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SPRI Wind Design Seminar

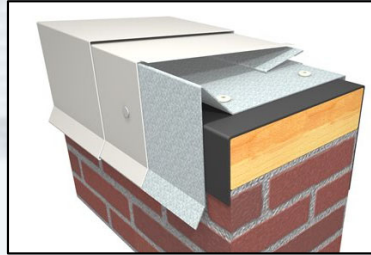
Perimeter Edge Metal Systems for Low-Slope Roofing



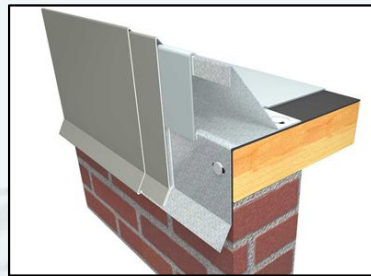
Perimeter Edge Metal Includes:



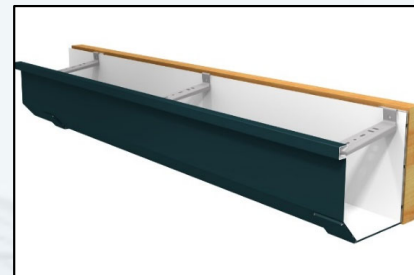
Photos courtesy of ATAS



Coping



Fascia



Gutter

Importance of Roof Perimeter



Photo courtesy of Roofing Contractor

A study of FM Global losses involving BUR systems showed 59% occurred because the roof perimeter failed

- FM Global
Approved Product
News No. 2, 2005

“The integrity of the perimeter flashing is a critical first line of defense against roof failure.”

- Phil Smith, FM Global

Key Findings from RICOWI Research

Published in October 2005 Issue of RCI



Photo courtesy of RICOWI

- Failure of roofing systems was because of system failure at the perimeter...
- The membrane attachment to the deck cannot resist the loads created when the perimeter securement fails...

SPRI Edge Standards Evolution

- **1998** **ANSI/SPRI ES-1**
 - Design and testing of low-slope perimeter edge metal, excluding gutters
- **2010** **ANSI/SPRI GD-1**
 - Design and testing of low slope gutters
- **2011** **ANSI/SPRI/FM 4435/ES-1**
 - Revision of ANSI/SPRI ES-1 incorporating components of FM 4435

SPRI Edge Standards Evolution

- **2016*** **ANSI/SPRI GT-1**
 - Test standard for gutters—low or steep slope
- **2017**** **ANSI/SPRI/FM 4435/ES-1**
 - Test standard for low-slope perimeter edge metal, excluding gutters
- **2019***** **ANSI/SPRI ED-1**
 - Design standard for all low-slope perimeter edge metal including gutter, fascia, and coping

* ANSI/SPRI GT-1 was updated in 2022 with editorial changes.

** ANSI/SPRI/FM 4435/ES-1 was updated in 2023 with minor changes.

*** ANSI/SPRI ED-1 is currently being updated with minor revisions

2006 and 2009 International Building Code Requires Testing per ES-1

1504.5 Edge Securement for Low Slope Roofs

Low slope membrane roof systems metal edge securement, except gutters, installed in accordance with Section 1507, shall be designed and installed for wind loads in accordance with Chapter 16 **and tested for resistance in accordance with ANSI/SPRI ES-1**, except the basic wind speed shall be determined from Figure 1609.

(Figure 1609 is a reference to the latest ASCE Wind Speed Map)

2012 IBC Is More Specific

1504.5 Edge Securement for Low Slope Roofs

Low slope **built-up, modified bitumen and single-ply** roof system 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 ES-1**, except V_{ult} wind speed shall be determined from Figure 1609A, 1609B or 1609C as applicable.

No Changes made in 2015. In 2018 the test reference was changed to ANSI/SPRI/FM 4435/ES-1

2021 IBC - It's About the Edge System

1504.6 Edge systems for low-slope roofs.

Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems having a slope less than 2 units vertical in 12 units horizontal (2:12), 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 ES-1, except basic design wind speed, V, shall be determined from Figures 1609.3(1) through 1609.3(12) as applicable.

