



Update on Current Roofing Industry Technical Issues

presented by

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Vice President, Technical Services
National Roofing Contractors Association (NRCA)



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Topics

- A common code question
- Construction-generated moisture
- FM Global-insured roofing projects
- Roof deck considerations
- 2021 I-code changes: Gutter testing
- CERTA

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A code question...

I have two existing roofs on a building. I understand the code says there is a two-roof maximum limit.

However, can I peel-off the topmost roof layer and install a new roof? In the end, I'd only have two roofs.

Does (2 - 1) + 1 = 2?



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1511.3 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION 1512
PHOTOVOLTAIC PANELS AND MODULES

1512.1 Photovoltaic panels and modules. Photovoltaic panels and modules installed on a roof or as an integral part of a roof assembly shall comply with the requirements of this code and the International Fire Code.

Existing structural systems that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.

3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 1511.4.

4. The application of a new protective roof coating over an existing protective roof coating, metal roof panel, built up roof, spray polyurethane foam roofing system, metal roof shingles, mineral-surfaced roll roofing, modified bitumen roofing or thermoset and thermoplastic single-ply roofing shall be permitted without tear off of existing roof coverings.

1511.3.1.1 Exceptions. A roof re-cover shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

1511.4 Roof re-covering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

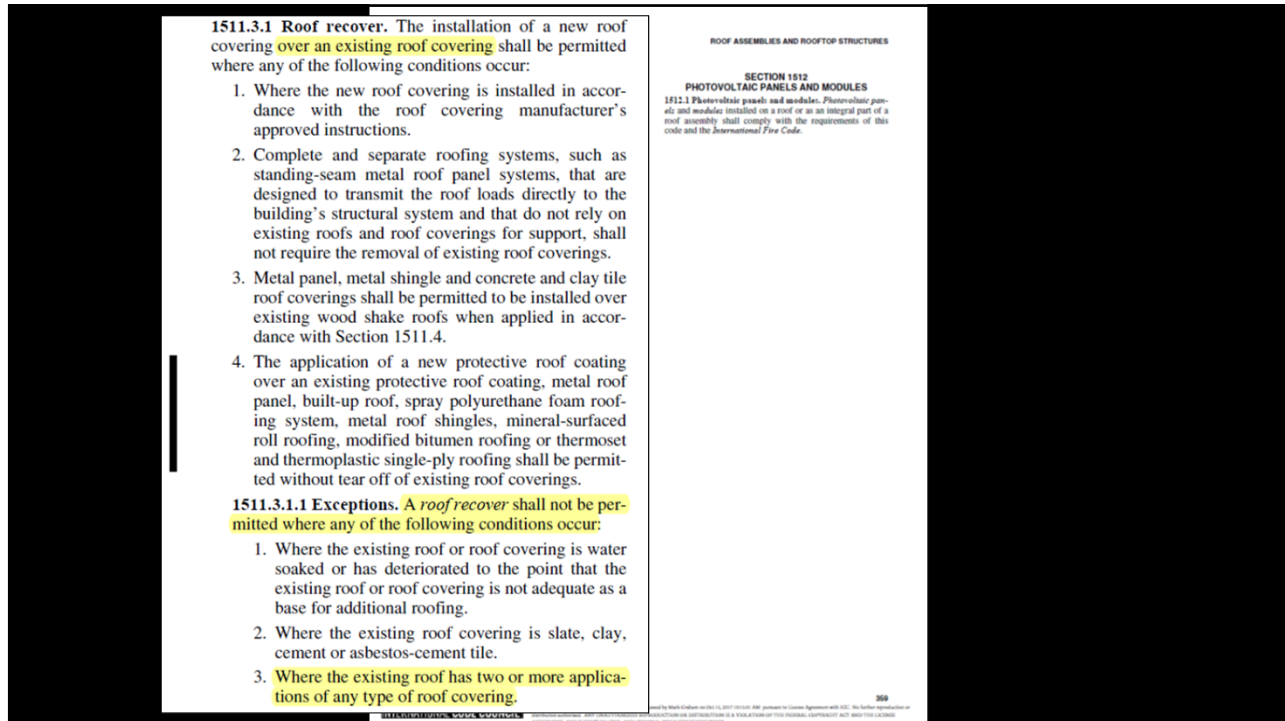
1511.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

