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Windload Fact Sheet

Wind Velocity

The correlation between dynamic wind speed and static equivalent pressure is formulaic in nature. Dynamic wind speeds at various locations in the United States are determined from wind speed maps in the ASCE/ SEI 7 document. These wind speed maps are based on the historical weather data and provide the maximum expected 3 second wind gust speed. ASCE/ SEI 7 also details a calculation procedure for determining the required design pressure (also known as the wind load or DP) for a specific building opening application. In addition to wind speed, this process applies various factors for application details including the building use, the surrounding terrain, the building height and dimensions, the size and location of openings in the building, Importance and Safety factors, etc. It is important to note that this process is application specific – the required design pressure is not merely a conversion of wind speed using the previously indicated equations – it is dependent on many other factors.

Wind Speed Conversion (MPH)

DP	10	15	18	22	26	30	35	40	45	50	55	62
V_{asd}	63	78	85	93	101	108	116	124	132	139	147	155
V_{ult}	81	100	110	120	130	140	150	160	170	180	190	200

These values are calculated from the Ensewiler Formula, $P = 0.00256 \times V^2$, where V = Wind Velocity in MPH and P = the Differential Pressure across the window in Pounds per Square Foot (PSF). The equation assumes the direction of wind is perpendicular to the window and there are no effects from surrounding terrain or the shape of the building in which it is installed. Positive (+) pressures act inward and Negative (-) pressures act outward on the window. Ie: if the wind speed is 70 mph, the wind pressure is $0.00256 \times 70^2 = 12.5$ psf.

V = Velocity (MPH)
DP = **Design Pressure** (ASTM E330) $DP = 0.00256 \times V^2$
V_{asd} = Nominal design wind speed: $V_{asd} = \sqrt{DP / 0.00256}$ or $V_{asd} = V_{ult}\sqrt{0.6}$
V_{ult} = Ultimate design wind speed: $V_{ult} = V_{asd} / \sqrt{0.6}$

Design Classification (All products may not meet all criteria for a full Design Classification)

Air Infiltration: ASTM E283

	Equivalent Wind Velocity in MPH
1.57psf (0.30 scfm/ft2) - STD	25
6.24psf (1.20 scfm/ft2) - HIGH	50

Water Penetration: ASTM E547

Water Pressure = DP (psf) x 15%
5gal/hr or 8" in one hour. (4, five minute cycles)

Allowable Stress Design vs. Ultimate Wind Design

DP is calculated to account for the short duration (3 second gust) peak loads and is the universal term for describing how much pressure a window can withstand under severe weather conditions. Door and Window Design Pressure (DP) is based on V_{asd} and are based on ASTM E330 (Uniform Load Deflection) at Design Pressure and at 150% of Design Pressure.

ASD is based on known material properties such as yield strength and tensile strength and utilizes a percentage of the known strength to limit bending stress, tensile stress, shear stress, etc.

USD – used for (V_{ult}) "Ultimate Wind Speeds" known as Load and Resistance Factor Design (LRFD) in the world of concrete design – is based on the known failure point of a material (i.e., ultimate yield strength or tensile strength subject to a safety factor of 0.9 or more).

in ASCE/SEI 7-10, the design wind speeds are higher than in previous editions. The change is to provide for "Ultimate Wind Speeds" and is directly applicable for determining design wind pressures utilizing the USD approach. While the fenestration industry has always used the ASD approach, the current and future FBC (and the 2012 IBC on which it is based) will utilize ultimate wind speeds.

ASD and USD cannot be intermixed. However, USD values can effectively be converted to ASD values by applying the 0.6 multiplier.

Table 1: When the 0.6 modifier is to be used, and when it is not

Applicable Code Edition	Design Wind Speed Model	Apply 0.6 Modifier
2009 IBC	Allowable Stress Design	No
2009 IRC	Allowable Stress Design	No
2012 IBC	Stress Design	Yes
2012 IRC	Allowable Stress Design	No
2015 IBC	Stress Design	Yes
2015 IRC	Stress Design	Yes