



Project Managers Meeting

Oglebay Resort, Wheeling, WV
February 20, 2020

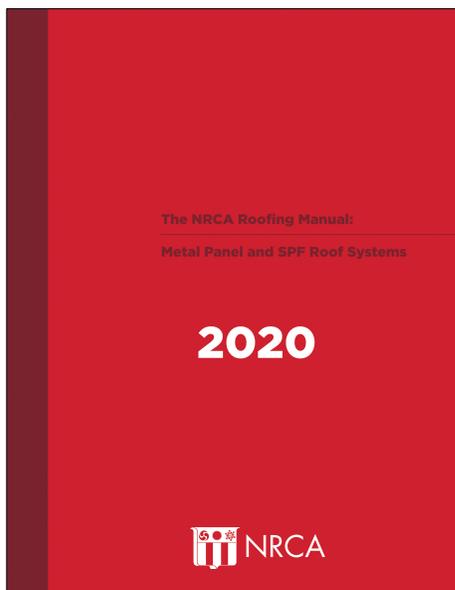
Emerging Technical Issues and Risks



Mark S. Graham

Vice President, Technical Services
National Roofing Contractors Association
Rosemont, Illinois

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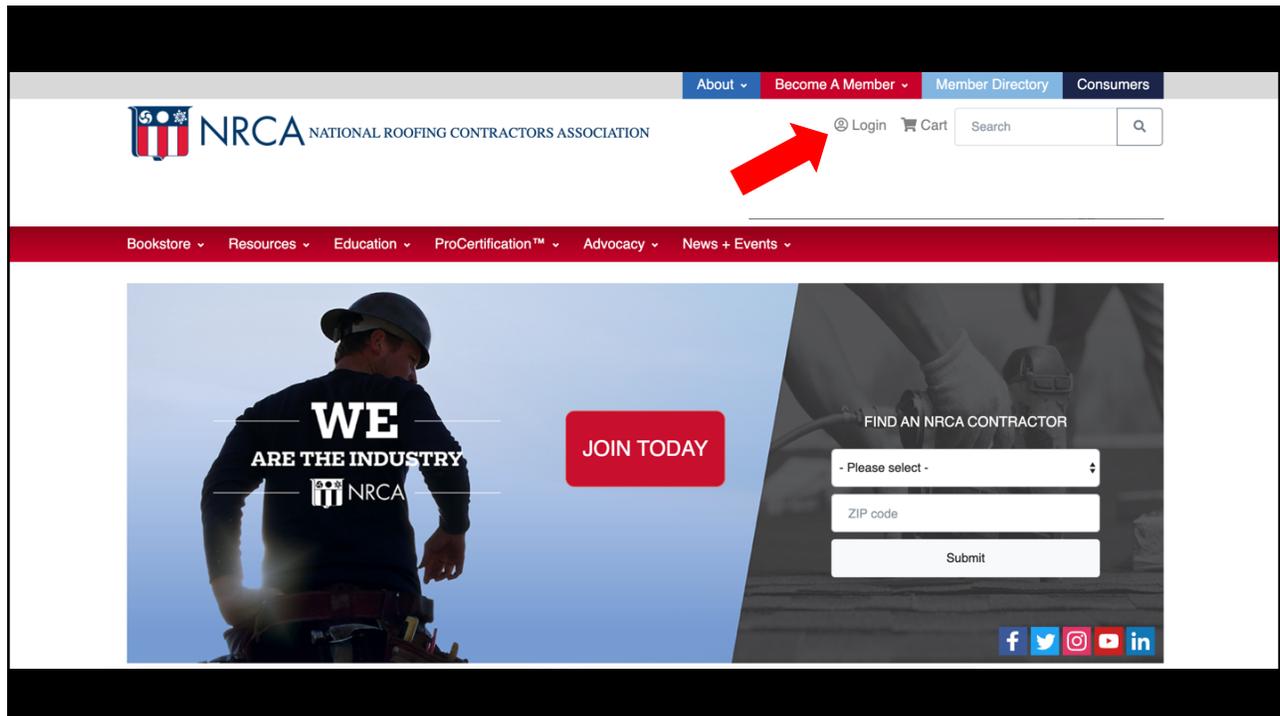
**The NRCA Roofing Manual:
Metal Panel and SPF Roof Systems-2020**

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The NRCA Roofing Manual

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Some "fun" with RoofNav

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Enter Assembly #

MY PROJECTS | PRODUCT SEARCH | SYSTEM SEARCH | ASSEMBLY SEARCH | RATINGS CALCULATOR | REFERENCE MATERIALS

Classifications | Specifications | Search Results

Assembly Characteristics

Roof System: (Select)

Application: (Select)

Cover Securement: (Select)

Deck Type: (Select)

Slope: (Select)

Assembly Ratings

Wind Uplift: >= 60 psf

Internal Fire: (Select)

Exterior Fire: (Select)

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Enter Assembly #

MY PROJECTS PRODUCT SEARCH SYSTEM SEARCH ASSEMBLY SEARCH RATINGS CALCULATOR REFERENCE MATERIALS

Classifications Specifications Search Results

Found: 943026 records → **943,026 assemblies (as of Feb. 19, 2020)**

Assembly # ↑	Cover Type	Application Type	Securement Type	Deck Type	Wind Uplift	I/Fire	E/Fire	Slope	Hail
1-0-0	Composite Panel System	New Roof	Attached	No Deck	105	1	A	5	SH
2-0-0	Standing/Lap Seam System	New Roof	Attached	No Deck	90	1	A	5	SH
3-0-0	Com						A	2	SH
4-0-0	Com						A	2	SH
5-0-0	Com						A	2	SH
6-0-0	Stan						A	5	SH
7-0-0	Com						A	5	SH
9-0-0	Standing/Lap Seam System	New Roof	Attached	No Deck	120	1	A	5	SH
10-0-0	Standing/Lap Seam System	New Roof	Attached	No Deck	90	1	A	5	SH
12-0-0	Standing/Lap Seam System	New Roof	Attached	No Deck	60	1	C	5	SH
13-0-0	Standing/Lap Seam System	New Roof	Attached	No Deck	90	1	A	5	SH
14-0-0	Composite Panel System	New Roof	Attached	No Deck	90	1	A	5	SH

Built up: 150,999
Polymer-modified bitumen: 600,688
Single ply: 176,153

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Moisture in concrete roof decks

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PORTLAND CEMENT ASSOCIATION
RESEARCH AND DEVELOPMENT LABORATORIES

Development Department • Bulletin DB9

Table 1 Drying time in days at 73 F and 50% relative Humidity for a 4-inch-thick specimen to reach 3 lbs/1,000 sq. ft./24 hrs.

Water-Cement Ratio	Bottom Sealed	Bottom Exposed to Water Vapor	Bottom in Contact with Water
0.4	46	52	54
0.5	85	144	199
0.6	117	365	>>365
0.7	130	>>365	>>365
0.8	148	>>365	>>365
0.9	166	>>365	>>365
1.0	190	>>365	>>365

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Moisture in concrete roof decks

Tech Today

Moisture in concrete roof decks

Concrete curing and drying rates can affect roof systems.

Feb. 2010

Proceedings of the 2011 International Society of Automation

THE SHORTCOMINGS OF SOME PREScriptive SPECIFICATIONS WITH REGARD TO ROOF TECHNOLOGIES

By Mark A. Grotz, Ph.D., PE
NATIONAL CENTER FOR CONSTRUCTION EDUCATION
RESEARCH, BOSTON, U.S.A.

Sept. 2011

TECH TODAY

Concrete deck dryness

Alternative approaches are needed to determine when concrete decks are dry.

By Mark A. Grotz

Dec. 2012

SPECIAL ADVERTISING SECTION

Moisture in Lightweight Structural Concrete Roof Decks

Concrete Moisture Features Critical Design for Roofing Contractors

Aug. 2013

TECH TODAY

A troubling issue

Moisture in lightweight structural concrete presents concerns.

By Mark A. Grotz

Dec. 2013

RESEARCH-TECH

Moisture in concrete roof decks

Normal weight and lightweight structural concrete moisture features.

By Mark A. Grotz

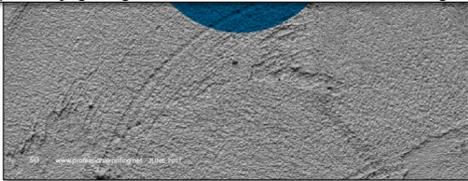
Sept. 2017

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Age	ASTM E96 calculated perm			
	Lightweight structural concrete		Normal weight concrete	
	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.



Professional Roofing, June 2017

RESEARCH + TECH



Are admixtures the answer?

Moisture in concrete roof decks continues to be problematic
by Mark S. Graham

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

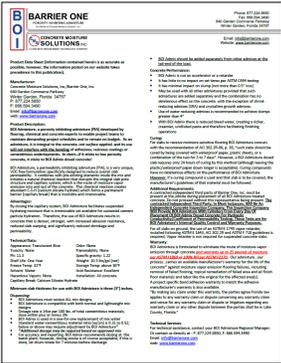
PERVA.
Concrete admixtures intended as MVRAs are specific chemicals added during concrete's batching and mixing to provide an additional chemical reaction during the concrete's hydration and curing process. MVRAs use the concrete mix's calcium hydroxide and chloride to create a calcium silicate hydrate gel within the concrete. The gel is said to fill the small pores and capillary openings in curing concrete, restricting the concrete's ability to pass and release moisture vapor. The gel is intended to be permeable and integral throughout the concrete's entire thickness.

