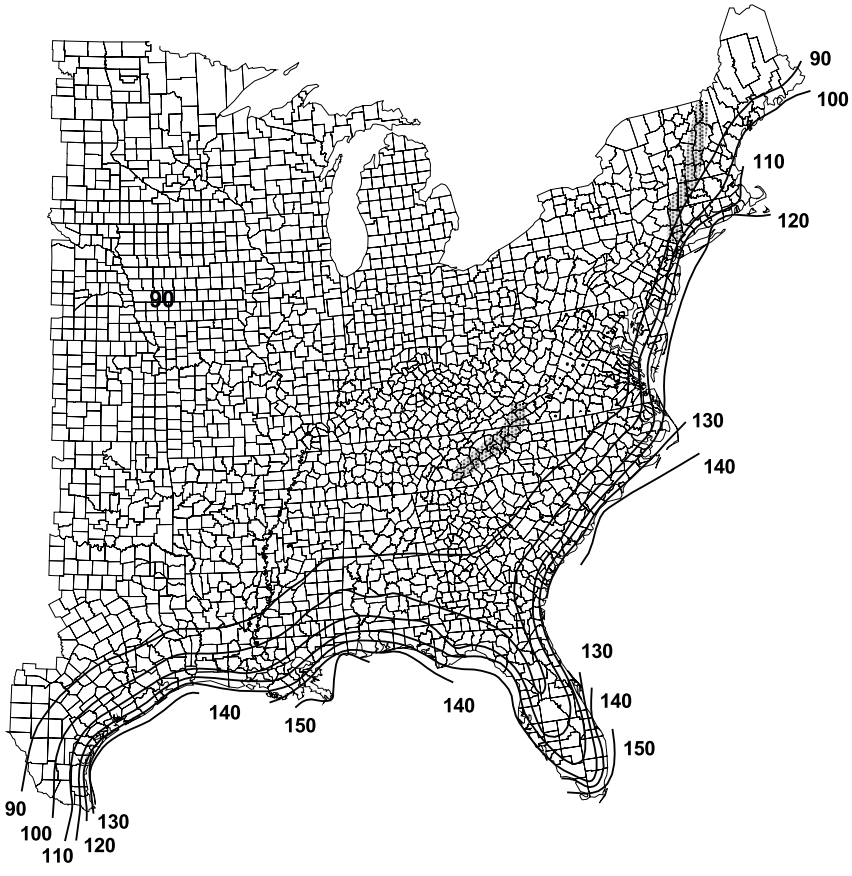
Choosing the Right Window

Which storm-resistant window is right for a particular opening depends on that opening's "design pressure." An opening's design pressure is expressed as a pair of positive and negative numbers that denote the air pressure the opening will likely experience during a hurricane. The window has to be able to resist these pressures without popping out of the opening.

How do you determine the design pressure? While the geographic wind speed map is the starting place, other variables come into play. According to Steve Berge, specialty products manager for Andersen Windows, structures right on the beach have the toughest requirements because they bear the brunt of any storm. Homes a few miles inland generally have a lower design pressure, because the code assumes that surrounding structures will provide some shelter from the wind. Downtown urban areas might get an additional break because of the shelter provided by tall buildings. The heights of the structure and the surrounding structures also come into play, as does the size of the opening. Buildings that are critical to the community, such as fire stations and hospitals, have tougher requirements than other structures in a particular zone.

Design pressure calculations can get extremely complex. To simplify matters, Andersen has added an interactive Design Pressure Estimator to its website. It asks you to input the above information, along with the type of window you want (casement, double-hung, etc.), then gives you an estimated design pressure. You should confirm this number with your local building department before ordering. Go to www.andersenwindows.com/stormwatch. You'll need to fill out a registration form to use the tool.

—*C.W.*



Source: *IRC*

PELLA

Figure 1. To keep hurricane-force winds out of the house, impact-resistant windows have to sustain a 34-mph hit from an airborne 2x4. They can crack, as shown, but not shatter.

mandating them all the way up the eastern seaboard. Not all areas need the same windows as South Florida. Windows must meet a "design pressure" requirement that's determined by a number of factors, the most important of which is the geographic wind speed zone the house is in (see "Choosing the Right Window," left). The wind speeds zones are numbered from 1 to 4; in general, the closer to the coast, the higher the number and the stronger the window needs to be.

While the *IRC* requirement has led all the major window manufacturers to develop storm-resistant products (see source list, page 5), so far relatively few builders have installed them. Those who have find ready acceptance among high-end customers, but, because the windows can cost twice as much as standard models, they see the windows as just one more financial burden on the average home buyer.

