PM meeting
Oglebay Resort, Wheeling, WV
February 18-20, 2018

Technical issues and risks

Mark S. Graham
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National Roofing Contractors Association
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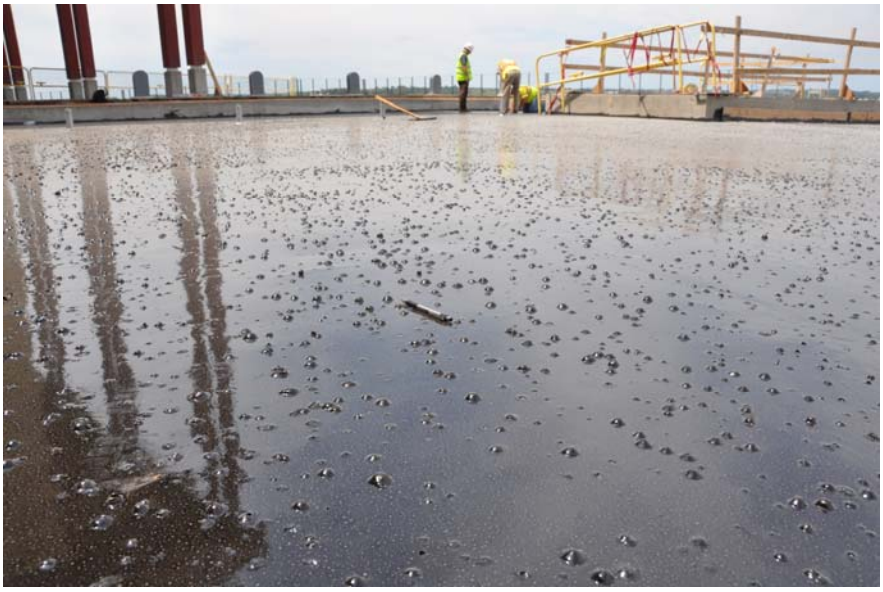
Today's topics

- Concrete roof decks
- Code issues:
  - Building code
  - Energy code
  - Plumbing code
- Factory Mutual (FM)
- ANSI/SPRI ES-1
- Polyiso issues
- Silica exposure regulation
- Questions… and other topics

Concrete roof decks

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All of these are problems related to moisture in concrete roof decks…

Concrete mix design

- Aggregate:
  - Large aggregate
  - Fine (small) aggregate
- Portland cement
- Water
- Admixtures:
  - Fly ash
  - Air entrainment
  - Curing compounds
  - Etc.

Concrete Aggregates

60-80% of Concrete Mix Design

- Normal-weight aggregates (stone):
  - Dense
  - Absorb about 2% by weight
- Light-weight aggregates (expanded shale):
  - Porous
  - Absorbs from 5 - 25% by weight

Lightweight structural concrete inherently contains more moisture

When is it OK to roof?

Historical guidelines

- After 28 days
- Application of hot bitumen
- Plastic film test
  - ASTM D4263, "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method"

These are not appropriate for current generations of concrete mixes

Concrete Floors and Moisture, 2nd Edition

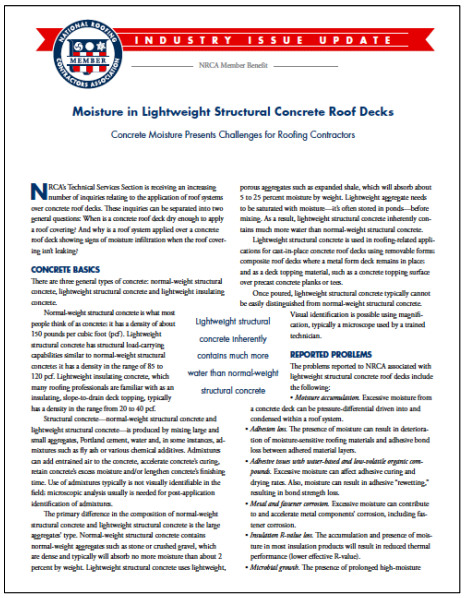
Howard M. Kanare, CTL Group

75% internal RH can be achieved:

- Normal weight structural concrete
  - Less than 90 days
- Lightweight structural concrete
  - Almost 6 months

These values are based upon "protected" concrete, without re-wetting

NRCA Industry Issue Update, August 2013



INDUSTRY ISSUE UPDATE

NRCA Member Benefit

Moisture in Lightweight Structural Concrete Roof Decks

Concrete Moisture Presents Challenges for Roofing Contractors

NRCA's Technical Services Section is receiving an increasing number of inquiries relating to the application of roof systems over concrete roof decks. These inquiries can be separated into two general questions: When is a concrete roof deck dry enough to apply a roof covering? And why is a roof system applied over a concrete roof deck showing signs of moisture infiltration when the roof covering isn't leaking?

CONCRETE BASICS

There are three general types of concrete: normal-weight structural concrete, lightweight structural concrete and lightweight insulating concrete.

Normal-weight structural concrete is what most people think of as concrete: it has a density of about 150 pounds per cubic foot (pcf). Lightweight structural concrete has structural load-carrying capabilities similar to normal-weight structural concrete: it has a density in the range of 85 to 120 pcf. Lightweight insulating concrete, which many roofing professionals are familiar with as an insulating, slope-to-drain deck topping, typically has a density in the range from 20 to 40 pcf.

Structural concrete—normal-weight structural concrete and lightweight structural concrete—is produced by mixing large and small aggregates, Portland cement, water and, in some instances, admixtures such as fly ash or various chemical additives. Admixtures can add entrained air to the concrete, accelerate concrete's curing, retain concrete's excess moisture and/or lengthen concrete's finishing time. Use of admixtures typically is not visually identifiable in the field; microscopic analysis usually is needed for post-application identification of admixtures.

The primary difference in the composition of normal-weight structural concrete and lightweight structural concrete is the large aggregates' type. Normal-weight structural concrete contains normal-weight aggregates such as stone or crushed gravel, which are dense and typically will absorb no more moisture than about 2 percent by weight. Lightweight structural concrete uses lightweight, porous aggregates such as expanded shale, which will absorb about 5 to 25 percent moisture by weight. Lightweight aggregate needs to be saturated with moisture—it's often stored in ponds—before mixing. As a result, lightweight structural concrete inherently contains much more water than normal-weight structural concrete.

Lightweight structural concrete is used in roofing-related applications for cast-in-place concrete roof decks using removable forms; composite roof decks where a metal form deck remains in place; and as a deck topping material, such as a concrete topping surface over precast concrete planks or tees.

Once poured, lightweight structural concrete typically cannot be easily distinguished from normal-weight structural concrete. Visual identification is possible using magnification, typically a microscope used by a trained technician.

Lightweight structural concrete inherently contains much more water than normal-weight structural concrete

REPORTED PROBLEMS

The problems reported to NRCA associated with lightweight structural concrete roof decks include the following:

- *Moisture accumulation.* Excessive moisture from a concrete deck can be pressure-differential driven into and condensed within a roof system.
- *Adhesion loss.* The presence of moisture can result in deterioration of moisture-sensitive roofing materials and adhesive bond loss between adhered material layers.
- *Adhesive issues with water-based and low-volatile organic compounds.* Excessive moisture can affect adhesive curing and drying rates. Also, moisture can result in adhesive "rewetting," resulting in bond strength loss.
- *Metal and fastener corrosion.* Excessive moisture can contribute to and accelerate metal components' corrosion, including fastener corrosion.
- *Insulation R-value loss.* The accumulation and presence of moisture in most insulation products will result in reduced thermal performance (lower effective R-value).
- *Microbial growth.* The presence of prolonged high-moisture

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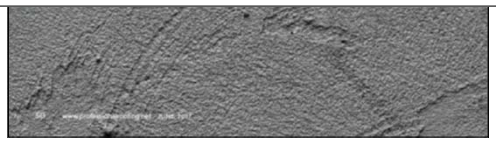
June 2017

	ASTM E96 calculated perm			
	Lightweight structural concrete		Normal weight concrete	
Age	Wet cup	Dry cup	Wet cup	Dry cup
28 days	1.48	0.78	3.42	1.05
60 days	1.45	0.47	2.03	1.13

The figure shows results of ASTM E96 water vapor transmission testing. Note the lightweight structural concrete has about half of the permeability of regular weight concrete. Considering lightweight structural concrete arrives with more than twice the evaporable water of regular weight concrete, this explains why lightweight structural concrete retains moisture for so long.



Moisture on concrete roof decks


RESEARCH+TECH

Moisture in concrete roof decks

Normal-weight and lightweight structural concrete cause some concern

by Mark S. Graham

20 www.professionalroofing.net SEPTEMBER 2017

Professional Roofing,
Sept. 2017

Specification language

ASTM F2170 testing

4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
5. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F 2170.
   a. Test Frequency: One test probe per each 1000 sq. ft. (93 sq. m), or portion thereof, of roof deck, with no fewer than three test probes.
   b. Submit test reports within 24 hours of performing tests.
6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
7. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

NRCA has still not seen capillary-blocking or water-retention admixtures perform successfully in concrete roof deck applications

The roofing industry needs to re-think the concept of concrete roof deck "acceptance"

Building codes

Roofing specific

Some background

- The I-Codes are “model codes” developed by the International Code Council (ICC)
- Model codes serve as the technical basis for state or local code adoption
- The code provides the minimum legal requirements for building construction…and operation
- The code is enforced by the “authority having jurisdiction” (AHJ)
- The code can also provide a basis for construction claims-related litigation

Who is responsible?

- The building owner
- And, everyone else involved

Legal considerations

"In most states, a building code violation is considered to be evidence of negligence. In some situations, a building code violation may be considered *negligence per se…"*

--Stephen M. Phillips
Hendrick, Phillips, Salzman & Flatt

Code enforcement

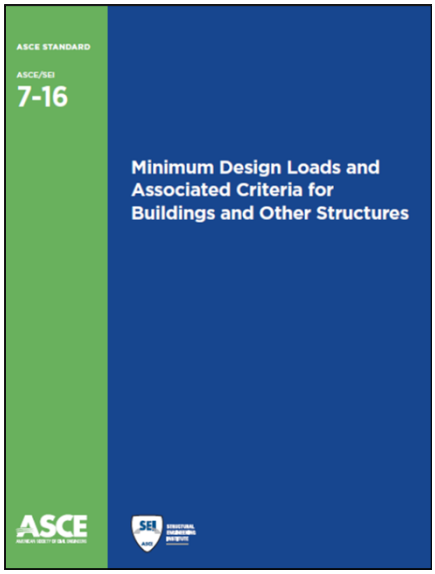
- Code official
- Construction litigation

Publication cycle

- 2000 edition
- 2003 edition
- 2006 edition
- 2009 edition
- 2012 edition
- 2015 edition
- 2018 edition (just published)

Three-year code development and publication cycle

International Building Code, 2018 Edition (IBC 2018)



American Society of Civil Engineers Standard 7, "Minimum design loads and associated criteria for buildings and other structures" (ASCE 7-16)

Noteworthy changes in ASCE 7-16

Compared to ASCE 7-10

- Revised basic wind speed map
- Changes (and new) pressure coefficients
- Revised perimeter and corner zones

While center field pressures may be slightly lower, field, perimeter and corner uplift pressures will generally be greater

Comparing GC_p pressure coefficients

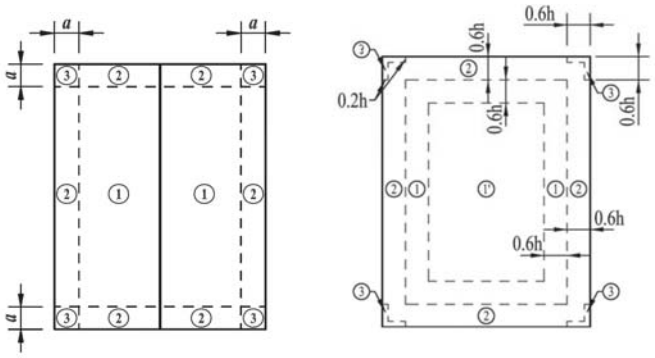
h ≤ 60 ft., gable roofs ≤ 7 degrees

Zone	ASCE 7-10	ASCE 7-16	Change
1’	n/a	0.9	-10%
1 (field)	-1.0	-1.7	+70%
2 (perimeter)	-1.8	-2.3	+28%
3 (corners)	-2.8	-3.2	+14%

Zones

Defining the applicability of pressure coefficients

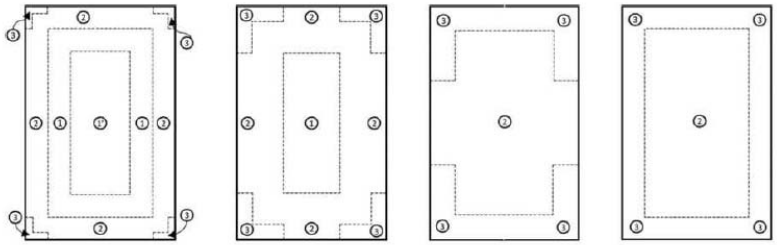
h ≤ 60 ft., gable roofs ≤ 7 degrees



ASCE 7-10 **ASCE 7-16**

ASCE 7-16's roof zones

Defining the applicability of pressure coefficients



Buildings with least horizontal dimension greater than 2.4*h*

Buildings with least horizontal dimension greater than 1.2*h* but less than 2.4*h*

Buildings with least horizontal dimension less than 1.2*h* and largest horizontal dimension greater than 1.2*h*

Buildings with largest horizontal dimension less than 1.2*h*

FIGURE C30-1 Four Possible Scenarios for Roof Zones, Which Depend on the Ratios of the Least and Largest Horizontal Plan Dimensions to the Mean Roof Height *h*

How the roofing industry will adapt to ASCE 7-16 remains to be seen….