2021 version clarifies that metal edge needs to be tested regardless as to whether it secures the roof system or not

Coping Wind Failure

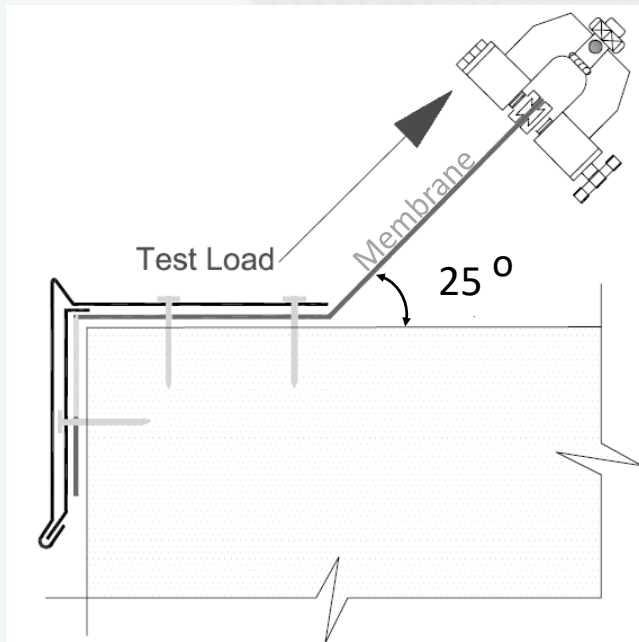


Edge Metal needs to remain attached in high winds even if it does not secure the roof



How to Test Edge Systems Using ANSI/SPRI/FM 4435/ES-1

TEST METHOD RE-1



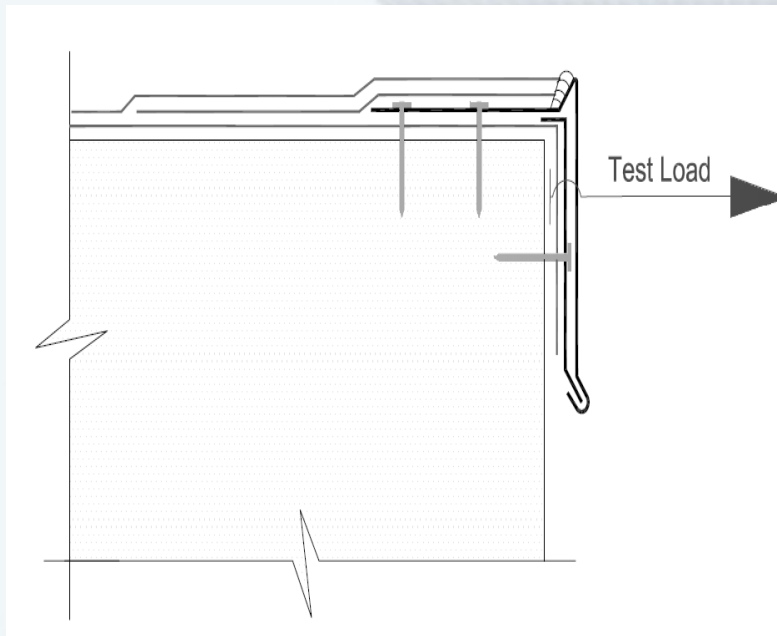
ANSI/SPRI/FM 4435/ES-1

- A minimum length mock-up of the termination system to include a minimum of 3 fasteners at standard
- 25-degree angle to the roof deck
- Test to Failure

Only required for Mechanically attached or Ballasted membrane when there is no “peel stop” or first row of fasteners is greater than 12” from the edge

TEST METHOD RE-2

ES-1 and 4435/ES-1



- All parts of the test specimen shall be full size in all dimensions
- Length as designed for field use (8' minimum)
- Cycled increasing loads until failure