How They Work

The code says that impact-resistant windows must be able to take a hit from a 9-pound 2x4 traveling at 34 mph without breaking (see Figure 1).

ANDERSEN WINDOWS

Figure 2. To meet code requirements for impact resistance and energy efficiency, manufacturers start with a sandwich of glass and polyvinyl butyral — sort of a beefed-up car window — then add a spacer and a pane of tempered glass.

KOLBE & KOLBE

Figure 3. Glass is just half the story. Heavy-duty hardware is supposed to prevent cycles of extreme positive and negative air pressure from pulling a window out of its frame.

They also have to survive 9,000 cycles of high positive and negative air pressures — which, in a real hurricane, could pull a standard window right out of its frame.

To meet the first requirement, all window companies use a similar type of impact-resistant glass that's basically a heavy-duty car window. It consists of a clear plastic interlayer sandwiched between two panes of glass. Manufacturers use two types of interlayer: Polyvinyl butyral (PVB) and SentryGlas Plus (SGP). The latter is more rigid and less likely to tear than PVB. That has led some manufacturers to use it in their larger windows, or those designed for the highest wind zones.

In South Florida, that three-ply sandwich is all that's needed. Farther up the coast, however, window construction is complicated by the fact that storm-resistant windows also have to meet state energy codes. To do so, manufacturers add a spacer and an extra pane of tempered glass to create a dead-air space (Figure 2). Some companies put the tempered glass on the inside, some on the outside.

Marvin puts the tempered glass on the outside, on the theory that it will disperse some of the shock of impact. "The exterior pane of glass is sacrificial," says Anthony Head, the company's regulatory product planner. Hurd puts laminated glass on the outside. "If you have a suit of armor, why put it on the inside?" notes Cindy Bremer, director of marketing for Hurd Millwork. "A piece of debris that will break the tempered glass and make you replace the entire window might hit the laminated panel and do no damage at all."

Regardless of where the various panes are, the glass is the simplest part of the window design. The need to survive pressure cycling means that manufacturers have had to strengthen their frames and hardware as well (Figure 3). How much extra strength the window needs depends on the region it's designed for, so it's important to work with your supplier to make sure you get the right windows for the job.

Some of the extra strength comes from better glazing systems. For instance, a standard silicone sealant

WEATHER SHIELD

Figure 4. Manufacturers use different techniques to strengthen their frames. For instance, Weather Shield uses interlocking dovetails and side locks to keep double-hung sash in place.

may be strong enough to hold the glass in place in Zone 3, but that same sealant will likely fail under a Zone 4 impact and pressure test, causing the glass to pop out of the frame. Windows used in those areas would use a structural adhesive instead. "It's the difference between Elmer's glue and superglue," says Bill Lazor, senior product manager with Simonton Windows.

Reinforced frames are also common. Weather Shield fortifies window checkrails with a flush-mounted aluminum interlock mechanism, which ties the sash together when shut (Figure 4). The new interlock features a female receiver on the top sash that connects with a male dovetail connector on the bottom sash. The bottom sash rail is reinforced with a hardwood (versus pine) insert. Two pins extend one inch from the sill into the bottom sash to hold it in place.

Manufacturers also use heavier locks. Steve Berge, Andersen's specialty products manager, says that hardware is critical on certain window types, such as casements. "With a casement, the only thing holding the sash in place under negative pressure is the hinge. What holds hinges to the frame is the fastener."

Installation

Storm-resistant windows must be installed so that they transfer the stress of impact and pressure cycling to the rough framing around the window, lessening the forces acting on the window frame and hardware. Otherwise, the force would be more likely to break the glass or blow the sash out of the window. In the highest wind zones, installers have to drive screws through the window jamb into the rough framing. For other zones, some manufacturers supply clips that the installer has to screw into the jamb and the rough frame (Figure 5, next page). The clip takes the force and transfers it to the frame. "It reminds me of a commercial building in the city, with high wind loads," says Ron Ferrarri of Lion's Head Builders in Easthampton, N.Y. "You have to do it right to keep the warranty, but as far as I'm concerned, it's just the right way to do it. Once your team learns how, it doesn't add that much time to the job."

Other builders we spoke with agree. Andy DiGiammo runs Master Builder Construction in Freetown, Mass. Although his state hasn't adopted the *IRC* yet, he used Andersen's Stormwatch product on a house in Westport, Mass. He says that the installation wasn't that different. The biggest differences were that the windows are a bit heavier than standard ones, and you have to put a nail in every hole in the nailing fin, plus surround the window with a self-adhesive water barrier.

