

Guideline for Specifying Windstorm Products



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Guideline for Specifying Windstorm-Resistant Products

1 Introduction

Modern building design and construction science have evolved to a degree where ‘near-absolute’ protection can be achieved, providing occupants and contents safety from nature’s most severe windstorm events. In parallel to this evolution, building codes have advanced to provide both optional and mandatory requirements to ensure life safety and the protection of property from these destructive forces of nature.

This guide is intended to inform the reader about the methodology and criteria used for specification and selection of windstorm-resistant door opening assemblies for non-residential construction. In order to properly specify products for these applications, the user must understand multiple parameters including the type of threat – hurricane or tornado – the geographic area in which the building is located, and the design pressures as calculated by the structural engineer of record. It is important to note that buildings with multiple openings will often have different calculated design pressures for each opening, based on multiple factors as determined by ASCE 7. Once these parameters have been identified, a specification and product selection process can begin. The following sections provide an overview of the definitions and process for determining the design requirements associated with each threat.

2 Definitions

ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

Design Pressure – expressed in pounds-per-square-foot, the positive and negative wind loads to which a door opening assembly is subjected.

Enhanced Hurricane Protection Area (EHPA) – criteria within the FBC applicable to specific portions of K-12 and Florida college educational facilities in order to serve as public hurricane evacuation shelters.

Florida Building Code (FBC) – set of standards designed by the Florida Building Commission for the construction of buildings in the state of Florida.

High Velocity Hurricane Zone (HVHZ) – the geographic area of Broward and Dade counties.

ICC 500 – Standard for the Design and Construction of Storm Shelters.

International Building Code (IBC) – a model building code developed by the International Code Council (ICC) and adopted for use as a base code by most jurisdictions in the United States.

International Existing Building Code (IEBC) – a model code applicable to renovations and additions to existing buildings, developed by the International Code Council (ICC) and adopted for use by many jurisdictions in the United States.

Large Missile – a No. 2 or better Southern Yellow Pine or Douglas Fir 2 × 4 in. lumber having a mass of between 9 and 15 lbs.

Registered Design Professional – an individual registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

Risk Category – a categorization of buildings for determination of loads based on the risk associated with unacceptable performance of the building.

Small Missile – a solid steel ball having a mass of 0.07 oz with a 0.315 in nominal diameter.

Wind-Borne Debris Region – Areas within hurricane-prone regions located within 1 mile of the mean high water line where an Exposure D condition exists upwind at the waterline and the ultimate design wind speed is 130 mph or greater; or in areas where the ultimate design wind speed is 140 mph or greater.

Wind Speed Map – graphic depiction of wind velocity indicated by contour lines.

3 Wind-Borne Debris-Resistant Opening Protectives

The *Florida Building Code* is widely regarded as the most comprehensive document for addressing the unique performance characteristics of wind-borne debris-resistant construction for wind-borne debris regions and the High Velocity Hurricane Zone. The International Building Code additionally provides performance characteristics for wind-borne debris regions outside of Florida. These model codes classify building types by Risk Category I through IV, using wind speed maps for the categories.

In order to calculate the design pressure for a particular opening, the Registered Design Professional must first define the following variables as they pertain to the project:

1. Risk Category of the building
2. Applicable Wind Speed Map for the identified Risk Category
3. Geographic location of the building on the wind speed map and the wind speed associated with that location

Following the methodology of *ASCE 7*, these variables are utilized to calculate design pressures for each specific opening. The unique calculation also takes into account the opening's location relative to the height above grade-plane, the proximity to the corners of the building, exposure of the building to the surrounding terrain, as well as other attributes. The result of the calculation is a design pressure, expressed in both positive and negative values, in pounds-per-square foot.

Openings located in the wind-borne debris region also require a level of impact resistance. During testing, wind-borne debris is simulated by small or large missile impacts as described in the *Florida Building Code and International Building Code*. The determination of small versus large missile requirements is based on the elevation of the opening in the building envelope, relative to grade-plane. This test, when combined with the dynamic pressurized cycling of the assembly, will ensure the integrity of the opening so that it does not fail during a hurricane or other windstorm event and allow the building envelope to be breached.

Design pressures, missile impact requirements and the specific attributes (size, swing, and glazing) of an opening, most often found in a door schedule, provide the basis for the selection of wind-borne debris-resistant door opening assemblies.

4 Impact Protectives within Storm Shelters During Tornado, Hurricane, or Other Severe Windstorm

With the issuance of the ICC 500 Standard in 2008, a distinct standard explicitly written for the design and construction of storm shelters was available for the first time. This document sought to improve and further develop the concepts of protection against high winds, hurricanes, and tornadoes as first discussed in FEMA 320 and FEMA 361, for all parts of storm shelter design including residential and non-residential structures. Impact protective systems such as doors, are used within the storm shelter envelope to protect openings and provide needed access and egress.

