International Roofing Expo
February 17, 2016
Orlando, Florida

NRCA Technical Operations Committee: Technical programs and issues

Today's speakers

Mark S. Graham (Moderator)
National Roofing Contractors Association
Rosemont, IL

Dave Tilsen (TOC chairman)
Tilsen Roofing Co.
Madison, WI

Scott Baxter
Interstate Roofing, Inc.
Portland, Oregon

Dennis Runyan
Dryspace, Inc.
Cedar Rapids, Iowa

Committee objectives

- Manage and direct NRCA's technical activities, including NRCA's technical committees and task forces
- Direct and manage CERTA in conjunction with MRCA's T & R Committee
- Determine contractor members' technical needs and establish technical priorities.
- Recommend to NRCA's Chairman of the Board establishment of committees and task forces to meet those needs
- Recommend to NRCA's Executive Committee actions necessary to carry out NRCA's technical programs
- Oversee NRCA's technical research projects and, where appropriate, report to NRCA members on these projects
- Report on significant technical developments

Past program topics

2015 (New Orleans):

- ASTM D312 (mopping asphalt) revision
- Polyiso. R-value testing
- Water-based adhesive testing
- Concrete deck moisture issues
- Steel roof deck concerns
- Energy code adoption status

2014 (Las Vegas):

- Water-based adhesives study
- Steel roof deck issues
- Lightweight structural concrete
- Asphalt: IARC, EVT and FP
- R-value payback vs. energy code

2013 (San Antonio):

- IBHS commercial wind test
- Cold weather application
- FM 4470 revision (steel roof decks)
- Air barriers

2012 (Orlando):

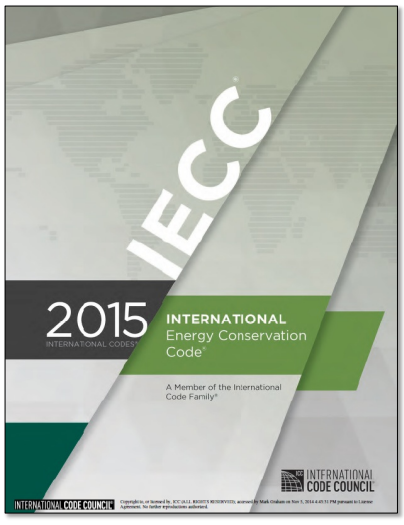
- MB sheet testing
- TPO membranes (thickness)
- Slip-resistance testing
- Water-based adhesives (cold weather)
- Asphalt: IARC 2A classification
- Alternative asphalt shingles (AC 438)

Many any of these topics are still applicable today,….
but we will move on to some new issues.

Dave Tilsen

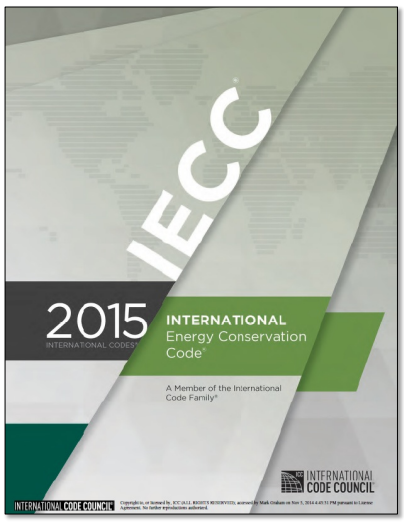
Chairman, NRCA Technical Operations Committee

Implementation of IECC 2015



Roof requirements:

- R-value
- Roof reflectivity
- Air retarder



Commercial buildings:

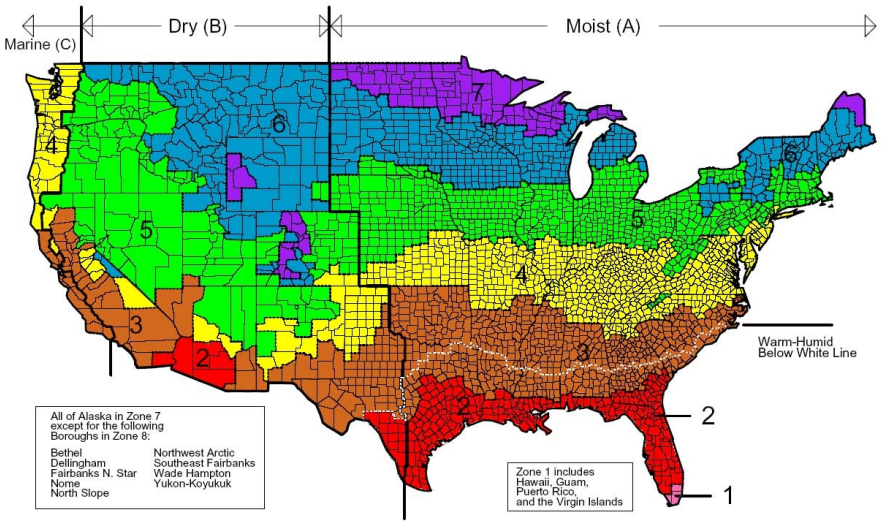
- All except "Residential Buildings"

