

http://www.floridadisaster.org/brm/rcmp/hrg/content/openings/debris_impact_standards.asp

- Florida Building Code: TAS 201 Large and Small Missile Test Standards, TAS 202 Uniform Structural Load Standards, and TAS 203 Uniform Cyclic Pressure Test Standards. These are the Test Standards required for a Miami-Dade Product Approval. A product with a NOA (Notice of Acceptance) is approved for use in Miami-Dade and Broward counties if it meets the requirements of these test standards.
- ASTM E 1886 Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials, and, ASTM E 1996 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes. These are the Test Standards required for Product Approval in the rest of Florida and in International Building Code for use in Windborne Debris Regions for the US, Hawaii, and Caribbean Islands.
- SBCCI Test Standard for Determining Impact Resistance From Windborne Debris SSTD-12-97 (Note: This Test Standard will no longer be accepted beginning January 1, 2008)

Standards for Impact Protection

Shutter and Awning systems have been in use for over 200 years. They can be designed to provide protection from wind and water, increase security, block solar heat from the sun, increase privacy, and some are designed purely decorative use.

Here we focus on their impact resistance and the test standards that have been developed in the last 20 years to assess their ability to provide protection from windborne debris. Shutter systems may also provide some additional protection from water damage. However, this is not their primary purpose nor are they tested in any way to determine a specific level of water penetration protection. Impact resistant shutter systems are designed to protect the openings in a house from the type of failure that will lead to a huge increase in internal pressure in the house and reduce the likelihood of hurricane propelled flying debris from entering through the openings.

All houses leak air around windows and doors, and a myriad of other gaps and cracks. Since the roof and three of the four walls typically see negative or outward acting pressures as the wind blows at and around a house, normal leakage results in the internal pressure being slightly negative, which would tend to help hold the roof down and the side and back walls from being

pulled outward. If an opening is created on the windward side of the house that is large enough to allow enough wind flow into the house to overcome the leaks through all of the other walls and roof (attic), then the pressure that would have occurred at that opening builds up in the house, much like someone blowing up a balloon. That pressure buildup works to try and push the roof up and the side and back walls outward, in the same direction as the forces caused by the wind blowing around the house. In some cases, this internal pressure can double the uplift on the roof or the outward forces on the side and rear walls. Research has shown that the internal pressure begins to build up when the opening on the windward face reaches about 1% of the area of the wall and the internal pressure completely follows the pressure that would have occurred at the opening when the area of the opening reaches about 4% of the area of the wall. By protecting the openings from the kind of failure that can lead to internal pressurization and the reduction in the chances of debris entering your house, shutters significantly decrease the chances that the house will be pulled and pushed apart by the wind and they provide increased safety for occupants sheltered inside. This is the primary function of an impact resistant shutter system. The impact resistant testing standards are designed to establish the shutter's ability to meet the minimum level of protection as defined in building codes for Windborne Debris Areas of the country.

National model building codes, such as the International Residential Code, define the Windborne Debris Areas as areas in hurricane prone regions where the design wind speed is greater than or equal to 120 mph and areas within 1 mile of the coast in hurricane prone regions where the design wind speed is greater than or equal to 110 mph. These design wind speeds and the resulting map for Florida (see [Understanding The Risks](#)) are defined as 3-second gust wind speeds occurring at a height of 33 feet (10 meters) above the ground at an open location like an airport.

Impact rated residential doors and windows or the protective systems for doors and windows are tested to determine their ability to resist the impact of large wind borne debris (missiles) by shooting 2x4s of specified lengths and weights against them at specific speeds. Several different groups have developed engineering standards that establish missile sizes, test methods and acceptance criteria for the tests. For houses, the typical large missile test consists of a 9-pound 2x4 piece of lumber impacting the shutter or product end on at 34 mph.



Video: 1/4"
Polycarbonate Shutter
Impact Test
(click image to view video)

The referenced standards for opening protection in hurricane windborne debris area are:

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There is a fundamental difference in the acceptance criteria for impact rated windows and doors and storm shutter performance between the Miami-Dade County Standard (Florida Building Code High Velocity Hurricane Zone test standard - HVHZ) and those of other organizations. The Miami-Dade County Standard does not allow the test missile (9-pound 2x4 at 34 mph) to penetrate the unit or protective system and does not allow it to

break the glass behind the protective system. The other standards allow the test missile to penetrate the protective system provided the opening does not increase in size as it is subjected to wind pressures and so long as after all the testing is completed, the hole is small enough so that a 3-inch diameter sphere will not pass through the hole. The focus of these alternative test standards is to prevent pressurization of the home and reduce the chances of additional pressure related failures of the home. The Miami-Dade County Standard targets protection of the window behind the protective system. Consequently, a protective system that meets the Miami-Dade Standard and is installed according to their product approval requirements will provide the highest level of protection available in a commercial product. An exception is impact resistant glass, where all of the standards including the Miami-Dade County Standard allow the glass to be broken, but not penetrated.