1511.6 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

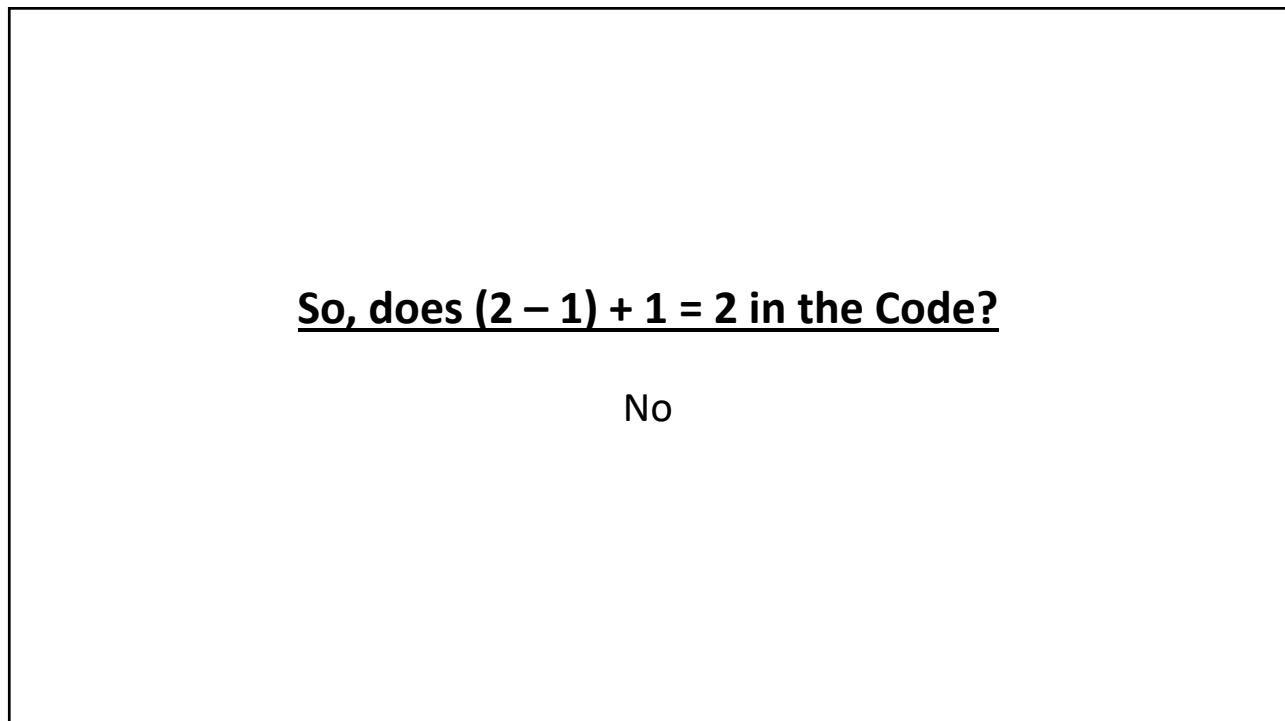
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SPRI
SINGLE PLY ROOFING INSTITUTE

SPRI ADVISORY BULLETIN

CONSTRUCTION-GENERATED MOISTURE AND ITS EFFECT ON ROOFING SYSTEMS

Roofing system assemblies are typically designed to accommodate occupancy-generated moisture based on building usage and function. Buildings with relatively small amounts of occupancy-generated moisture (office buildings, retail buildings, etc.) can be designed differently from buildings with large amounts of occupancy-generated moisture (swimming pools, paper mills, etc.).

However, moisture generated during the construction phase of a building is rarely recognized and seldom addressed by roof designers. In moderate climate regions (ASHRAE Zones 1-3), construction-generated moisture may go unnoticed until musty air is detected or mold growth is discovered.

In colder climate regions (ASHRAE Zones 4-7), construction-generated moisture may be detected in the form of drips inside the building after the first freeze-thaw cycle. These drips are often misinterpreted as a roof leak. For this reason, it is vitally important that projects with elevated levels of construction-generated moisture be engineered to accommodate, dissipate or avoid this moisture load.

Sources of construction generated moisture
Moisture associated with construction can be generated by various trades. According to *The Manual of Low Slope Roofing Systems* (Giffins & Frickles, pp 112):

- A 4" thick concrete floor slab poured in an enclosed building generates 1 ton of water per 1000 square feet of concrete.
- The use of propane heaters (to provide more comfortable working conditions or to help "dry" the construction) also generates large quantities of moisture. For each 200-pound tank of propane burned, 30 gallons of water are produced.
- Oil-burning heaters produce 1 gallon of water for every 1 gallon of oil burned.
- Paint, plaster, drywall and other water-based construction materials also contribute to construction-generated moisture and potential accumulation in the roofing system assembly.

Approved August 2018 1

SPRI Advisory: Construction-Generated Moisture and Its Effect on Roofing Systems

[Link](#)

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Some things we know...

Construction-generated moisture

- Cooler temperatures are more challenging than warmer temperatures
 - Cool air holds less moisture
- Many “modern” materials are less moisture tolerant
- Water-based products release moisture; more than solvent-based materials
- Concrete is placed using much more water than is necessary for proper hydration
- Many concrete admixtures slow moisture release

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Some things we know (cont.)...

Construction-generated moisture

- Temporary enclosures can trap moisture/prevent moisture release
- Temporary heating can be problematic
 - Propane heaters release large amounts of moisture vapor
- Bringing warm, stored materials out into a cold environment can result in surface condensation

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Recommendations

Construction-generated moisture

- Realize practical (and physical) limitations
- Consider appropriate contract provision language so you don't take on additional liability