Residential buildings:

- One- and two-family dwellings, multiple single-family dwellings and Group R-2, R-3 and R-4 buildings three stories or less

IECC 2015, Fig. C301.1-Climate zones

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



Minimum R-value – Residential

IECC 2015: Residential – Table R402.1.2-Insulation Requirement by Component

Climate zone	Ceiling R-value
1	30
2	38
3	
4 except Marine	49
5 and Marine 4	
6	
7 and 8	

Note: Values are similar to IECC 2012

Minimum R-value – Commercial

IECC 2015: Commercial Buildings (Insulation component R-value-based method)

Climate zone	Assembly description		
	Insulation entirely above deck	Metal buildings	Attic and other
1	R-20ci (all other)	R-19 + R-11 LS	R-38
	R-25ci (Group R)		
2	R-25ci		
3			
4	R-30ci		R-38 (except Marine 4)
5			R-38 (all other) R-49 (Group R, Marine 4)
6		R-25 + R-11 LS	R-49
7	R-35ci	R-30 + R-11 LS	
8			

ci = Continuous insulation; LS = Liner system
Note: Shaded values denote increases over IECC 2012

Reflectivity

International Energy Conservation Code, 2015 Edition (Commercial)

In Climate Zones 1-3, for low-slope roofs over conditioned spaces:

Roof Reflectivity requirements

Three-year solar reflectance of 0.55 and 3-year aged thermal emittance of 0.75
Three-year-aged solar reflectance index of 64

Air barrier

International Energy Conservation Code, 2015 Edition (Commercial), Sec. C402.5

"A continuous building envelope air barrier shall be provided throughout the building envelope…." (Except 2B)

Test methods:

- Whole building: Not greater than 0.40 cfm/ft^3
- Assembly: Not greater than 0.04 cfm/ft^3
- Material: Not greater than 0.004 cfm/ft^3
  - Deemed to comply: BUR, MB, adhered single ply and SPF

Air barrier not required in reroofing projects unless also recladding (IECC 2015 only: Sec. C502.4)

Current adoption status

IECC 2015 adopted:

- Illinois
- Maryland
- New Jersey (Residential only)
- Vermont

Adoption pending:

- Texas (Commercial: Sept. 1; Residential: Nov. 1)

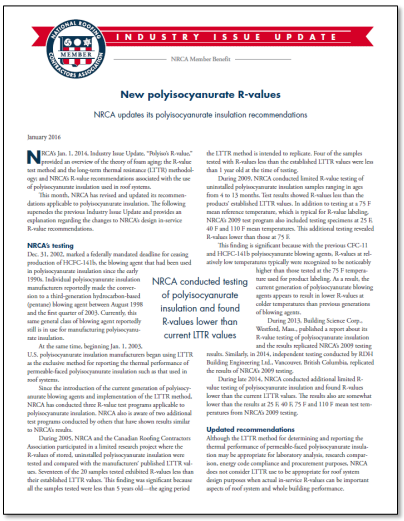
Watch for additional state adoptions in 2016

NRCA energy code adoption database

www.nrca.net/Technical/EnergyCodes

Click here to access this web page

NRCA's revised polyiso. R-value recommendation



INDUSTRY ISSUE UPDATE

NRCA Member Benefit

New polyisocyanurate R-values

NRCA updates its polyisocyanurate insulation recommendations

January 2016

NRCA's Jan. 1, 2016, Industry Issue Update, "Polyiso's R-value," provided an overview of the theory of foam aging; the R-value test method and the long-term thermal resistance (LTTR) methodology and NRCA's R-value recommendations associated with the use of polyisocyanurate insulation used in roof systems.

This month, NRCA has revised and updated its recommendations applicable to polyisocyanurate insulation. The following supersedes the previous Industry Issue Update and provides an explanation regarding the changes to NRCA's design in-service R-value recommendations.

NRCA's testing

Dec. 31, 2002, marked a federally mandated deadline for ceasing production of HCFC-141b, the blowing agent that had been used in polyisocyanurate insulation since the early 1990s. Individual polyisocyanurate insulation manufacturers reportedly made the conversion to a third-generation hydrocarbon-based (pentane) blowing agent between August 1998 and the first quarter of 2003. Currently, this same general class of blowing agent reportedly still is in use for manufacturing polyisocyanurate insulation.