Commercially produced products that pass one or more of these standards should have a certificate or label that identifies which standard(s) it has passed. These are usually listed by the test standard number such as SSTD-12, TAS-201 (or PA-201), ASTM E 1886, etc. Note that products that pass the Miami-Dade County test standard will pass the other test standards; but, products that pass the other test standards will not necessarily pass the Miami-Dade County test standard.

In layman's terms these are the required test standards for determining the compliance of an impact resistant system or impact resistant window for use as a protective system. All three Test Standards require that the system survive missile impact and more importantly cyclic pressure loading. The Cyclic Pressure Test subjects specimen to impact and, after impact, to about four hours or more of positive and negative pressure cycles (9000 cycles). This works the system back and forth testing its ability to resist fatigue and the fastener systems to keep it attached. This simulates the forces a hurricane will generate on the system and its connections to the structure of the building. Note that some manufacturers may talk about meeting or passing the large missile test but unless their products also withstand the cyclic pressure tests they have not qualified the product as a large missile resistant system.



Video: Shutter Cyclic Vacuum Test

(click image to view video)

Finally, don't be deceived by advertising and brochures, all

shutters are not necessarily hurricane resistant. Impact resistant shutters only became available around 1996 and were not widely used until 2002. There are still systems on the market today that are not impact resistant, these are either older systems that are still around for decorative use, or, new emerging systems being offered by small or local companies that are untested and do not have any product approval, these systems are not allowed to be used for hurricane impact protection under the Florida Building Code because they fail to meet the standards for product approval.

[Back to Main Openings Page](#)

Department of Emergency Management

Windstorm Insurance Incentives

2555 Shumard Oak Boulevard

Tallahassee, Florida 32399-2100

Voice: (850) 413-9816

[Feedback](#)

Openings

Openings (Windows and Doors)

Protecting windows and doors (including sliding glass doors and garage doors) from windborne debris is an important part of protecting your home, your belongings, **and your roof** in a hurricane. Your home is particularly vulnerable to having unprotected windows being broken by windborne debris if:

- The design wind speed for your area is 130 mph or greater regardless of tree cover or your surroundings
- The design wind speed for your area is 120 mph or greater and you live in an area with moderate tree cover
- You live in a neighborhood with few trees and the design wind speed



Tiles from surrounding roofs banded up these shutters

(click image for larger version)

- for your area is 110 mph or greater
- Vulnerability goes up significantly if you have a tile roof or if one or more of your neighbors has a tile roof, a flat roof with gravel ballast or, old shingles that are starting to curl

Also, if your home is an older home or was built in an area where they have not been following a modern high-wind building code, you may not have hurricane clips or straps holding your roof structure to your walls. If that is the case, window and door protection may make the critical difference between losing your roof and keeping it on. If a large window or door is broken open on the wall facing into the wind, the overall uplift forces that are trying to lift the roof off your house may be doubled. Research has shown that protecting the windows and doors can raise the wind speed required to lift your roof off your house by one to two hurricane intensity categories. In other words, if it is likely that the roof of your home would lift off during a Category 2 hurricane if a large window broke open on the windward side of your house, it might take a Category 3 or possibly even a Category 4 storm to lift the roof off if all of the windows and doors are protected.

Installing shutters over windows and doors can protect them from the impacts of windborne debris and can keep wind pressures from building up in your house to the point where it significantly increases the uplift forces on the roof. However, it probably won't keep the doors and windows from bursting open from wind pressure if they are weak or poorly anchored to the walls of the house.

Joe Lstiburek of Building Science Corporation likes to point out that there are only two types of windows and doors, "Those that leak and those that are going to leak." This comment actually contains a tremendous amount of truth since the test standards for water intrusion are set at a very small fraction of the design pressure for the window or door. A realistic example is that if the window or door you have in your home is rated for 50 pounds per square foot of wind pressure (a pressure you might expect from a storm with wind gusts approaching 140 mph) it only has to resist a pressure of 7.5 pounds per square foot without leaking (a pressure that might occur when wind gusts reach about 55 mph) to pass the water intrusion test standard. Since windows and doors are going to leak, he makes the point that the key is to minimize or manage the water intrusion. Keeping water from being driven against and building up on windows and doors is one way to try and minimize the water intrusion during a hurricane. Fixed glass window systems (windows that are not operable) with impact resistant glass that is mounted into the frames with structural adhesives is another approach.