24 www.professionroofing.net DECEMBER 2018

Professional Roofing, December 2018

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Moisture vapor reduction admixtures (MVRAs)







NRCA still has not seen an MVRA perform successfully in concrete roof deck applications

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RESEARCH+TECH


	Deck 1 (no MVRA)		Deck 2 (with an MVRA)		Deck 3 (with an MVRA)	
Specimen No.	1-1	1-2	2-1	2-2	3-1	3-2
Permeability (U.S. perm)	1.9	1.8	3.7	3.4	3.7	3.8

Table: Average tested permeability values

Putting it to the test
NRCA conducts testing of moisture vapor reduction admixtures
by Mark S. Graham

Non admixture intended to minimize a concrete roof deck's ability to pass and release moisture vapor. Some background and an overview of NRCA's testing and results follow.

What's an MVRA?
Concrete admixtures intended as MVRA's are specific chemicals added during concrete's batching and mixing to provide an additional chemical reaction during the concrete's hydration and curing process. MVRA's use the concrete mix's excess water and chlorides 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, minimizing the concrete's ability to pass and release moisture vapor. The gel is intended to be permanent and integral throughout the concrete thickness.

MVRA's are available from numerous suppliers and typically added to a concrete mix at the concrete batch plant separately from any other admixtures. Some MVRA suppliers permit their MVRA's to be added to concrete mixers at job sites provided the concrete mixer's drum is rotated for a supplier's recommended minimum amount of time after dosage and before concrete discharge and placement.

Professional Roofing

February 2020

"...These test results contradict claims an MVRA minimizes concrete's ability to pass and release moisture vapor..."

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Contract provision addresses installation of roof system over concrete deck

Assessing moisture content in roof deck: Roofing Contractor is not responsible for the effects of moisture migration originating within the roof deck or substrate, including concrete decks, or due to moisture vapor drive from within the building. Residual moisture within the roof deck, particularly structural concrete decks, can adversely affect the properties and performance of roofing materials, regardless of additives or concrete admixtures that may be included in the concrete mix. Roofing Contractor's commencement of roof installation indicates only that the Roofing Contractor has visibly inspected the surface of the deck for visible defects prior to commencement of roofing and the surface of the deck appeared dry. The 28-day concrete curing period does not signify the deck is sufficiently dry.

Roofing Contractor is not responsible to test or assess the moisture content of the deck or evaluate the likelihood of condensation from moisture drive within the building. Roofing contractor recommends that roofing not commence until probes in concrete decks show moisture content is no greater than 75% relative humidity when there is no organic content within the roofing materials. Wood fiberboard, perlite and organic paper facers on polyisocyanurate insulation will generate mold with relative humidity as low as about 65-70%.

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Coming soon...

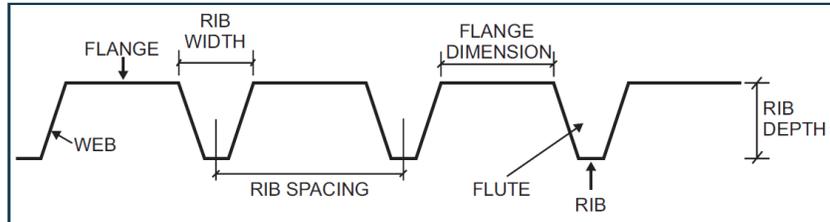
- Publication of the final report on SRI's industry-sponsored concrete moisture research
- Research summary article written by Matt Dupuis in the March issue of *Professional Roofing*
- NRCA "Industry Issue update," which will summarize the research to date and provide NRCA latest recommendations

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Fastener pull-out testing in steel roof decks

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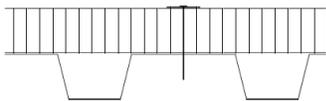
Terminology -- Steel roof decks



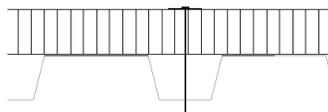
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Tested fastener locations

Fastener in flange



Fastener in rib



Fastener in web



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Other test parameters

Steel deck types:

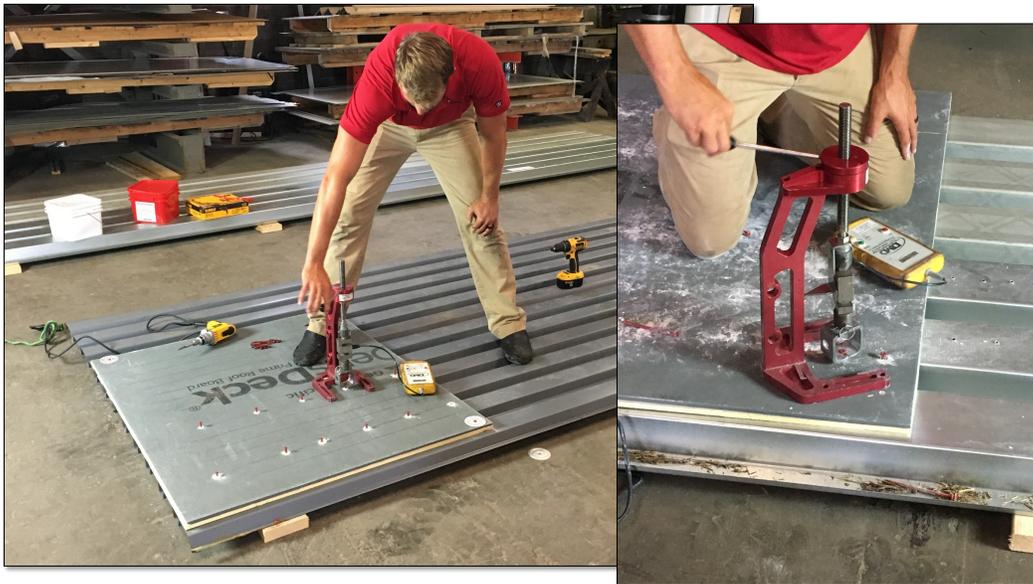
- 22 ga., 1½-in.-thick, Type B-deck
- 20 ga., 3-in.-thick, Type N-deck (Type 3DR)

Fastener types:

- All-purpose fastener (#14)
 - Published pull-out values:
 - 22 ga.: 315 lbf at 33 ksi and 480 lbf at 80 ksi
 - 20 ga.: 420 lbf at 33 ksi and 615 lbf at 80 ksi
- Heavy duty fastener (#15)
 - Published pull-out values:
 - 22 ga.: 595 lbf at 33 ksi and 650 lbf at 80 ksi

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Test set-up and equipment



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Test data

22 ga., 1½-in.-thick, Type B deck
All-purpose Fastener (#14)
Average value 10 pull-out tests

Fastener in flange	Fastener in rib	Fastener in web
637.4 lbf	561.1 lbf	556.2 lbf

Published pull-out value is 315-480 lbf

Tested fastener in rib value is 88 % of fastener in flange value
Tested fastener in web value is 87% of fastener in flange value

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Test data

22 ga., 1½-in.-thick, Type B deck
Heavy Duty Fastener (#15)
Average value 10 pull-out tests

Fastener in flange	Fastener in rib	Fastener in web
761 lbf	680.9 lbf	674.8 lbf

Published pull-out value is 595-650 lbf

Tested fastener in rib value is 89 % of fastener in flange value
Tested fastener in web value is 89% of fastener in flange value

22

Test data
 20 ga., 3-in.-thick, Type3DR deck
 All-purpose Fastener (#14)
 Average value 10 pull-out tests

Fastener in flange	Fastener in rib	Fastener in web
848.8 lbf	732.8 lbf	733.0 lbf

Published pull-out value is 420-615 lbf

Tested fastener in rib value is 86% of fastener in flange value
Tested fastener in web value is 86% of fastener in flange value

23

Test data
 20 ga., 3-in.-thick, Type3DR deck
 Heavy Duty Fastener (#15)
 Average value 10 pull-out tests

Fastener in flange	Fastener in rib	Fastener in web
1,044 lbf	1,037 lbf	978.2 lbf

No published pull-out value

Tested fastener in rib value is 99% of fastener in flange value
Tested fastener in web value is 94% of fastener in flange value

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Conclusions

Fastener pull-out testing

- Tested pull-out values are greater than published values
- “Fastener in web” or “Fastener in rib” placement results in a less than 15% reduction in pull-out load versus “Fastener in flange” placement
- Actual deck gauge, deck yield strength and fastener selection have larger impacts on fastener pull-out values
- A safety factor is typically applied to fastener pull-out loads which more than covers this reduction
- This test data applies to insulation fasteners’ performances, not necessarily membrane fasteners’ (e.g, fastener “rocking” due to membrane fluttering)

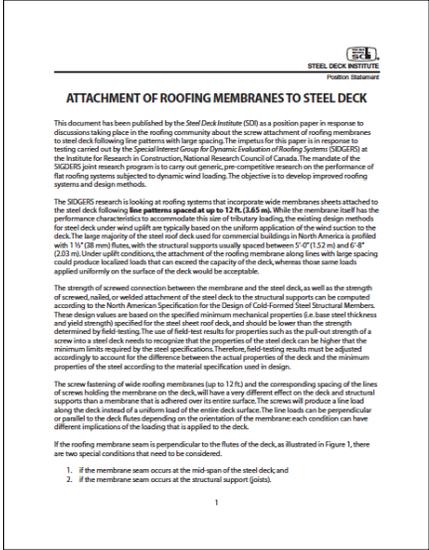
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Steel roof decks/seam-fastened systems

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SDI bulletin

2009



ATTACHMENT OF ROOFING MEMBRANES TO STEEL DECK

This document has been published by the Steel Deck Institute (SDI) as a position paper in response to discussions taking place in the roofing community about the screw attachment of roofing membranes to steel deck following line patterns with large spacing. The impetus for this paper is in response to testing carried out by the Special Interest Group for Dynamic Evaluation of Roofing Systems (SIGEDERS) at the Institute for Research in Construction, National Research Council of Canada. The mandate of the SIGEDERS joint research program is to carry out generic, pre-competitive research on the performance of flat roofing systems subjected to dynamic wind loading. The objective is to develop improved roofing systems and design methods.

