# Understanding Wind Uplift Ratings

First, let's define 'wind uplift'. Roof damage caused by wind occurs when the air pressure below the roofing assembly is greater than the air pressure above the building's roof. As wind flows over the building, the pressure directly above the roof surface decreases. At the same time, internal air pressure increases due to air infiltration through openings, cracks, etc. The result is a net upward force on the roofing system. This force is referred to as wind uplift.

## Maximum Design Pressure: Roof System Pounds per Square Foot (PSF) Rating

Maximum design pressure (MDP) is a performance specification that expresses how strong a roof system (roof material attached to underlying roof sheathing) is secured to the underlying structural roof framing members when wind uplift forces are applied to the roof system. In a test lab, a roof system is built and tested to failure when subjected to carefully measured wind uplift force to the point of roof system failure – the PSF force measured and recorded at the immediate point of failure. Other portions of the building code deal with a building's structural framing requirements needed to secure the roof system assembly to the building frame structure.

## Wind Uplift Lab Test Criteria

**DECRA Metal Roofing** conducts wind uplift lab tests per **UL 1897** test standard to meet compliance for most U.S. code jurisdictions abiding by either the International Residential Code (IRC) or the International Building Code (IBC) standards. For the most severe wind exposure market, the State of Florida, DECRA conducts lab test **TAS 125**, a test standard prescribed to meet Florida Building Code and Miami-Dade County building code wind resistance requirements.

**UL 1897** applies a wind uplift force to the test roof system, incrementally increasing the wind PSF force to a set exposure time frame, and records the PSF force achieved the moment when the roof system exhibits uplift failure – usually an incident where the roof system fasteners pull loose from its attachment to the underlying roof sheathing.

**TAS 125** applies "cycling" wind forces to the test roof system – a combination of cycle-timed positive and negative wind pressures in a sealed test chamber. These cycling wind pressures are prescribed in the **UL 580** – Class 90 test standard and are conducted over a specific period of time and cycle count. Then, once the wind pressure cycle testing is completed, the test roof system is then subjected to successively increased PSF

wind uplift pressures to the point of roof attachment failure. Final achieved PSF roof uplift pressure, at point of failure, is recorded. These series of roof system tests continue throughout the lab test period, testing various fastener installation configurations, number of fasteners used per panel, and fastener size variables, to record point-of-failure PSF forces incurred.

## Lab Test Result 'Safety Factor' Calculation

DECRA submits wind uplift test results to various building code compliance agencies and code jurisdictions, including the ICC Evaluation Service (ICC-ES), Miami-Dade Building Code Compliance Offices' Product Control Division and the State of Florida Building Code offices for review, approval and incorporation into our DECRA published compliance reports. These various building code offices do not publish the actual achieved lab test results, but instead use "factored tested load capacity" of our roof test assemblies. In other words, they determine factored tested uplift load capacity by dividing the tested uplift point-of-failure value by a safety factor of 2. Thus, DECRA's reported PSF point-of-failure value is actually half of the test lab recorded actual point-of-failure PSF rating.

## Wind Uplift Factors When Considering a Roof System Installation

1. **Building Height**
   Higher roof areas will incur stronger wind velocity.

2. **Building Location**
   A building's location determines the wind speed used to determine the uplift loads. Wind maps are available for any region of the U.S. and Canada to identify the local basic wind speed gust exposures that can occur within the region. The wind maps are based on a 3-second peak gust measured at 33 feet above grade in an exposure condition that is referenced as "basic wind speed".

3. **Surrounding Terrain**
   The more obstructions there are around a building, the more they will break up the wind and assist in reducing the wind effect. Knowing if a building is in an urban/suburban area, an open-terrain area, or near a large body of water becomes important when considering a roof system install.

4. **Building Openings**
   With the more openings in a building, the greater the chance of internal pressures increasing in a wind event. It is important to know if the building is enclosed, partially enclosed, or open in its design configuration.