FM Global has indicated they will update their FM 1-28 to be based on ASCE 7-16 (with modifications) by the end of the 2018.

Comparing FM 1-28 and ASCE 7-05, -10 & -16

Example: A manufacturing building is located in New Orleans, LA. The building is an enclosed structure with a low-slope roof system and a roof height of 35 ft. The building is located in an area that is categorized as Exposure Category C.

Document	Basic wind speed (mph)	Design wind pressure (psf)			
		Zone 1' (Center)	Zone 1 (Field)	Zone 2 (Perimeter)	Zone 3 (Corners)
ASCE 7-05	120	NA	38	61	95
FM 1-28	120	NA	43	72	109
ASCE 7-10 Strength design	150	NA	59	96	148
ASCE 7-10 ASD	116	NA	35	59	89
ASCE 7-16 Strength design	150	47	81	107	146
ASCE 7-16 ASD	116	28	49	65	88

This comparison illustrates why it is important for Designers to include wind design loads in their Construction Documents (per IBC Sec. 1603.1)…

…It also illustrate why specifying a wind warrantee can create an uneven playing field. Unless the Designer indicates the wind design loads, which design method will the manufacturer use (e.g., in a competitive environment)?

Professional Roofing

May 2014

TECH TODAY

Specifying wind design

Many roof system designers inadequately address wind loads in contract documents

by Mark S. Graham

Specifying wind speed warranties is not a substitute for code-required wind design data

NRCA is receiving an increasing number of reports indicating project drawings and specifications incompletely, inadequately or inaccurately address proper wind design for low-slope membrane roof systems. Some designs, according to reports, only include a specification requirement for the roof system manufacturer to provide a wind warranty.

But there are minimum requirements for proper wind design of low-slope membrane roof systems.

Code requirements

Building codes typically provide specific requirements for reporting design loads, including wind loads, in contract documents.

The *International Building Code®, 2012 Edition* (IBC 2012), Chapter 16-Structural Design, Section 1603-Contract Documents, indicates contract documents need to include a roof system's live load, snow load data, wind design data and any special loads.

Required wind design data includes identifying the ultimate design wind speed, nominal design wind speed, risk category, wind exposure and applicable internal pressure coefficient. For component and cladding systems that are not specifically designed by a registered design professional, design wind pressures in terms of psf (pounds per square foot) also are required. Roof systems typically are considered component and cladding systems. Design wind pressures in the field, perimeter and corner regions of roof areas should be noted in contract documents.

IBC's previous editions include similar contract document requirements.

For new construction projects, design loads most commonly will be identified on structural drawings in the project drawing set. For projects without specific structural drawings, design loads may be provided on architectural drawings or drawing notes or in project specifications.

ANSI/SPRI ES-1

ANSI/SPRI ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems," which is referenced in IBC 2012, includes two primary elements: determination of design wind loads at roof edges (fascia, copings) and testing for resistance loads of copings and fascia.

Designers should not simply specify compliance with ANSI/SPRI ES-1 in project specifications; they should determine and clearly include design wind loads at roof edges in contract documents.

IBC 2012 indicates in Section 1504.5-Edge Securement for Low-slope Roofs design wind loads should be determined using the ultimate design wind speed and IBC 2012's Chapter 16, which is based on ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures."

IBC 2012 references ANSI/SPRI ES-1-03. ANSI/SPRI ES-1-03 is based upon ASCE 7-02, which is not an ultimate design wind speed-based method. Therefore, the design wind load determination method contained in ANSI/SPRI ES-1 does not satisfy IBC 2012's requirements for design wind loads at roof edges.

Design wind loads at roof edges should be determined using IBC 2012's Chapter 16 and be clearly noted in contract documents.

Responsibilities

Designers should not place the responsibility for determining roof system or individual component design wind loads on manufacturers, component suppliers or installers, or roofing contractors.

Also, designers' sole reliance on specifying wind speed warranties is not a substitute for code-required wind design data. Such warranties typically do not address consideration of ultimate and nominal design wind speeds, building height, risk category, wind exposure and internal pressure coefficients applicable to the specific building necessary for properly determining roof systems' design wind loads.

Responsibility for properly determining and clearly identifying wind design data, including design wind loads for roof systems, is required by the building code and is clearly that of roof system designers. Designers may retain a structural engineer or qualified consultant to help them fulfill their design responsibilities.

To help designers determine wind loads for commonly encountered low-slope roof systems, NRCA, the Midwest Roofing Contractors Association and North/East Roofing Contractors Association have developed and offer a free online application, Roof Wind Designer.

Roof Wind Designer is a web application that allows users to determine design wind loads using ASCE 7's, "Minimum Design Loads for Buildings and Other Structures," 2005 or 2010 editions.

Roof Wind Designer is accessible at www.roofwinddesigner.com.

MARK S. GRAHAM is NRCA's [illegible] director of technical services.

16 www.professionalroofing.net MARCH 2014

roofwinddesigner.com

ASCE 7-05, ASCE 7-10 and ASCE 7-16

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Roof Wind Designer is intended to provide users with an easy-to-use means for determining roof systems' design wind loads for many commonly encountered building types that are subject to building code compliance.

Design-wind loads are derived using the American Society of Civil Engineers (ASCE) Standard ASCE 7, "Minimum Design Loads for Buildings and Other Structures." This standard is a widely recognized consensus standard and is referenced in and serves as the technical basis for wind load determination in the International Building Code and NFPA 5000: Building Construction and Safety Code. Roof Wind Designer allows users to choose between ASCE 7's 2005, 2010, and 2016 editions. Roof Wind Designer uses ASCE 7-05's Method 1—Simplified Method, ASCE 7-10's Envelope Procedure, Part 2: Low-rise Buildings (Simplified) of Chapter 30, ASCE 7-16's Envelope Procedure, Part 2: Low-rise Buildings (Simplified) of Chapter 30, and Part 4: Buildings with 60ft < h ≤ 160ft (Simplified). For a more detailed explanation of ASCE 7's three editions, please click here.

Also, Roof Wind Designer determines roof systems' minimum recommended design wind-resistance loads, which are derived from the building's design wind loads, taking into consideration a safety factor in reliance of ASTM D6630, "Standard Guide for Low Slope Insulated Roof Membrane Assembly Performance," AISI S100, "North American Specification for the Design of Cold-formed Steel Structural Members" and AA ADM1, "Aluminum Design Manual: Part 1-A—Specification for Aluminum Structures, Allowable Stress Design; and Part 1-B—Aluminum Structures, Load and Resistance Factor Design." Using these minimum recommended design wind-resistance loads, users can select appropriate wind resistance classified roof systems.

Edge-metal flashing systems take into consideration a safety factor in reliance of ANSI/SPRI ES-1 "Test Standard for Edge Systems Used with Low Slope Roofing Systems."

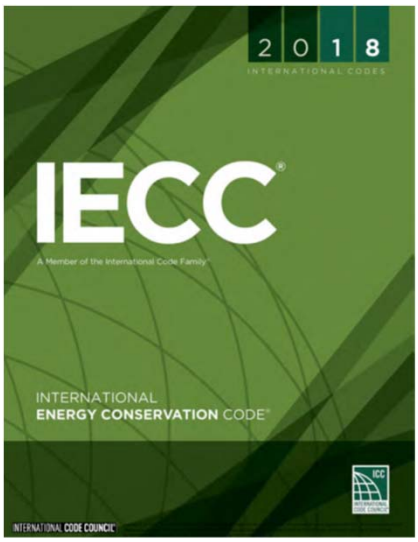
Roof Wind Designer has been developed and is maintained by the National Roofing Contractors Association (NRCA), with initial support of the Midwest Roofing Contractors Association (MRCA) and the North/East Roofing Contractors Association (NERCA). The application is currently available at no cost.

Questions regarding Roof Wind Designer can be directed to the Contact Us page.

To register for a new account click here. If you already have an account, click here to login.

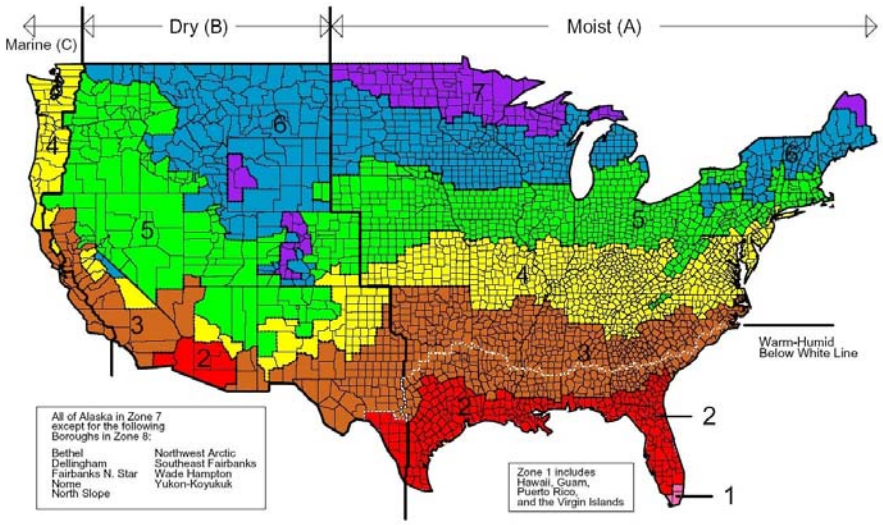
NRCA
National Roofing Contractors Association

International Energy Conservation Code, 2018 Edition (IECC 2018)



IECC 2018, Fig. C301.1-Climate zones

Fig. R301.1 (residential climate zones) is similar

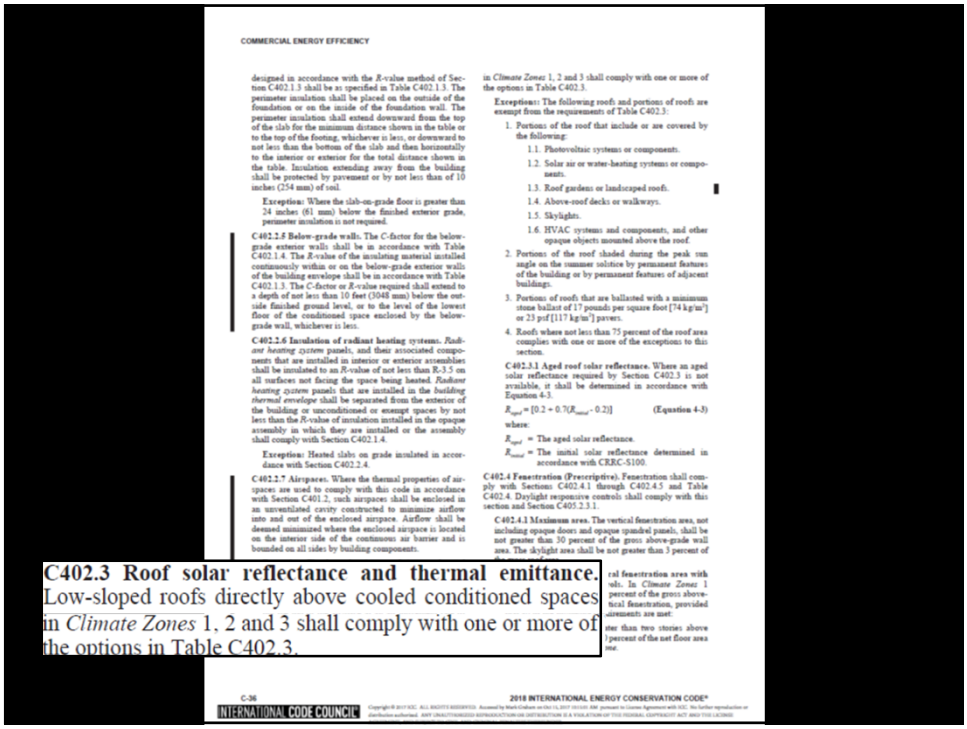


Comparison of IECC's various editions

Commercial Buildings (Insulation component R-value-based method)

Climate Zone	IECC 2003	IECC 2006	IECC 2009	IECC 2012*	IECC 2015*	IECC 2018*
1	R-12 ci	R-15 ci	R-15 ci	R-20 ci	R-20 ci	R-20 ci
2	R-14 ci		R-20ci		R-25 ci	R-25 ci
3	R-10 ci					
4	R-12 ci			R-25 ci	R-30 ci	R-30 ci
5	R-15 ci	R-20 ci				
6	R-11 ci					
7	R-15 ci	R-25 ci	R-25 ci	R-30 ci	R-35 ci	R-35 ci
8						

* Applies to roof replacement projects
ci = continuous insulation



COMMERCIAL ENERGY EFFICIENCY

designed in accordance with the *R*-value method of Section C402.1.3 shall be as specified in Table C402.1.3. The perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil.