The SIGEDERS research is looking at roofing systems that incorporate wide membrane sheets attached to the steel deck following line patterns spaced at up to 12 ft (3.65 m). While the membrane itself has the performance characteristics to accommodate this type of loading, the existing design methods for steel deck under wind uplift are typically based on the uniform application of the wind suction to the deck. The large majority of the steel roof deck used for commercial buildings in North America is profiled with 1 1/4" (38 mm) flutes, with the structural supports usually spaced between 5'-0" (1.52 m) and 6'-0" (1.83 m). Under right conditions, the attachment of the roofing membrane along lines with large spacing could produce localized loads that can exceed the capacity of the deck, whereas those same loads, applied uniformly on the surface of the deck would be acceptable.

The strength of screwed connection between the membrane and the steel deck, as well as the strength of screwed, nailed or welded attachment of the steel deck to the structural supports can be computed according to the North American Specification for the Design of Cold-Formed Steel Structural Members. These design values are based on the specified minimum mechanical properties (i.e. have steel thickness and yield strength) specified for the steel sheet roof deck, and should be lower than the strength determined by field testing. The use of field test results for properties such as the pull-out strength of a screw into a steel deck needs to recognize that the properties of the steel deck can be higher than the minimum limits required by the steel specifications. Therefore, field testing results must be adjusted accordingly to account for the difference between the actual properties of the deck and the minimum properties of the steel according to the material specification used in design.

The screw fastening of wide roofing membranes (up to 12 ft) and the corresponding spacing of the lines of screws holding the membrane on the deck, will have a very different effect on the deck and structural supports than a membrane that is adhered over its entire surface. The screws will produce a line load along the deck instead of a uniform load of the entire deck surface. The line loads can be perpendicular or parallel to the deck flutes depending on the orientation of the membrane; each condition can have different implications of the loading that is applied to the deck.

If the roofing membrane seam is perpendicular to the flutes of the deck, as illustrated in Figure 1, there are two special conditions that need to be considered:

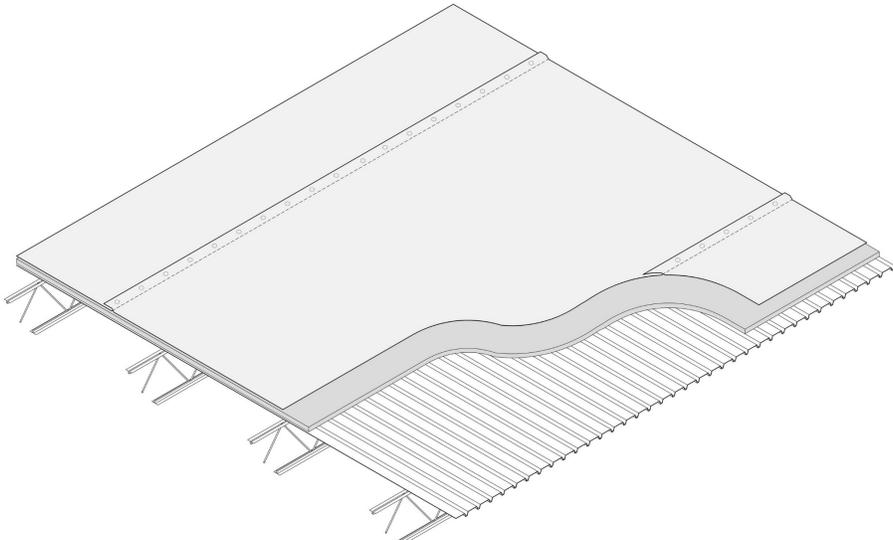
1. if the membrane seam occurs at the mid-span of the steel deck; and
2. if the membrane seam occurs at the structural support (joist).

1

- Decks designed for joist spacing between 5' and 6' 8" o.c.
- Deck designed for uniform loading
- Seam-fastened single-ply membranes are a concern

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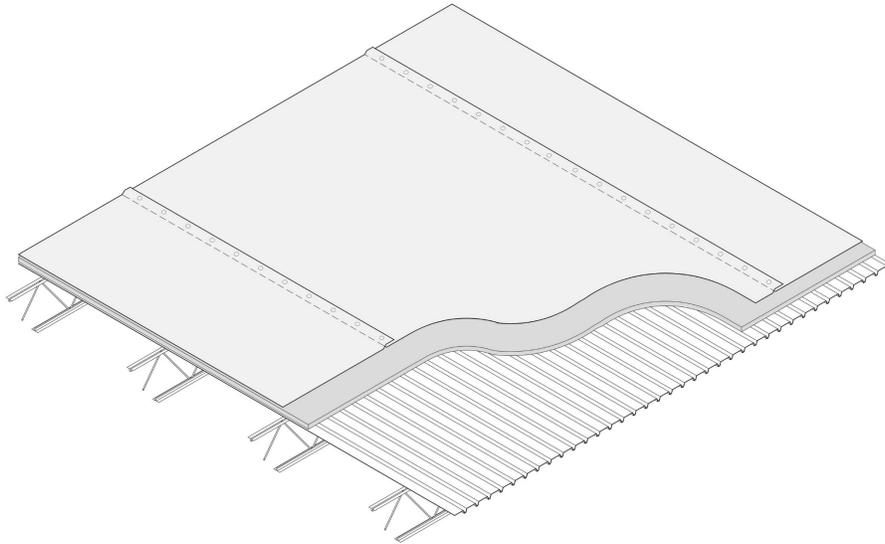
Membrane seams across deck flutes



SDI: 3.8 X moment (deck); 2 X load (joists)

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Membrane seams in deck flute direction



SDI: 12 X bending moment and shear (deck)

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SDI bulletin – Conclusion

2009 bulletin

“...SDI does not recommend the use of roofing membranes attached to the steel deck using line patterns with large spacing unless a structural engineer has reviewed the adequacy of the steel deck and the structural supports to resist to wind uplift loads transmitted along the lines of attachment. Those lines of attachment shall only be perpendicular to the flutes of the deck.”

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FM Global's Loss Prevention Data Sheet 1-29

April 2016

FM Global Property Loss Prevention Data Sheets		1-29
		January 2016
		Interim Revision: April 2016
		Page 1 of 48
ROOF DECK SECUREMENT AND ABOVE-DECK ROOF COMPONENTS		
Note to Insureds of Factory Mutual Insurance Company: Contact the local FM Global office before beginning any roofing work.		
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- Revised/new criteria:
- Steel roof decks:
 - Uniformly-distributed loading
 - Concentrated loading
 - Lightweight structural concrete

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FM Global
Property Loss Prevention Data Sheets 1-29

January 2016
Interim Revision: April 2016
Sheet 1 of 48

2.2.3.2 When designing the steel deck, give consideration to the needed wind rating, and how the load is applied (concentrated vs. uniformly distributed) from the above-deck components to the deck. Where the distance between rows of roof cover fasteners is greater than half the deck span, treat as a concentrated load.

As an alternative to using Tables 1A or 1B for concentrated loads, a performance-based approach may be used if calculations are conducted by a licensed S.E. or P.E. in structural engineering. This applies to situations where the distance between rows of roof cover fasteners is greater than one-half the deck span. Make the following assumptions:

- Assume a 3-span structural condition.
- Assume the first row of roof cover fasteners is located at mid-point of the first deck span.
- Assume maximum allowable stresses are determined using allowable strength design (ASD) in accordance with AISI S100-2012, or comparable standard outside the United States

Due to the more brittle nature of higher grade steels, the maximum yield stress used in the analysis is 60,000 psi (414 MPa), even for 80,000 psi (552 MPa) yield stress steel. Use Tables 1A through 1E as follows to facilitate deck selection:

Table 1A. Use for roof covers or base plies that are mechanically fastened to the steel deck when the distance between rows of roof cover fasteners is more than half the deck span and the deck is 1-1/2 in. (38 mm) deep, wide rib (Type B) with a minimum yield stress of 33,000 psi (228 MPa).

