Stronger Sliding Glass Doors Are a Good Thing

by Terri Chalaire, PE

In the past few years, there has been much discussion about hurricane windows and sliding glass doors in South Florida. There's also all this talk about impact windows and sliding glass doors. Contractors and manufacturers have been heavily promoting the new shutters, sliding glass doors, and window systems. Also, these storms now seem to be occurring on a more frequent basis. Many owners and contractors think that only recently the building codes have been changed to require hurricane resistant windows and sliding glass doors. It's true that recently the requirements have increased, but having hurricane resistant windows

and sliding glass doors has always been required, ever since the very first South Florida building codes. It helps to really understand just how hurricanes "push" on windows and doors, especially older sliding glass doors in existing buildings.

During the recent hurricanes, many older sliding glass doors failed. The sliding glass door frames bowed visually in or out under high wind pressures, sometimes as much as one or two inches. In most failures, the movable window assemblies popped out of the fixed frames. The bowing shortened the door height, which then allowed the top or bottom of the door to pop out of the fixed frame. After falling out, the doors landed inside or outside depending on which way the wind was blowing. These failures happened even where shutters were in place.

The primary concern regarding hurricanes is protection of the building interior by keeping the building walls in place. The openings with sliding glass doors must stay covered. If sliding glass doors fall out or break apart, the interior areas are exposed to high velocity wind.

Hurricanes attack buildings with high wind speed. High wind speed creates high-pressure forces on the building surfaces. The high-pressure forces can be in either direction, sometimes pushing inward, or sometimes pulling outward. Wind pressure forces vary significantly. Wind loads are pressure loads. The pressures are calculated based on window location, window height, and building height and configuration. Wind loads are significantly higher in the building corners. Wind pressures are also significantly higher on the upper floors of high-rise buildings. High-pressure forces can break out window systems. High-strength window systems resist high-pressure forces.

The strength of a window system is provided by the stiffness of the aluminum framing. The aluminum frames prevent and reduce glass bending under high wind pressure. If glass panels bend too much, they will break. If the glass door assemblies bend too much, they shorten and can literally pop out of the fixed frame. The bottom, top, left, and right sides of the movable frames are supported by fixed frames attached to the floor, ceilings, and walls. The vertical frames that separate each of the glass panel sections rely only on thickness and section depth for stiffness. Older, low-strength frames can deflect as much as one or two inches under hurricane wind pressures. Newer

sliding glass door frames typically have thicker and deeper aluminum frame sections. The newer, stiffer frames typically deflect less than one-fourth inch under hurricane wind pressures.

The current Florida building code for South Florida requires hurricane resistant, high strength window systems on all new buildings. High strength is rated in PSF capability. High pressure ratings (PSF) window systems are more costly than lower pressure ratings (PSF) window systems. Higher PSF ratings are very good to have.

Existing sliding glass doors that are still in good condition can be significantly strengthened against high pressure winds by adding storm bars to the vertical frames and adding corner plates with new fasteners to all the movable panels. There is essentially no change in appearance.

New hurricane resistant sliding glass doors have published product approval documents showing rated wind pressures. The pressures are calculated first from basic wind speed, and then window location, building height and configuration. The calculated pressure ratings vary considerably. The product approvals list exactly how each product is to be used, and any limitations which apply. The fact that a window has a product approval does not mean it is approved for a particular installation. There are limitations listed in the product approval document that need to be evaluated. Surprisingly, most contractors only recommend doors that meet the minimum required ratings. Amazingly, most new window customers don't know to ask for higher pressure ratings. Sometimes the local pressures during bad storms can get higher than the minimum requirements.

The older building codes for South Florida also required high strength windows everywhere on all new buildings. Hurricane resistant windows were always required but not with the same higher strength ratings as today. The older sliding glass door frames were not as stiff as today's high strength sliding glass door frames.

Older sliding glass doors that are still in good condition can be significantly strengthened by adding stiffeners to the inner vertical frames that separate each of the movable glass panel

sections. Evidence of the strengthening is immediately apparent because of the greatly reduced deflections behind lateral wind forces. Deterioration—such as corroded framing or missing fasteners—can also weaken window frames. The corners are held together with stainless steel screws into extruded aluminum slots. These fasteners corrode the aluminum away, leaving little or no corner connections. These frames can also be significantly strengthened by adding corner plates with new fasteners. A window or door that does not close or open entirely would be considered to have a bad fit. A window or door that does not operate properly would be considered non-functional, and not safe. These windows cannot safely be strengthened and would need to be repaired or replaced.

Basic New Window Requirements

All new sliding glass doors must have strength to resist high velocity wind pressure forces. This pressure strength is verified by the window and door system passing test requirements. Sliding glass doors meeting pressure test requirements must have published product approval documents for wind pressure.

Some new sliding glass doors must also resist impacts from flying objects. Sliding glass doors below 60 feet elevations are required to be "missile impact" protected—large missile, less than 30 feet; small missile, 30 to 60 feet. The "impact" protection is verified by the window passing test requirements. Sliding glass doors meeting impact requirements must have published product approval documents for missile impact ratings. Shutters installed over sliding glass doors have been accepted as an exception to the window impact requirement. Shutters must have published product approval documents. Shutters do not change the pressure rating requirements for the window systems.

The current Florida building code for South Florida coastal areas also provides protection for building interiors by requiring sliding glass doors or shutters on lower floors less than 30 feet from the ground. The current Florida building code for South Florida coastal areas does not require or even suggest the use of large missile impact sliding glass

doors or shutters on upper floors of high-rise buildings greater than 30 feet above ground level.

Large missile impact rated sliding glass doors are laminated with plastic between two sheets of glass. These sliding glass doors are commonly known as "Impact Windows." Costs for large missile impact rated sliding glass doors are significantly higher than for small missile impact rated sliding glass doors.

Shutters are allowed as an alternative for large missile impact protection in front of small missile impact rated sliding glass doors on lower floors. Shutters are not credited in the code as protection against wind pressures. Shutters, if installed, just like all other building accessories, are required to be safely installed, and because they are exposed to wind forces, must also resist wind forces.

Many building owners feel that strong shutters are protection against high wind pressures. There have been many cases of failed sliding glass doors behind closed shutters. The shutters did not prevent high pressures. Shutters do not strengthen windows.

The recent concerns about impact protection were caused by components of other buildings falling off and hitting your windows. The building codes require that all components of buildings stay attached during hurricanes. Since the 90s, new buildings have been more and more compliant with the code requirements. If you live above the sixth floor, there will be no debris coming at your windows during hurricanes. If you live facing the ocean, there will be no debris coming at your windows during hurricanes. The threat of flying debris is no longer significant. The real threat is the high pressures, and sometimes the pressures can be very high.

Existing sliding glass doors that are still in good condition can be significantly strengthened against high pressure winds by adding storm bars to the vertical frames and adding corner plates with new fasteners to all the movable panels. There is essentially no change in appearance. The cost for strengthening is minimal. Sliding glass doors typically have a life cycle of 35 to 40 years. Why wait ten more years before you get high strength sliding glass doors?

Terri Chalaire, PE, is an engineer with Chalaire and Associates, Inc., located in Palm Beach Gardens, FL.■