At the same time, beginning Jan. 1, 2003, U.S. polyisocyanurate insulation manufacturers began using LTTR as the exclusive method for reporting the thermal performance of permeable-faced polyisocyanurate insulation such as that used in roof systems.

Since the introduction of the current generation of polyisocyanurate blowing agents and implementation of the LTTR method, NRCA has conducted three R-value test programs applicable to polyisocyanurate insulation. NRCA also is aware of two additional test programs conducted by others that have shown results similar to NRCA's results.

During 2005, NRCA and the Canadian Roofing Contractors Association participated in a limited research project where the R-values of stored, uninstalled polyisocyanurate insulation were tested and compared with the manufacturers' published LTTR values. Seventeen of the 20 samples tested exhibited R-values less than their established LTTR values. This finding was significant because all the samples tested were less than 5 years old—the aging period the LTTR method is intended to replicate. Four of the samples tested with R-values less than the established LTTR values were less than 1 year old at the time of testing.

During 2009, NRCA conducted limited R-value testing of uninstalled polyisocyanurate insulation samples ranging in ages from 4 to 15 months. Test results showed R-values less than the products' established LTTR values. In addition to testing at a 75 F mean reference temperature, which is typical for R-value labeling, NRCA's 2009 test program also included testing specimens at 25 F, 40 F and 110 F mean temperatures. This additional testing revealed R-values lower than those at 75 F.

This finding is significant because with the previous CFC-11 and HCFC-141b polyisocyanurate blowing agents, R-values at relatively low temperatures typically were recognized to be noticeably higher than those tested at the 75 F temperature used for product labeling. As a result, the current generation of polyisocyanurate blowing agents appears to result in lower R-values at colder temperatures than previous generations of blowing agents.

During 2013, Building Science Corp., Westford, Mass., published a report about its R-value testing of polyisocyanurate insulation and the results replicated NRCA's 2009 testing results. Similarly, in 2014, independent testing conducted by RDH Building Engineering Ltd., Vancouver, British Columbia, replicated the results of NRCA's 2009 testing.

During late 2014, NRCA conducted additional limited R-value testing of polyisocyanurate insulation and found R-values lower than the current LTTR values. The results also are somewhat lower than the results at 25 F, 40 F, 75 F and 110 F mean test temperatures from NRCA's 2009 testing.

Updated recommendations

Although the LTTR method for determining and reporting the thermal performance of permeable-faced polyisocyanurate insulation may be appropriate for laboratory analysis, research comparison, energy code compliance and procurement purposes, NRCA does not consider LTTR use to be appropriate for roof system design purposes when actual in-service R-values can be important aspects of roof system and whole building performance.

NRCA conducted testing of polyisocyanurate insulation and found R-values lower than current LTTR values

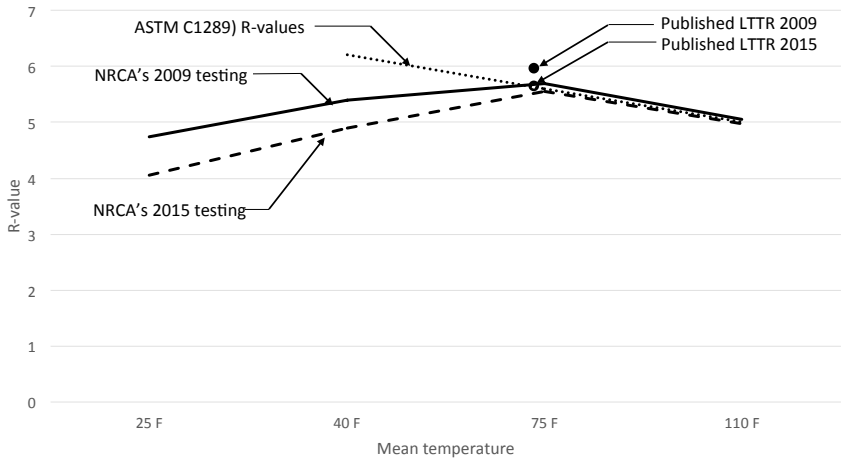
NRCA recommends designers:

- Use an in-serve design R-value of 5.0 per inch thickness for polyiso.
- Specify insulation by its thickness, not its R-value

NRCA's recommendation is based upon our own testing, and confirming replicate testing by:

- Building Science Corp.
- RDH Building Engineering, Ltd.

