

## WATER INFILTRATION DURING SEVERE STORMS

The most recent hurricanes of 2005 created situations where windows and doors were taxed beyond their capabilities. It is important we all understand why.

In 1992, Hurricane Andrew devastated south Florida. The aftermath of Andrew was the first time that engineers and architects assessed hurricane damage to determine the causes of window and door failures and to understand what could be done to lessen catastrophic damage in future hurricanes. It became evident that window and door failures resulting from both wind and impacting debris were a leading cause of major structural failures. Building codes were then developed to address both anchorage requirements (to keep the windows and doors from being blown out of their openings) and wind-borne debris. Now that windows and doors are staying in the openings the issue has changed from catastrophic failures to water infiltration.

**All** products are tested and comply with current industry standards and code requirements. These standards and requirements equate to conditions, events and environmental circumstances that the product will typically encounter during its life. Simply put, windows and doors were not designed to be leak proof. Rather, windows and doors were designed to repel and disperse water under defined performance conditions, as required by building codes and industry standards. As with other building components, the forces imposed on windows and doors by extraordinary events such as hurricanes can exceed their ability to keep out water.

Here is a list of myths and facts that may be helpful:

**Myth:** There are window and door products that are "hurricane proof."

**Fact:** Impact resistant products are designed, tested and built to withstand certain conditions to provide reasonable storm protection. It is unsafe when at risk to consider any product "hurricane proof."

**Myth:** Impact resistant glass will not break.

**Fact:** It can break if struck or damaged but is designed to remain in the opening to help protect the structure from collapse due to winds, pressure and other factors.

**Myth:** Windows and doors will not leak in a hurricane.

**Fact:** Increasing wind speed, duration, direction, rain volume and other natural phenomena that accompany any storm can combine to increase the possibility that leaks may occur.

As with Hurricane Andrew, the industry is reacting as quickly as possible to resolve newly found problems. The Florida Building Commission has just established the Hurricane Advisory Committee to address these new water intrusion issues.

The Institute for Business and Home Safety (IBHS) recommends that if an owner sustains damages as a result of extreme weather conditions, the owner should file a claim with his or her insurance carrier to ensure proper handling.

The swift and innovative responses to these events have resulted in far less catastrophic property damage and personal loss. This is a testament to all in the industry who work to improve the quality of building and public safety.



## **Storm-Driven Rain Penetration of Windows and Doors**

### **Purpose of this Document**

In the aftermath of tropical storms and hurricanes, questions have been raised by some residents who experienced wind-driven rain leaking through or around their windows and doors that otherwise remained unbroken and structurally intact during these extraordinary events. AAMA has chosen to publish this document in order to provide information to homeowners, distributors, and builders as well as code officials regarding water penetration during severe wind-driven rain storms.

### **Actual source of water entry**

Rain driven by high winds may enter the wall cavity of a home or building at any number of points, some well above the location at which it appears, such as the attic or roof, soffit or wall penetrations such as exhaust fans. Running down the inside of the wall, it may exit the wall around the rough opening at a window or door.

### **Installation**

Even though the window was properly anchored for structural integrity, it may leak if not correctly flashed and sealed. Windows and doors that are not installed plumb, square, and in plane will not close properly. This leaves gaps which, though very small, are sufficient to admit rain when driven by storm-force winds.

### **Maintenance**

The age of the window or door, condition of seals and weatherstripping, and other maintenance matters such as clogged drainage/weep holes, can contribute to leaks appearing during wind-driven rain conditions. All windows and doors should be regularly inspected for damage or wear, and repaired as needed.

### **Ratings**

Windows and doors are usually selected for their structural performance characteristics based on local or State building code requirements. The primary consideration is structural integrity of the window or door, to keep it intact and prevent the pressure of high-velocity wind from entering the building and causing catastrophic structural damage. In tropical storms and hurricane wind-driven rain conditions the product selected to meet the state and local code requirements may still experience water leakage because these extraordinary conditions exceed the rated/code requirements for water penetration. The tables on the back of this page provide information to help understand how extreme environmental conditions may cause water leakage.

**TABLE 1**  
**Water Test Pressure Equivalent Wind Velocities**  
**for Windows Tested to the Nationally-Recognized Standard <sup>1</sup>**

Design Pressure Rating	Water Test Pressure <sup>2</sup>	Approximate Wind Speed Equivalent to Water Test Pressure <sup>3</sup>
15 psf	2.86 psf	33 mph
20 psf	3.00 psf	34 mph
25 psf	3.75 psf	38 mph
30 psf	4.50 psf	42 mph
35 psf	5.25 psf	45 mph
40 psf	6.00 psf	49 mph
45 psf	6.75 psf	51 mph
50 psf	7.50 psf	54 mph
55 psf	8.25 psf	57 mph
60 psf	9.00 psf	59 mph
65 psf	9.75 psf	62 mph
70 psf	10.50 psf	64 mph
75 psf	11.25 psf	66 mph
80 psf	12.00 psf	68 mph
85 psf	12.75 psf <sup>4</sup>	71 mph
90 psf	13.50 psf <sup>4</sup>	73 mph
95 psf	14.25 psf <sup>4</sup>	75 mph <sup>5</sup>
100 psf	15.00 psf <sup>4</sup>	77 mph <sup>5</sup>

<sup>1</sup> 2003 International Residential Code® for One- and Two-Family Dwellings

<sup>2</sup> Applies to R, LC, C, and HC performance class windows & doors (15% of design pressure; minimum 2.86 psf; max 12 psf); AW performance class is tested for water penetration at 20% of design pressure.

<sup>3</sup> Pressure/Velocity conversions are based on a standard engineering equation; not to be used for code compliance.

<sup>4</sup> For comparison only; the national standard caps water test pressure at 12 psf

<sup>5</sup> This test exceeds the minimum Saffir-Simpson wind velocity for a category one hurricane

## Summary

Many window and door products are tested for water penetration resistance at wind pressures as shown in Table 1. When rain events are coupled with extraordinary wind speeds, it is not uncommon to experience water leakage through or around a window or a door. Water resistance performance of a window or door product is often affected by a variety of design parameters including operational or functional concerns, market or economic preferences, life safety and egress codes, or other physical limitations to water control capacity.