NRCA University Webinar
December 18, 2014

NRCA webinar: Technical Roofing Industry Update

presented by

Mark S. Graham
Associate Executive Director, Technical Services
National Roofing Contractors Association

Previous webinar topics

May 15, 2014:

- IECC 2012 adoption status
- Steel roof decks
- Attic ventilation
- LTTR
- Mopping asphalt testing
- Designers' and consultants' responsibilities

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More previous webinar topics

December 13, 2013:

- New LTTR values

October 17, 2013:

- IECC 2012

July 18, 2013:

- Lightweight structural concrete roof decks

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Professional Roofing, "Tech today" column

TECH TODAY

Revisiting important issues

Rooftop photovoltaic systems, adhesives and new manual developments

by Mark S. Graham

In January 2011, I shared NRCA's concerns regarding how installation of rack-mounted photovoltaic (PV) systems may affect roof assemblies' fire classifications. At that time, Underwriters Laboratories (UL) Inc. was determining the fire classifications of rack-mounted PV systems separately from the fire classification determination for roof assemblies using UL 790, "Standard Test Methods for Fire Tests of Roof Coverings." Research testing of rack-mounted PV systems in combination with roof assemblies showed flame spread results significantly greater than when the two components were tested individually.

LVOC and water-based adhesives continue to have their limitations

UL has since incorporated a revised fire classification test method within UL 1703, "Flat-Plate Photovoltaic Modules and Panels." Using UL 1703's October 2013 and subsequent editions, rack-mounted PV systems are tested in combination with representative roof assembly specimens.

The effective date for the new version of UL 1703 is Oct. 25, 2014. Until that date, PV panels still are permitted to be classified using UL 1703's previous fire test methods of testing PV panels and roof assemblies individually.

The new edition of UL 1703 is incorporated into and will be required for compliance with the *International Building Code,® 2015 Edition* and *International Residential Code,®2015 Edition*.

To date, only a few manufacturers have evaluated their PV panels and racking systems using the new edition of UL 1703. As a result, when compliance with UL 1703's new version is required, the availability of rooftop-mounted, fire-classified, rack-mounted PV systems may be limited.

LVOC and water-based adhesives

In December 2012, I discussed NRCA's concerns relating to manufacturers' storage and application temperature restrictions for their low-volatile organic compound (LVOC) and water-based adhesive products.

Since that time, several manufacturers have changed their adhesive formulations and some have introduced new adhesives. Several manufacturers now offer low-temperature-grade (as low as 25 F) LVOC adhesives.

LVOC and water-based adhesives continue to have their limitations and are less than ideal for field applications in much of the U.S. during late fall, winter and early spring. Some manufacturers even restrict the sale and use of certain adhesives during these months.

Building owners, designers, general contractors, construction managers and quality-assurance observers need to be aware of limitations regarding LVOC and water-based adhesives in cold (and hot, humid) temperatures. They also need to acknowledge in some weather conditions, roofing work involving LVOC or water-based adhesives may need to be suspended until more favorable conditions exist.

In situations where roofing work must take place during periods of unfavorable weather, building owners and designers may need to consider substituting roof system types that do not rely on LVOC or water-based adhesives. Roofing manufacturers and contractors should be consulted for specific recommendations.

The NRCA Roofing Manual

Every January since 2007, NRCA has published an updated volume of The NRCA Roofing Manual. For 2015, publication and availability of *The NRCA Roofing Manual: Membrane Roof Systems—2015* is being delayed pending the resolution of a significant ASTM International ballot item regarding mopping asphalt.

NRCA and the Asphalt Roofing Manufacturers Association have worked together and proposed changes to the U.S. product standard for mopping asphalt, ASTM D312, "Standard Specification for Asphalt Used in Roofing," including establishment of a maximum kettle (or tanker) heating temperature and maximum equiviscous temperature values. These proposed changes are addressed in greater detail in the May NRCA Industry Issue Update: Asphalt Health and Safety Issues, which is available to all NRCA members at www.nrca.net/roofing/IndustryIssue Updates.

Resolution of this ballot item will be addressed at ASTM International's next meeting, which will be held in New Orleans Dec. 7-10.

Delaying the publication of the manual's 2015 volume until resolution of this ASTM International ballot item will make The NRCA Roofing Manual the most up-to-date technical resource for NRCA members and the roofing industry. NRCA anticipates the 2015 volume will be published in March 2015. ●●●

MARK S. GRAHAM is NRCA's associate executive director of technical services.