Table 1B. Use for roof covers or base plies that are mechanically fastened to the steel deck when the distance between rows of roof cover fasteners is more than half the deck span and the deck is 1-1/2 in. (38 mm) deep, wide rib (Type B) with a minimum yield stress of 60,000 psi (414 MPa).

Note: Where the minimum specified yield stress is between 33,000 psi (228 MPa) and 60,000 psi (414 MPa), it is reasonably accurate to interpolate the maximum deck span linearly based on Tables 1A and 1B.

Table 1C. Use for roof covers or base plies that are adhered to insulation or cover board, or mechanically fastened to the steel deck when the distance between rows of roof cover fasteners is one-half the deck span or less and the deck is 1-1/2 in. (38 mm) deep, wide rib (Type B) with minimum yield stresses of 33,000 psi (228 MPa) and ultimate wind ratings of from 60 to 225 psf (2.9 to 10.8 kPa).

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FM Global
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Table 1C. Maximum Steel Deck Span (ft) for 1½ in. (38 mm) Deep, Wide Rib (Type B) Steel Deck with an Adhered Roof Cover, for Wind Ratings from 60 to 225 psf (2.9 to 10.8 kPa)
(NOTE: Use this table when the distance between rows of roof cover fasteners is one-half the deck span or less. Green font indicates that deflection governs over bending stress.)

Yield Stress psi	Deck Gauge	Ultimate Wind Rating per RoofNav (psf)											
		Maximum Span (ft)											
		60	75	90	105	120	135	150	165	180	195	210	225
33,000	22	7.10	7.10	7.10	7.10	7.07	6.67	6.33	6.03	5.78	5.55	5.35	5.17
	20	7.78	7.78	7.78	7.78	7.78	7.43	7.05	6.72	6.44	6.18	5.96	5.76
	18	9.08	9.08	9.08	9.08	9.08	8.66	8.22	7.84	7.50	7.21	6.95	6.71
40,000	16	10.36	10.36	10.36	10.36	10.36	9.89	9.38	8.94	8.56	8.23	7.93	7.66
	22	7.10	7.10	7.10	7.10	7.10	7.10	6.96	6.67	6.35	6.10	5.88	5.68
	20	7.78	7.78	7.78	7.78	7.78	7.78	7.76	7.40	7.08	6.80	6.56	6.33
45,000	18	9.08	9.08	9.08	9.08	9.08	9.08	9.04	8.62	8.25	7.93	7.64	7.38
	16	10.36	10.36	10.36	10.36	10.36	10.36	10.32	9.84	9.42	9.05	8.72	8.43
	22	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.04	6.74	6.48	6.24	6.03
50,000	20	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.51	7.22	6.95	6.72
	18	9.08	9.08	9.08	9.08	9.08	9.08	9.08	9.08	8.76	8.41	8.11	7.83
	16	10.36	10.36	10.36	10.36	10.36	10.36	10.36	10.36	9.99	9.60	9.25	8.94
55,000	22	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	6.93	6.66	6.42	6.20
	20	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.72	7.42	7.15	6.91
	18	9.08	9.08	9.08	9.08	9.08	9.08	9.08	9.08	9.00	8.65	8.33	8.05
60,000	16	10.36	10.36	10.36	10.36	10.36	10.36	10.36	10.36	10.28	9.87	9.51	9.19
	22	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	6.97
	20	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.78	7.77
+	18	9.08	9.08	9.08	9.08	9.08	9.08	9.08	9.08	9.08	9.08	9.08	9.06
	16	10.36	10.36	10.36	10.36	10.36	10.36	10.36	10.36	10.36	10.36	10.36	10.34

Green font indicates that deflection governs over bending stress.

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FM Global
Property Loss Prevention Data Sheets 1-29

January 2016
Interim Revision April 2018

Table 1A. Maximum Steel Deck Span (ft) for 1½ in. (38 mm) Deep, 33,000 psi (228 MPa) Yield Stress with a Mechanically Fastened Roof Cover
(Note: Use this table when the distance between rows of roof cover fasteners is more than one-half the deck span.)

Max Deck Spans By Wind Rating/Fastener Spacing, Sheet Gauge for 33 ksi, 1½ in. Deep Wide Rib Deck

Roof Cover Fastener Row Spacing (ft)	Gauge	Wind Rating [psf]																		
		330	315	300	285	270	255	240	225	210	195	180	165	150	135	120	105	90	75	60
3.5	18	4.5	5.5	5.5	5.5	5.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	-	4	4	4.5	4.5	4.5	5	5.5	5.5	5.5	6	6	6	6	6	6	6	6	6
	22	-	-	-	-	4	4	4.5	4.5	4.5	5.5	5.5	5.5	6	6	6	6	6	6	6
4	18	4.5	4.5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	4	4.5	4.5	5	5.5	6	6	6	6	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	4	4.5	5	5	6	6	6	6	6	6	6	6
4.5	18	-	4	4	4.5	5	5	5.5	6	6	6	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	4	4	5	5	5.5	6	6	6	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	4	4.5	5	5	6	6	6	6	6	6	6
5	18	-	-	-	4	4	4.5	5	5	5.5	6	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	4	4.5	5	5.5	6	6	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6	6	6	6
5.5	18	-	-	-	-	-	-	4	4.5	5	5.5	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	4.5	5	6	6	6	6	6	6
6	18	-	-	-	-	-	-	-	-	4	5	5.5	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	-	4.5	5.5	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	5.5	6	6	6	6
6.5	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	20	-	-	-	-	-	-	-	-	-	4	4.5	5.5	6	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	5.5	6
7	18	-	-	-	-	-	-	-	-	-	-	-	4	5.5	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.5	18	-	-	-	-	-	-	-	-	-	-	-	-	4	5.5	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	5	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	6	6

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**FM Global
Property Loss Prevention Data Sheets** 1-29
January 2016
Interim Revision April 2016
Page 1 of 49

Table 1B. Maximum Steel Deck Span (ft) for 1 1/2 in. (38 mm) Deep, Yield Stress ≥ 60,000 psi (414 MPa) with a mechanically fastened Roof Cover (continued)
(Note: Use this table when the distance between rows of roof cover fasteners is more than one-half the deck span.)

Max Deck Spans By Wind Rating/Fastener Spacing, Sheet Gauge for 80 ksi, 1 1/2 in. Deep Wide Rib Deck

Roof Cover Fastener Row Spacing (ft)	Gauge	Wind Rating [psf]																		
		330	315	300	285	270	255	240	225	210	195	180	165	150	135	120	105	90	75	60
8.5	18	-	-	-	-	-	4	4	4.5	5	5.5	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	4	4	4.5	5.5	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6	6
9	18	-	-	-	-	-	4	4	4.5	5	5.5	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	4	4.5	5	5.5	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5.5	6	6	6	6	6
9.5	18	-	-	-	-	-	4	4	4	4.5	5	5.5	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	4	4	4.5	5	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6	6
10	18	-	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5.5	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5.5	6	6	6	6
10.5	18	-	-	-	-	-	-	-	4	4	4.5	4.5	5	5.5	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	4	4	4.5	5	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5.5	6	6	6	6
11	18	-	-	-	-	-	-	-	-	4	4	4.5	5	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	5.5	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6
11.5	18	-	-	-	-	-	-	-	-	4	4	4.5	5	5.5	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	5.5	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6
12	18	-	-	-	-	-	-	-	-	-	4	4	4.5	5	5.5	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	-	-	4	5	5.5	6	6	6
Roof Cover Fastener Row Spacing	Gauge	330	315	300	285	270	255	240	225	210	195	180	165	150	135	120	105	90	75	60

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**FM Global
Property Loss Prevention Data Sheets** 1-29
January 2016

Table 1B. Maximum Steel Deck Span (ft) for 1 1/2 in. (38 mm) Deep, Yield Stress ≥ 60,000 psi (414 MPa) with a mechanically fastened Roof Cover
(Note: Use this table when the distance between rows of roof cover fasteners is more than one-half the deck span.)