NRCA's R-value testing



NRCA's new polyiso. R-value recommendation is included in the January 2016 interim update to *The NRCA Roofing Manual: Membrane Roof Systems-2015* (PDF and App versions)

Modified bitumen sheet testing

Scott Baxter

Purpose

NRCA's MB sheet testing

Analyze critical physical properties of popular MB sheet products and compare results to applicable ASTM product standards and past test results

Modified bitumen sheet testing

ASTM D5147-Test methods for MB sheet materials

Low-temperature flexibility test:

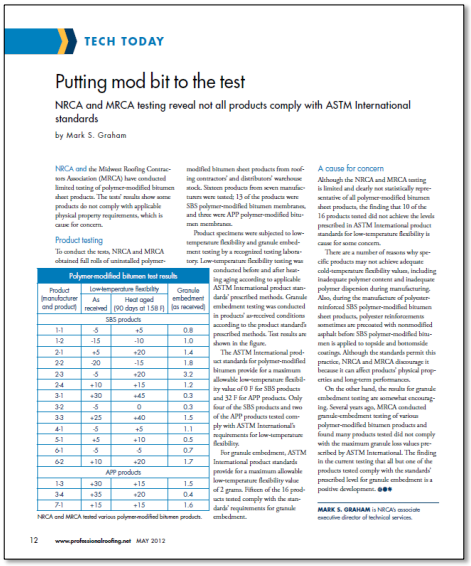
- 1" diameter mandrel
- 180° bend
- Visually observe cracking

Granule loss test:

- Weigh specimen
- 50 scrub cycles
- Re-weigh specimen
- Calculate difference

NRCA's 2011 MB testing

Professional Roofing, May 2012



TECH TODAY

Putting mod bit to the test

NRCA and MRCA testing reveal not all products comply with ASTM International standards

by Mark S. Graham

NRCA and the Midwest Roofing Contractors Association (MRCA) have conducted limited testing of polymer-modified bitumen sheet products. The tests' results show some products do not comply with applicable physical property requirements, which is cause for concern.

Product testing

To conduct the tests, NRCA and MRCA obtained full rolls of uninstalled polymer-modified bitumen sheet products from roofing contractors' and distributors' warehouse stock. Sixteen products from seven manufacturers were tested; 13 of the products were SBS polymer-modified bitumen membranes, and three were APP polymer-modified bitumen membranes.

Product specimens were subjected to low-temperature flexibility and granule embedment testing by a recognized testing laboratory. Low-temperature flexibility testing was conducted before and after heat-aging aging according to applicable ASTM International product standards' prescribed methods. Granule embedment testing was conducted in products' as-received conditions according to the product standard's prescribed methods. Test results are shown in the figure.

The ASTM International product standards for polymer-modified bitumen provide for a maximum allowable low-temperature flexibility value of 0 F for SBS products and 32 F for APP products. Only four of the SBS products and two of the APP products tested comply with ASTM International's requirements for low-temperature flexibility.

For granule embedment, ASTM International product standards provide for a maximum allowable low-temperature flexibility value of 2 grams. Fifteen of the 16 products tested comply with the standards' requirements for granule embedment.

A cause for concern

Although the NRCA and MRCA testing is limited and clearly not statistically representative of all polymer-modified bitumen sheet products, the finding that 10 of the 16 products tested did not achieve the levels prescribed in ASTM International product standards for low-temperature flexibility is cause for some concern.

There are a number of reasons why specific products may not achieve adequate cold-temperature flexibility values, including inadequate polymer content and inadequate polymer dispersion during manufacturing. Also, during the manufacture of polyester-reinforced SBS polymer-modified bitumen sheet products, polyester reinforcements sometimes are precoated with nonmodified asphalt before SBS polymer-modified bitumen is applied to topside and bottomside coatings. Although the standards permit this practice, NRCA and MRCA discourage it because it can affect products' physical properties and long-term performances.

On the other hand, the results for granule embedment testing are somewhat encouraging. Several years ago, MRCA conducted granule-embedment testing of various polymer-modified bitumen products and found many products tested did not comply with the maximum granule loss values prescribed by ASTM International. The finding in the current testing that all but one of the products tested comply with the standards' prescribed level for granule embedment is a positive development. ●●●

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

Polymer-modified bitumen test results

NRCA and MRCA tested various polymer-modified bitumen products.