Exception: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

C402.2.5 Below-grade walls. The *C*-factor for the below-grade exterior walls shall be in accordance with Table C402.1.4. The *R*-value of the insulating material installed continuously within or on the below-grade exterior walls of the building envelope shall be in accordance with Table C402.1.3. The *C*-factor or *R*-value required shall extend to a depth of not less than 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor of the conditioned space enclosed by the below-grade wall, whichever is less.

C402.2.6 Insulation of radiant heating systems. *Radiant heating system* panels, and their associated components that are installed in interior or exterior assemblies shall be insulated to an *R*-value of not less than R-3.5 on all surfaces not facing the space being heated. *Radiant heating system* panels that are installed in the *building thermal envelope* shall be separated from the exterior of the building or unconditioned or exempt spaces by not less than the *R*-value of insulation installed in the opaque assembly in which they are installed or the assembly shall comply with Section C402.1.4.

Exception: Heated slabs on grade insulated in accordance with Section C402.2.4.

C402.2.7 Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section C401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where the enclosed airspace is located on the interior side of the continuous air barrier and is bounded on all sides by building components.

in *Climate Zones* 1, 2 and 3 shall comply with one or more of the options in Table C402.3.

Exceptions: The following roofs and portions of roofs are exempt from the requirements of Table C402.3:

1. Portions of the roof that include or are covered by the following:
   - 1.1. Photovoltaic systems or components.
   - 1.2. Solar air or water-heating systems or components.
   - 1.3. Roof gardens or landscaped roofs.
   - 1.4. Above-roof decks or walkways.
   - 1.5. Skylights.
   - 1.6. HVAC systems and components, and other opaque objects mounted above the roof.
2. Portions of the roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings.
3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot [74 kg/m^2] or 23 psf [117 kg/m^2] pavers.
4. Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.

C402.3.1 Aged roof solar reflectance. Where an aged solar reflectance required by Section C402.3 is not available, it shall be determined in accordance with Equation 4-3.

$$R_{aged} = [0.2 + 0.7(R_{initial} - 0.2)] \quad \text{(Equation 4-3)}$$

where:

R_{aged} = The aged solar reflectance.

$R_{initial}$ = The initial solar reflectance determined in accordance with CRRC-S100.

C402.4 Fenestration (Prescriptive). Fenestration shall comply with Sections C402.4.1 through C402.4.5 and Table C402.4. Daylight responsive controls shall comply with this section and Section C405.2.3.1.

C402.4.1 Maximum area. The vertical fenestration area, not including opaque doors and opaque spandrel panels, shall be not greater than 30 percent of the gross above-grade wall area. The skylight area shall be not greater than 3 percent of

C402.3 Roof solar reflectance and thermal emittance. Low-sloped roofs directly above cooled conditioned spaces in *Climate Zones* 1, 2 and 3 shall comply with one or more of the options in Table C402.3.

ral fenestration area with ols. In *Climate Zones* 1 percent of the gross above- tical fenestration, provided elements are used:

ter than two stories above percent of the net floor area ne.

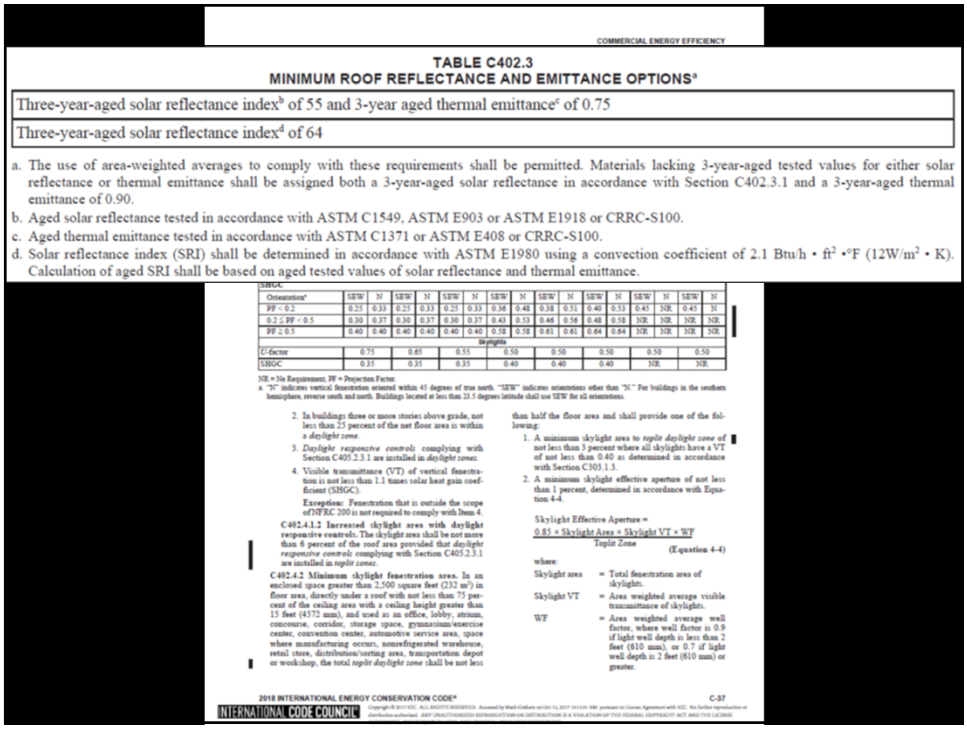


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TABLE C402.3
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

Three-year-aged solar reflectance index[b] of 55 and 3-year aged thermal emittance[c] of 0.75
Three-year-aged solar reflectance index[d] of 64

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year-aged solar reflectance in accordance with Section C402.3.1 and a 3-year-aged thermal emittance of 0.90.
b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.
c. Aged thermal emittance tested in accordance with ASTM C1371 or ASTM E408 or CRRC-S100.
d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h • ft^2 •°F (12W/m^2 • K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

SHGC															
Orientation[a]	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N
PF < 0.2	0.25	0.33	0.25	0.33	0.25	0.33	0.36	0.48	0.38	0.51	0.40	0.53	0.45	NR	0.45	N
0.2 ≤ PF < 0.5	0.30	0.37	0.30	0.37	0.30	0.37	0.43	0.53	0.46	0.56	0.48	0.58	NR	NR	NR	NR
PF ≥ 0.5	0.40	0.40	0.40	0.40	0.40	0.40	0.58	0.58	0.61	0.61	0.64	0.64	NR	NR	NR	NR
Skylights																
U-factor	0.75		0.65		0.55		0.50		0.50		0.50		0.50		0.50	
SHGC	0.35		0.35		0.35		0.40		0.40		0.40		NR		NR	

NR = No Requirement. PF = Projection Factor.
a. "N" indicates vertical fenestration oriented within 45 degrees of true north. "SEW" indicates orientations other than "N." For buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall use SEW for all orientations.

2. In buildings three or more stories above grade, not less than 25 percent of the net floor area is within a *daylight zone*.
3. *Daylight responsive controls* complying with Section C405.2.3.1 are installed in *daylight zones*.
4. Visible transmittance (VT) of vertical fenestration is not less than 1.1 times solar heat gain coefficient (SHGC).

Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 4.

C402.4.1.2 Increased skylight area with daylight responsive controls. The skylight area shall be not more than 6 percent of the roof area provided that *daylight responsive controls* complying with Section C405.2.3.1 are installed in *toplit zones*.

C402.4.2 Minimum skylight fenestration area. In an enclosed space greater than 2,500 square feet (232 m^2) in floor area, directly under a roof with not less than 75 percent of the ceiling area with a ceiling height greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, space where manufacturing occurs, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation depot or workshop, the total *toplit daylight zone* shall be not less than half the floor area and shall provide one of the following:

1. A minimum skylight area to *toplit daylight zone* of not less than 3 percent where all skylights have a VT of not less than 0.40 as determined in accordance with Section C303.1.3.
2. A minimum skylight effective aperture of not less than 1 percent, determined in accordance with Equation 4-4.

$$\text{Skylight Effective Aperture} = \frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Toplit Zone}} \quad \text{(Equation 4-4)}$$

where:

Skylight area = Total fenestration area of skylights.

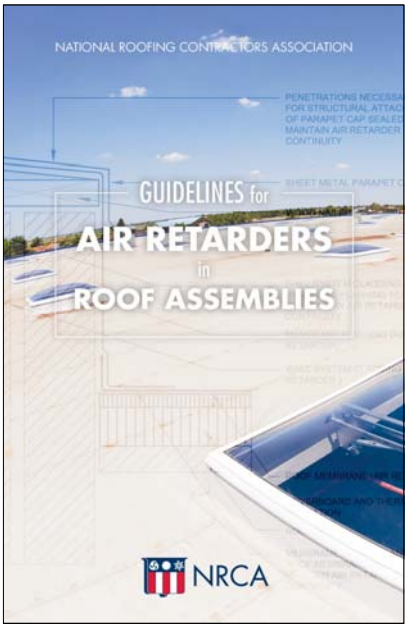
Skylight VT = Area weighted average visible transmittance of skylights.

WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.

C402.5 Air leakage—thermal envelope (Mandatory). The *thermal envelope* of buildings shall comply with Sections C402.5.1 through C402.5.8, or the building *thermal envelope* shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft^2 (2.0 L/s • m^2). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

Exception: Air barriers are not required in buildings located in *Climate Zone* 2B.



Guidelines for Air Retarders in Roof Assemblies

Roof drainage

SECTION 1502
ROOF DRAINAGE

[P] 1502.1 General. Design and installation of roof drainage systems shall comply with Section 1502 of this code and Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

[P] 1502.2 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

1502.3 Scuppers. Where scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing scuppers.

1502.4 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3, private garages and buildings of Type V construction, shall be of noncombustible material or not less than Schedule 40 plastic pipe.

CHAPTER 11
STORM DRAINAGE

SECTION 1105
ROOF DRAINS

1105.1 General. Roof drains shall be installed in accordance with the manufacturer's instructions. The inside opening for the roof drain shall not be obstructed by the roofing membrane material.

1105.2 Roof drain flow rate. The published roof drain flow rate, based on the head of water above the roof drain, shall be used to size the storm drainage system in accordance with Section 1106. The flow rate used for sizing the storm drainage piping shall be based on the maximum anticipated ponding at the roof drain.

SECTION 1106
SIZE OF CONDUCTORS, LEADERS AND STORM DRAINS

1106.1 General. The size of the vertical conductors and leaders, building *storm drains*, building storm *sewers* and any horizontal branches of such drains or *sewers* shall be based on the 100-year hourly rainfall rate indicated in Figure 1106.1 or on other rainfall rates determined from *approved* local weather data.

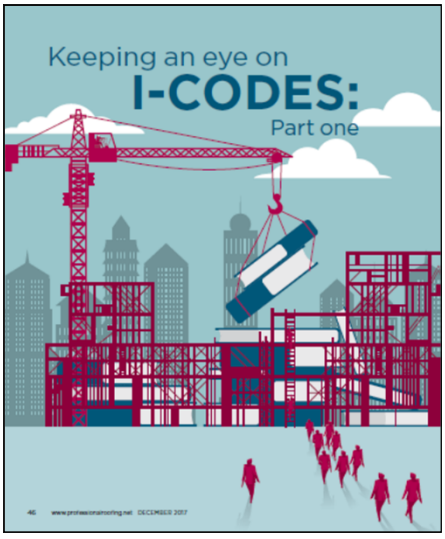
Primary roof drain

Retrofit roof drain insert

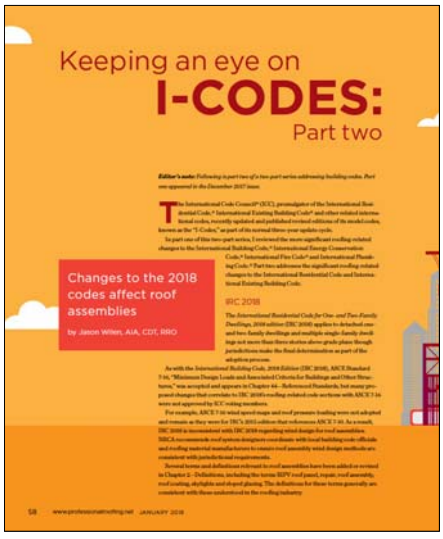
NRCA's interim recommendations

Roof drainage concerns

- Be cautious of roof drain issues, particularly in reroofing situations
  - IBC 2009 adds secondary drainage
  - IBC 2015 provides exception
  - IPC 2015 and IPC 2018 changes
- Assure membrane opening is larger than drain outlet/piping opening
- Be cautious of retrofit drain inserts
- Consider proposal/contract language



Professional Roofing, December 2017
Link to access this article



Professional Roofing, January 2018
Link to access this article

FM Global (FM)

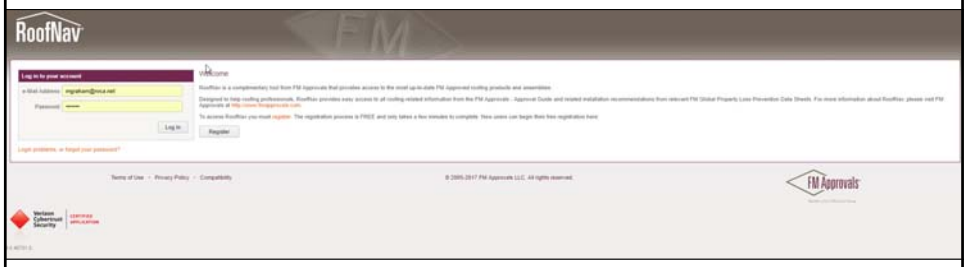
Is compliance is FM (or UL) "required"?