Max Deck Spans By Wind Rating/Fastener Spacing, Sheet Gauge for 80 ksi, 1 1/2 in. Deep Wide Rib Deck

Roof Cover Fastener Row Spacing (ft)	Gauge	Wind Rating [psf]																		
		330	315	300	285	270	255	240	225	210	195	180	165	150	135	120	105	90	75	60
3.5	18	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	22	5.5	5.5	5.5	5.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
4	18	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	22	4.5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
4.5	18	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	5.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	22	4	4	4.5	5	5	5.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6
5	18	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	4.5	5	5.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	22	-	-	4	4	4.5	4.5	5	5.5	6	6	6	6	6	6	6	6	6	6	6
5.5	18	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	4	4.5	4.5	5	5.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6
	22	-	-	-	-	-	4	4.5	5	5.5	6	6	6	6	6	6	6	6	6	6
6	18	5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	-	-	-	4	4.5	5	5.5	6	6	6	6	6	6	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	4	4.5	5	5.5	6	6	6	6	6	6	6	6
6.5	18	4.5	5	5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	4	4.5	5	5.5	6	6	6	6	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	4	5	5.5	6	6	6	6	6	6	6
7	18	-	4	4	4.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	4	4	5	5.5	6	6	6	6	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	4	4.5	5.5	6	6	6	6	6	6
7.5	18	-	-	-	4	4.5	4.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	4	4.5	5.5	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	4	4.5	5	6	6	6	6	6
8	18	-	-	-	-	4	4	4.5	5	6	6	6	6	6	6	6	6	6	6	6
	20	-	-	-	-	-	-	-	-	-	-	4	4.5	5.5	6	6	6	6	6	6
	22	-	-	-	-	-	-	-	-	-	-	-	4	5	6	6	6	6	6	6
Roof Cover Fastener Row Spacing	Gauge	330	315	300	285	270	255	240	225	210	195	180	165	150	135	120	105	90	75	60

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The screenshot shows the Vulcraft website's 'Factory Mutual' page. The navigation bar includes 'VULCRAFT HOME', 'ABOUT US', 'BIM TECHNOLOGY', 'JOISTS & JOIST GIRDERS', 'DECKS' (highlighted), 'CONTACT US', and 'DESIGN TOOLS'. The main content area is titled 'Factory Mutual' and contains two columns: 'Loss-Prevention Requirements For Vulcraft Steel Deck Systems' and 'FM Data'. The 'Loss-Prevention' section includes a paragraph about consulting with the FM Regional Engineer and a list of requirements. Two items in the list are highlighted with a red box: 'The fastener pattern in Zone 2, Edge, should be two times the requirement in Zone 1.' and 'The fastener pattern in Zone 3, Corner, should be two-and-one-half times the requirement in Zone 1.'. The 'FM Data' section lists three report types with 'Download' buttons: 'VULCRAFT FM DECK REPORTS', '32" 3N DECK FM REPORT', and 'DOVETAIL DECK FM REPORT'. A fourth report, 'VULCRAFT FM DECK REPORTS (UPDATED FOR PUNCHLOCK)', is also listed with a 'Download' button.

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This screenshot shows the same Vulcraft website page as above. A large white text box with a black border is overlaid on the content. The text inside the box reads: 'The approach outlined in the Vulcraft document is sufficient only for wind ratings up to 1-90. In situations where deck profile or gages desired are not listed in the Vulcraft FM documents available on this page or the wind rating required is greater than 1-90, the specifier should contact Vulcraft for assistance in seeking special consideration from the FM Regional Engineer. Allowable FM deck span charts for windstorm ratings less than 1-105 are based upon numerous limit states defined in FM Class 4451 Approval Standard which include;'. Below this text is a bulleted list: '200 lb construction and maintenance deck stress and deflection,', 'Uplift deck stress,', 'Fastener tensile capacity and', and 'Membrane width < 1/2 deck span'. At the bottom of the box, there is a small line of text: 'for one, two, and three-span conditions. Please note that these maximum span values include consideration of:'.

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The screenshot shows the NUCOR VULCRAFT website. The navigation bar includes links for VULCRAFT HOME, ABOUT US, BIM TECHNOLOGY, JOISTS & JOIST GIRDERS, DECKS (highlighted), CONTACT US, and DESIGN TOOLS. The main content area is titled "Factory Mutual" and contains the following text:

Membrane widths > 1/2 deck span require additional calculations beyond the scope of this summary. Minimum connection patterns listed per windstorm rating are within Zone 1 (Field) with prescriptive patterns in Zones 2 and 3;

- Zone 1 (Field) fastener patterns are listed per windstorm rating.
- Zone 2 (Edge) fastener pattern = 2.0 x Zone 1.
- Zone 3 (Corner) fastener pattern = 2.5 x Zone 1.

Listed and prescriptive patterns are minimums and do not supersede structural requirements defined by the Specifying Professional.

Windstorm ratings equal to or greater than 1-105 require panel yield strength of 80 ksi and calculations to satisfy Standard 4451 performance requirements for fastener and deck stress based on field, corner, and edge zone pressures. Negative pressures and zone widths can be calculated from FM data sheet 1-28 or RoofNav. Please refer to data sheets 1-28 and 1-29 for additional above deck securement.

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The image shows the cover of an article titled "THE SITUATION WITH STEEL DECKS". The cover features a blue-tinted photograph of a steel roof deck. The text on the cover includes:

THE SITUATION WITH STEEL DECKS

Steel roof deck design can affect roof system selection and design

by Mark S. Graham

32 www.professionalroofing.net MARCH 2017

To the right of the cover, the following text is displayed:

Professional Roofing
March 2017
www.professionalroofing.net

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Fastener pull-out tests...

There is little correlation between fastener pull-out resistance and a steel roof deck's yield strength and uplift (bending) strength

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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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Technical Note - No. 7

Analysis of Steel Deck and Supports for Mechanically Attached Membrane Roofs

For both new construction, and recovering or reroofing, the following guidelines reflect generally accepted industry practice:

1. Analyze the deck as a continuous 3-span beam, unless shorter spans are used.
2. Utilize all load combinations required by the applicable building code.
3. For the design spacing of fastener lines, place the first uplift line load at the midspan of the first deck span, then continue to add line loads as applicable. Repeat as necessary to determine the maximum positive and negative bending moments.
4. To determine maximum uplift on deck securement fasteners and support framing, place a line load atop a support.

SDI Recommendations

1. The SDI does not recommend the use of roofing membranes attached to the steel deck using line patterns with large spacing (spacing greater than 1/2 of the deck span) unless a structural engineer has reviewed the adequacy of the steel deck and the structural supports to resist wind uplift loads transmitted along the lines of attachment.
2. When existing buildings with steel roof deck are recovered or reroofed with a mechanically attached membrane, a competent structural engineer should be engaged to determine the limitations imposed by the existing steel deck.
3. The lines of attachment for mechanically attached membranes shall only be perpendicular to the ribs of the deck. Membranes should not be attached with lines of fasteners parallel to the deck ribs.
4. Designers should require pre-construction submittals of membrane layouts to ensure that the lines of fasteners (direction and spacing) comply with structural design assumptions. Determination of membrane layouts should not be left to the option of field crews.

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Technical Note - No. 7

The steel deck bending and shear strength (resistance) and strength (resistance) of the fasteners attaching the deck to the supports are calculated using the *North American Specification for the Design of Cold-Formed Steel Structural Members* (ANSI S100-16) and the *Standard for Steel Roof Deck* (ANSI/SDI RD-2017). These design strengths are dependent on the specified minimum mechanical properties (i.e. base steel thickness, yield and ultimate strength) for the roof deck, and should be lower than the strength determined by field-testing. Results of field-tests utilized to determine strengths which are dependent on the mechanical properties of the steel deck, such as pull-out or pull-over of a screw fastened through deck, must recognize the properties of the delivered steel may exceed the minimum limits required by the steel specification. Therefore, field-test results must be adjusted.

SDI Recommendations

1. The SDI does not recommend the use of roofing membranes attached to the steel deck using line patterns with large spacing (spacing greater than 1/2 of the deck span) unless a structural engineer has reviewed the adequacy of the steel deck and the structural supports to resist wind uplift loads transmitted along the lines of attachment.
2. When existing buildings with steel roof deck are recovered or reroofed with a mechanically attached membrane, a competent structural engineer should be engaged to determine the limitations imposed by the existing steel deck.
3. The lines of attachment for mechanically attached membranes shall only be perpendicular to the ribs of the deck. Membranes should not be attached with lines of fasteners parallel to the deck ribs.
4. Designers should require pre-construction submittals of membrane layouts to ensure that the lines of fasteners (direction and spacing) comply with structural design assumptions. Determination of membrane layouts should not be left to the option of field crews.

6

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***Expect additional scrutiny of seam-fastened,
mechanically-attached, single-ply membrane roof systems***

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*The roofing industry needs to re-think
the concept of “deck acceptance.”*

Deck acceptance should be limited to:

- Its physical presence
- Top surface is visually dry
- Surface is broom clean

*If we do not limit deck acceptance, we do nothing other than
incur someone else’s liability (and not get paid for it).*

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RESEARCH+TECH



Consider the deck
SDI provides additional guidance for steel roof deck designers
by Mark S. Graham

In November 2019, the Steel Deck Institute issued new guidance for steel roof decks that feature seams-fastened, mechanically attached, single-ply membranes. Although this guidance is directed toward roof deck designers, single-ply membrane manufacturers and suppliers, roof system designers and roofing contractors also should be aware of SDI's latest guidance.

Previous guidance

In May 2009, SDI issued a position statement, "Attachment of Roofing Membranes to Steel Decks," indicating seams-fastened, mechanically attached, single-ply membrane roof systems apply wind-uplift loads to roof decks differently than adhered membrane roof systems. Although adhered membrane roof systems apply uplift loads uniformly across a roof deck, seams-fastened membrane systems result in concentrated line loads along the deck. Such line loads can result in excess bending moment and shear applied to the deck, or a doubling of uplift loads on specific structural supports (girders) depending on the orientation of the membrane sheets relative to the deck flutes and joists.