12 www.professionalroofing.net MAY 2012

NRCA

Polymer-modified bitumen test results			
Product (manufacturer and product)	Low-temperature flexibility		Granule embedment (as received)
	As received	Heat aged (90 days at 158 F)	
SBS products			
1-1	-5	+5	0.8
1-2	-15	-10	1.0
2-1	+5	+20	1.4
2-2	-20	-15	1.8
2-3	-5	+20	3.2
2-4	+10	+15	1.2
3-1	+30	+45	0.3
3-2	-5	0	0.3
3-3	+25	+40	1.5
4-1	-5	+5	1.1
5-1	+5	+10	0.5
6-1	-5	-5	0.7
6-2	+10	+20	1.7
APP products			
1-3	+30	+15	1.5
3-4	+35	+20	0.4
7-1	+15	+15	1.6

NRCA

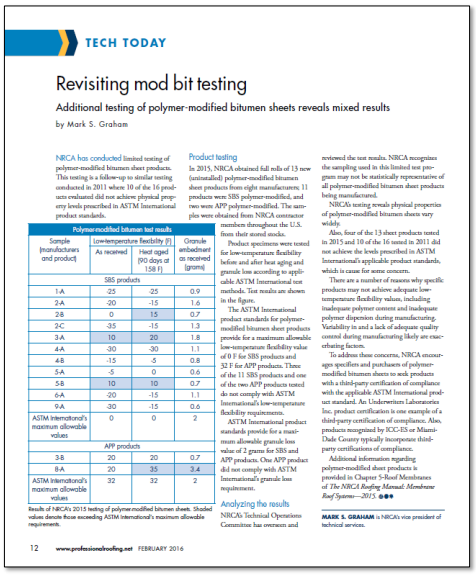
Summary of results

NRCA's 2011 MB testing

- 9 of 13 SBS products did not comply with ASTM's low-temp. flex requirement (0 F max.)
- 1 of 3 APP products did not comply with ASTM's low-temp. flex requirement (32 F max.)
- 1 of 16 products did not comply with ASTM's granule loss requirement (2 grams max.)

NRCA's 2015 MB testing

Professional Roofing, February 2016



TECH TODAY

Revisiting mod bit testing

Additional testing of polymer-modified bitumen sheets reveals mixed results

by Mark S. Graham

NRCA has conducted limited testing of polymer-modified bitumen sheet products. This testing is a follow-up to similar testing conducted in 2011 where 10 of the 16 products evaluated did not achieve physical property levels prescribed in ASTM International product standards.

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

Results of NRCA's 2015 testing of polymer-modified bitumen sheets. Shaded values denote those exceeding ASTM International's maximum allowable requirements.

Product testing

In 2015, NRCA obtained full rolls of 13 new (uninstalled) polymer-modified bitumen sheet products from eight manufacturers; 11 products were SBS polymer-modified, and two were APP polymer-modified. The samples were obtained from NRCA contractor members throughout the U.S. from their stored stocks.

Product specimens were tested for low-temperature flexibility before and after heat aging and granule loss according to applicable ASTM International test methods. Test results are shown in the figure.

The ASTM International product standards for polymer-modified bitumen sheet products provide for a maximum allowable low-temperature flexibility value of 0 F for SBS products and 32 F for APP products. Three of the 11 SBS products and one of the two APP products tested do not comply with ASTM International's low-temperature flexibility requirements.

ASTM International product standards provide for a maximum allowable granule loss value of 2 grams for SBS and APP products. One APP product did not comply with ASTM International's granule loss requirement.

Analyzing the results

NRCA's Technical Operations Committee has overseen and reviewed the test results. NRCA recognizes the sampling used in this limited test program may not be statistically representative of all polymer-modified bitumen sheet products being manufactured.

NRCA's testing reveals physical properties of polymer-modified bitumen sheets vary widely.

Also, four of the 13 sheet products tested in 2015 and 10 of the 16 tested in 2011 did not achieve the levels prescribed in ASTM International's applicable product standards, which is cause for some concern.

There are a number of reasons why specific products may not achieve adequate low-temperature flexibility values, including inadequate polymer content and inadequate polymer dispersion during manufacturing. Variability in and a lack of adequate quality control during manufacturing likely are exacerbating factors.

To address these concerns, NRCA encourages specifiers and purchasers of polymer-modified bitumen sheets to seek products with a third-party certification of compliance with the applicable ASTM International product standard. An Underwriters Laboratories Inc. product certification is one example of a third-party certification of compliance. Also, products recognized by ICC-ES or Miami-Dade County typically incorporate third-party certifications of compliance.

Additional information regarding polymer-modified sheet products is provided in Chapter 5-*Roof Membranes* of *The NRCA Roofing Manual: Membrane Roof Systems—2015*.

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

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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

Summary of results

NRCA's 2015 MB testing

- 3 of 11 SBS products did not comply with ASTM's low-temp. flex requirement (0 F max.)
- 1 of 2 APP products did not comply with ASTM's low-temp. flex requirement (32 F max.)
- 1 of 13 products did not comply with ASTM's granule loss requirement (2 grams max.)

