



Home

Roofs

Openings

Features & Equip.

Leaks

Structural

Survey & Decisions

[Home](#) > [Openings](#) > Standards for Impact Protection

[PDF Version](#) [Questions](#)

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:

- 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)

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](#)

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