FM Global (FM)

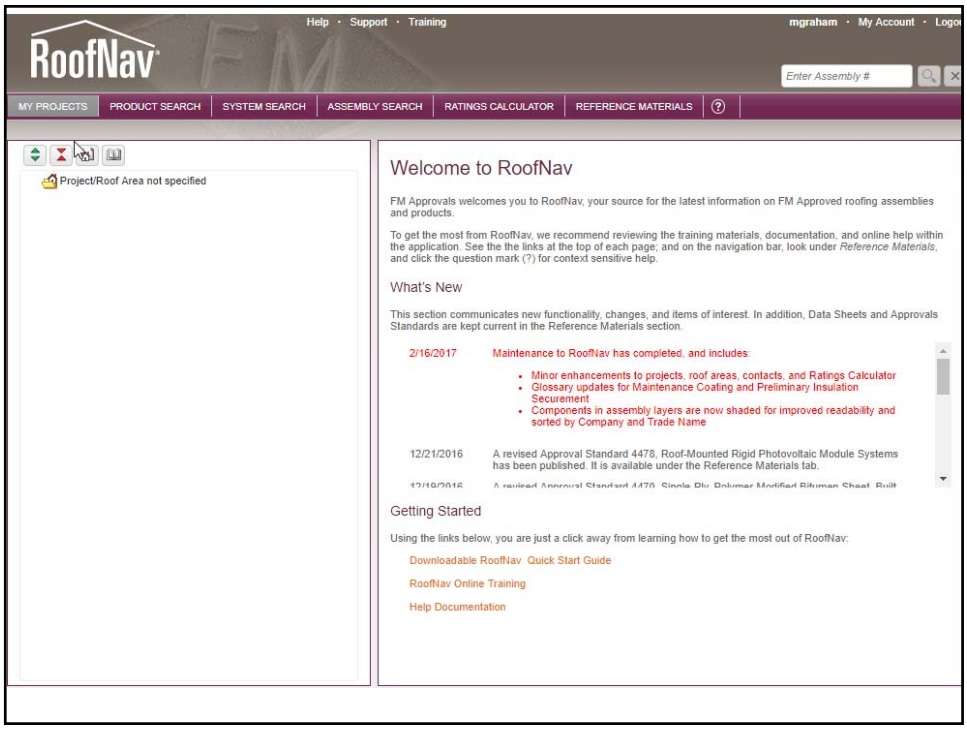
- FM Global:
  - Insurance company
  - Insures about 1/3 of Fortune 1000 companies
  - Specializes is highly-protected risk (HPR)
  - Engineering-based approach to risk management
- FM Approvals:
  - Subsidiary of FM Global
  - Code-approved testing agency
  - Accredited certification agency