Before we move on to methods for protecting windows and doors, it is important to address a couple of common misconceptions about ways to protect windows.

Tape: We often see windows with masking tape, duct tape, or any other type of tape placed across the glass and are asked whether this will provide protection against storm debris - the unequivocal answer is **NO**. Hurricanes are devastating forces of nature and more substantial protection than tape is required to withstand their wrath.



(click image for larger version)

Window Film: Some homeowners have considered window film as an alternative to other window protection systems. The most common method of installing window film is known as "daylight installation." The process involves pre-cutting the adhesive-backed film to a size slightly larger than the windowpane to which it will be applied. Then, at the time of installation, the film is trimmed back to the size of the windowpane. This type of installation does nothing to keep the window attached to the frame, so it provides very little or no additional protection from winds and rain entering your house.



This window was impacted by a light weight missile at enough speed to just crack the glass but not high enough to knock the glass out of the frame. The missile weighed less than 1 pound and was traveling at less than 20 mph (much much less of an impact than

One of the most common types of window film is known as "safety film." This type of film should never be less than 4 mils in thickness. Typically, safety film products meet the same break-safe requirements as tempered safety glass. This means that the safety film should hold the glass shards together, thus preventing a potential hazard from sharp, broken glass. Safety film may also

any of the standard missiles used for certifying window protection against large missile impacts). Raising the missile speed a couple of miles per hour completely knocked a similar pane out of the window frame. Note that the window film does keep the shards of glass together.

(click image for larger version)

offer a degree of protection in the case of high winds, particularly if it is well anchored to the window frame using a method that has been shown to keep the film in place after the window is broken. Window film installations with proper anchorage tend to be quite expensive compared to the "daylight installation" and usually have only been proven for commercial applications where the frames are more substantial than those typically found in residences. Some products have passed the small missile test standard when applied to Commercial Windows glazed with 3/16 tempered glass and the film is adhered or mechanically fastened to the window frame, but we are not aware of any systems that have passed the large (9 lb lumber) missile impact at 34 mph. Experts and the building codes do not consider window film to be an adequate protection for windows of homes in hurricane-prone areas.

The link listed below is to the International Window Film Associations website, this will take you to a letter they prepared for the Florida Attorney General's office concerning dealers selling window film to Florida residents for use as a hurricane protection product.

[IWFA Letter to Florida State Attorneys](#)

What You Should Do: As a homeowner in a hurricane-prone area, you should always purchase a product or system that has been tested and certified as passing one of the large missile (i.e. 9-lb 2x4 wood member striking end on at a specified impact speed) impact-resistant standards. See [Local and National Standards](#) to get more information on the various test standards and performance requirements. In Florida you can determine if the product has been tested and certified by looking at the label on the product or by looking it up on the Florida Department of Community Affairs product approval website.

[Florida Department of Community Affairs Product Approval](#)

For Miami/Dade and Broward County approvals you can look it up on their product approval web site.

[Miami-Dade County Building Code Compliance Product Search](#)



Manufacturer Members of the International Hurricane Protection Association, a Not-for-Profit trade association, have all submitted for independent testing and engineering. Member Manufacturers produce products that have the necessary Texas Department of Insurance, Miami-Dade and/or Florida Building Code approvals for use in Florida and Texas. This is important because buying an unapproved system means you will not be eligible for Windstorm Insurance Discounts, and the strength or reliability of the system will likely be unknown. It is possible to waste your investment in a protection system or on a product that is substandard or virtually worthless. Look for the IHPA logo at dealers and manufacturer's websites this will help identify systems that are Florida Building Code and International Building Code compliant.

The best way to protect your existing windows and doors from damage in hurricanes is to install tested and approved impact-resistant shutters over **all** windows and glass doors. Not only do they protect doors and windows from most common wind-borne objects, but they can reduce the chances of damage caused by pressurization of your home if a window or door is broken.

The easiest retrofits are typically those that simply cover the opening with an approved structural panel. In addition to [Commercial Products](#) that are professionally installed, there are a wide variety of [Do-it-Yourself Options](#), some of which will qualify for Windstorm Insurance Discounts and some that may not qualify. **Note that insurance companies will not give a Windstorm Insurance Discount unless all openings are protected by an approved product.**

You can find out more about windborne debris protection options by clicking on the links below. The information has been organized according to the type of "opening" you are trying to protect. A matrix that summarizes protection options has been prepared and can be viewed or printed. See the link below.

[HRG_Shutter_Matix.pdf](#)

Protecting				Windows
Protecting		Entry		Doors
Protecting	Sliding		Glass	Doors
Protecting Garage Doors				

Tallahassee, Florida 32399-2100
Voice: (850) 413-9816

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