Choosing Performance Tested Edge Systems

The roof is widely recognized as one of the most vulnerable parts of a building. Of the various components of a roof, the roof edge is the most critical because of the way in which wind acts on a building.

Commonly the roof edge receives little attention. It is considered simply an add-on accessory; however, careful selection of an appropriately tested edge is necessary to guard against the effects of potential wind damage.

In addition to longevity issues, a tested edge is required by building code in all states and US territories. This guide will walk you through the often confusing landscape of testing standards, code requirements and key issues related to choosing the appropriately performance tested roof edge for each project.

Industry Background:

SMACNA

The Sheet Metal & Air Conditioning Contractors Association (SMACNA) has long been involved in providing guidance on metal gauges, cleat gauge and fastener placement through its recommended details. It is important to note that they provide no performance numbers to match jobsite requirements.

The details are not tested to any performance standards and are a prescriptive standard, not a performance standard. SMACNA has tested some of their details, but that does not mean a contractor following them is within code compliance.

Industry Background:

NRCA

The National Roofing Contractors Association (NRCA) has also long been instrumental in providing guidance to roofing contractors and other design professionals.

The NRCA supplies details for edge metal terminations, but is not and has no plans to become a roof edge manufacturer.

The NRCA has created a sub-listing process that is offered to NRCA members, but only limited details and select gauges have been approved.

An explanation of the NRCA's program for listing sheet metal fabricators is found in Mark Graham's response to "Reader Clarifies FM Approval Information." The article explains the sub-listing process as follows:

1. Payment of fees to NRCA and FM and/or Intertek Testing Services (ITS) and execution of sublisting agreements
2. Payment of initial setup fee to NRCA and execution of a sublisting agreement
3. NRCA authorizes FM and/or ITS to begin their sublisting processes, which generally requires:
   - Payment of fees
   - Factory audit manual reports
   - Inspections of the sheet metal fabricator's shop
   - Execution of sublisting agreements
   - Use of FM and/or ITS labels on all listed edge metal flashings
   - Periodic follow-up inspections to ensure continued compliance

For a contractor to meet the FM guidelines and now the ES-1 requirement, they must achieve two things:

- Follow an approved design
- Be listed as an approved contractor by ITS and FM

Both items must be in place for a metal edge to actually meet the code.

Industry Background:

FM

Factory Mutual (FM) is formed of a conglomeration of insurance companies. In order to limit their exposure to loss, FM has developed testing standards for materials used on the properties they insure.

This standard became popular to use even on buildings that were not FM insured, simply because the roofing industry had no standard of its own.

Meeting the FM Loss Prevention data Bulletin 1-49 does not make the edge ANSI/SPRI/FM 4435/ ES-1 tested. FM testing should not be confused with ANSI/SPRI/FM 4435/ES-1 testing; they are two separate and unique testing methods. Specifiers should carefully list which testing requirement(s) are needed for each building project. Likewise, roofers should fully understand the different testing methodologies in order to supply the appropriate product for each project.

ANSI/SPRI/ FM 4435/ ES-1:

Overview

Key Players
The American National Standard Institute (ANSI) is a non-profit organization that does third party endorsements of performance testing processes and procedures.

The Single-Ply Roofing Industry (SPRI) is comprised of manufacturers and professionals in the single-ply roofing industry

From Idea to Code
The standard was canvased throughout the industry to develop consensus and followed the below steps on its way to becoming an international code:

1. Developed by SPRI
2. Approved by ANSI
3. Approved by ICC
4. Added to the IBC
5. Recognized by FM

ANSI/SPRI/ FM 4435/ ES-1:

2015 IBC

The 2015 version of the International Building Code (IBC) includes the requirement that roof edges be ANSI/SPRI/FM 4435/ES-1 tested:

> 2015 IBC § 1504.5: "Edge securement for low-slope roofs. Low-slope built-up, modified bitumen and singly ply roof systems metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, Re-2 and RE-3 of ANSI/SPRI/ FM 4435/ES-1, except Vult wind speed shall be determined from Figure 1609.3(1), 1609.3(2) or 1609.3(3) as applicable."