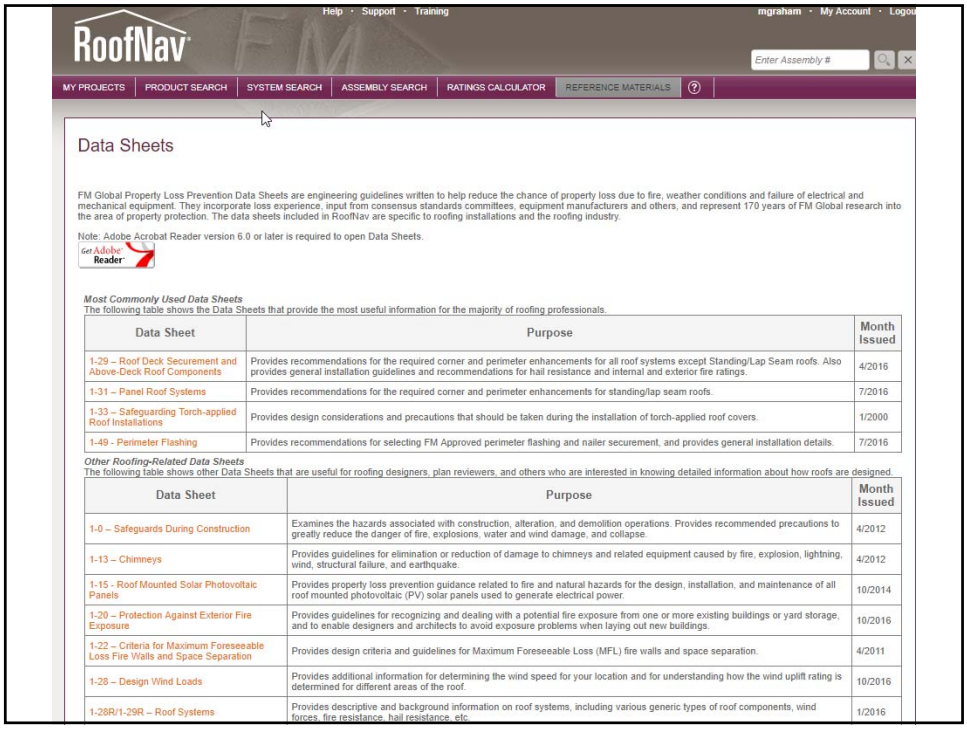
FM's RoofNav

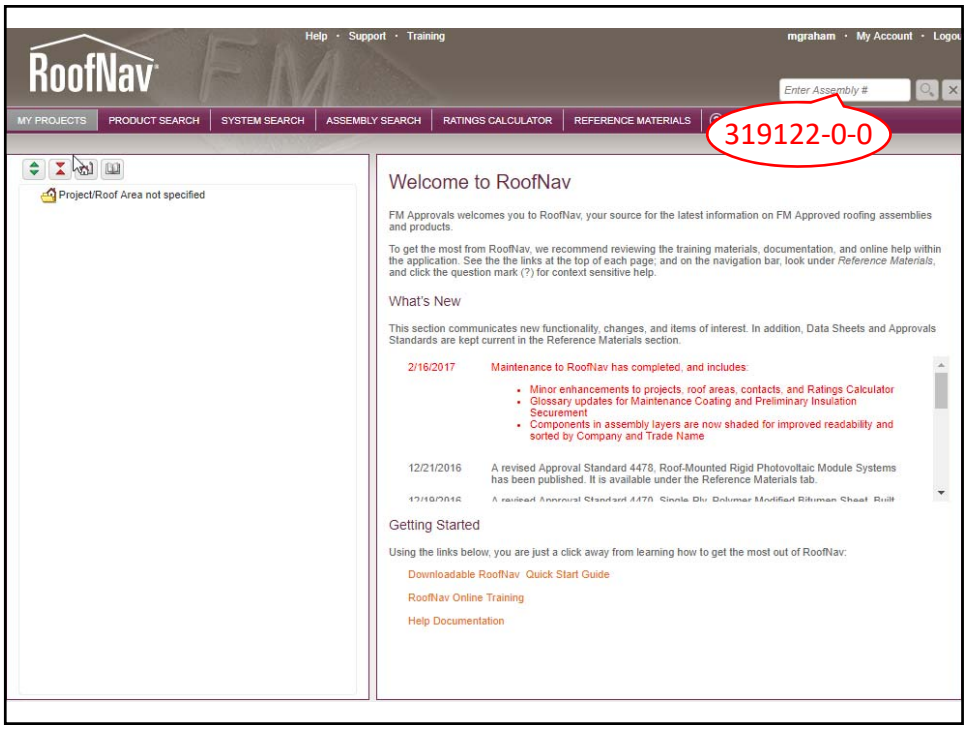
www.roofnav.com

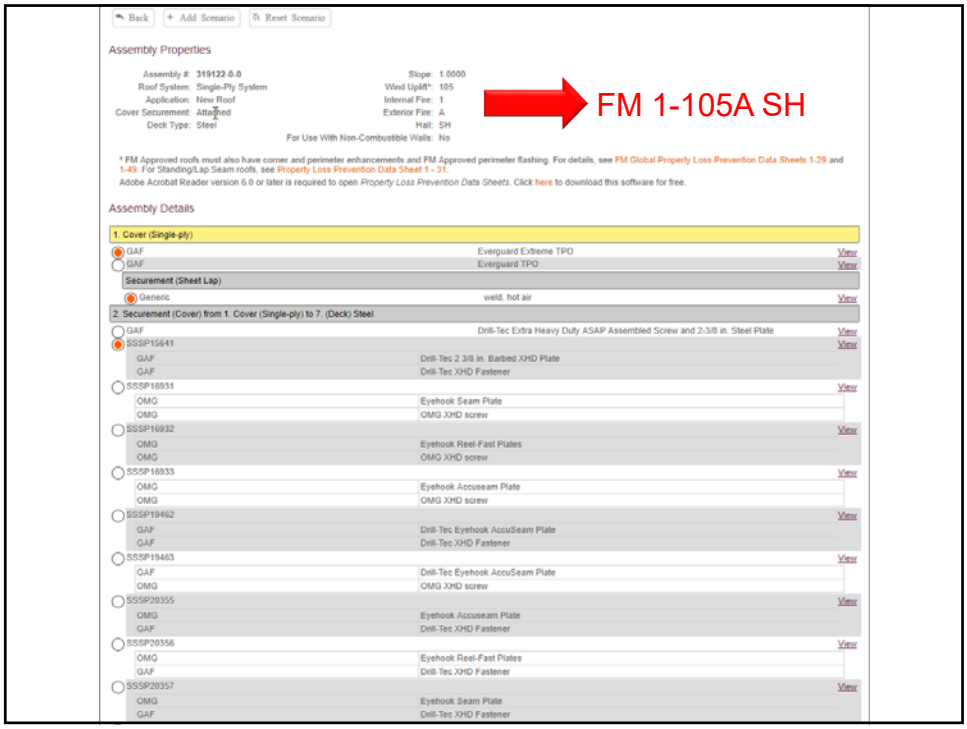


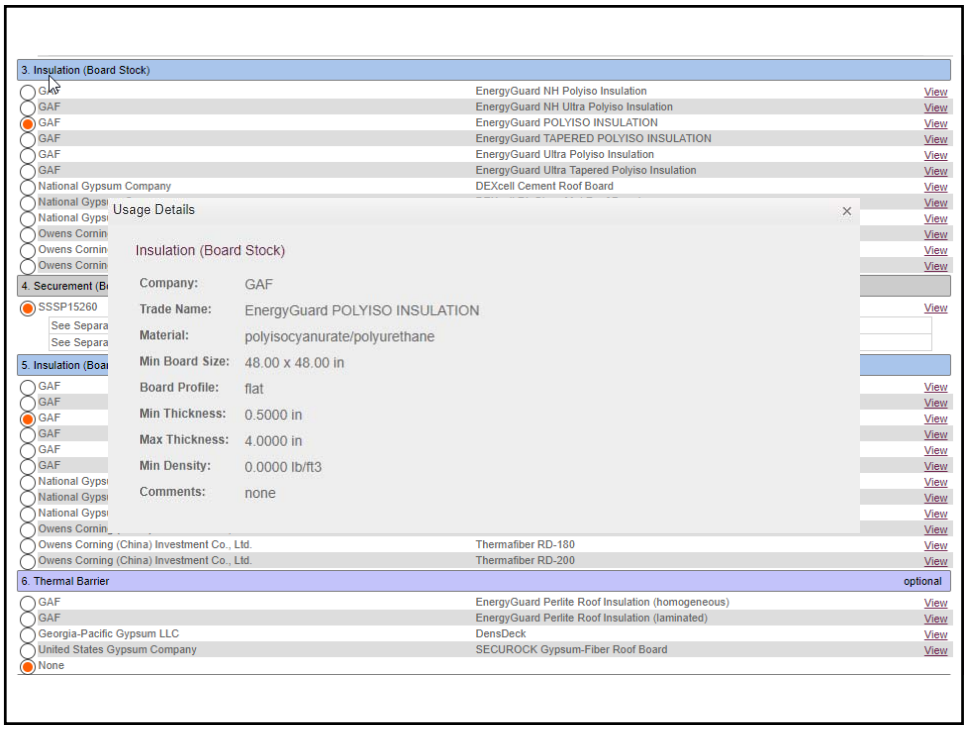
49

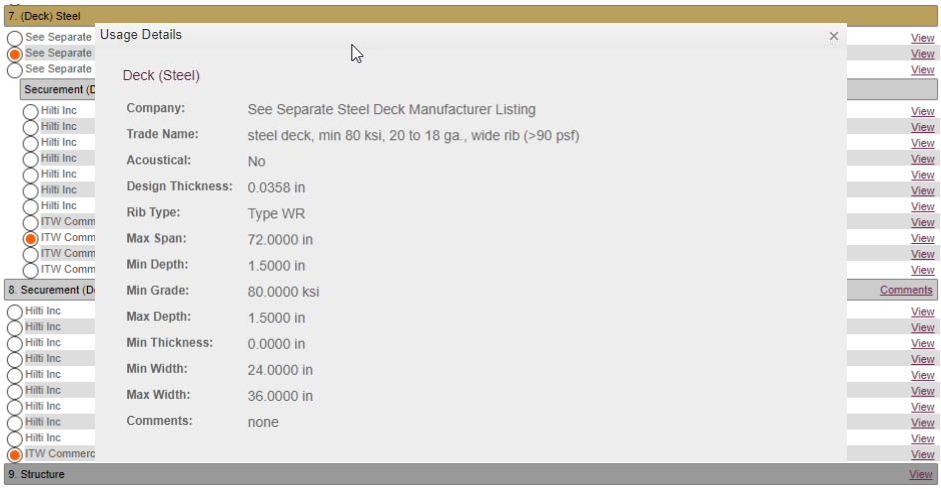



RoofNav
Help · Support · Training
mgraham · My Account · Logou
Enter Assembly #
MY PROJECTS
PRODUCT SEARCH
SYSTEM SEARCH
ASSEMBLY SEARCH
RATINGS CALCULATOR
REFERENCE MATERIALS
Data Sheets
FM Global Property Loss Prevention Data Sheets are engineering guidelines written to help reduce the chance of property loss due to fire, weather conditions and failure of electrical and mechanical equipment. They incorporate loss experience, input from consensus standards committees, equipment manufacturers and others, and represent 170 years of FM Global research into the area of property protection. The data sheets included in RoofNav are specific to roofing installations and the roofing industry.
Note: Adobe Acrobat Reader version 6.0 or later is required to open Data Sheets.
Get Adobe Reader
Most Commonly Used Data Sheets
The following table shows the Data Sheets that provide the most useful information for the majority of roofing professionals.
Data Sheet | Purpose | Month Issued
1-29 – Roof Deck Securement and Above-Deck Roof Components | Provides recommendations for the required corner and perimeter enhancements for all roof systems except Standing/Lap Seam roofs. Also provides general installation guidelines and recommendations for hail resistance and internal and exterior fire ratings. | 4/2016
1-31 – Panel Roof Systems | Provides recommendations for the required corner and perimeter enhancements for standing/lap seam roofs. | 7/2016
1-33 – Safeguarding Torch-applied Roof Installations | Provides design considerations and precautions that should be taken during the installation of torch-applied roof covers. | 1/2000
1-49 - Perimeter Flashing | Provides recommendations for selecting FM Approved perimeter flashing and nailer securement, and provides general installation details. | 7/2016
Other Roofing-Related Data Sheets
The following table shows other Data Sheets that are useful for roofing designers, plan reviewers, and others who are interested in knowing detailed information about how roofs are designed.
Data Sheet | Purpose | Month Issued
1-0 – Safeguards During Construction | Examines the hazards associated with construction, alteration, and demolition operations. Provides recommended precautions to greatly reduce the danger of fire, explosions, water and wind damage, and collapse. | 4/2012
1-13 – Chimneys | Provides guidelines for elimination or reduction of damage to chimneys and related equipment caused by fire, explosion, lightning, wind, structural failure, and earthquake. | 4/2012
1-15 - Roof Mounted Solar Photovoltaic Panels | Provides property loss prevention guidance related to fire and natural hazards for the design, installation, and maintenance of all roof mounted photovoltaic (PV) solar panels used to generate electrical power. | 10/2014
1-20 – Protection Against Exterior Fire Exposure | Provides guidelines for recognizing and dealing with a potential fire exposure from one or more existing buildings or yard storage, and to enable designers and architects to avoid exposure problems when laying out new buildings. | 10/2016
1-22 – Criteria for Maximum Foreseeable Loss Fire Walls and Space Separation | Provides design criteria and guidelines for Maximum Foreseeable Loss (MFL) fire walls and space separation. | 4/2011
1-28 – Design Wind Loads | Provides additional information for determining the wind speed for your location and for understanding how the wind uplift rating is determined for different areas of the roof. | 10/2016
1-28R/1-29R – Roof Systems | Provides descriptive and background information on roof systems, including various generic types of roof components, wind forces, fire resistance, hail resistance, etc. | 1/2016


RoofNav
Help · Support · Training
mgraham · My Account · Logou
Enter Assembly #
MY PROJECTS
PRODUCT SEARCH
SYSTEM SEARCH
ASSEMBLY SEARCH
RATINGS CALCULATOR
REFERENCE MATERIALS
319122-0-0
Project/Roof Area not specified
Welcome to RoofNav
FM Approvals welcomes you to RoofNav, your source for the latest information on FM Approved roofing assemblies and products.
To get the most from RoofNav, we recommend reviewing the training materials, documentation, and online help within the application. See the the links at the top of each page; and on the navigation bar, look under Reference Materials, and click the question mark (?) for context sensitive help.
What's New
This section communicates new functionality, changes, and items of interest. In addition, Data Sheets and Approvals Standards are kept current in the Reference Materials section.
2/16/2017 Maintenance to RoofNav has completed, and includes:
Minor enhancements to projects, roof areas, contacts, and Ratings Calculator
Glossary updates for Maintenance Coating and Preliminary Insulation Securement
Components in assembly layers are now shaded for improved readability and sorted by Company and Trade Name
12/21/2016 A revised Approval Standard 4478, Roof-Mounted Rigid Photovoltaic Module Systems has been published. It is available under the Reference Materials tab.
Getting Started
Using the links below, you are just a click away from learning how to get the most out of RoofNav:
Downloadable RoofNav Quick Start Guide
RoofNav Online Training
Help Documentation


Back
Add Scenario
Reset Scenario
Assembly Properties
Assembly #: 319122-0-0
Roof System: Single-Ply System
Application: New Roof
Cover Securement: Attached
Deck Type: Steel
Slope: 1.0000
Wind Uplift*: 105
Internal Fire: 1
Exterior Fire: A
Hail: SH
For Use With Non-Combustible Walls: No
FM 1-105A SH
* FM Approved roofs must also have corner and perimeter enhancements and FM Approved perimeter flashing. For details, see FM Global Property Loss Prevention Data Sheets 1-29 and 1-49. For Standing/Lap Seam roofs, see Property Loss Prevention Data Sheet 1 - 31.
Adobe Acrobat Reader version 6.0 or later is required to open Property Loss Prevention Data Sheets. Click here to download this software for free.
Assembly Details
1. Cover (Single-ply)
GAF Everguard Extreme TPO View
GAF Everguard TPO View
Securement (Sheet Lap)
Generic weld, hot air View
2. Securement (Cover) from 1. Cover (Single-ply) to 7. (Deck) Steel
GAF Drill-Tec Extra Heavy Duty ASAP Assembled Screw and 2-3/8 in. Steel Plate View
SSSP15641 View
GAF Drill-Tec 2 3/8 in. Barbed XHD Plate
GAF Drill-Tec XHD Fastener
SSSP16931 View
OMG Eyehook Seam Plate
OMG OMG XHD screw
SSSP16932 View
OMG Eyehook Reel-Fast Plates
OMG OMG XHD screw
SSSP16933 View
OMG Eyehook Accuseam Plate
OMG OMG XHD screw
SSSP19462 View
GAF Drill-Tec Eyehook AccuSeam Plate
GAF Drill-Tec XHD Fastener
SSSP19463 View
GAF Drill-Tec Eyehook AccuSeam Plate
OMG OMG XHD screw
SSSP20355 View
OMG Eyehook Accuseam Plate
GAF Drill-Tec XHD Fastener
SSSP20356 View
OMG Eyehook Reel-Fast Plates
GAF Drill-Tec XHD Fastener
SSSP20357 View
OMG Eyehook Seam Plate
GAF Drill-Tec XHD Fastener


3. Insulation (Board Stock)
GAF EnergyGuard NH Polyiso Insulation View
GAF EnergyGuard NH Ultra Polyiso Insulation View
GAF EnergyGuard POLYISO INSULATION View
GAF EnergyGuard TAPERED POLYISO INSULATION View
GAF EnergyGuard Ultra Polyiso Insulation View
GAF EnergyGuard Ultra Tapered Polyiso Insulation View
National Gypsum Company DEXcell Cement Roof Board View
Usage Details
Insulation (Board Stock)
Company: GAF
Trade Name: EnergyGuard POLYISO INSULATION
Material: polyisocyanurate/polyurethane
Min Board Size: 48.00 x 48.00 in
Board Profile: flat
Min Thickness: 0.5000 in
Max Thickness: 4.0000 in
Min Density: 0.0000 lb/ft3
Comments: none
4. Securement (Bi
SSSP15260 View
5. Insulation (Boar
Owens Corning (China) Investment Co., Ltd. Thermafiber RD-180 View
Owens Corning (China) Investment Co., Ltd. Thermafiber RD-200 View
6. Thermal Barrier optional
GAF EnergyGuard Perlite Roof Insulation (homogeneous) View
GAF EnergyGuard Perlite Roof Insulation (laminated) View
Georgia-Pacific Gypsum LLC DensDeck View
United States Gypsum Company SECUROCK Gypsum-Fiber Roof Board View
None



FM APPROVED

An FM Approvals' approval applies to all of the attributes of the specific FM standard referenced and may address multiple attributes (e.g., fire, uplift, impact, solar reflectivity).

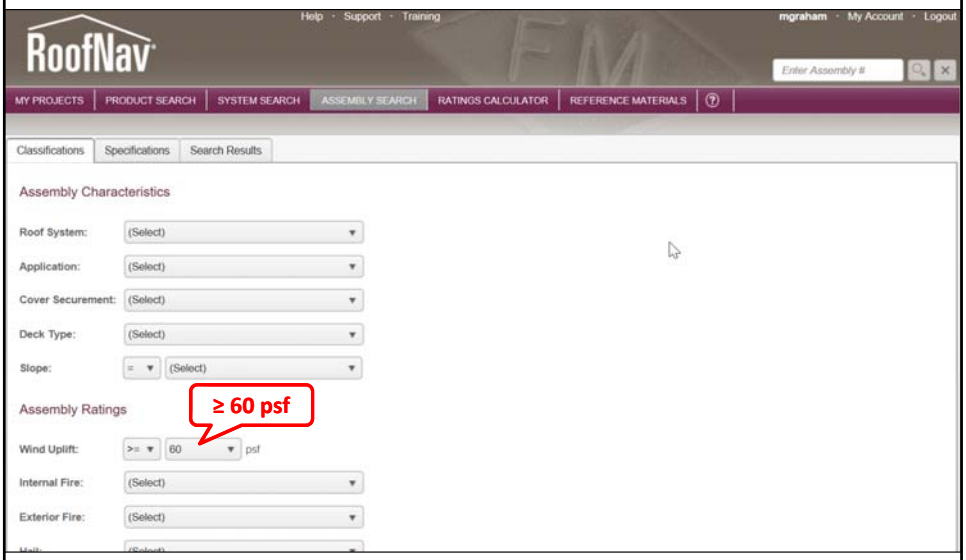
Recommendations

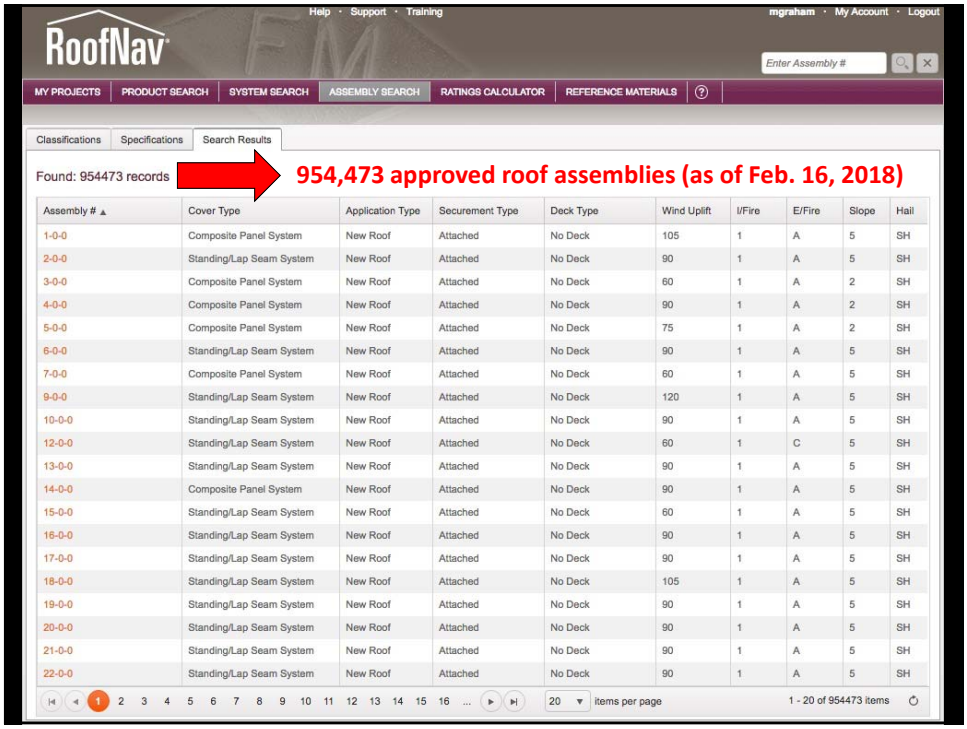
Compliance with FM and UL requirements

- Obtain UL rating and/or FM approval information from manufacturers
  - FM Roofnav number
  - UL certification
- Maintain this information in your project file

  Note: With FM and UL's current online systems, only current information is accessible; legacy information is not readily available.