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Today's topics

- Asphalt update and developments
- Concerns with steel roof decks
- Water-based bonding adhesives
- Questions (other topics)

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Asphalt update and developments

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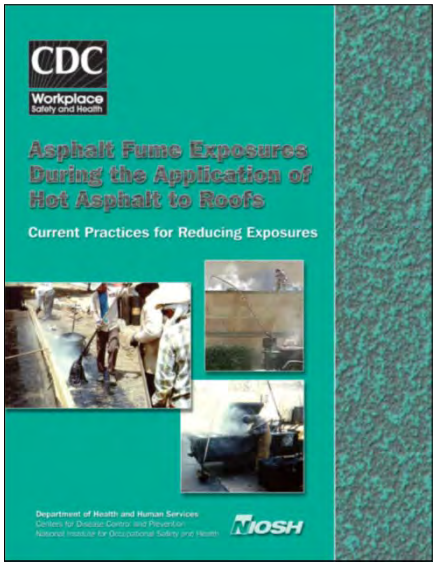
Asphalt

June 2003



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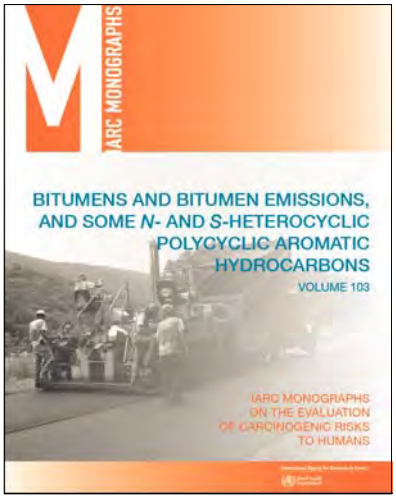
Asphalt

May 2013



IARC Monograph – 103:

- Group 2A –Probably carcinogenic to humans
- Pgs. 160 – 165 specific to "Roofing workers exposed to bitumens"

No new regulation (yet)

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NRCA asphalt testing -- 1989

- 26 asphalt samples
- EVTs:
  - Type III (125 cps) 400 – 430 F
  - Type III (75 cps) 420 – 470 F
  - Type IV (125 cps) 420 – 455 F
  - Type IV (75 cps) 445 – 485 F
- FPs:
  - Not reported

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NRCA asphalt testing -- 2000

- 19 asphalt lots sampled
- EVTs:
  - Type III (mop) 390 – 440 F
  - Type III (spreader) 415 – 475 F
- FPs: 585 – 640 F
- ASTM D312 compliance:
  - 10 of 19 did not comply

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NRCA asphalt testing – 2014

- 14 asphalt lots (7 suppliers) sampled
- EVTs:
  - Type III (mop) 424 – 462 F
  - Type III (spreader) 452 – 486 F
  - Type IV (mop) 455 – 482 F
  - Type IV (spreader) 480 – 506 F
- FPs: 615 – 660 F
- 10 of 14 do not comply with ASTM D312's physical property requirements

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Industry Issue Update, May 2014

INDUSTRY ISSUE UPDATE

NRCA Member Benefit

Asphalt Health and Safety Issues

Changing values and guidelines will affect applications

May 2014

Asphalt has been one of the fundamental products used in the manufacture and construction of roof systems in the U.S. Even with the development and maturation of single-ply membrane roof systems and other alternative products, asphalt use continues to be widespread in the U.S. Asphalt is used in the manufacture of asphalt shingles, polymer-modified bitumen sheet products and certain roof coating products. In field applications, hot-applied asphalt is used for adhering base sheets, vapor retarders, insulation layers and polymer-modified bitumen sheets; interply moppings between ply sheets in built-up membrane construction; and as a membrane surfacing, commonly with aggregate.

Although asphalt has been used in the U.S. roofing industry for years, health and safety concerns when using hot asphalt and changes to asphalt's physical properties are issues of which users need to be aware.

HEALTH AND SAFETY

Roofing professionals have long recognized many of the health and safety concerns relating to using hot asphalt, and asphalt's odor when heated to elevated temperatures is objectionable to some people.