Recommendations

NRCA's 2011 and 2015 MB testing

Seek third-party certifications of compliance with the applicable ASTM product standard:

- UL product certification
- ICC-ES evaluation report
- Miami-Dade County product approval

Polyisocyanurate insulation testing

Dennis Runyan

Purpose

NRCA's polyisocyanurate insulation testing

Analyze critical physical properties of faced polyisocyanurate insulation products and compare results to applicable the ASTM product standard and past test results

Past testing

NRCA's polyisocyanurate insulation testing

2002 testing:

- HCFC-141b blowing agent
- Hydrocarbon-based blowing agent (current)

2009 testing:

- Hydrocarbon-based blowing agent (current)

2015 testing

NRCA's polyisocyanurate insulation testing

- Density (not in ASTM C1289)
- Compressive strength
- Dimensional stability
- Flexural strength
- Tensile strength
- Knit line assessment (not in ASTM C1289)

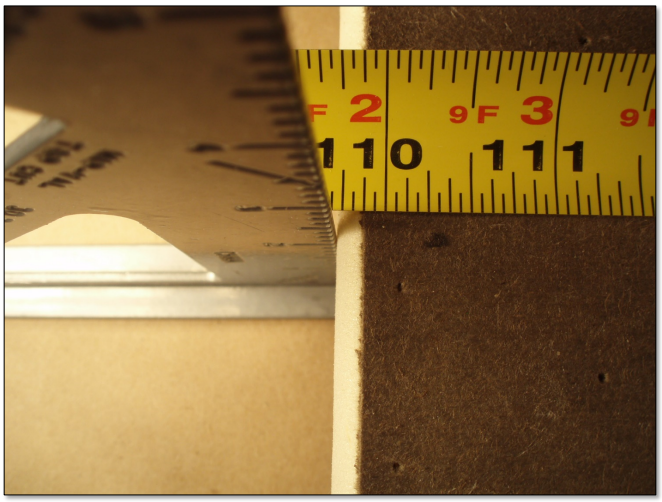
Sample	Facer type	Density (lb/ft³)	
		Apparent overall density	Apparent foam core density
1-A	Cellulosic (Class 1)	2.16	1.57
1-B	Coated fiberglass (Class 2)	3.80	1.68
2	Cellulosic (Class 1)	2.25	1.56
3	Cellulosic (Class 1)	2.26	1.65
4	Cellulosic (Class 1)	2.25	1.64
5	Coated fiberglass (Class 2)	3.16	1.79
6	Cellulosic (Class 1)	2.39	1.68

Sample	Compressive strength (psi)		
	With facers	Machine direction	Cross-machine direction
1-A	22.3	16.1	26.5
1-B	28.4	21.2	29.8
2	24.4	16.7	22.0
3	24.5	17.5	19.4
4	23.5	18.5	21.0
5	24.4	20.6	19.8
6	24.5	18.9	21.1
ASTM C1289, Type II requirement	Grade 1: 16 (minimum) Grade 2: 20 (minimum) Grade 3: 25 (minimum)	No requirement	

Sample	Dimensional stability (Percent linear change after seven days at 158 F and 97 percent relative humidity)		
	Machine direction	Cross-machine direction	Thickness
1-A	1.22	1.27	1.77
1-B	0.54	1.31	5.88
2	3.35	2.91	-1.11
3	2.42	1.53	3.19
4	2.14	2.24	1.21
5	0.56	0.75	3.74
6	2.52	1.96	1.68
ASTM C1289, Type II requirement	2.0 (maximum)		4.0 (maximum)

Shaded cells denote values in excess of maximal ASTM allowable requirement

Dimensional stability – "Edge growth"



View from board topside (top facer) looking down.

NRCA

Sample	Flexural strength		Tensile strength perpendicular to surface (lbf/ft³)
	Modulus of rupture (psi)	Break strength (lbf)	
1-A	MD: 79.6 XMD: 61.2	MD: 64.8 XMD: 49.3	3259
1-B	MD: 127.9 XMD: 135.5	MD: 102.4 XMD: 108.2	2590
2	MD: 93.0 XMD: 64.1	MD: 75.4 XMD: 51.1	3080
3	MD: 98.4 XMD: 59.5	MD: 75.8 XMD: 47.2	3083
4	MD: 73.0 XMD: 52.6	MD: 58.1 XMD: 42.2	2904
5	MD: 121.1 XMD: 93.6	MD: 92.9 XMD: 76.9	3668
6	MD: 96.3 XMD: 55.8	MD: 71.3 XMD: 41.7	2657
ASTM C1289, Type II requirement	40	17	500