ES-1 Test Protocols

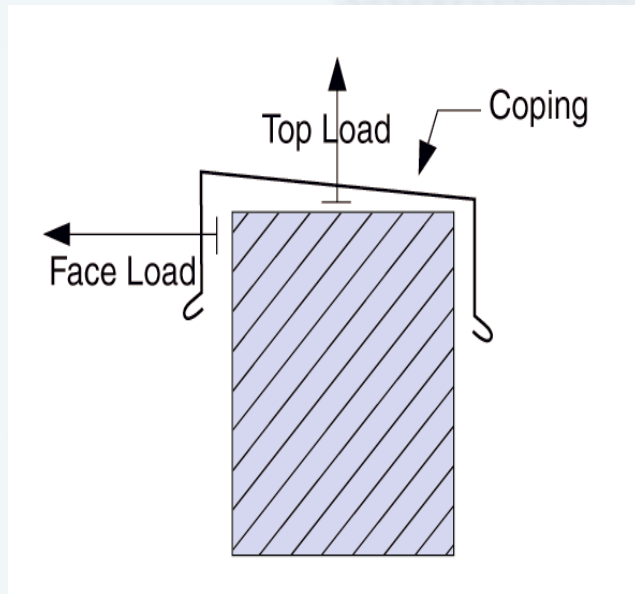


Photo courtesy of ATAS International

- RE-2 tests the outward pull (negative pressure) on the vertical face of an edge device

TEST METHOD RE-3

ES-1 and 4435/ES-1



- Bi-Directional test for coping caps - face and top loadings applied simultaneously
 - Ratio of load is 1.73 Vert. : 1.00 Horz.
- Cycled increasing loads until failure
- Repeated with loads on back and top

ES-1 Test Protocols



Photo courtesy of Hickman Edge Systems

- RE-3 tests upward and outward simultaneous pull on the horizontal top and vertical sides of a parapet coping cap

IBC Code Language Prior to 2021

1503.3 Coping.

Parapet walls shall be properly coped with noncombustible*, weatherproof materials of a width not less than the thickness of the parapet wall.

*metal, stone, tile are noncombustible...what about single-ply?

Coping Parapet Walls



Metal



Stone



Tile

Membrane Wrapping



IBC Code Language 2021 & 2023

1503.3 Parapet Walls.

Parapet walls shall be covered in accordance with Sections 1503.3.1 and 1503.3.2. The top surface of the parapet wall shall provide positive drainage.

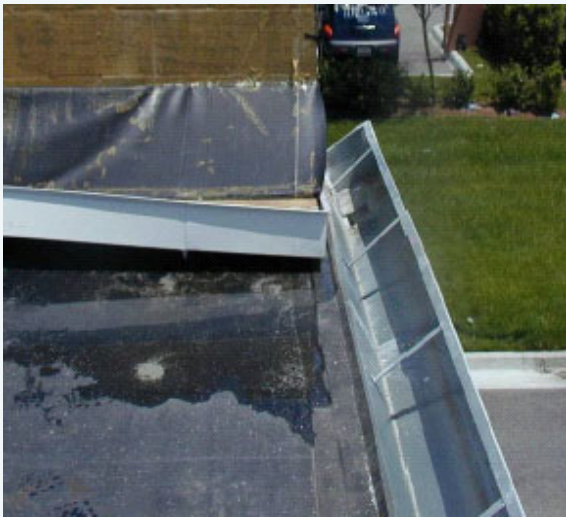
- 1503.3.1 Fire-resistance-rated parapet walls. Parapet walls required by section 705.11 shall be coped or covered with non-combustible, weatherproof materials of a width not less than the thickness of the parapet wall.
- 1503.3.2 Other parapet walls. Parapet walls meeting one of the exceptions in Section 705.11 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall.

This clarifies how to properly cope or cover the two different types of parapet wall types (those that must comply with Section 705.11 and those that do not).