For more than 20 years, NRCA has worked closely with asphalt suppliers, product manufacturers, the United Union of Roofers, Waterproofers & Allied Workers, the Asphalt Roofing Manufacturers Association (ARMA) and the Asphalt Institute through an informal partnership to represent the roofing industry to government bodies studying health and safety aspects of hot-applied asphalt. This has included individual and joint research and outreach efforts.

An important combined effort includes development of the National Institute for Occupational Safety and Health's document "Asphalt Fume Exposures During the Application of Hot Asphalt to Roofs—Current Practices for Reducing Exposures" that provides industry guidelines for the safe use of hot asphalt. Its provisions have been incorporated into most asphalt suppliers' and product manufacturers' installation guidelines and their safety data sheets (SDSs).

In October 2011, the World Health Organization's International Agency for Research on Cancer (IARC) issued a conclusion stating occupational exposures to oxidized bitumens and their emissions during roofing applications probably are carcinogenic to humans (Group 2A). Oxidized bitumens include mopping asphalt used on roof systems.

In May 2013, IARC issued a report of its findings and conclusion, IARC Monograph Volume 103, "Bitumens and Bitumen Emissions, and Some N- and S-Heterocyclic Polycyclic Aromatic Hydrocarbons." Although the timing of this report was not surprising, NRCA believes IARC's research is not definitive.

With the IARC determination, in the coming years U.S. government and scientific groups such as the National Toxicology Program and the American Conference of Governmental Hygienists will make their own assessments.

ASPHALT TESTING

Originally published in 1929, the U.S. product standard for oxidized asphalt used in roofing is ASTM D312, "Standard Specification for Asphalt Used in Roofing." The current edition was published in 2000 and reapproved in 2006.

ASTM D312 provides for four types of asphalt—Types I, II, III and IV—based upon the asphalt's physical properties. An asphalt's tested softening point, hardness (penetration) and ductility properties dictate its type.

ASTM D312 also requires asphalt to have a minimum 500 F flash point (FP). The standard currently does not prescribe minimum or maximum values for an asphalt's equiviscous temperature (EVT); it simply requires asphalt suppliers report the asphalt's EVT on the package labeling or bill of lading.

In 1989, NRCA conducted a temperature-viscosity data study of 26 asphalt samples procured from around the U.S. EVT data from the samples are provided in Figure 1. The 1989 study was limited to EVT testing and did not include FP testing or testing of other physical properties to determine compliance with ASTM D312.

In 2000, NRCA conducted a limited study of 19 lots of Type III asphalt procured from around the U.S. EVT and FP data for these samples are provided in Figure 2. Ten of the 19 samples analyzed did not meet the physical property requirements of ASTM D312, Type III.

This year, NRCA conducted limited testing of 14 lots of Types III and IV asphalt obtained in late 2013 from roofing contractors'

NRCA and ARMA have proposed a revision to ASTM D312

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Revision to ASTM D312

Will be published as ASTM D312-15

- Maximum heating temp.: 550 F (575 F min. FP)
- Maximum EVTs:
  - Type III (mop) 430 F
  - Type III (spreader) 455 F
  - Type IV (mop) 470 F
  - Type IV (spreader) 485 F
- Lot-specific package labeling of EVT

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NRCA's recommendations

Asphalt

- Seek out asphalt complying with ASTM D312-15
- Consider asking for certificates of compliance
- Do not overheat asphalt
  - 550 F maximum kettle/tanker temperature
- Apply at EVT (BUR application)
- Make field crews aware
- Contact NRCA with any questions or issues

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Concerns with steel roof decks

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Issues with steel roof decks

- Probable under-design for wind uplift
- Deck overstress:
  - Seam-fastened mechanically-attached single–plies
- Possible structural overload:
  - Seam-fastened mechanically-attached single–plies

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Steel deck design

Prior to 2010:

- SDI's *Design Manual for Composite Decks, Form Decks and Roof Decks*
- ANSI/SDI RD1.0-2006, "Standard for Steel Roof Deck" (referenced in IBC 2009)

30-pound-per-square-foot (psf) uplift
and 45-psf uplift at roof overhangs

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Steel deck design

Since 2010:

- ANSI/SDI RD1.0-2010, "Standard for Steel Roof Deck" (referenced in IBC 2012 and IBC 2015)

"… be anchored to resist the required net uplift forces, but not less than…"
30 psf and 45 psf for eave overhangs