5. **Building Use**
   This factor is based on how important the building is to the surrounding infrastructure in terms of people's safety. An example would be comparing a school or hospital to a warehouse. In a natural disaster, one has to apply a different safety standard to where protection of a building's occupants is critical.

## Wind Force Test Procedures

DECRA prescribes to various wind force test procedures by testing roof system mock-ups in contracted independent labs. The lab test results provide PSF wind force values at the immediate point of system failure.

Those lab test results then submit to our contracted independent Professional Engineer (PE) evaluation team to confirm our achieved lab values.

They apply the test 'safety factor', and further determine the uplift pressures for each zone area of the roof system (as wind loads will vary for each of these roof zones):

- **Field**
- **Perimeter**
- **Corners**

Take note that the roof corners typically experience the highest uplift pressure. The roof zone area uplift pressure detail for all 3 roof zones is carefully documented in our DECRA Roof Systems Florida Building Code document addendum – FL 9759-R8 (DECRA.com > Professionals > Code Compliance > Code Compliance Sheet > Florida Building Code > Approval #9759-R8)

## Importance of the DECRA Roof Systems Fastener

DECRA sells a roof fastener specifically tested to provide performance values required to stand up to the rigors of wind resistance lab tests so that they meet actual market roof system installation requirements. Important fastener attributes include: withdrawal force, lateral shear force, corrosion resistance.

Please reference **DECRA Product Knowledge** document:
***DECRA FASTENERS: Design Features and Lab Test Protocol Validate Severe Environment Performance***

## PSF to MPH Conversion Chart

Use this table to convert positive and negative pressure to comparable basic wind speeds. Please be advised that wind speed is normally measured at ground level – wind speeds will almost always be greater at roof height.

For specific values not shown on the table, use these calculation formulas:

- If you know PSF and want to know MPH: Calculate the square roof of (PSF / .00256)
- If you know MPH and want to know PSF: square MPH and multiply by .00256

| PSF | MPH |
|---|---|
| 10.00 | 62.50 |
| 15.00 | 76.55 |
| 20.00 | 88.38 |
| 22.50 | 93.75 |
| 25.00 | 98.82 |
| 25.60 | 100.00 |
| 27.50 | 103.64 |
| 30.00 | 108.25 |

| PSF | MPH |
|---|---|
| 40.00 | 125.00 |
| 45.00 | 132.58 |
| 50.00 | 139.75 |
| 55.00 | 146.58 |
| 60.00 | 153.09 |
| 65.00 | 159.34 |
| 70.00 | 165.36 |
| 72.50 | 168.29 |

| PSF | MPH |
|---|---|
| 75.00 | 171.16 |
| 80.00 | 176.78 |
| 85.00 | 182.22 |
| 90.00 | 187.50 |
| 95.00 | 192.64 |
| 100.00 | 197.64 |
| 105.00 | 202.52 |
| 110.00 | 207.29 |

| PSF | MPH |
|---|---|
| 115.00 | 211.95 |
| 120.00 | 216.51 |
| 125.00 | 220.97 |
| 130.00 | 225.35 |
| 135.00 | 229.64 |
| 140.00 | 233.85 |
| 150.00 | 242.06 |
| 155.00 | 246.06 |

## Summary

When it comes to roofing, one of the most important attributes of roof system design is wind resistance. Wind uplift ratings are a critical safety metric for building and testing roof systems for superior wind performance. Wind uplift is a near constant force on roofs with wind movement from zero to over 170 mph. Although none of the systems devised are fool-proof, they can help you compare roofing construction and the probability of failure for each roof system you consider.

It's important to remember that building codes are the minimum requirements. Buildings can be, and often should be, designed to better-than-code requirements. The conservative approach to wind resistance design is to believe ***"not if – but when"*** a major wind storm event will be encountered virtually anywhere throughout the Americas.

DECRA's higher tensile strength steel specification, along with its roof system fastener specification and lab-test installation requirements help ensure that you are receiving an outstanding roof system with exceptional strength-to-installed-weight ratio – well exceeding numerous competitive choices offered in the asphalt and tile roof industry for steep-slope roofing applications.