SDI's document goes on to recommend structural engineers should review the adequacy of steel roof decks and their underlying

20 www.professionalroofing.net JANUARY 2020

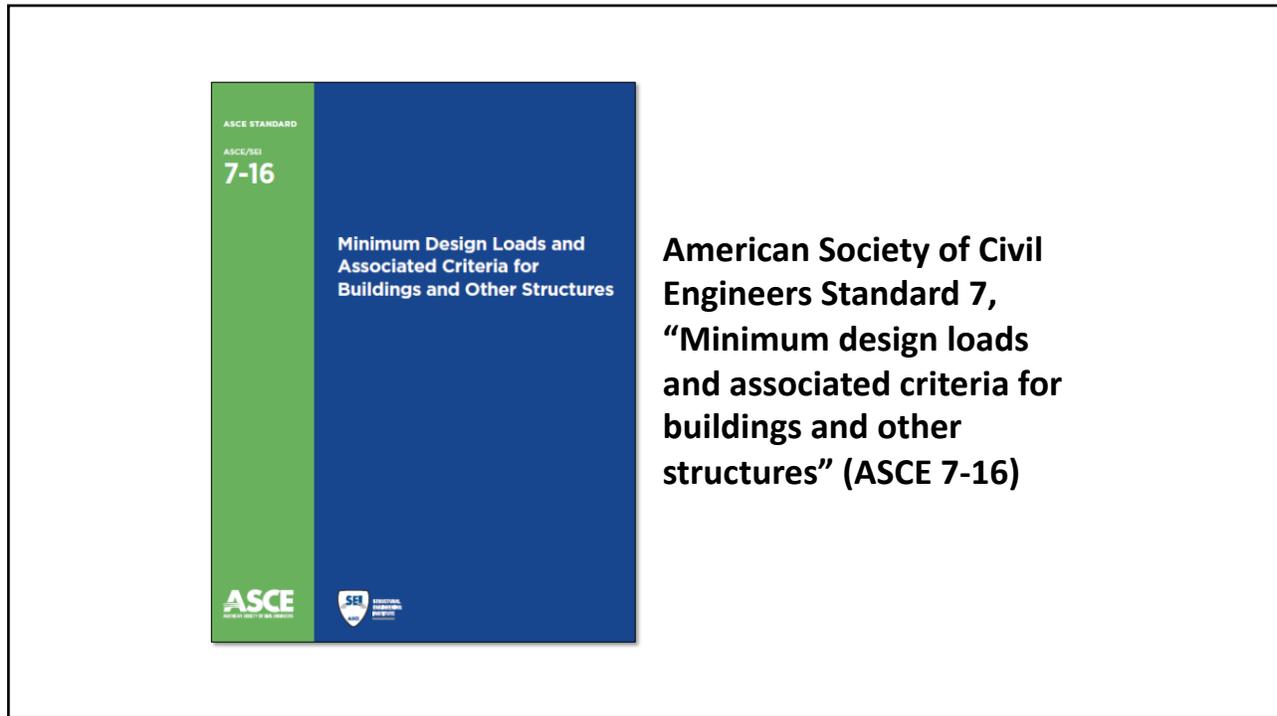
Professional Roofing

January 2020

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ASCE 7-16 implementation

48

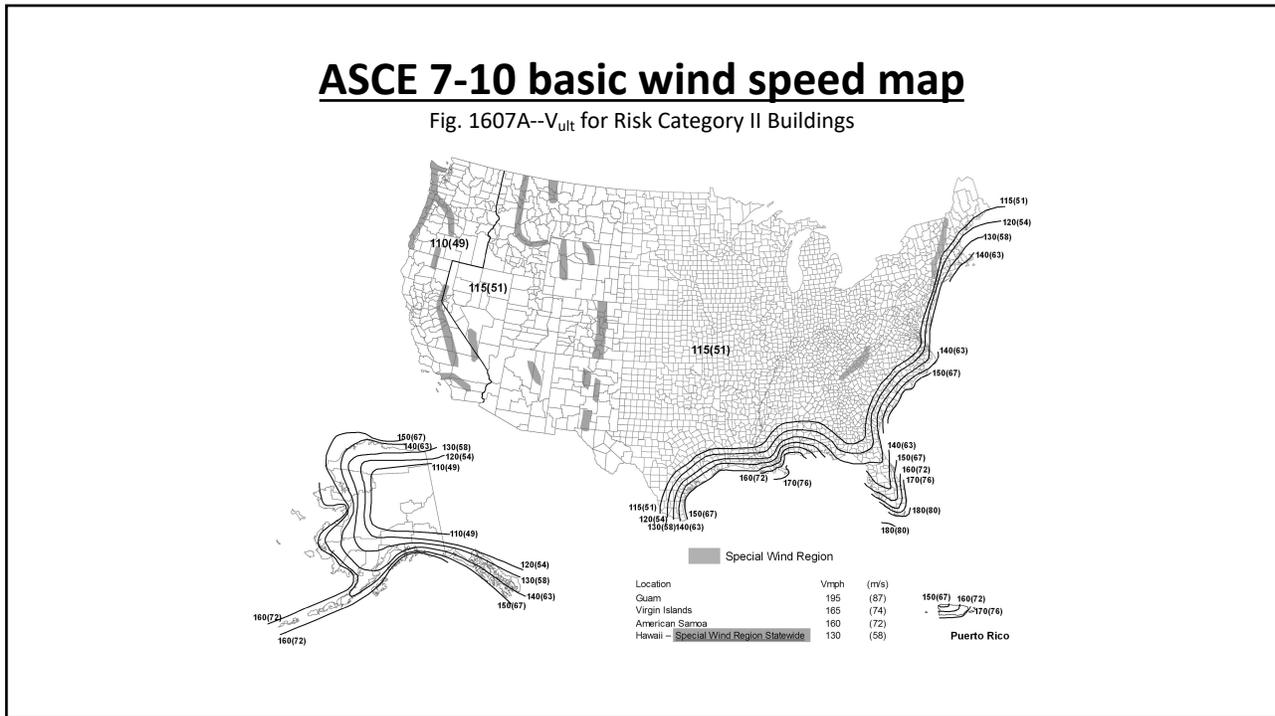


49

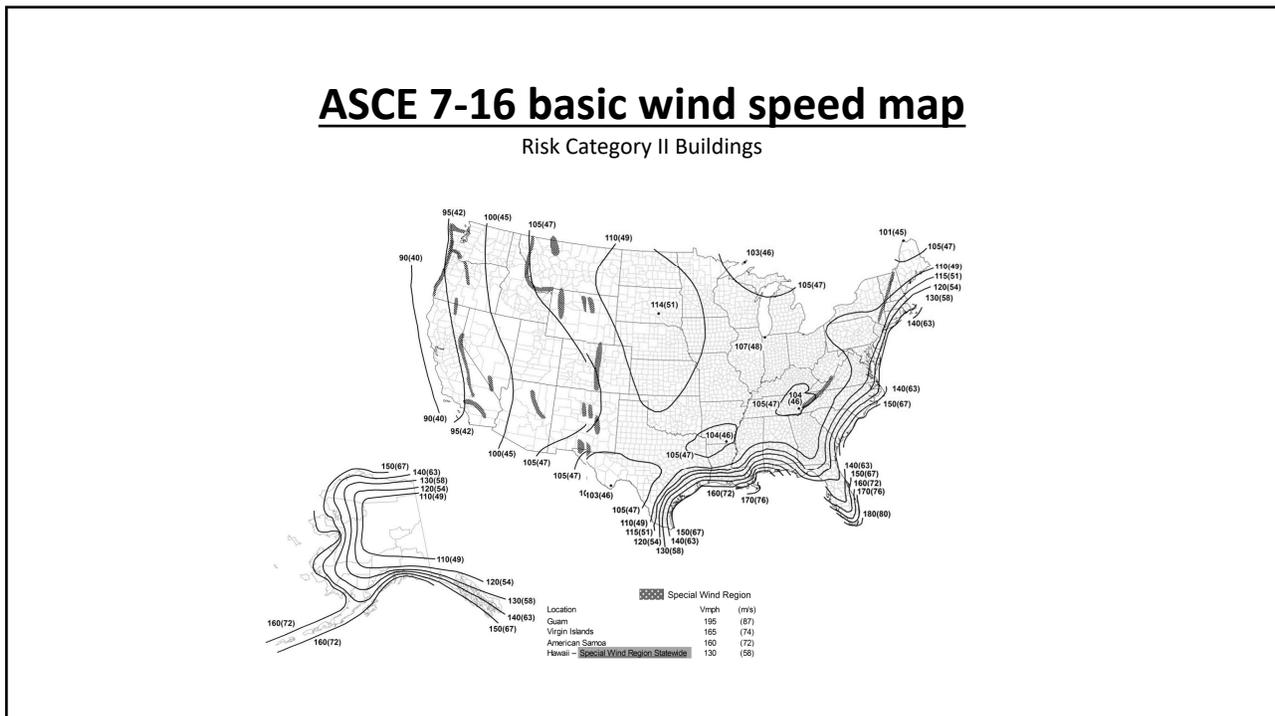
Noteworthy changes in ASCE 7-16
Compared to ASCE 7-10

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

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Comparing G_{Cp} pressure coefficients