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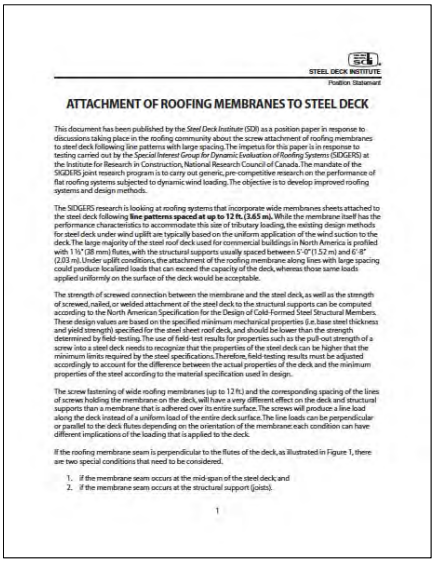
SDI bulletin



STEEL DECK INSTITUTE
Position Statement

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 (SIDGERS) at the Institute for Research in Construction, National Research Council of Canada. The mandate of the SIDGERS 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 SIDGERS research is looking at roofing systems that incorporate wide membranes 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 size of tributary 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 ½" (38 mm) flutes, with the structural supports usually spaced between 5'-0" (1.52 m) and 6'-8" (2.03 m). Under uplift 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. base 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 that 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 (joists).

1

- Decks designed for joist spacing between 5’ and 6’ 8” o.c.
- Steel decks designed for uniform loading
- Seam-fastened single-ply membranes are a concern

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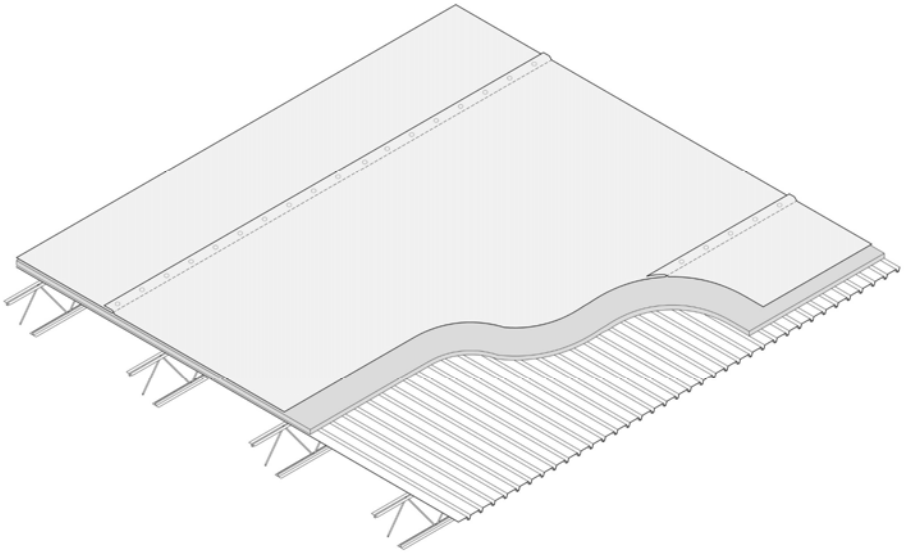
Membrane seams across deck flutes



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

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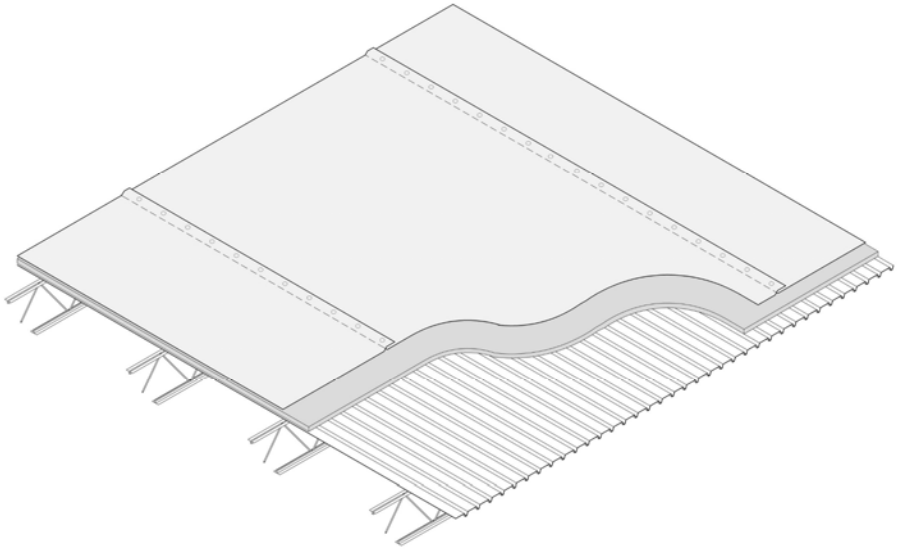
Membrane seams in deck flute direction