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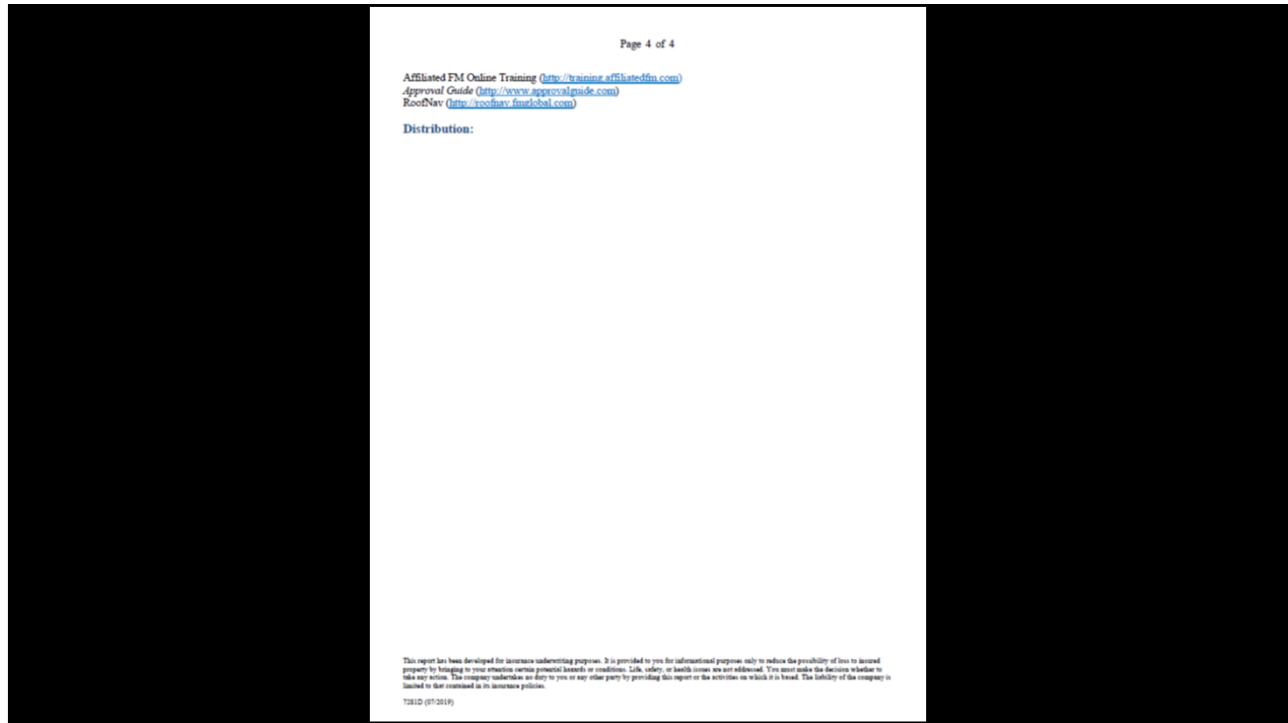
FM Global-insured roofing project process



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<p>CHECKLIST FOR ROOFING SYSTEM</p> <p>FM Global Client: submit completed form and completed Roofing Co</p> <p>CONTACT INFORMATION: FM GL</p> <p>ROOFING CONTRACTOR (NAME, ADDRESS, PROJECT NO.) TE</p> <p>CLIENT SITE (NAME & ADDRESS) TE</p> <hr/> <p>OVERVIEW OF WORK: (Submit 1 form per roof area)</p> <p>Building Name & Number (provide building diagram as appropriate)</p> <p>Type of Work: <input type="checkbox"/> New Construction <input type="checkbox"/> Recover (New roof over)</p> <p><input type="checkbox"/> Reroof (New cover/remove existing roofing system)</p> <p>Building Dimensions: Length _____ ft. Width _____ ft.</p> <p>Roof Slope _____ in. per ft. / degrees</p> <p>Parapet Height max. (in. / m)</p> <p>Roof Zone Width (Dimension) _____ Zone 1 _____ Zone 2 _____</p> <p>FM Approved Roof/Nav Assembly Numbers (provide Assembly Num)</p> <p>Refer to FM Global Property Loss Prevention Data Sheet 1-28, W1 dimension.</p> <p>ROOF SURFACING:</p> <p><input type="checkbox"/> Type _____ (Trade Name/Application Rate)</p> <p><input type="checkbox"/> Coating _____ (Trade Name/Application Rate)</p> <p><input type="checkbox"/> Granules _____ (Application Rate)</p> <p><input type="checkbox"/> Cracking/Slag _____ (Application Rate)</p> <p><input type="checkbox"/> Ballast _____ Stone Size _____ Pavers _____ (Ballast)</p> <p>Ballast Weight (psf): Zone 1: _____ Zone 2: _____</p> <p>Additional Detail: _____</p> <p>ROOF COVER / MEMBRANE:</p> <p>(Provide all applicable details including trade name, type, number)</p> <p>Roof Cover: Trade Name _____</p> <p>Roll Rating Provided: <input type="checkbox"/> Single Ply <input type="checkbox"/> Adhered <input type="checkbox"/> M</p> <p><input type="checkbox"/> Multi-Ply Built Up Roofing (BUR) <input type="checkbox"/> Adhered <input type="checkbox"/> M</p> <p>Number of Plys _____</p> <p><input type="checkbox"/> Lap Width _____ in/mm <input type="checkbox"/> Lap Adhesion Type _____</p> <p><input type="checkbox"/> Panel: <input type="checkbox"/> Through Fastened Metal <input type="checkbox"/> Adhered <input type="checkbox"/> Lap Adhes</p> <p><input type="checkbox"/> Standing Seam Metal <input type="checkbox"/> Fiber Reinforced Plastic (FRP) <input type="checkbox"/> Other _____</p> <p><input type="checkbox"/> Spray Applied _____</p> <p>Additional Detail: _____</p> <p style="font-size: small;">X2488 ENGINEERING (Rev. FEB 2020)</p>	<p>CHECKLIST FOR ROOFING SYSTEM</p> <p>ROOF COVER / MEMBRANE SECUREMENT:</p> <p>Roof Cover Fasteners: Trade Name _____ Size _____</p> <p>Stress Plate/Batten: Trade Name _____ Size _____</p> <p>Flow Spacing: Zone 1: _____ Zone 2: _____ Zone 3: _____</p> <p>Fastener Spacing: Zone 1: _____ Zone 2: _____ Zone 3: _____</p> <p>Bonding Adhesive: Trade Name _____</p> <p>Adhesive Ribbon Width (in.) _____</p> <p>Adhesive Ribbon Spacing (in.): Zone 1: _____ Zone 2: _____</p> <p>Adhesive Application Rate (gal./sq. ft.) _____</p> <p>Additional Detail: _____</p> <p>INSULATION / COVER BOARD:</p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <thead> <tr> <th>Layer</th> <th>Insulation / Cover Board Trade Name</th> <th>Board Dimensions (ft. x ft.)</th> <th>Thic (in.)</th> </tr> </thead> <tbody> <tr> <td>1. Top</td> <td></td> <td></td> <td>X</td> </tr> <tr> <td>2. Next</td> <td></td> <td></td> <td>X</td> </tr> <tr> <td>3. 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Conclusions and recommendations
FM Global-insured roofing project process