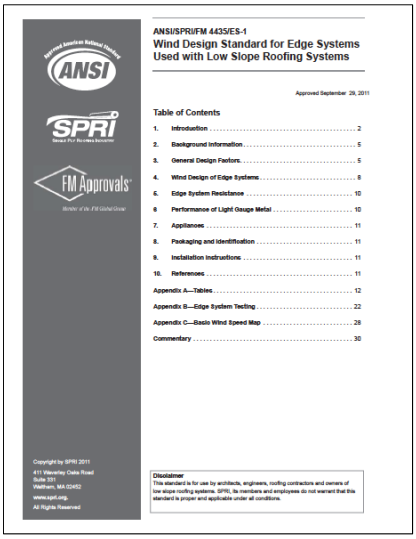
Some "fun" with RoofNav





ANSI/SPRI/FM 4435/ES-1, 2011 Edition

ANSI/SPRI/FM 4435/ES-1, 2011 Edition



ANSI/SPRI/FM 4435/ES-1
Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

Approved September 29, 2011

Table of Contents

Disclaimer
This standard is for use by architects, engineers, roofing contractors and owners of low slope roofing systems. SPRI, its members and employees do not warrant that this standard is proper and applicable under all conditions.

- Design wind loads
- Tested resistance:
  - RE-1
  - RE-2
  - RE-3
- Prescriptive requirements
- Appendixes
- Commentary

Tested resistance

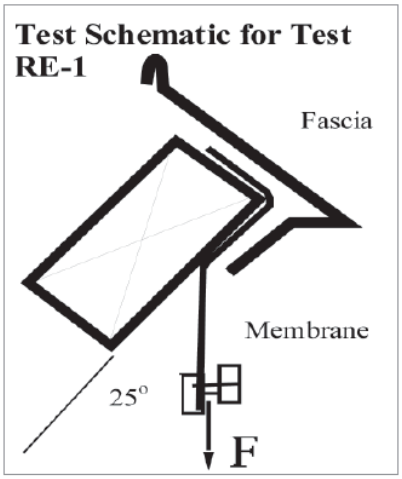


Figure RE1.1

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Tested resistance

ANSI/SPRI FM 4435/ES-1, 2011 Edition

Fascia Blow-Off Test Set Schematic

(Force at Failure x Face Area = Blowoff Resistnace)

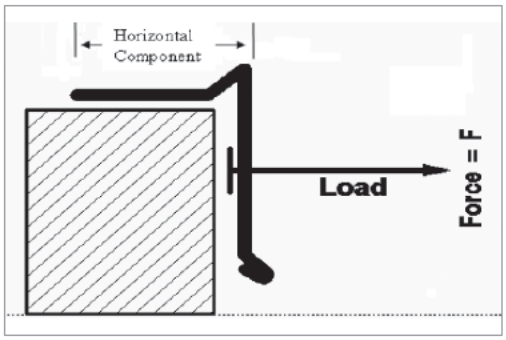

Figure RE2.1

63

Tested resistance

ANSI/SPRI FM 4435/ES-1, 2011 Edition

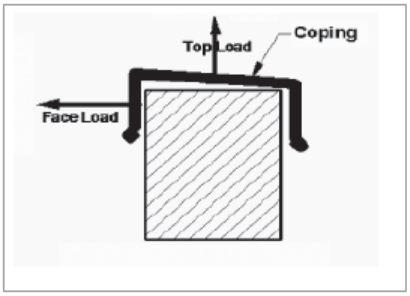

Figure RE3.1
RE3 Test—Face Leg Pull

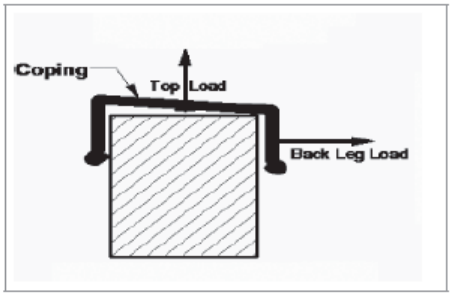

Figure RE3.2
RE3 Test—Back Leg Pull

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NRCA's shop-fabricated edge metal testing

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Shop-fabricated edge metal testing

ANSI/SPRI ES-1 testing

ANSI/SPRI ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems," is a standard addressing the design wind loads and wind resistances testing of edge metal systems, except gutters, used to secure the perimeters of low-slope membrane roof systems.

The *International Building Code* (IBC) and *NFPA 5000, Building Construction and Safety Code*, contain specific provisions requiring specific edge metal flashings to comply with ANSI/SPRI ES-1. For example, in the *International Building Code, 2012 Edition*, the provision reads as follows:

> "**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 be 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."

The 2003 Edition of ANSI/SPRI ES-1 is applicable to the *International Building Code*, 2012 Edition.

ANSI/SPRI ES-1 also is sometimes referenced in project specifications as a specific requirement for edge metal flashings.

ANSI/SPRI ES-1 consists of two primary parts. The first part provides an analytical procedure for estimating the design wind loads that will act on the perimeter edges of low-slope roof systems. The second part provides three test methods—RE-1, RE-2 and RE-3—for evaluating the wind resistances of edge-metal systems design. The fundamental concept of ANSI/SPRI ES-1 is the tested wind resistances of a specific edge metal system need to be greater than the design wind loads for the specific building being evaluated.

Customarily, design wind loads for building designs are determined by the project designer. Design wind loads should be clearly delineated on the project drawings or in the construction documents.

Wind resistance values for specific edge metal flashing profiles typically are provided by the manufacturers of edge metal systems. Project designers should include in their designs specific edge metal systems that have wind resistance values suitable for the specific building design.

NRCA has conducted extensive testing using ANSI/SPRI ES-1 of various edge metal flashing profiles that are usually shop fabricated. The edge metal profiles tested are based upon the construction details contained in The NRCA Roofing Manual. This testing provides roofing professionals who fabricate edge metal flashings in their own sheet metal shops a means of supplying edge metal flashings that comply with ANSI/SPRI ES-1.

NRCA also maintains certification programs with Underwriters Laboratories Inc. (UL) and Intertek Testing

Links

NRCA's ITS certification for compliance with ANSI/SPRI ES-1

NRCA's UL certification for compliance with ANSI/SPRI ES-1

Renew your membership

Click here to renew your membership dues online in one easy step! Don't lose your member benefits! Renew and receive $50 in NRCA Bonus Bucks.

Roofing industry news

NRCA will hold Roofing Day in D.C. 2018

NRCA will hold ProCertification Program workshop at IRE

Last call for Alliance scholarship program applications!

NRCA offers class for foremen

[More news]

Find a contractor

Roof type: Please select

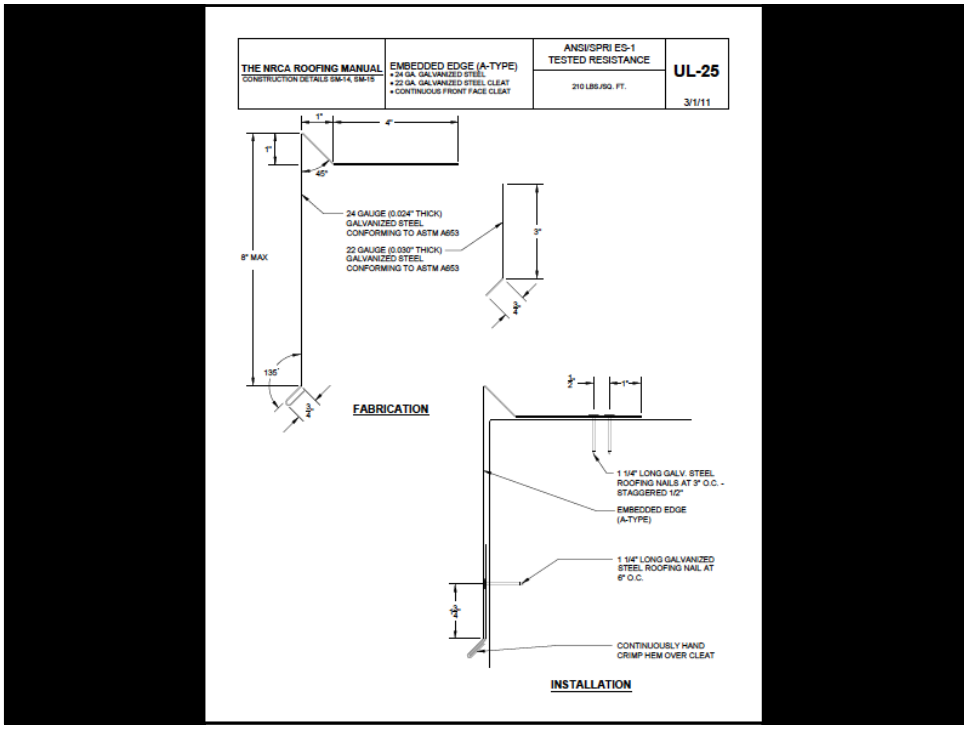
ZIP Code: Go

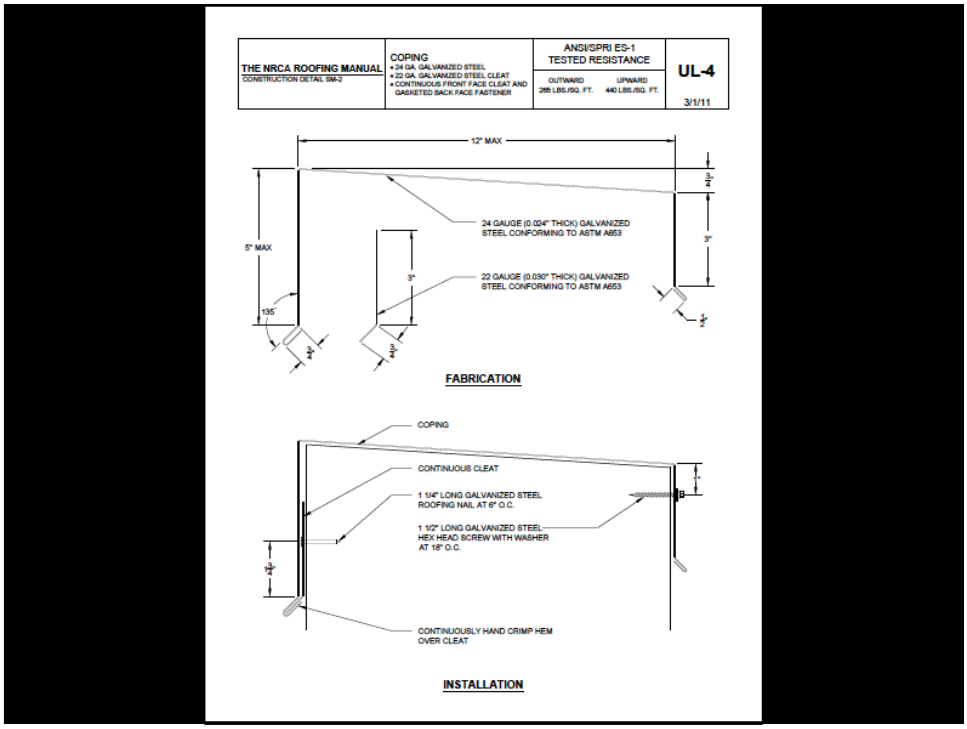
Find roofing contractors by state

Sponsored links

Roofing Day in D.C. 2018

NRCA will hold Roofing Day in D.C. 2018 March 6-7 to meet with members of Congress