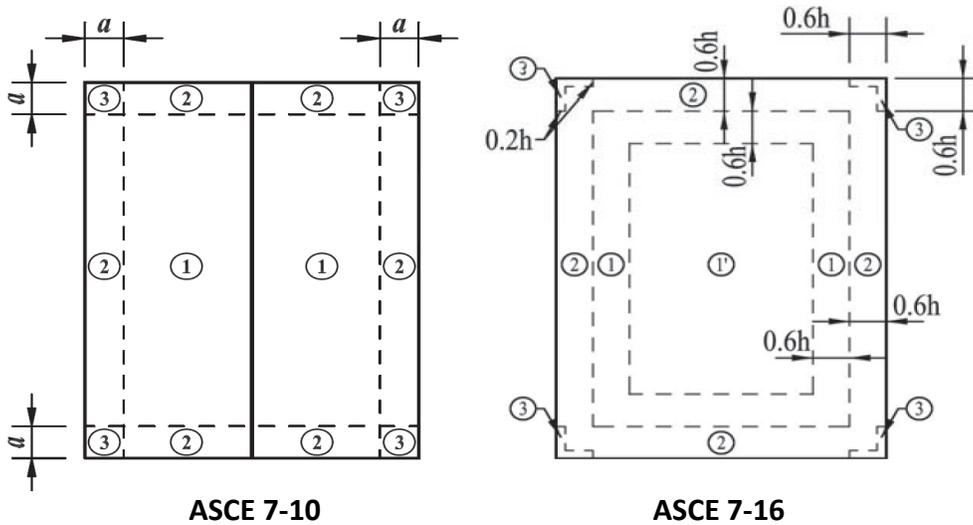
$h \leq 60$ ft., gable roofs ≤ 7 degrees

Zone	ASCE 7-10	ASCE 7-16	Change
1' (center field)	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%

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Zones

$h \leq 60$ ft., gable roofs ≤ 7 degrees



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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

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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-
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minimum

Edge-me
Roofing

Roof Win
Contract

Question

To register for a new account [click here](#). If you already have an account, [click here](#) to login.

Roof Wind Designer provides design wind loads based upon ASCE 7-16's:

- **Part 2: Low-rise Buildings (Simplified) [h ≤ 60 ft.]**
- **Part 4: Buildings with 60 ft. < h ≤ 160 ft. (Simplified)***

* Does not include hip and gable roofs h > 60 ft. and all roof slopes over 7 degrees (about 1.5:12)

 **NRCA**
National Roofing Contractors Association

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

Example: A office building (Risk Category II) is located in Baltimore, MD. The building is an enclosed structure with a mean roof height of 40 ft. The building is located in an open terrain area that can be categorized as Exposure Category C. An adhered, membrane roof systems is to be installed.

Document	Basic wind speed (mph)	Design wind pressure (psf)			
		Zone 1' (Center)	Zone 1 (Field)	Zone 2 (Perimeter)	Zone 3 (Corners)
ASCE 7-05	90	--	22	36	55
FM 1-28	90	--	25	42	63
ASCE 7-10 Ult.	115	--	36	60	90
ASCE 7-10 ASD	90	--	21	36	54
ASCE 7-16 Ult.	115	33	57	75	102
ASCE 7-16 ASD	90	20	34	45	61

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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)?

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FM Global has indicated they will update their Loss Prevention Data Sheet FM 1-28 and RoofNav Ratings Calculator to be based upon ASCE 7-16 (with modifications) this month.

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TECH TODAY

Considering the winds

Properly specifying wind design is key to roof system performance

by Mark S. Graham

With increasing frequency, NRCA has been receiving reports of roof system designs that include inadequate provisions for wind loads and resistance. Designs that only specify wind speed, wind direction or dispositionally high or low uplift-resistance classifications are telltale signs of insufficient design considerations for high winds.

Where it appears
designers have not properly addressed wind design, contractors are encouraged to seek further guidance from designers

Code requirements
Building codes typically provide minimum requirements for determining and reporting design wind loads on a project-specific basis. For example, in the International Building Code, 2015 Edition,² (IBC), design wind loads should be determined according to Chapter 16—Structural Design. This chapter specifically references the 2010 edition of ASCE Standard 7, “Minimum Design Loads for Buildings and Other Structures.” ASCE 7-10 also is referenced in IBC 2012.

With ASCE 7-10, roof systems typically are considered components and cladding elements, and design wind loads are determined using one of two methods: strength design or allowable stress design (ASD). Most roof systems are designed using the ASD method. IBC 2006 and IBC 2009 reference ASCE 7-05, which results in design wind loads near those derived using ASCE 7-10 ASD method. IBC 2015 Section 1603—Construction Documents indicates a building design

loads, including a roof system live load, snow load data, wind design and any special loads to be used in construction documents. Code-required wind design data include identifying the ultimate design wind speed, nominal design wind speed, risk category, wind exposure and applicable internal pressure coefficient. For components and cladding systems not specifically designed by a registered design professional, design wind pressure in terms of pounds per square foot (psf) also are required. Design wind pressure for the field, perimeter and corner regions of roof areas should specifically be noted.

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

IBC 2012 and previous editions include similar construction document requirements for indicating building design loads.

IBC 2015 also has specific requirements for designing roof systems’ ability to resist design wind loads. For built-up, polymer-modified bitumen, and adhered and mechanically fastened single-ply membrane roof systems, for example, IBC 2015 Section 1504—Performance Requirements specifies laboratory testing according to one of the following:

- FIA AC108, “American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Pressure and/or Negative Pressure”
- UL 580, “Test for Uplift Resistance of Roof Assemblies”
- UL 1897, “Uplift Tests for Roof Covering Systems”

These tests provide the basis for FM Approvals’ and Underwriters Laboratories’ (UL) approval classifications for roof systems.

Roof Wind Designer
NRCA’s Roof Wind Designer application can help roof system designers properly determine and specify design wind loads on roof systems. Roof Wind Designer allows users to input specific project information and determine design wind loads using ASCE 7-05 or ASCE 7-10 strength design and ASD methods for many commonly encountered building types. The application also determines minimum recommended tested wind-resistance load capacities, taking into consideration a safety factor that allows designers to select appropriate uplift-resistance-classified roof systems. Roof Wind Designer generates a project-specific report, which can be used for project documentation and submittal purposes.

Roof Wind Designer is free and can be accessed at www.roofwinddesign.com. To date, the application has been used on more than 17,750 roofing projects.

In situations where it appears roof system designers have not properly addressed code-required considerations for wind design, contractors are encouraged to seek further guidance from designers. Referencing designers to Roof Wind Designer is one possible approach to helping designers provide code-required documentation of design wind loads in contract documents. ■■

MARK S. GRAHAM is NRCA’s vice president of technical services.

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Polymer-modified bitumen sheet testing

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Polymer-modified bitumen test results			
Sample (manufacturers and product)	Low-temperature flexibility (F)		Granule embedment as received (grams)
	As received	Heat aged (90 days at 158 F)	
SBS products			
1-A	-25	-25	0.9
2-A	-20	-15	1.6
2-B	0	15	0.7
2-C	-35	-15	1.3
3-A	10	20	1.8
4-A	-30	-30	1.1
4-B	-15	-5	0.8
5-A	-5	0	0.6
5-B	10	10	0.7
6-A	-20	-15	1.1
9-A	-30	-15	0.6
ASTM International's maximum allowable values	0	0	2
APP products			
3-B	20	20	0.7
8-A	20	35	3.4
ASTM International's maximum allowable values	32	32	2

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Nine of 13 products tested complied...

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2011 testing

Only six of the 16 products tested complied....

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2019 MB testing

- ASTM D5147 -- Low-temperature flexibility (as received)
- ASTM D4977 -- Granule embedment (as received)
- ASTM D3461 -- Softening point (as received)

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Products tested

2019 MB testing

- 18 products tested:
 - 7 APP
 - 9 SBS
 - 15 products with granules
 - 3 products without granules (granule embedment doesn't apply)
- Manufacturers:
 - 10 (CertainTeed, Derbigum, Firestone, GAF, Garland, JM, Polyglass, Siplast, Soprema and Tremco)

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Results – SBS products

2019 testing

Sample ID	Modifier	ASTM designation	Low-temp. flex. (F)	Granule loss (g)
1-A	SBS	ASTM D6164, Type I, Grade G	-13	0.56
3-A	SBS	ASTM D6164, Type I, Grade S	-27	NA
3-B	SBS	ASTM D6164, Type II, Grade G	-15	0.48
4-A	SBS	ASTM D6164, Type II, Grade G	-16	1.13
5-A	SBS	ASTM D6162, Type III, Grade G	-15	2.05
6-A	SBS	ASTM D6164, Type I, Grade G	-13	0.34
6-B	SBS	ASTM D6164, Type II, Grade G	-13	0.53
6-C	SBS	ASTM G6164, Type I, Grade G	-9	0.55
8-A	SBS	ASTM D6163, Type I, Grade G	-20	0.09
9-A	SBS	ASTM D6164, Type I, Grade G	-8	0.53
10-A	SBS	ASTM D6163, Type III, Grade G	Less than -40	1.16
ASTM spec.			0 (max.)	2.0 (max)