- FM Global/FM Approvals is not likely a party to the Contract for roofing work
 - FM Global makes recommendations to their insureds/building owner clients
 - FM Global should not be dictating to the Roofing Contractor
- A FM Global-insured roof assembly is a premium product
 - It is typically (well) above minimum code requirements
- Actively manage roofing projects for FM Global-insured clients

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FM Global
Property Loss Prevention Data Sheets

1-52
February 2020
Interim Revision July 2021
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FIELD VERIFICATION OF ROOF WIND UPLIFT RESISTANCE

FM Global clients must contact the local FM Global office before beginning uplift testing or any roofing work.

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FM 1-52: Field uplift testing

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NRCA Member Benefit

Field-uplift testing

ASTM E907 and FM 1-52 tests continue to be problematic

June 2015

NRCRA continues to receive a significant number of reports from roofing contractors, manufacturers and designers regarding the use of and problems associated with field-uplift tests in post-installation quality assurance measures for membrane roof systems. NRCA has addressed these testing issues a number of times during the year. Following is a summary of NRCA's previous discussions, as well as updated information and recommendations.

ASTM E907/FM 1-52
There are two recognized field test methods for determining adhered membrane roof systems' uplift resistance: ASTM E907, "Standard Test Method for Field Testing Uplift Resistance of Adhered Membrane Roofing Systems," and FM Global Loss Prevention Data Sheet 1-52 (FM 1-52), "Field Verification of Roof Wind Uplift Resistance."

An example of a test chamber used for negative-pressure uplift testing.

Both test methods are similar and provide for affixing a 5- by 5-foot dome-like chamber to a roof surface's topside and applying a defined negative uplift pressure inside the chamber to the roof system's exterior side surface using a vacuum pump (see photo). During the test, membrane surface deflection inside the chamber is visually monitored and measured to determine whether a roof system passes or is "suspect."

Using ASTM E907, a roof system is considered to be suspect if the deflection measured during the test is 25 mm (about 1 inch) or greater. During FM 1-52 testing, a roof system is suspect if the measured deflection is between 1/4 of an inch and 3/8 of an inch depending

on the maximum test pressure: 1 inch where a thin tapping board (over board) is used or 2 inches where a thin cover board or flexible, mechanically attached insulation is used.

If an ASTM E907 or FM 1-52 test yields a suspect result, a test cut should be taken in the test area to determine whether failure has occurred and the specific failure mode.

ASTM E907 and FM 1-52 differ notably in their test cycles and maximum test pressures for determining roof system deflections and whether a roof system passes or is suspect. ASTM E907 testing is conducted in 15-pounds per square foot (psf) pressure intervals up to the calculated design wind uplift pressure for the specific roof system being evaluated. FM 1-52 testing is conducted using an initial 15-pounds psf pressure followed by 7.5-pound psf increments up to a maximum test pressure of 1.25 times the design uplift pressure for the specific roof system being evaluated.

Considering maximum test loading and allowable test deflections in combination, FM 1-52 requires 25 percent higher test loads, yet only allows as little as 1/4 the test deflection of ASTM E907. That said, FM 1-52 is a significantly more stringent test than ASTM E907.

ASTM E907 originally was published as a recognized consensus standard in 1983, and it was revised in 1996. In 2013, ASTM withdrew ASTM E907 because a consensus could not be reached regarding necessary revisions—most significantly, defining the test method's precision and bias (accuracy). ASTM E907-96 still is available for use and can be obtained directly from ASTM's website, www.astm.org.

FM 1-52 is an FM Global proprietary evaluation method and not a recognized industry-consensus test standard. FM 1-52's scope indicates it only is intended to confirm acceptable wind-uplift resistance on completed roof systems in hurricane-prone regions, where a partial blow-off has occurred or where interior roof system construction is inspected or known to be present.

FM 1-52 originally was published by FM Global in October 1970. The negative-pressure uplift test was added in August 1980 and has been revised several times. The current edition is dated July 2012 and includes an option for "visual construction observation (VCO)" as an alternative to negative-pressure uplift testing. VCO provides for full-time, third-party monitoring of a roof system application to verify roof system installation in accordance with contract documents.

NRCA Industry Issue Update

June 2015

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Field Verification of Roof Wind Uplift Resistance 1-52
FM Global Property Loss Prevention Data Sheets Page 3

1.0 SCOPE

This data sheet describes two methods of field testing new installations of above-deck roofing assemblies to determine if there is adequate wind resistance. It also provides alternative visual construction observation guidelines. Confirmation of acceptable wind uplift resistance on completed roof systems is critical in **tropical cyclone-prone regions**.

Field tests can be used to assess existing roofs for adequate wind resistance, but not to determine the cause of wind uplift damage after a storm event. Field tests are not applicable to metal panel roofs (standing seam and through fastened), ballasted roofs, or mechanically fastened covers with fasteners spaced more than 2 ft (0.6 m) apart in either direction.

1.1 Changes


July 2021. Interim revision. Updated the scope of this data sheet to clarify the intent of the document for existing situations. Also removed references to an incorrect FM Global form.

meets the specifications in this data sheet.
 2.1.3 Have testing witnessed by the owner's representative.
 2.1.4 Record the results of uplift tests or visual construction observation (VCO) and forward to the FM Global local servicing office. See Appendix C for a copy and suggested contract wording.
 2.1.5 Have a roofing professional present to repair the test areas and return the roof area to a watertight condition should any of the tests fail.
 2.2 General
 2.2.1 Prior to any testing, ensure adequate curing of roof adhesives in accordance with the manufacturer's instructions.
 2.2.2 Select the appropriate field uplift test based on roof system per Table 2.2.2-1.