Since the introduction of the ICC 500 Standard, it has been a referenced standard in the IBC and subsequently became a mandated requirement for protection of life against high winds, hurricanes, and tornadoes across the U.S.

ICC 500 was first included in the 2009 Edition of the IBC and was first mandated within the 2015 IBC for K-12 schools and critical emergency operation centers located in areas where the design wind speeds for tornadoes are designated at 250 mph. These facilities include 911 call stations, emergency operation centers, fire, rescue, ambulance and police stations as well as educational occupancies through grade 12 with occupant loads of 50 or greater. ICC 500 was also included in the 2018 Edition of the IEBC, relative to additions constructed for existing educational occupancies.

Impact protective systems are listed with a design tornado pressure, design wind pressure, or both. These pressures are calculated based upon the location of the structure and the maximum wind speeds shown in the design tornado speed and design wind speed map within ICC 500. The test standard requires an impact-protective assembly and the components within the assembly to be able to sustain a specified Design Pressure with a safety factor of 20%, as well as resist multiple impacts, while providing protection for the occupants inside. The missile impact details for various storm shelter constructions are listed below:

1. Fifteen pound 2x4 missile fired at a velocity up to one hundred miles per hour for tornado and combination tornado/hurricane shelters
2. Nine pound 2x4 missile fired at a velocity up to ½ the design wind speed

ICC 500 evaluates protective assemblies such as swinging shutters or doors with frames, latching

hardware and all other assembly components. The Registered Design Professional must determine key parameters for the project such as:

1. design pressure
2. opening size
3. occupant load and egress requirements
4. swing direction
5. geographic location of building

These factors will allow someone to properly specify and select compliant openings. Since these impact protective assemblies are a product of many components working together, substitution of other types of hardware or any materials is not permitted without additional testing or evaluation being completed by the listing agency. Even the smallest change can have significant consequences to the performance of an assembly in a severe weather event.

5 Summary

Tornado and hurricane-resistant opening protectives, often required by the building code, are complex pieces of the overall building envelope. To ensure their proper function, it is essential that they be specified correctly and installed per the manufacturers' listing and installation instructions.

This guideline is provided by the Steel Door Institute to assist the reader in doing so.

6 Disclaimer

This guideline is intended to provide general information and should not be used as a substitute for the role of a Registered Design Professional.

7 Additional Resources

American Society of Civil Engineers,
www.asce.org

Florida Building Commission,
www.floridabuilding.org

International Code Council,
www.iccsafe.org

Intertek Directory of Building Products
bpdirectory.intertek.com

Steel Door Institute,
www.steeldoor.org

Texas Department of Insurance
www.tdi.texas.gov

Underwriters Laboratories Directory,
www.ul.com/ul-databases-and-directories

AVAILABLE PUBLICATIONS

Specifications

- ANSI/SDI A250.6** Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
- ANSI/SDI A250.8** Specifications for Standard Steel Doors and Frames (SDI-100)
- ANSI/SDI A250.14** Hardware Preparation in Steel Doors and Steel Frames
- SDI-108** Recommended Selection & Usage Guide for Standard Steel Doors
- SDI-118** Basic Fire Door, Fire Door Frame, Transom/Sidelight Frame, and Window Frame Requirements
- SDI-128** Guidelines for Acoustical Performance of Standard Steel Doors and Frames
- SDI-129** Hinge and Strike Spacing
- SDI-133** Guideline for Specifying Steel Doors & Frames for Blast Resistance
- SDI-136** Guideline for Specifying Windstorm Products

Test Procedures

- ANSI/SDI A250.3** Test Procedure & Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames
- ANSI/SDI A250.4** Test Procedure & Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors
- ANSI/SDI A250.10** Test Procedure & Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
- ANSI/SDI A250.13** Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies for Protection of Building Envelopes (Not applicable for FEMA 320/361 or ICC-500 Shelters)
- SDI-113** Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door and Frame Assemblies
- SDI-131** Accelerated Physical Endurance Test Procedure for Steel Doors

Construction Details

- ANSI/SDI A250.11** Recommended Erection Instructions for Steel Frames
- SDI-110** Standard Steel Doors & Frames for Modular Masonry Construction
- SDI-111** Recommended Details for Standard Steel Doors, Frames, Accessories and Related Components
- SDI-122** Installation Troubleshooting Guide for Standard Steel Doors & Frames

Miscellaneous Documents

- SDI-112** Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames
- SDI-117** Manufacturing Tolerances for Standard Steel Doors and Frames
- SDI-124** Maintenance of Standard Steel Doors & Frames
- SDI-127** Industry Alert Series (A-L)
- SDI-130** Electronic Hinge Preparations
- SDI-134** Glossary of Terms for Hollow Metal Doors and Frames
- SDI-135** Guidelines to Measure for Replacement Doors in Existing Frame Openings

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