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Results – APP products

2019 testing

Sample ID	Modifier	ASTM designation	Low-temp. flex. (F)	Granule loss (g)
2-A	APP	ASTM D6223, Type I, Grade G	21	0.95
2-B	APP	ASTM D6223, Type I, Grade S	10	NA
2-C	APP	D6223, Grade G	14	0.60
2-D	APP	ASTM D6222, Type II, Grade G	10	0.65
2-E	APP	D6223, Grade G	9	NA
7-A	APP	D6222, Grade G	Greater than 41	0.10
7-B	APP	D6222, Type I, Grade G	Greater than 41	0.88
		ASTM spec.	32 (max.)	2.0 (max)

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Summary of results

- 15 of the 18 products tested comply
- Results notably are better than 2015 and 2011
- Still some reason(s) for concern

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Softening point testing

- Tested sheet backside (bottomside) coating material and parting media (sand, film)
- Tested using ASTM D3461 (ring and ball)

APP products: 309 F to 330 F

SBS products: 239 F to 293 F

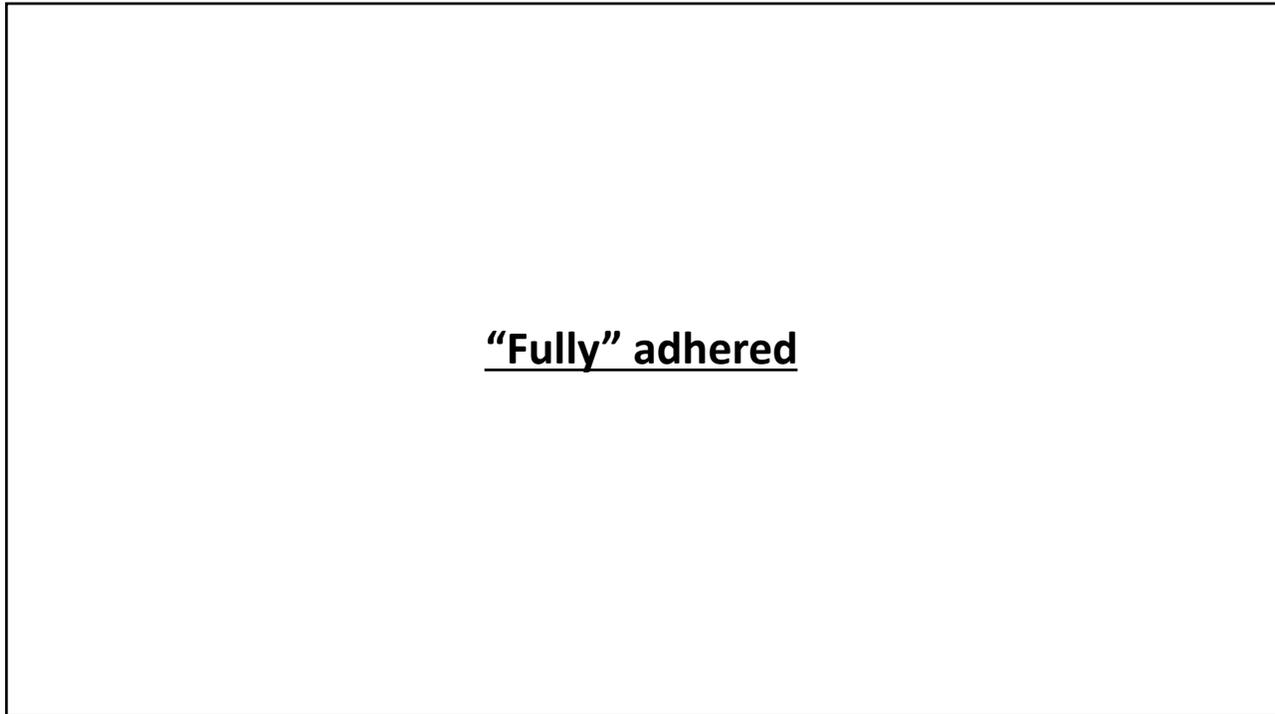
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Recommendations

2019 MB testing

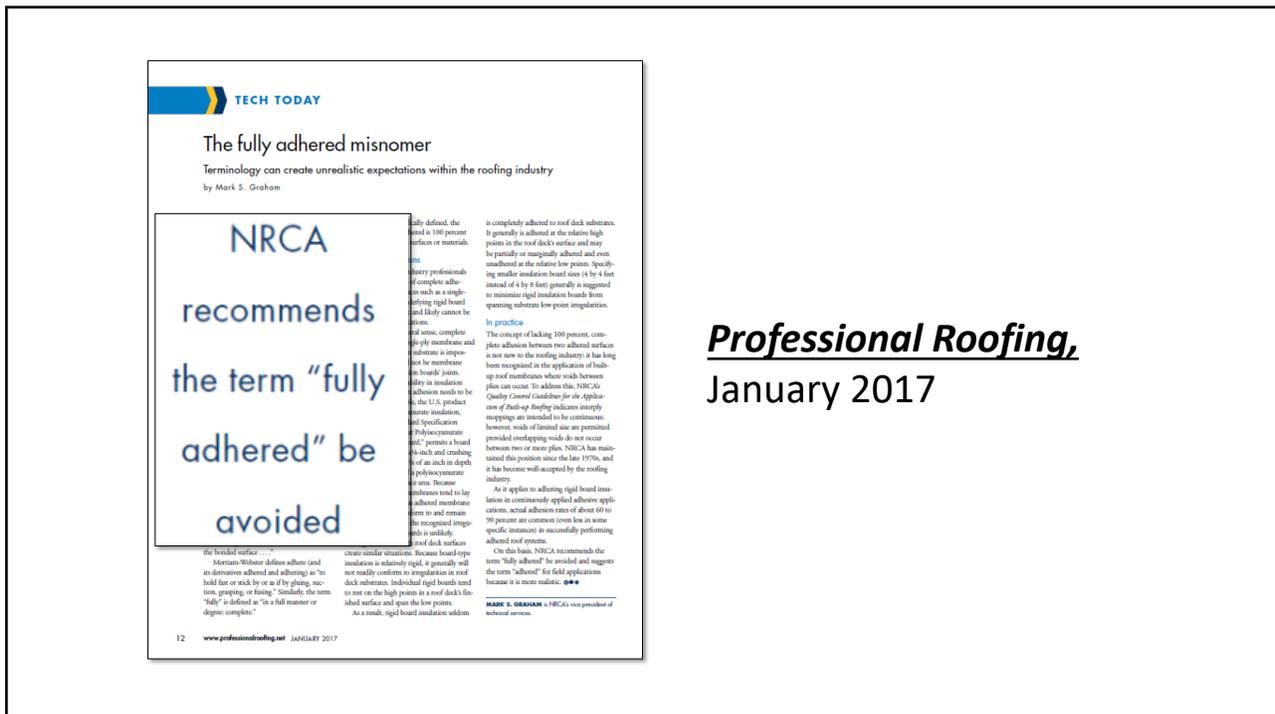
- Select MB products carefully
- Consider seeking out products with third-party verification of compliance:
 - UL product certification
 - PRI Product Validation
 - Dade County Approval
- As always, call NRCA Technical Services if you see anything unusual

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“Fully” adhered

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TECH TODAY
The fully adhered misnomer

Terminology can create unrealistic expectations within the roofing industry

by Mark S. Graham

NRCA
recommends
the term “fully
adhered” be
avoided

fully defined, the term is 100 percent adhered to the substrate or materials.

Industry professionals of complete adhesion such as a single-ply membrane and rigid board, and likely cannot be avoided.

single-ply membrane and substrate is impossible to bond between boards' joints. ability in insulation adhesion needs to be the U.S. product means insulation, and Specification of Polysulfonate. It permits a bond of an inch in depth if polysulfonate is used. Because membranes tend to lay adhered membrane items to and remain the recognized impregnated is unlikely of roof deck surface create similar situations. because bond-type insulation is relatively rigid, it generally will not readily conform to irregularities in roof deck substrates. Individual rigid boards tend to rest on the high points in a roof deck's finished surface and span the low points. As a result, rigid board insulation seldom is completely adhered to roof deck substrates. It generally is adhered at the relative high points in the roof deck's surface and may be partially or marginally adhered and even unadhered at the relative low points. Specifying smaller insulation board sizes (4 by 4 feet instead of 4 by 8 feet) generally is suggested to minimize rigid insulation boards from spanning substrate low-point irregularities.

In practice

The concept of lacking 100 percent, complete adhesion between two adhered surfaces is not new to the roofing industry; it has long been recognized in the application of built-up roof membranes where weak between-plies can occur. To address this, NRCA's Quality Control Guidelines for the Application of Built-up Roofing indicates interply mappings are intended to be continuous; however, weak or limited areas are permitted provided overlapping voids do not occur between two or more plies. NRCA has maintained this position since the late 1970s, and it has become well-accepted by the roofing industry.

As it applies to adhering rigid board insulation in continuously applied adhesive applications, actual adhesion rates of about 60 to 90 percent are common (even less in some specific instances) in successfully performing adhered roof systems.

On this basis, NRCA recommends the term “fully adhered” be avoided and suggests the term “adhered” for field applications because it is more realistic. ■■■

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