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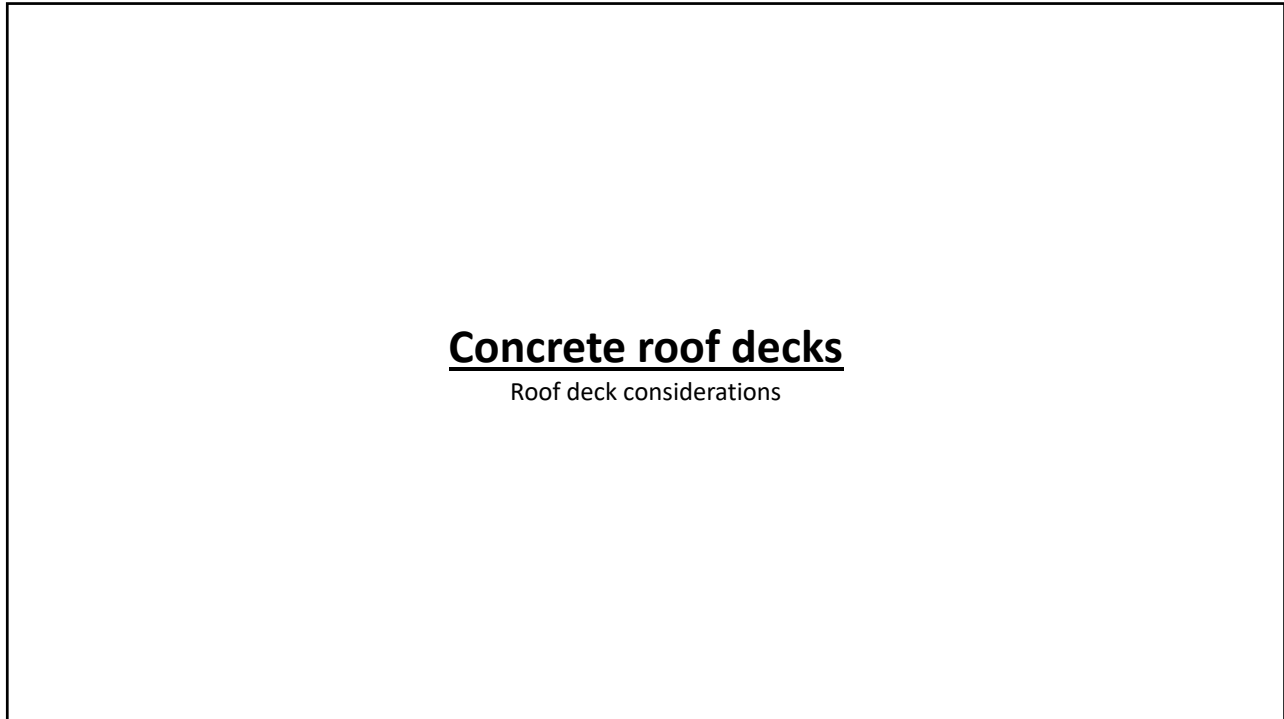
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Roof deck considerations



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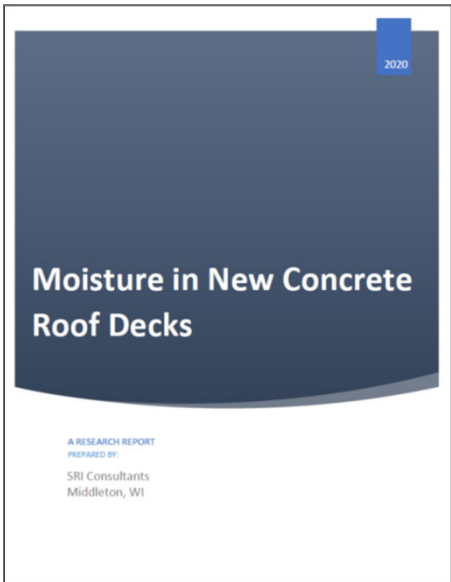
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Concrete roof decks

Roof deck considerations

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Moisture in New Concrete Roof Decks


A RESEARCH REPORT
PREPARED BY:
SRI Consultants
Middleton, WI

2020

Roofing industry research


- Phase 1:
 - Characterization
 - Hygrothermal testing and initial analysis
- Phase 2:
 - Laboratory simulation
 - Computer simulations

[Link](#)



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RESEARCH + TECH



Are admixtures the answer?
Moisture in concrete roof decks continues to be problematic
by Mark S. Graham

NBCA's Technical Services Section has been receiving inquiries regarding the use and effectiveness of specific concrete mix additives and topical surface treatments to address moisture-related concerns with concrete roof decks. Each admixture family are referred to as moisture vapor reduction admixtures (MVRAs) or permeability reducing admixtures. NBCA provides recommendations regarding their use.

MVRAs
Concrete admixtures intended as MVRAs are specific chemicals added during concrete's handling and curing to provide an additional chemical reaction during the concrete's hydration and curing process. MVRAs seal the concrete mix's exterior water and chloride to create a calcium silicate hydrate gel within the concrete. The gel is said to fill the small pores and capillary openings in curing concrete, maintaining the concrete's ability to gain and release moisture vapor. The gel is intended to be permanent and integral throughout the concrete's entire thickness.