SDI: 12 X bending moment and shear (deck)

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SDI bulletin -- Conclusion

"…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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NRCA's recommendations

- Beware of the situation
- Roof system designers should not rely on "excess capacity" in steel roof decks
- Be cautious of "accepting" responsibility for the roof deck; use NRLRC recommended proposal/contract language
- Better communication is needed between Roof system designers and roof deck designers

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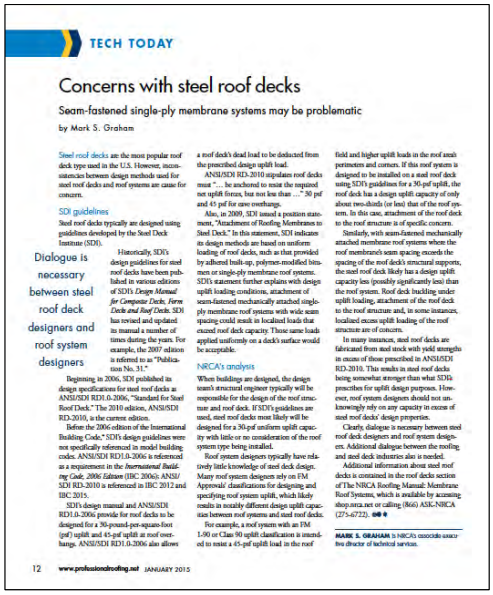
January 2015



TECH TODAY

Concerns with steel roof decks

Seam-fastened single-ply membrane systems may be problematic

by Mark S. Graham

Steel roof decks are the most popular roof deck type used in the U.S. However, inconsistencies between design methods used for steel roof decks and roof systems are cause for concern.

SDI guidelines

Steel roof decks typically are designed using guidelines developed by the Steel Deck Institute (SDI).

Historically, SDI's design guidelines for steel roof decks have been published in various editions of SDI's *Design Manual for Composite Decks, Form Decks and Roof Decks*. SDI has revised and updated its manual a number of times during the years. For example, the 2007 edition is referred to as "Publication No. 31."

Dialogue is necessary between steel roof deck designers and roof system designers

Beginning in 2006, SDI published its design specifications for steel roof decks as ANSI/SDI RDI.0-2006, "Standard for Steel Roof Deck." The 2010 edition, ANSI/SDI RD-2010, is the current edition.

Before the 2006 edition of the International Building Code," SDI's design guidelines were not specifically referenced in model building codes. ANSI/SDI RDI.0-2006 is referenced as a requirement in the *International Building Code, 2006 Edition* (IBC 2006); ANSI/SDI RD-2010 is referenced in IBC 2012 and IBC 2015.

SDI's design manual and ANSI/SDI RDI.0-2006 provide for roof decks to be designed for a 30-pound-per-square-foot (psf) uplift and 45-psf uplift at roof overhangs. ANSI/SDI RDI.0-2006 also allows a roof deck's dead load to be deducted from the prescribed design uplift load.

ANSI/SDI RD-2010 stipulates roof decks must "… be anchored to resist the required net uplift forces, but not less than …" 30 psf and 45 psf for eave overhangs.

Also, in 2009, SDI issued a position statement, "Attachment of Roofing Membranes to Steel Deck." In this statement, SDI indicates its design methods are based on uniform loading of roof decks, such as that provided by adhered built-up, polymer-modified bitumen or single-ply membrane roof systems. SDI's statement further explains with design uplift loading conditions, attachment of seam-fastened mechanically attached single-ply membrane roof systems with wide seam spacing could result in localized loads that exceed roof deck capacity. Those same loads applied uniformly on a deck's surface would be acceptable.

NRCA's analysis

When buildings are designed, the design team's structural engineer typically will be responsible for the design of the roof structure and roof deck. If SDI's guidelines are used, steel roof decks most likely will be designed for a 30-psf uniform uplift capacity with little or no consideration of the roof system type being installed.