NRCA

Surface depressions—"rutting"

Correspond to knit lines

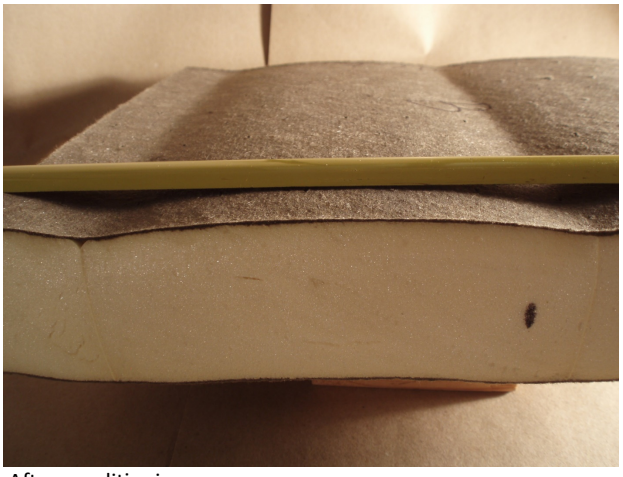
Sample	Board side indication	Knit line depth (inch)							
		Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Line 8
1-A	None	-0.084	-0.078	-0.068	—	—	—	—	—
	"This side down"	-0.061	-0.137	-0.110					
1-B	None	-0.038	-0.030	-0.048	—	—	—	—	—
	None	-0.049	-0.085	-0.041					
2	None	-0.015	-0.059	-0.060	-0.028	-0.020	-0.028	-0.010	-0.005
	"This side down"	-0.130	-0.167	-0.161	-0.193	-0.210	-0.166	-0.171	-0.143
3	None	-0.023	-0.049	-0.046	-0.051	-0.047	—	—	—
	None	-0.015	-0.031	-0.045	-0.036	-0.021			
4	None	-0.035	-0.038	-0.068	-0.055	-0.062	—	—	—
	"This side down"	-0.091	-0.112	-0.122	-0.114	-0.072			
5	None	-0.023	-0.036	-0.045	-0.040	-0.025	—	—	—
	None	-0.013	-0.016	-0.013	-0.013	-0.012			
6	None	-0.136	-0.169	-0.189	-0.170	-0.171	-0.173	-0.165	-0.146
	None	-0.035	-0.015	-0.017	-0.007	-0.005	-0.018	-0.036	-0.037

Shaded cells denote values greater than ⅛-inch depth

Combining dimensional stability and knit lines issues

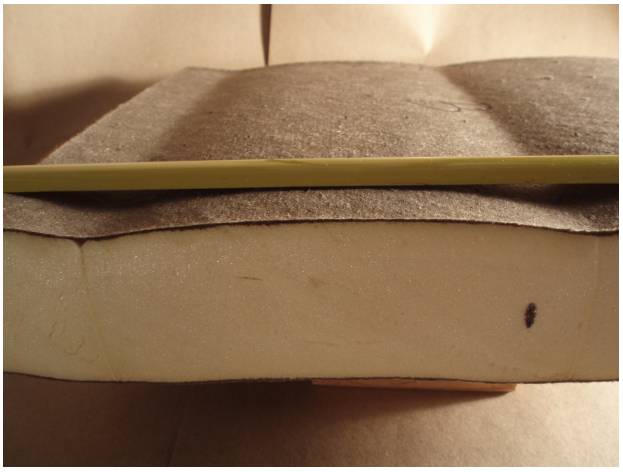
As delivered by manufacturer.

Combining dimensional stability and knit lines issues – cont.



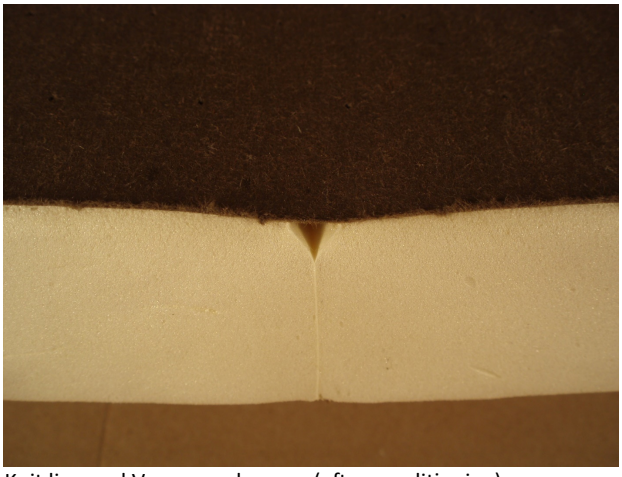
After conditioning

Combining dimensional stability and knit lines issues – cont.