24 www.professionalroofing.net DECEMBER 2018

Professional Roofing

December 2018

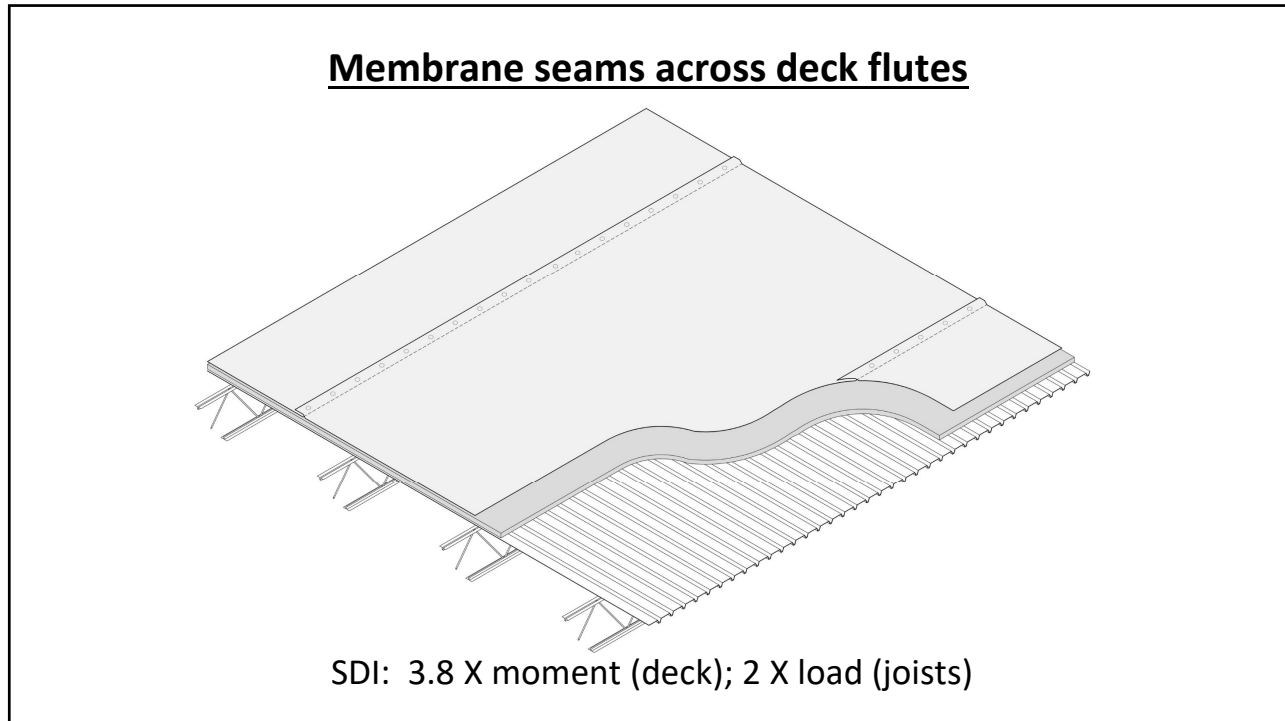
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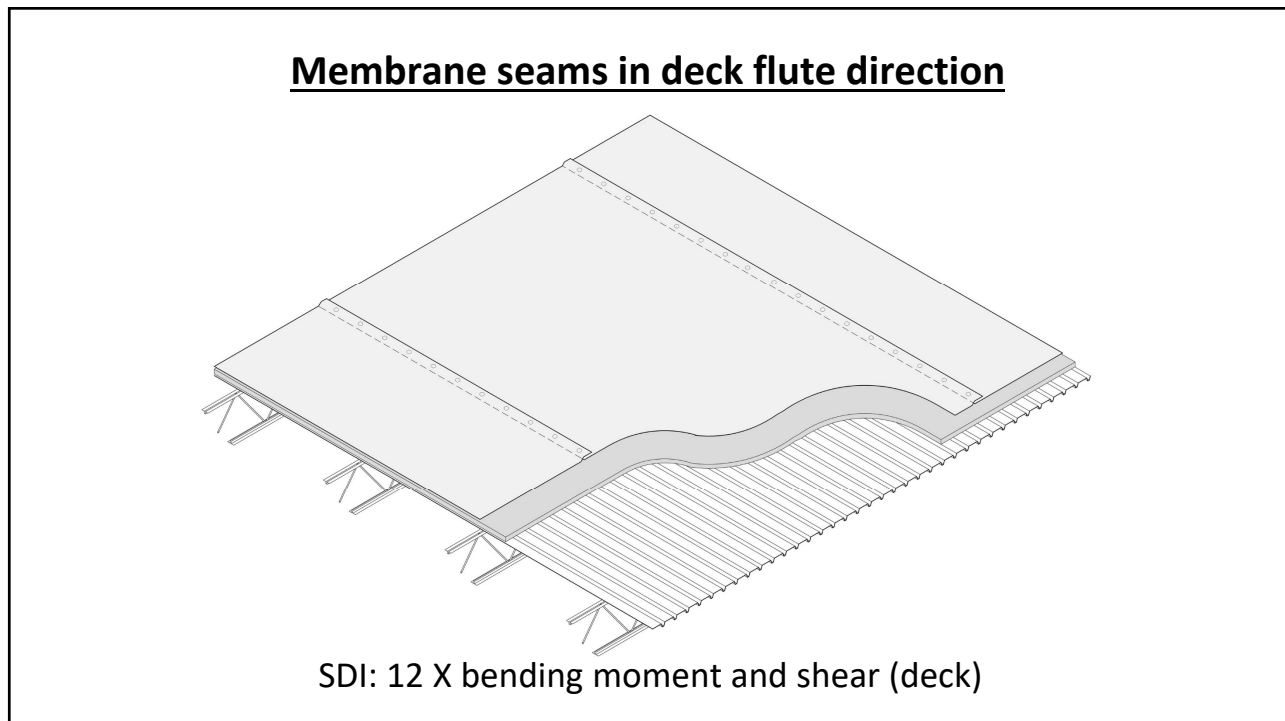
Steel roof decks