Roof system designers typically have relatively little knowledge of steel deck design. Many roof system designers rely on FM Approvals' classifications for designing and specifying roof system uplift, which likely results in notably different design uplift capacities between roof systems and steel roof decks.

For example, a roof system with an FM 1-90 or Class 90 uplift classification is intended to resist a 45-psf uplift load in the roof field and higher uplift loads in the roof area's perimeters and corners. If this roof system is designed to be installed on a steel roof deck using SDI's guidelines for a 30-psf uplift, the roof deck has a design uplift capacity of only about two-thirds (or less) that of the roof system. In this case, attachment of the roof deck to the roof structure is of specific concern.

Similarly, with seam-fastened mechanically attached membrane roof systems where the roof membrane's seam spacing exceeds the spacing of the roof deck's structural supports, the steel roof deck likely has a design uplift capacity less (possibly significantly less) than the roof system. Roof deck buckling under uplift loading, attachment of the roof deck to the roof structure and, in some instances, localized excess uplift loading of the roof structure are of concern.

In many instances, steel roof decks are fabricated from steel stock with yield strengths in excess of those prescribed in ANSI/SDI RD-2010. This results in steel roof decks being somewhat stronger than what SDI's prescribes for uplift design purposes. However, roof system designers should not unknowingly rely on any capacity in excess of steel roof decks' design properties.

Clearly, dialogue is necessary between steel roof deck designers and roof system designers. Additional dialogue between the roofing and steel deck industries also is needed.

Additional information about steel roof decks is contained in the roof decks section of The NRCA Roofing Manual: Membrane Roof Systems, which is available by accessing shop.nrca.net or calling (866) ASK-NRCA (275-6722).

MARK S. GRAHAM is NRCA's associate executive director of technical services.

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Continuing concerns with water-based bonding adhesives

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Professional Roofing, Aug. 2012


THE SAM
BUT DIFFERI

In markets subject to volatile organic compound (VOC) regulations, single-ply roof membrane manufacturers supply alternative materials for solvent-based adhesives and primers. Among the VOC regulation-compliant materials that have emerged, low-VOC solvent-based and water-based adhesives are marketed as direct replacements for VOC-solvent-based contact adhesives.

Although intended as direct replacements, these materials should be considered apart from traditional solvent-based contact adhesives. For one thing, work and handling practices for low-VOC materials differ somewhat from those for traditional solvent-based materials. And water-based materials present some challenges that set them apart from both types of solvent-based materials. Additionally, depending on specific products and manufacturers, different recommendations for handling and use may apply for products within the same general category.

Where are VOCs regulated?

The California Clean Air Act of 1988 established the framework for the state's air quality management efforts, including requirements for controlling ground-level ozone. To meet the requirements, in 1989, the South Coast Air Quality Management District, which is the air pollution control agency for Orange County and urban portions of Los Angeles, Riverside and San Bernardino counties, adopted Rule 1168. Rule 1168 limits VOC content of adhesives and sealants, including single-ply roof membrane adhesives and sealants. The VOC content limits introduced in Rule 1168 later were included in similar regulations adopted by a number of other California air districts.

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***Professional Roofing*, "Tech today," Dec. 2013**

TECH TODAY

Cold weather application

Installing roofing products and roof systems in fall and winter can prove challenging

by Mark S. Graham

Certain roofing products and roof system types are temperature-sensitive

Manufacturers:

- Store at 60F-90F
- Install at 40F and rising
- Longer green time

NRCA:

- Don't freeze
- Dew point differential of 5F or more

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MRCA/NRCA testing

Water-based bonding adhesives

- Products vary
- Pails variability
- Long times to develop strengths
- Peel strengths are relatively low, particularly with paper-faced polyisocyanurate insulation

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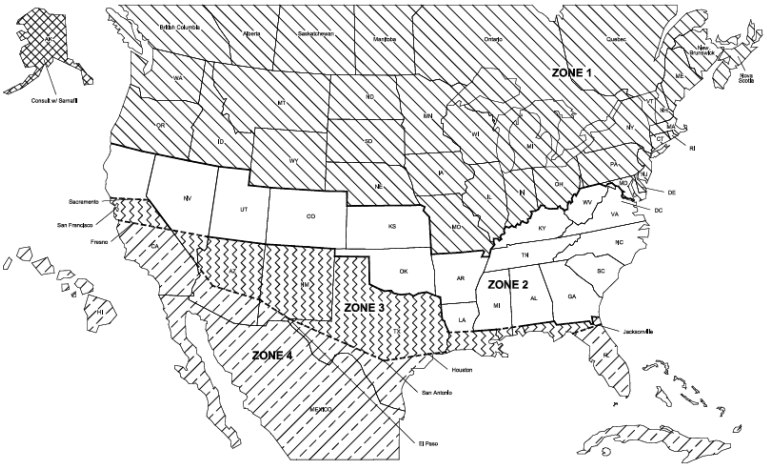
Sika/Sarnafil