THE NRCA ROOFING MANUAL
CONSTRUCTION DETAILS SM-14, SM-15
EMBEDDED EDGE (A-TYPE)
• 24 GA. GALVANIZED STEEL
• 22 GA. GALVANIZED STEEL CLEAT
• CONTINUOUS FRONT FACE CLEAT
ANSI/SPRI ES-1
TESTED RESISTANCE
210 LBS./SQ. FT.
UL-25
3/1/11
1"
4"
1"
45°
24 GAUGE (0.024" THICK) GALVANIZED STEEL CONFORMING TO ASTM A653
22 GAUGE (0.030" THICK) GALVANIZED STEEL CONFORMING TO ASTM A653
3"
8" MAX
135°
FABRICATION
1"
1 1/4" LONG GALV. STEEL ROOFING NAILS AT 3" O.C. - STAGGERED 1/2"
EMBEDDED EDGE (A-TYPE)
1 1/4" LONG GALVANIZED STEEL ROOFING NAIL AT 6" O.C.
CONTINUOUSLY HAND CRIMP HEM OVER CLEAT
INSTALLATION


THE NRCA ROOFING MANUAL
CONSTRUCTION DETAIL SM-2
COPING
• 24 GA. GALVANIZED STEEL
• 22 GA. GALVANIZED STEEL CLEAT
• CONTINUOUS FRONT FACE CLEAT AND GASKETED BACK FACE FASTENER
ANSI/SPRI ES-1
TESTED RESISTANCE
OUTWARD 285 LBS./SQ. FT.
UPWARD 440 LBS./SQ. FT.
UL-4
3/1/11
12" MAX
5" MAX
135°
24 GAUGE (0.024" THICK) GALVANIZED STEEL CONFORMING TO ASTM A653
22 GAUGE (0.030" THICK) GALVANIZED STEEL CONFORMING TO ASTM A653
3"
FABRICATION
COPING
CONTINUOUS CLEAT
1 1/4" LONG GALVANIZED STEEL ROOFING NAIL AT 6" O.C.
1 1/2" LONG GALVANIZED STEEL HEX HEAD SCREW WITH WASHER AT 18" O.C.
CONTINUOUSLY HAND CRIMP HEM OVER CLEAT
INSTALLATION

NRCA's shop-fabricated edge metal testing

- NRCA has third-party certifications:
  - UL
  - Intertek Testing Services, N.A.
- Contractors included in NRCA's third-party certification program are listed on NRCA's website: www.nrca.net
- If interested, contact me for more information.

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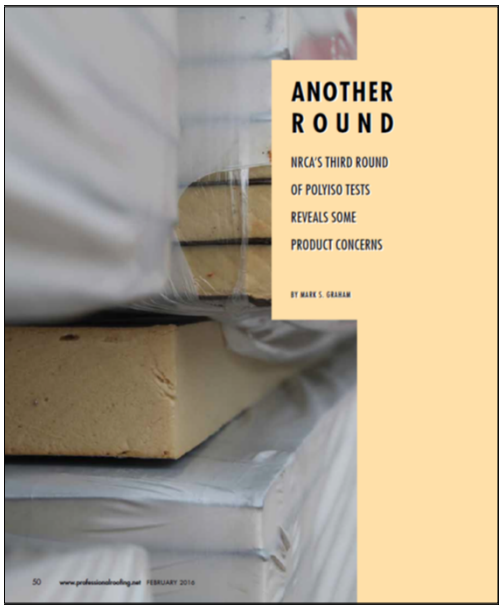
Polyisocyanurate insulation

Knit line, thickness and dimensional stability concerns



Professional Roofing
February 2016
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Knit lines

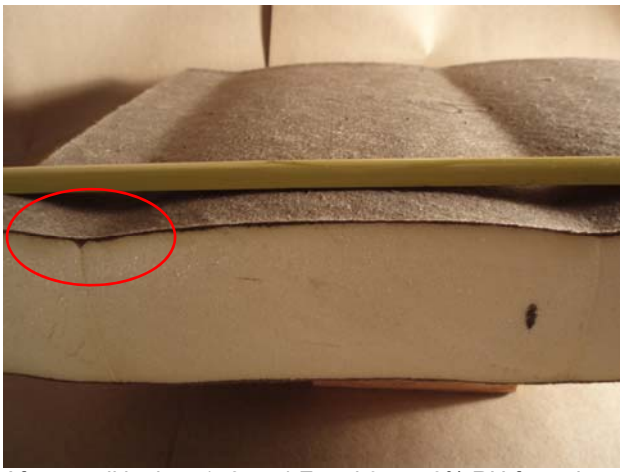
Knit lines -- continued

Photo from manufacturer's product literature

Thickness and knit lines

As delivered by manufacturer.

Knit lines -- continued



After conditioning: 158 ± 4 F and 97 ± 3% RH for 7 days

"NRCA recommends the use of a suitable cover board layer over polyisocyanurate insulation before the installation of roof membrane."

-The NRCA Roofing Manual: Membrane Roof Systems-2015

Thickness variations in polyio. insulation


RESEARCH+TECH

Not quite measuring up

Polyisocyanurate insulation thicknesses seem to vary

by Mark S. Graham

NRCA has received a limited number of reports of faced, rigid board polyisocyanurate insulation with thickness less than what was specified and indicated on the insulation's package labeling being delivered from manufacturers to distributors and job sites. Following is information about those reports, as well as information about recognized allowable thickness tolerances and NRCA's recommendations to roofing contractors for monitoring this situation.

Reports

NRCA has received reports of new, uninstalled polyisocyanurate insulation being received directly from polyisocyanurate insulation manufacturers with thicknesses notably less than nominal dimensions. Reports have been received from the East Coast to the Rocky Mountains and as far north as Wisconsin and south to Texas.

Reports have been received about various specified nominal thicknesses of polyisocyanurate insulation; however, the problems appear to be more common with thicker polyisocyanurate insulation products than thinner ones. For example, NRCA has received multiple reports of 3½-inch nominal thickness polyisocyanurate insulation measuring

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Professional Roofing,
July 2017

Thickness variations

Polyisocyanurate insulation

- Measured thicknesses notably less than nominal
- Reports from throughout the U.S.
- More common with thicker product
  - For example, 3.5 inch (nominal) measures less than 3¼-inch thick
- Most reports specific to one manufacturer
  - Multiple plants from the one manufacturer
  - Limited reports from other manufacturers

3.5 inch (nominal)

2.0 inch (nominal)

Allowable tolerances

ASTM C1289 (Polyisocyanurate insulation)

8. Dimensions

8.1 *Dimensional Tolerances*—The length and width tolerances shall not exceed ±¼ in. (6.4 mm), the thickness tolerance shall not exceed ⅛ in. (3.2 mm), and the thickness of any two boards shall not differ more than ⅛ in. (3.2 mm) when measured in accordance with Test Method C303.

8.3 *Edge Trueness in the x/y Direction*—Unless otherwise specified, the thermal insulation board shall be furnished with straight edges and edges shall not deviate more than 1/32 in./ft (2.6 mm/m) when examined in accordance with Practice C550.

8.4 *Shiplap Edges*—When specified, the insulation board shall be fabricated with shiplap edges along its longest dimensions.

8.4.1 The nominal depth of each shiplap shall be the sum of its thickest facer dimension plus one half the thickness of its core foam dimension.

8.4.2 For boards 2 in. (50.8 mm) or greater in nominal thickness, the width of the shiplap shall be 1 in. (25.4 mm). For boards less than 2 in. (50.8 mm) in thickness, the nominal width of the shiplap shall be one half the thickness of the faced board product.

8.5 *Face Trueness*—The thermal insulation boards shall not depart from absolute flatness more than ⅛ in./ft (10 mm/m) of length or width when examined in accordance with Practice C550.

8.6 *Available Sizes*—The thermal insulation boards are normally supplied in sizes of 4 by 4 ft (1.22 by 1.22 m), and 4 by 8 ft (1.22 by 2.44 m) for use in roofing applications. For sheathing applications the thermal insulation boards are normally supplied in sizes of 4 by 8 ft (1.22 by 2.44 m), 4 by 9 ft

8.7 *Crushings and Depressions*—The thermal insulation boards shall have no crushed or depressed areas on any surface exceeding ⅛ in. (3.2 mm) in depth on more than 10 % of the total surface area.

The issues…

Thickness variations in polyiso. insulation

- Most physical properties are thickness related
- R-value loss:
  - R-value decreases about 0.7 per ⅛-inch thickness loss (assuming an LTTR of 5.6 per inch)
- Insulation thickness does not match established wood blocking heights

NRCA's recommendations

Thickness variations in polyio. insulation

- Distributors and contractors should measure board edge thicknesses upon delivery, preferably while the insulation still is on the truck
- Contact the manufacturer or distributor if thicknesses are less (or more) than specified
- Also contact NRCA Technical Services

Silica exposure

NRCA Industry Issue Update

April 2016

INDUSTRY ISSUE UPDATE

NRCA Member Benefit

OSHA's final silica regulation

OSHA has issued a final rule regarding worker exposure to crystalline silica

April 2016

The Occupational Safety and Health Administration (OSHA) released its final rule on worker exposure to crystalline silica March 25. The rule had been delayed significantly by the review process conducted by the White House Office of Management and Budget, which began its final review Dec. 21, 2015. OSHA noted the rule's initial publication resulted in more than 2,000 public comments supported by more than 34,000 pages of submitted material and commanded 14 days of public hearings.

OSHA claims the final rule will save more than 600 lives and prevent more than 900 new cases of silicosis each year. The agency projects the rule will provide annual net benefits of about $7.7 billion with annual costs of $1 billion.

According to OSHA, about 2.3 million workers are exposed to respirable crystalline silica in their workplaces (respirable silica being inhaled particles 10 microns in size or less that can enter critical lung areas and cause health problems). The at-risk workforce includes about 2 million construction workers who drill, cut, crush or grind silica-containing materials such as concrete and stone and 300,000 workers in general industry operations such as brick manufacturing, foundries and hydraulic fracturing.

About 2.3 million workers are exposed to respirable crystalline silica

Silica refers to the chemical compound silicon dioxide (SiO_2); the most common form is quartz. Sand, a key component in many building products such as mortar, clay and concrete tiles, or pavers and brick, mainly is composed of silica in the form of quartz. Hazards develop when materials containing silica are cut, drilled or ground in a way that produces respirable silica. This most often occurs with powered saws or grinders with diamond blades or silicon carbide-cut wheels that produce airborne particles that can be inhaled.

The danger results when the smallest of particles penetrate the gas exchange area of the lungs; larger particles do not travel that deeply into the lungs and are purged by natural bodily actions. Respirable particles remain in the lungs, permanently scar lung tissue and make breathing increasingly more difficult—an occupational disease known as silicosis that often does not manifest itself until many years following exposure.

According to the American Lung Association, silicosis increases the risk of other lung illnesses such as tuberculosis, lung cancer and chronic bronchitis.

OSHA action

OSHA's construction regulation 29 CFR §1926.55 addresses silica as an airborne contaminant under the Mineral Dust Table, and the exposure limit in that regulation was adopted in 1971. However, the formula for determining worker exposure according to the Mineral Dust Table is based on an obsolete sampling method that renders the current regulation ineffective. The agency set about crafting a new regulation for occupational exposure to crystalline silica that first was proposed in September 2013.

The final rule:

- Establishes an action level and a permissible exposure limit (PEL) for worker exposures
- Specifies exposure control methods for construction tasks listed in what OSHA refers to as Table 1 that eliminate the requirement for initial exposure monitoring
- Requires a written exposure control plan
- Requires workers who use a respirator for 30 or more days in one year to be provided with medical surveillance
- Requires silica hazard communication to workers
- Requires use of objective data to assess worker exposure to silica
- Provides a specific compliance date for the construction industry

Action level and PEL

Under the new OSHA rule, an employer must ensure no worker is exposed to a respirable crystalline silica concentration in excess of the PEL of 50 micrograms per cubic meter ($\mu g/m^3$) of air calculated as an eight-hour time-weighted average. The employer also is obliged to assess the exposure of any worker who is or may reasonably be expected to be exposed to a level of respirable crystalline silica at or above the action level of 25 $\mu g/m^3$ of air calculated as an eight-hour time-weighted average.