The IBC is in use and adopted by all 50 states and US territories.

The ES-1 document is called "ANSI/SPRI/FM 4435/ ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems," and it can be downloaded for free on SPRI's website (www.spri.org).

ANSI/SPRI/ FM 4435/ ES-1:

The Tests

The ANSI/SPRI/FM 4435/ES-1 standard is comprised of three pull-off tests: two tests for fascia and one test for coping. For complete details, please refer to the ANSI/SPRI/FM 4435/ES-1 standard document found on www.spri.org.

The tests use either a pull-release, pull-release method or a continuous pull method. It is also important to understand that the corner of a building receives the most wind uplift stress, and that stress will suddenly increase and decrease with wind gust strength.
The RE tests measure the following:

1. Ability of edge treatment to resist the pull of the roof material inwardly
2. Resistance of the edge to outward & upward forces which tend to blow or "peel" edge systems off

Roof Edge Test RE-1
- Calibration of the testing apparatus shall be performed annually
- Mount device and pull membrane at a 25 degree angle to the roof deck to simulate a billowing membrane
- Load at a rate of 2 in./min (50mm/min.) until failure occurs
- Failure is any event that allows the membrane to come free or the termination to come free
- Results of the test shall be stated in pounds/lineal foot and rounded down to the nearest pound/ lineal foot

Roof Edge Test RE-2
- Determines the maximum load at failure
- Failure is the loss of securement of any component of the roof edge system

Roof Edge Test RE-3
- Simultaneously tests the vertical and horizontal wind gust load coefficient
- Failure is loss of securement of any component of the roof edge system

ANSI/SPRI/ FM 4435/ ES-1:

5 Key Factors

The equation for calculating the design pressure is found in "ANSI/SPRI/FM4435/ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems." The roof edge design pressure, P, shall be calculated using the equation show below:

P = 2.0 × qfz × GCp × I Equation (1)
where:
P = Roof Edge Design Pressure, psf (kPa)
2.0 = Design (Safety) Factor
qfz = Field of roof pressure at height z in feet
GCp = External Pressure Coefficient from Table 2
I = Importance Factor

To determine the Roof Edge Design Pressure (P):

1. Building Height (z) from project plans and specifications

2. The Wind Speed (V) from Appendix C or the authority having jurisdiction

3. The applicable Exposure Category (B, C or D) by referring to Section 3.6 and project plans or specifications.

4. Field of Roof Pressure (qfz) in Tables A2-A4

5. The roof edge design Pressure (P) from the equation above by multiplying qfz by I and GCp. Choose the GCp value from Table 2 for either a horizontal force or vertical force, and for either a perimeter or corner region. The horizontal or vertical force pressure, P, can then be compared to edge system resistance.

Metal-Era

No area of the country is exempt from wind related roofing damage, and one of the leading causes of commercial roofing damage has proven to be improperly designed and installed edge details. Conservative estimates show that 75% of all wind-related roofing failures are attributed to insufficient or poorly-installed perimeter metals.

Metal-Era understands the importance of a performance tested roof edge and supports the quality assurance provided through ANSI/SPRI/FM 4435/ ES-1 design standards. The addition of this standard to the IBC as well as recognition and required testing by FM will further aid in protecting buildings from wind uplift forces, particularly in coastal areas and hurricane zones. As a result, Metal-Era has ES-1 tested its product lines.

Specify a Tested Edge
It is important to frequently check your local code requirements because additional states, counties and municipalities are in the process of adopting the IBC. Understandably, it can be difficult and sometimes confusing to keep track of each locality's requirements, so in order to avoid the risk of not meeting the code, specify ES-1 tested roof edges.

Online Wind Calculator
In order to help design professionals choose a product that has been tested to meet the specific design requirements of each project, Metal-Era has developed a Wind Design Calculator (www.metalera.com). The calculator allows users to enter basic project data to receive the design pressure needed and a list of appropriate Metal-Era products. The testing provides customers with the piece of mind that they are not liable for a building code violation.