A bigger problem is that the windows cost twice as much as standard models. Jim Zizzi of Zizzi Construction in Quoque, N.Y., recently completed a $2.5 million spec home. Using the impact-resistant product raised window costs from $45,000 to $90,000. In his case, it wasn't a big issue. Zizzi builds for what he calls "high visibility" customers — wealthy Manhattanites who can afford a summer mansion, and who were actually more interested in the home as a result of the added storm security. "It showed that I was willing to spend the extra dollars to build a better home," Zizzi explains.

But there's still the question of who will certify that he put the windows in right. Proper installation is part of the code, but because the code is so new and the windows haven't been tested in a major storm, Zizzi says that some inspectors don't want to sign off on them. "Every municipality seems to implement compliance in a different way," he says. "While some have the building inspector do it, others want certification from an architect."

Alternatives

For those who can't afford, or don't want to deal with, storm-resistant products, the code offers two alternatives: automatic roll-down shutters or sheets of plywood precut to fit each window and ready to fasten in place when a storm approaches. But Zizzi says that

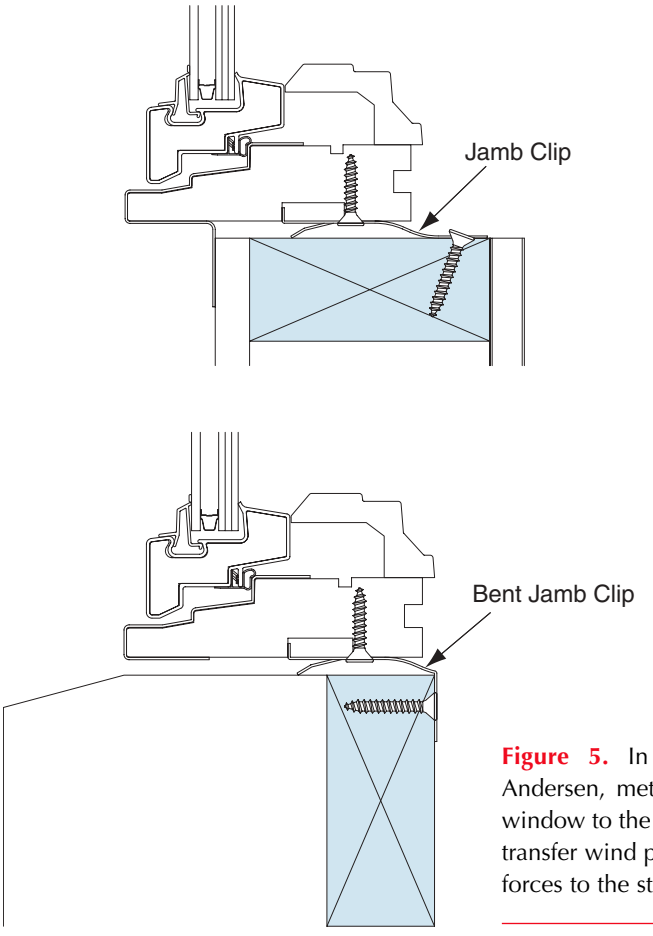


Figure 5. In this detail from Andersen, metal clips secure the window to the framing, helping to transfer wind pressure and impact forces to the structure.

the roll-downs actually cost more than the impact-resistant windows, and they look horrible on a nice home. And while plywood may satisfy the building inspector, good luck with the insurance company.

Zizzi started a 10,000-square-foot home on the Atlantic coast months before the new code went into effect. He was planning to use standard windows. The job was still in progress when the code changed, and the owner got a letter from the insurance company saying that the contractor had to certify that he was providing shutters. Zizzi wasn't going to certify anything. "The insurance company can subjugate a claim if you don't put the shutters up, or if they fail. And I wasn't willing to take on that kind of liability." Finally, the owner was pressured into using the storm-resistant windows. "Even if the windows aren't required by the municipality, they may be required by the insurance company. We found through conversations with various underwriters that while the requirement [for storm-resistant windows] may not impact insurance rates on an existing home today, once the requirement is in the code books, rates will eventually rise for homes that don't comply."

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Manufacturers of Wind-Resistant Windows

Most of the leading window companies now offer storm-resistant windows.

Andersen
Stormwatch
800/426-4261
www.andersenwindows.com

Hurd
FeelSafe
800/223-4873
www.hurd.com

Kolbe & Kolbe
Sterling
715/842-5666
www.kolbe-kolbe.com

Loewen
StormForce
800/563-9367
www.loewen.com

Marvin
StormPlus
800/328-0268
www.marvin.com

Pella
HurricaneShield
888/847-3552
www.pella.com

PGT
WinGuard
877/550-6006
www.winguard.com

Simonton
StormBreaker Plus
800/746-6686
www.simonton.com

Weather Shield
LifeGuard
800/477-6808
www.weathershield.com