After conditioning

Combining dimensional stability and knit lines issues – cont.



Knit line and V-groove close-up (after conditioning)

Conclusions

NRCA's polyisocyanurate insulation testing

- Only 2 of the 7 products tested comply with ASTM C1289
- Revisions to ASTM C1289 are needed:
  - Address knit lines and "rutting"

NRCA has already met with several polyisocyanurate insulation manufacturers… and we look forward to constructive individual manufacturers at ASTM International and elsewhere in the industry to address these issues.

Dave Tilsen

NRCA Board of Directors survey

February 2016

Material/system problems in last 6 month:

- TPO membranes (multiple reports)
- Water-based bonding adhesives (multiple reports)
- White EPDM flashings/accessories
- Facer delam. on HD polyiso.
- Above-deck conduit
- Building/energy code interpretations (reroofing)
- Internal condensation vs. tight building envelope
- Lightweight structural concrete decks
- Wrinkling in MB sheets

- Established by MRCA in 1986
- Joint agreement with NRCA beginning in 2003; renegotiated in 2015
- 1,600+ trainers
- 21,000+ applicators
- Substantially improved fire safety record

NRCA ANSI/SPRI ES-1 certifications

- In response to manufacturers' development of ANSI/SPRI ES-1 and code requirements
- NRCA has been testing since 1999
- Two certifications:
  - Intertek Testing Services, N.A.
  - Underwriters Laboratories, Inc. (UL)
- 205 companies participating
- Open to all NRCA members

Roof Wind Designer

www.roofwinddesigner.com

- Developed jointly by NRCA, MRCA and NERCA
- No cost to users
- Determine building-specific wind loads:
  - ASCE 7-05
  - ASCE 7-10
- Determine required wind resistances
  - Perimeter edge metal being added (Spring 2016)
- 17,750+ projects

EnergyWise

energywise.nrca.net

- Developed by NRCA in cooperation with the Roofing Industry Alliance for Progress
- Determine R-value requirements:
  - IECC 2006, 2012 and 2015
  - IgCC 2012
  - ASHRAE 90.1-99, -04, -07, -10 and -13
  - ASHRAE 189.1-09 and -13
- Calculates heating/cooling costs
- Verifies proper vapor retarder placement
- 7,900+ projects

NRCA online library

http://www.nrca.net/rp/technical/search/default.aspx

- Search by author, publisher, title or keyword
- NRCA-owned and non-copyright documents are downloadable
- 10,000+ documents accessible

Requests for technical assistance

1-800-323-9545 or www.nrca.net/contact.aspx

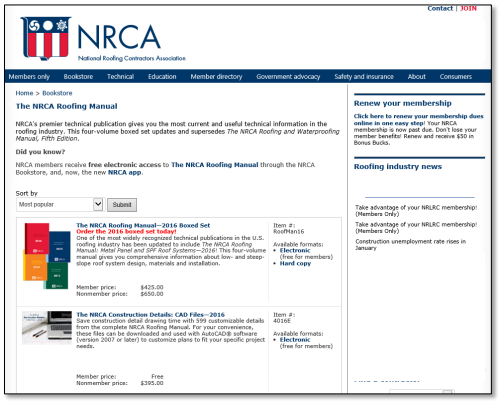
- Access to Technical Services section staff
- Used by NRCA members, building owners, A/E/Cs, code officials, media, etc.
- Questions range from simple to complex
- 3,000+ calls per year

The NRCA Roofing Manual

- 2016: SPF and Metal Panels
- 2015: Membranes
- 2014: Architectural Metal Flashing, Condensation Control & Reroofing
- 2013: Steep Slope

Manual online

www.nrca.net



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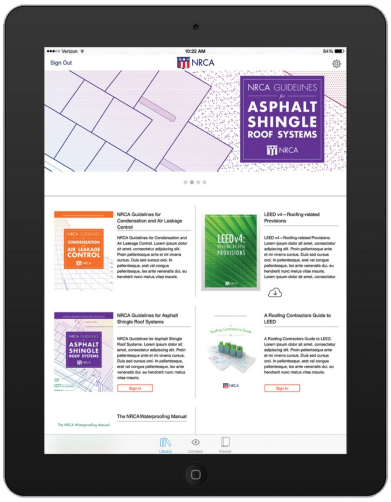
NRCA App



- NRCA App available on the Apple Store and Google Play Store for tablets
- iPhone App also available
- Register within App as being an NRCA member
- The NRCA Roofing Manual is viewable to NRCA members
- Favorite and send pages features

NRCA

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