BLACKOUT DATES FOR SIKACOAT & WATER BASED PRODUCTS
Zone 1: October 1st thru April 15th Zone 3: November 1st thru March 1st
Zone 2: October 15th thru April 1st Zone 4: No Blackout Dates

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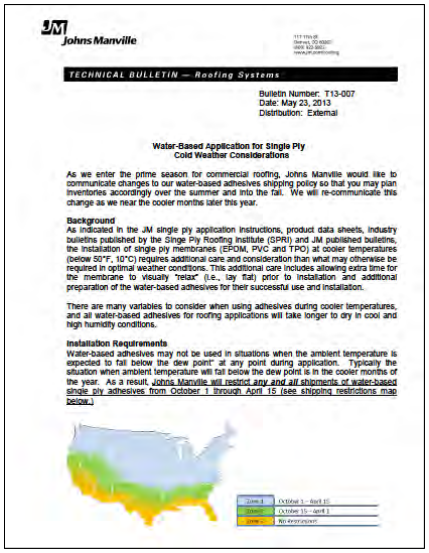
JM technical bulletin



Johns Manville

TECHNICAL BULLETIN — Roofing Systems

Bulletin Number: T13-007
Date: May 23, 2013
Distribution: External

Water-Based Application for Single Ply Cold Weather Considerations

As we enter the prime season for commercial roofing, Johns Manville would like to communicate changes to our water-based adhesives shipping policy so that you may plan inventories accordingly over the summer and into the fall. We will re-communicate this change as we near the cooler months later this year.

Background
As indicated in the JM single ply application instructions, product data sheets, industry bulletins published by the Singe Ply Roofing Institute (SPRI) and JM published bulletins, the installation of single ply membranes (EPDM, PVC and TPO) at cooler temperatures (below 50°F, 10°C) requires additional care and consideration than what may otherwise be required in optimal weather conditions. This additional care includes allowing extra time for the membrane to visually "relax" (i.e., lay flat) prior to installation and additional preparation of the water-based adhesives for their successful use and installation.

There are many variables to consider when using adhesives during cooler temperatures, and all water-based adhesives for roofing applications will take longer to dry in cool and high humidity conditions.

Installation Requirements
Water-based adhesives may not be used in situations when the ambient temperature is expected to fall below the dew point* at any point during application. Typically the situation when ambient temperature will fall below the dew point is in the cooler months of the year. As a result, Johns Manville will restrict *any and all* shipments of water-based single ply adhesives from October 1 through April 15 (see shipping restrictions map below.)

- Shipment restrictions from 10/1 to 4/15
- Storage 60F – 80F
- Should not be applied:
  - Below 40F
  - RH 90%+
  - DP separation < 5F
  - Temp. = DP within 6 hrs.
  - Temp. < 32F within 48 hrs.

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JM TechXpert app

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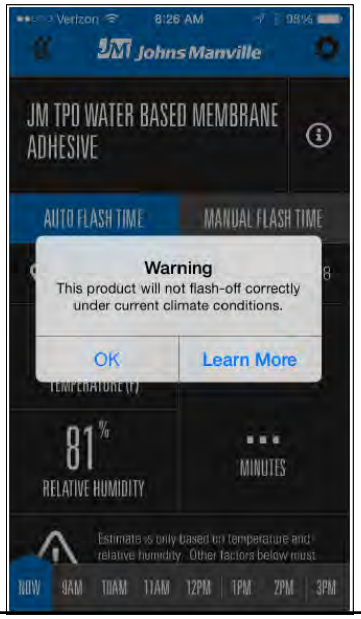
JM TechXpert app



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NRCA's interim recommendations

- Manufacturers need to take a more active role
- Designers need to consider/offer alternatives
- Designers should specify Class 2 (coated glass) facers when using water-based adhesives
- Make field crews aware of limitations
- Consider alternative products/systems

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Questions

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