ANSI/SPRI GT-1

Approved May 26, 2016 (reaffirmed July 8, 2022)

- *Test Standard for (External) Gutter Systems*



Testing Some Gutters per ANSI/SPRI GT-1 is a requirement of 2021 IBC

1504.5.1 Gutter securement for low-slope roofs.

External gutters that are **used to secure the edge of the roof membrane** on low-slope (less than 2:12 slope) built-up, modified bitumen, and single ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods **G-1 and G-2 of SPRI GT-1**

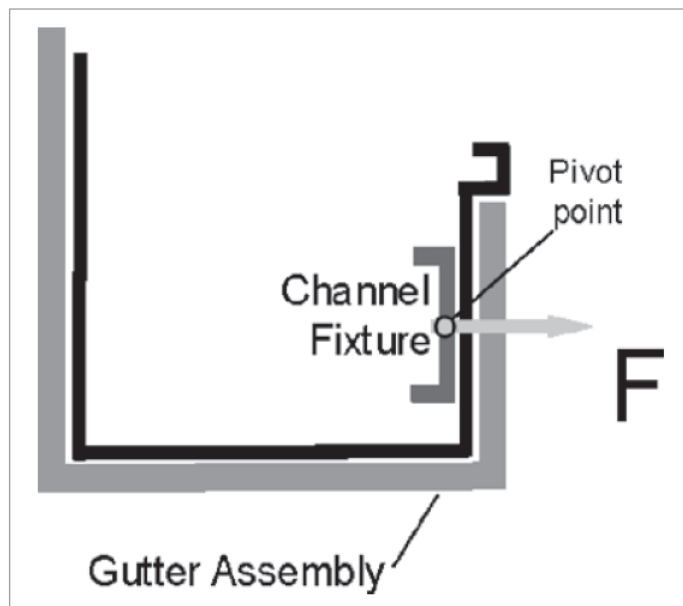


Photo Courtesy of Hickman Edge Systems and RICOWI

Test G-1

- Tests Gutter's resistance to horizontal negative pressure

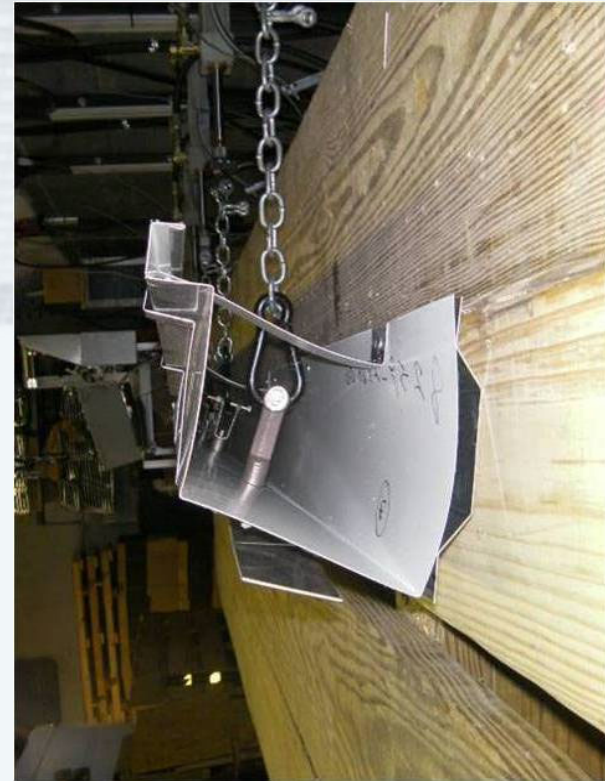
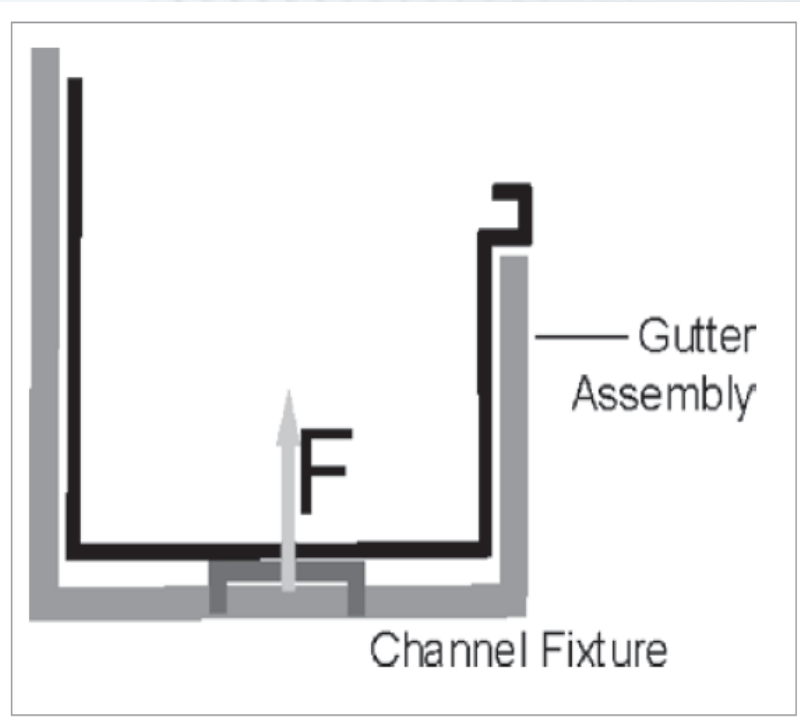
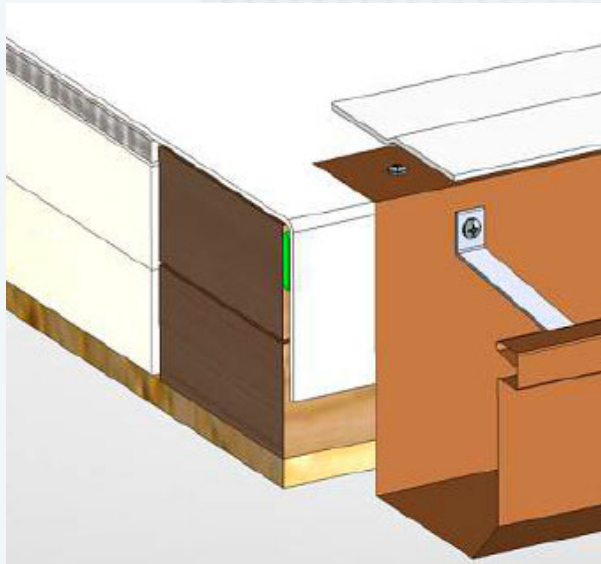


Photo Courtesy of Hickman
Edge Systems and RICOWI

Test G-2

- Tests gutter's resistance to vertical negative (or positive) pressure

“Gutters that are used to secure the perimeter edge of the roof membrane”?

