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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 [1]

Design Pressure Rating	Water Test Pressure [2]	Approximate Wind Speed Equivalent to Water Test Pressure [3]
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 [4]	71 mph
90 psf	13.50 psf [4]	73 mph
95 psf	14.25 psf [4]	75 mph [5]
100 psf	15.00 psf [4]	77 mph [5]

[1] 2003 International Residential Code® for One- and Two-Family Dwellings

[2] 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.

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

[4] For comparison only; the national standard caps water test pressure at 12 psf

[5] 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.

Released: November 28, 2005