The new PEL of 50 $\mu g/m^3$ reflects a significantly more protective (lower) exposure level than was permitted under the old formulaic calculation that approximated 250 $\mu g/m^3$ of air. Air monitoring workers to assess their exposures to respirable crystalline silica likely is the most costly feature of the new regulation. Two elements of the new rule can minimize its administrative burdens and financial


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Silica regulation resources (Members Only)
NRCA has developed tools for contractors to use to comply with provisions of the U.S. Occupational Safety and Health Administration's (OSHA's) new regulation targeted at respirable crystalline silica (RCS) in the workplace.
In this section you will find:
A PowerPoint presentation that contractors can use to facilitate a training session on RCS as required by the rule (The presentation also is available in Spanish by clicking here.)
A toolbox talk addressing the hazards of RCS cutting/grinding reglet and methods to control those hazards (also available in Spanish by clicking here)
A toolbox talk addressing the hazards of RCS while drilling into concrete/mortar and methods to control those hazards (also available in Spanish by clicking here)
A sample written exposure control plan that contractors may adapt to specify the elements required by the rule to limit worker exposures based on the specific tasks workers are performing
A sample respiratory protection program document that can be adapted for your company
Links to outside resources that may be useful for compliance assistance with equipment options, objective data compilations, industrial hygiene and laboratory needs, and plan development
The regulatory text of the rule at 29 CFR §1153 and Appendices A and B
NRCA's objective data collection for roofing industry exposures under 29 CFR 1926.1153 (this document will be supplemented as more roofing tasks are sampled and lab reports are received)
OSHA memorandum on interim enforcement guidance for the respirable crystalline silica in construction standard, 29 CFR 1926.1153
Following is a summary of the rule:
Silica
Silica refers to the chemical compound silicon dioxide (SiO2), the most common form of which is quartz. Sand, a key component in many building products such as mortar, clay and concrete tiles or pavers, and brick, is mainly composed of silica in the form of quartz. The danger results when the smallest of particles (respirable) penetrate to the gas exchange area of the lungs; larger particles do not travel that deep into the lungs and are purged by natural actions of the body. The respirable particles remain in the lungs and cause permanent scarring of lung tissue, making breathing increasingly more difficult—an occupational disease known as silicosis that often does not manifest until many years after exposure. According to the American Lung Association, silicosis also increases the risk of other lung issues such as tuberculosis, lung cancer and
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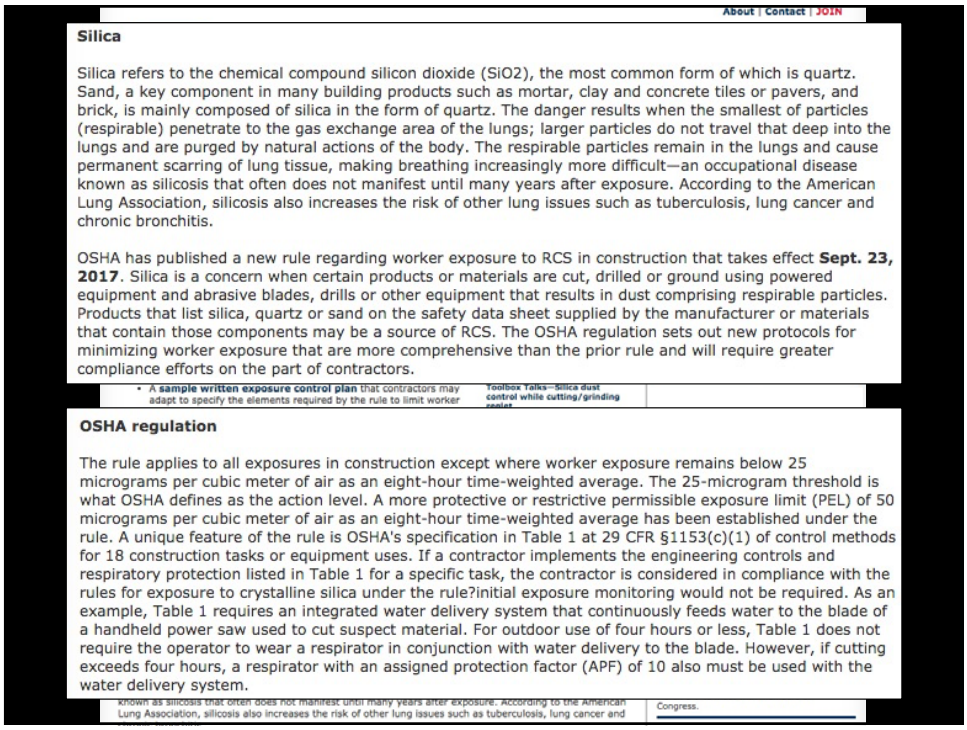
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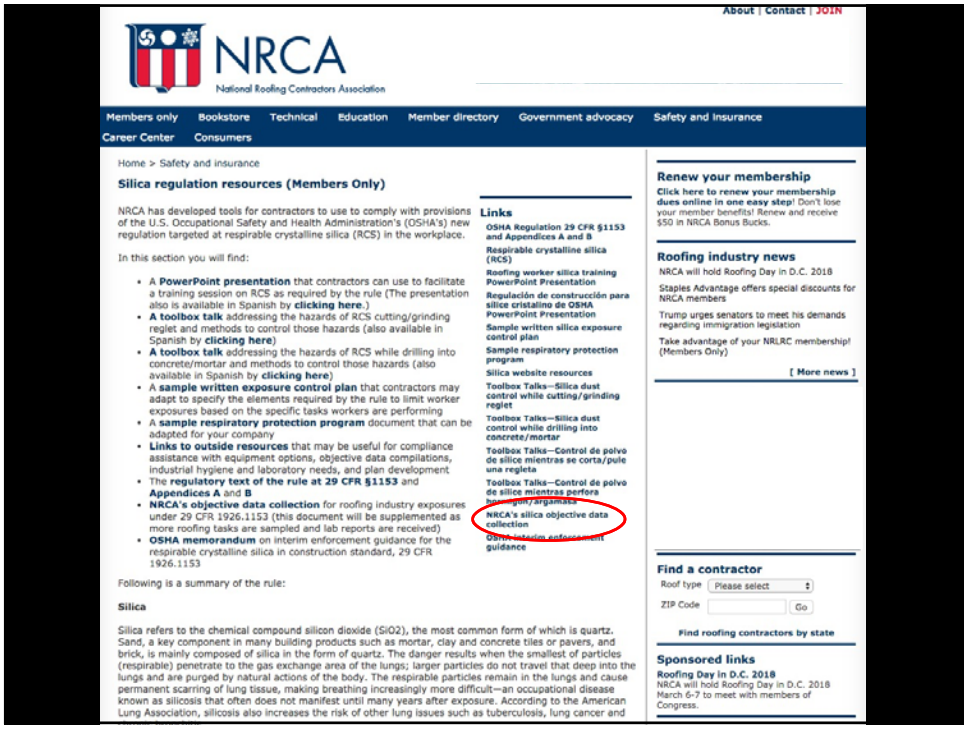
OSHA has published a new rule regarding worker exposure to RCS in construction that takes effect Sept. 23, 2017. Silica is a concern when certain products or materials are cut, drilled or ground using powered equipment and abrasive blades, drills or other equipment that results in dust comprising respirable particles. Products that list silica, quartz or sand on the safety data sheet supplied by the manufacturer or materials that contain those components may be a source of RCS. The OSHA regulation sets out new protocols for minimizing worker exposure that are more comprehensive than the prior rule and will require greater compliance efforts on the part of contractors.
OSHA regulation
The rule applies to all exposures in construction except where worker exposure remains below 25 micrograms per cubic meter of air as an eight-hour time-weighted average. The 25-microgram threshold is what OSHA defines as the action level. A more protective or restrictive permissible exposure limit (PEL) of 50 micrograms per cubic meter of air as an eight-hour time-weighted average has been established under the rule. A unique feature of the rule is OSHA's specification in Table 1 at 29 CFR §1153(c)(1) of control methods for 18 construction tasks or equipment uses. If a contractor implements the engineering controls and respiratory protection listed in Table 1 for a specific task, the contractor is considered in compliance with the rules for exposure to crystalline silica under the rule?initial exposure monitoring would not be required. As an example, Table 1 requires an integrated water delivery system that continuously feeds water to the blade of a handheld power saw used to cut suspect material. For outdoor use of four hours or less, Table 1 does not require the operator to wear a respirator in conjunction with water delivery to the blade. However, if cutting exceeds four hours, a respirator with an assigned protection factor (APF) of 10 also must be used with the water delivery system.



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NRCA will hold Roofing Day in D.C. 2018 March 6-7 to meet with members of Congress.

Jan. 11, 2018

Objective Data Collection for Roofing Industry Exposures under 29 CFR 1926.1153

On March 25, 2016, the Occupational Safety and Health Administration (OSHA) released a final rule on worker exposure to respirable crystalline silica (RCS). The rule became effective June 23, 2016, but enforcement initially was delayed until June 23, 2017, and finally initiated Sept. 23, 2017. According to OSHA, about 2.3 million workers are exposed to RCS in the workplace—respirable silica means inhaled particles 10 microns in size or less that can get into critical lung areas and cause health problems. The at-risk workforce comprises about 2 million construction workers who drill, cut, crush or grind silica-containing materials such as concrete and stone and 300,000 workers in general industry operations such as brick manufacturing, foundries and hydraulic fracturing. The common construction tasks cited by OSHA as involving exposure to RCS may not be performed extensively by roofing workers, but this objective data compilation has been established to assist contractors in minimizing roofing worker exposure.

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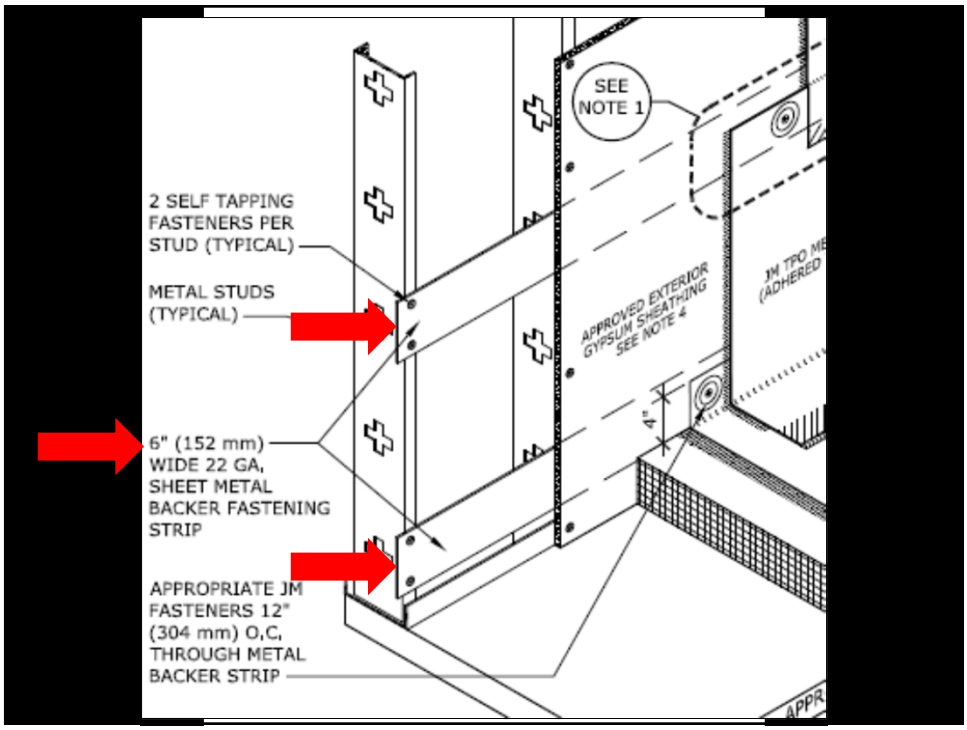
Questions… and other topics

Metal stud-framed parapet walls


SEE NOTE 1
2 SELF TAPPING FASTENERS PER STUD (TYPICAL)
METAL STUDS (TYPICAL)
6" (152 mm) WIDE 22 GA, SHEET METAL BACKER FASTENING STRIP
APPROPRIATE JM FASTENERS 12" (304 mm) O.C. THROUGH METAL BACKER STRIP
APPROVED EXTERIOR GYPSUM SHEATHING SEE NOTE 4
4"

Applicators need more guidance
on base termination/attachment details

The NRCA Roofing Manual - 2018

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www.nrca.net

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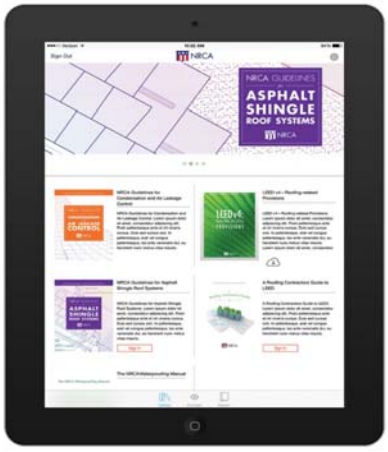
- "Members only" section, click on "My account", the "Electronic file"
- View, download and print

NRCA App



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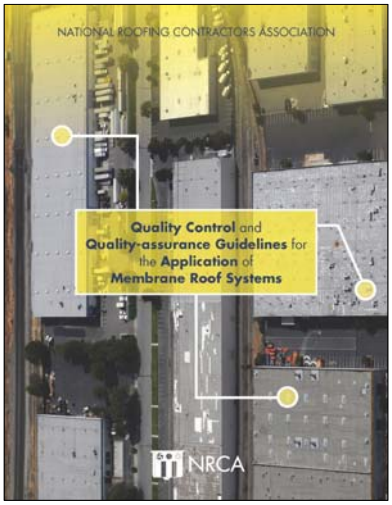

Quality Control and Quality-assurance Guidelines for the Application of Membrane Roof Systems

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