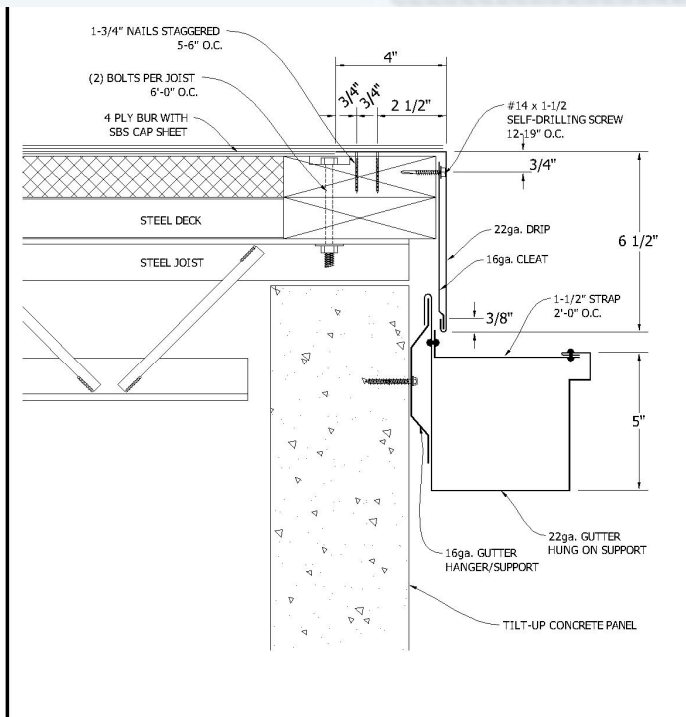


Gutter with a Roof Flange clearly secures the membrane; same as a drip edge or gravel stop.



Does the gutter secure the membrane or does the term bar? If the gutter lifts and pulls out the term bar the roof will no longer be secure.

“Gutters that are used to secure the perimeter edge of the roof membrane?”



The drip edge secured the membrane, but when the gutter lifted it caused the drip edge to fail and the roof was no longer secured.

Concern Addressed in IBC 2024

Attaching lighting protection (or anything) to edge metal systems can affect the system's performance.



Increasing the wind load, creating a leak point, limiting thermal movement, and inducing galvanic reaction are all potential issues

IBC 2024 Lightning Protection

- **1511.7.6.1 Installation on metal edge systems or gutters.** Lightning protection system components attached to ANSI/SPRI/FM 4435/ES-1 or ANSI/SPRI GT-1 tested metal edge systems or gutters **shall be installed** with compatible brackets, fasteners, or adhesives, **in accordance with the metal edge systems or gutter manufacturer's installation instructions**. When metal edge system or gutter manufacturer is unknown, installation shall be **as directed by a registered design professional**.
- **1511.7.6.2 Installation on roof coverings.** Lightning protection system components directly attached to or through the roof covering shall be installed in accordance with this chapter and the roof covering manufacturer's installation instructions. Flashing **shall be installed in accordance with the roof assembly manufacturer's installation instructions** and Sections 1503.2 and 1507 where the lightning protection system installation results in a penetration through the roof covering. When the roof covering manufacturer is unknown, installation shall be **as directed by a registered design professional**.

Solutions Exist...More are Needed



Membrane and Edge Metal manufacturers will need to provide solutions and installation instructions for mounting lightning protection on their systems



ANSI/SPRI ED-1

Approved 3, 2019

*Design Standard for Edge Systems Used with
Low Slope Roofing Systems*

SPRI ED-1

- With ANSI/SPRI/FM 4435/ES-1 becoming only a test standard for coping and fascia, and ANSI/SPRI GT-1 as only a test standard for gutters, SPRI felt a separate edge design standard was needed.
- ANSI/SPRI ED-1, was developed as a design standard for metal perimeter edge systems.

ANSI/SPRI ED-1 Includes

- Material Design
 - Nailer Attachment
 - Proper Coverage
 - Recommended Material Thicknesses
 - Galvanic Compatibility
 - Thermal Movement
 - Testing Requirements
 - “Appliance” Attachment to Edge Systems

ANSI/SPRI ED-1 Includes

- Limited Wind Design
 - Load to be as required by AHJ
 - Tables like those in original ANSI/SPRI/FM 4435/ES-1 and ANSI/SPRI GD-1 are included for reference

Nailer Attachment

- For the edge metal to perform as tested the nailer must be properly secured.
 - The ES-1 Standards do not include tests for nailers
 - ANSI/SPRI ED-1 does provide guidance
 - FM Data Sheet 1-49 is another good reference



Conclusions

- Edge metal failure is a leading cause of roof failures
- 2006 and later versions of International Building Code require that edge metal, except gutters, be tested per ANSI/SPRI ES-1 or ANSI/SPRI/FM 4435/ES-1
- The 2021 and later versions of International Building Code require that gutters be tested per ANSI/SPRI GT-1.
- ED-1 has been developed as an Edge Design Standard to be used for all low-slope metal perimeter edge (Fascia, Coping, and Gutter)