Roof deck considerations

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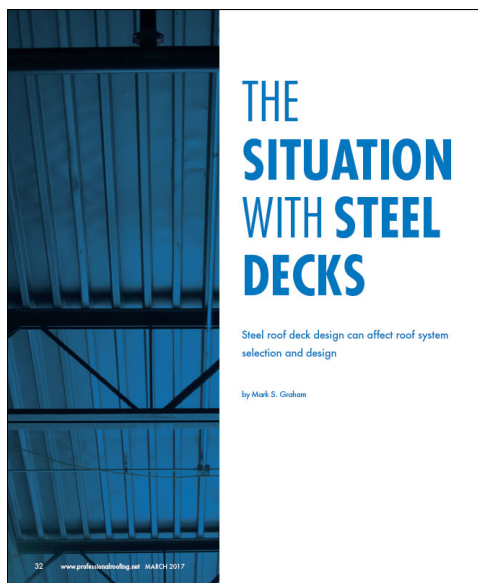
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FM Global's Loss Prevention Data Sheet 1-29

April 2016

- Revised/new criteria:
- Steel roof decks:
 - Uniformly-distributed loading
 - Concentrated loading
 - Lightweight structural concrete

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Professional Roofing

March 2017

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The image shows the cover of a technical note. At the top left is the SDI logo (Steel Deck Institute) with the text 'STEEL DECK INSTITUTE' to its right. Below this is a red horizontal line. The title 'Technical Note - No.7' is centered, with the subtitle 'MECHANICAL ATTACHMENT OF SINGLE-PLY ROOFING MEMBRANES TO STEEL ROOF DECK: IMPLICATIONS FOR STEEL DECK DESIGN' in smaller red text below it. A large, light gray 'sdi' watermark is visible in the background. At the bottom right, there is a small copyright notice: 'copyright 2019 steel deck institute'.

SDI Technical Note-No. 7 (Nov. 2019)
Mechanical attachment of single-ply roofing membranes to steel roof deck: Implications for steel deck design

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Plywood and OSB roof decks
Roof deck considerations

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RESEARCH+TECH



Know your steep-slope roof decks

Following plywood and OSB installation guidelines can help ensure a successful roof system performance

by Mark S. Graham

Plywood or oriented strand board structural panel sheathing are integral components of many steep-slope roof assemblies, and proper use of these products can help ensure successfully performing assemblies. If you use or encounter plywood and/or OSB structural panel sheathing roof decks, it is important to be knowledgeable of the applicable code requirements and APA-The Engineered Wood Association and NWCA guidelines applicable to them.

IBC 2018
 The International Residential Code® provides specific requirements applicable to plywood and OSB structural panel sheathing used as roof decks for one- and two-family dwellings. In IBC's introduction, specific requirements are provided in Section 603.0 Roof Sheathing.

IBC 2018 requires wood structural panels conform to the Department of Commerce PS-1, "Structural Plywood," or PS-2, "Performance Standard for Wood-based Structural-Use Panels," or CSA Group's O325, "Construction Sheathing," or O437, "Standards on OSB and Waferboard." PS-1 and O325 generally are required to apply to plywood, and PS-2 and O437 apply to OSB.

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Standards for wood structural panels

International Residential Code, 2018 Edition

Plywood:

- U.S. Department of Commerce PS-1, "Structural Plywood"
- CSA Group O325, "Construction Sheathing"

Oriented-strand board (OSB):

- U.S. Department of Commerce PS-2, "Performance Standard for Wood-based Structural-use Panels"
- CSA Group O437, "Standards for OSB and Waferboard"

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Common, but not referenced in the Code

Plywood and OSB:

- APA-The Engineered Wood Association Standard PRP-108, "Performance Standards and Policies for Structural-Use Panels"

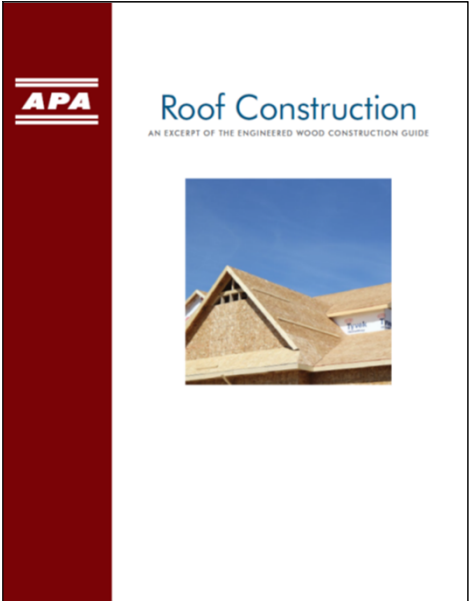
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Roof sheathing attachment

IRC 2018 Table 602.3(1), Rows 30-32 (minimum attachment):

- Panel edges:
 - 2½-inch-long 8d common nails at 6 inches o.c. at supported panel edges
- Intermediate supports:
 - 2½-inch-long 8d common nails at 12 inches o.c. at intermediate supports

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APA Form E30, "Roof Construction"
--Roofing-specific excerpts from APA's *Engineered Wood Construction Guide* (102 pages)

[Link](#)

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Recommendations

Roof deck considerations

- **New construction:**
 - Be careful with deck "acceptance".
 - Deck acceptance should be limited to the visual surface and no visual presence of moisture on the surface

- **Reroofing:**
 - Since deck condition and attachment typically cannot be determined until roof covering tear-off, consider unit price or T & M pricing for deck replacement and/or deck re-fastening

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2021 I-code changes: Gutter testing



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2021 IBC



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Edge metal testing

Changes in IBC 2021, Section 1504-Performance Requirements

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.

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Gutter testing

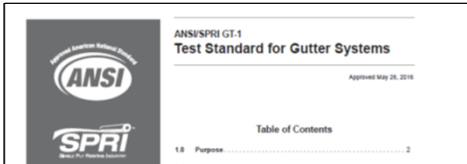
Changes in IBC 2021, Section 1504-Performance Requirements

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.

1504.6.1 Gutter securement for low-slope roofs. Gutters that are used to secure the perimeter 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.

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ANSI/SPRI GT-1



The image shows the cover of the ANSI/SPRI GT-1 Test Standard for Gutter Systems, approved May 26, 2016. The cover features the ANSI and SPRI logos. Below the cover is a Table of Contents with the following entries:

Table of Contents	
1.0 Purpose	2
1.1 Scope	2
1.2 Definitions	2
1.3 Test Requirements	2
1.4 SPRI Test Method	2
1.5 SPRI Test Method	2
1.6 Test Reporting	2
1.7 Safety	2

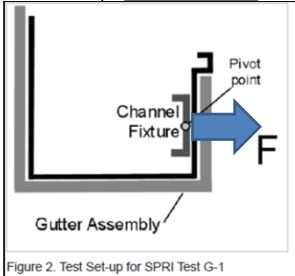


Figure 2. Test Set-up for SPRI Test G-1. This diagram shows a gutter assembly mounted on a channel fixture. A pivot point is indicated at the top of the gutter. A blue arrow labeled 'F' points horizontally to the right, representing the direction of the force applied during the test.

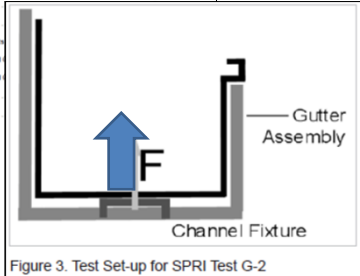


Figure 3. Test Set-up for SPRI Test G-2. This diagram shows a gutter assembly mounted on a channel fixture. A blue arrow labeled 'F' points vertically upwards from the bottom of the gutter, representing the direction of the force applied during the test.

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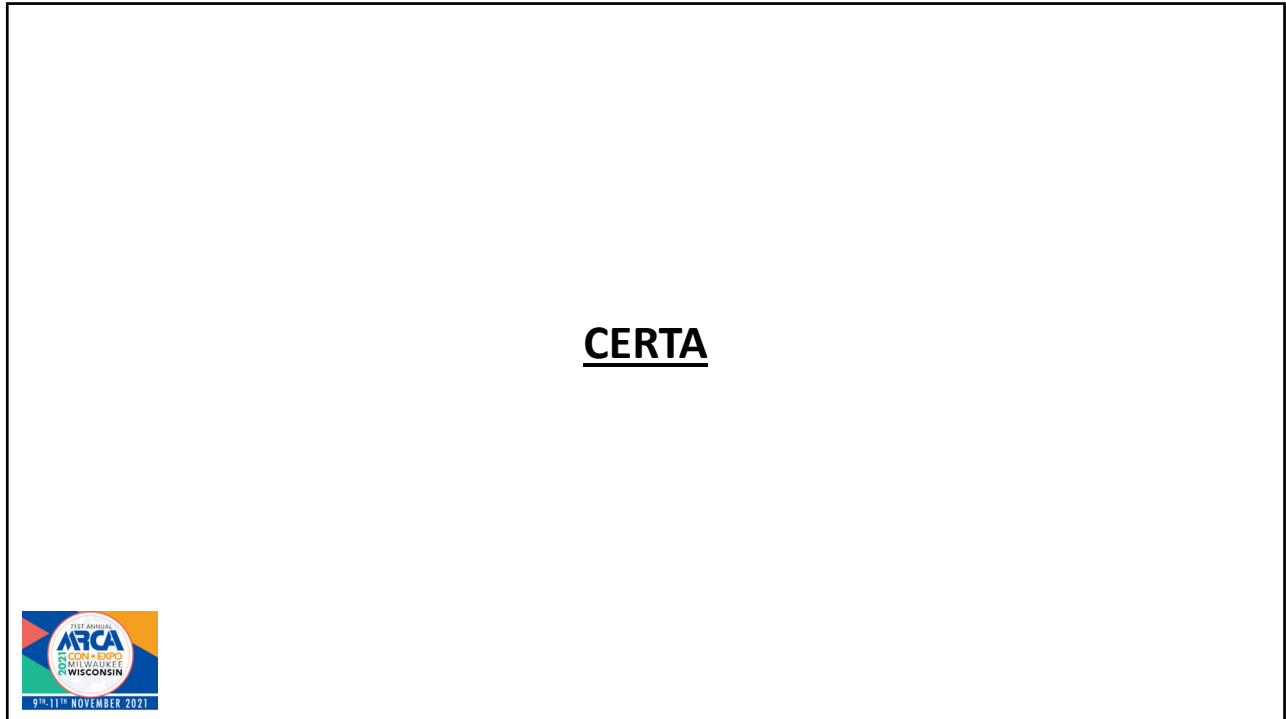
Disclaimer
This standard is for use by architects, engineers, roofing contractors and building owners when designing, installing or evaluating a building's gutter system. SPRI, its members and employees do not warrant that the standard is proper and/or applicable under all conditions.

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ANSI/SPRI GT-1

NRCA is in the process of GT-1 testing gutters. Test data and a certification program will be available in early 2022

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Mark S. Graham

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