CRA Colorado Roofing Association WEBINAR

December 8, 2021

Roofing Technical Update

presented by

Mark S. Graham
Vice President, Technical Services
National Roofing Contractors Association (NRCA)
NRCA

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Topics

- Wood roof deck concerns
- Synthetic underlayment
- Roofing related changes in the 2021 I-codes
- FM Global-insured roofing projects
- Construction-generated moisture
- IIBEC Manual of Practice and forms
- Material availability
- Questions… and other topics

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RESEARCH+TECH

Know your steep-slope roof decks

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

by Mark S. Graham

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

IRC 2018

The International Residential Code® provides specific requirements applicable to plywood and OSB structural panel sheathing used as roof decks for one- and two-family dwellings. In IRC's 2018 edition, specific requirements are provided in Section R803: Roof Sheathing.

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

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Standards for wood structural panels

International Residential Code, 2018 Edition

Plywood:

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

Oriented-strand board (OSB):

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

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Common, but not referenced in the Code

Plywood and OSB:

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

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Roof sheathing attachment

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

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

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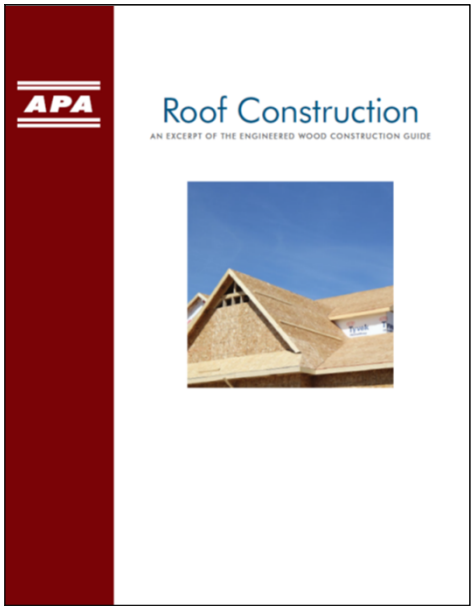

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APA Form E30, "Roof Construction"
--Roofing-specific excerpts from APA's *Engineered Wood Construction Guide* (102 pages)

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Recommendations

Roof sheathing attachment

- **New construction:**
  - Be careful with deck "acceptance".
  - Deck acceptance should be limited to the visual surface and no visual presence of moisture on the surface
- **Reroofing:**
  - Since deck condition and attachment typically cannot be determined until roof covering tear-off, consider unit price or T & M pricing for deck replacement and/or deck re-fastening

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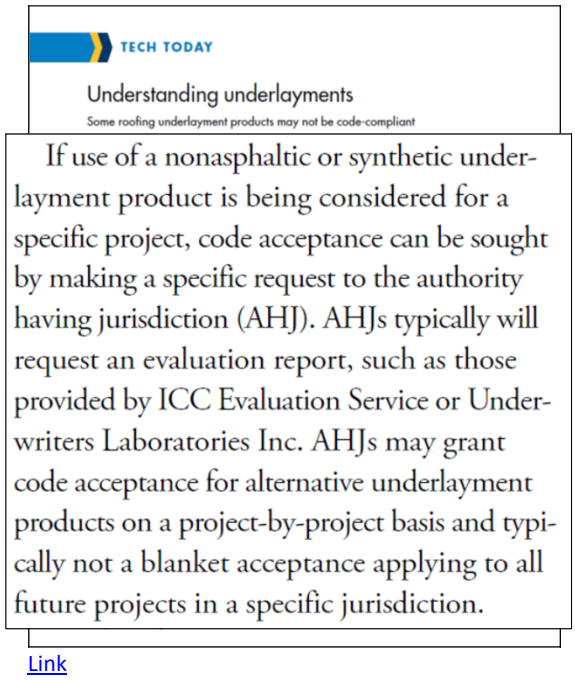

TECH TODAY

Understanding underlayments

Some roofing underlayment products may not be code-compliant

If use of a nonasphaltic or synthetic underlayment product is being considered for a specific project, code acceptance can be sought by making a specific request to the authority having jurisdiction (AHJ). AHJs typically will request an evaluation report, such as those provided by ICC Evaluation Service or Underwriters Laboratories Inc. AHJs may grant code acceptance for alternative underlayment products on a project-by-project basis and typically not a blanket acceptance applying to all future projects in a specific jurisdiction.

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NRCA testing

Synthetic underlayment products

- 18 products tested
- Water shedding (shower) test
- Dimensional stability
- Vapor permeability (ASTM E96)

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Sample ID	ASTM D 1204 Linear Dimensional Change (185°F for 24h) (% Linear Change)	
	MD	CMD
1A	2.3	0.9
2A	2.4	2.1
3A	0.9	0.6
4A	1.2	1.1
4B	1.3	0.8
4C	0.7	0.8
5A	1.1	1.2
6A	0.4	0.1
6B	2.6	2.4
6D	0.1	0.1
7A	3.4	2.7
8A	1.1	0.9
9A	1.6	0.9
9B	2.5	1.6
10A	1.5	0.9
12A	1.7	1.0
13A	1.3	1.5
13B	1.3	0.8

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Sample ID	ASTM E 96			
	Procedure A – Desiccant Method		Procedure B – Water Method	
	Water Vapor Trans. (grains/h·ft²)	Water Vapor Perm. (Perms)	Water Vapor Trans. (grains/h·ft²)	Water Vapor Perm. (Perms)
1A	0.02	0.05	0.05	0.13
2A	0.02	0.04	0.02	0.05
3A	0.01	0.03	0.02	0.04
4A	0.02	0.05	0.02	0.04
4B	0.02	0.05	0.02	0.04
4C	0.01	0.03	0.01	0.03
5A	0.02	0.04	0.02	0.06
6A	0.42	1.03	0.55	1.33
6B	0.02	0.04	0.02	0.05
6D	0.00	0.00	0.00	0.00
7A	0.06	0.13	0.04	0.11
8A	0.02	0.04	0.02	0.04
9A	0.03	0.07	0.03	0.07
9B	0.01	0.03	0.02	0.04
10A	0.02	0.04	0.02	0.05
12A	0.02	0.04	0.02	0.04
13A	0.02	0.04	0.01	0.03
13B	0.03	0.06	0.03	0.07

Vapor "open"

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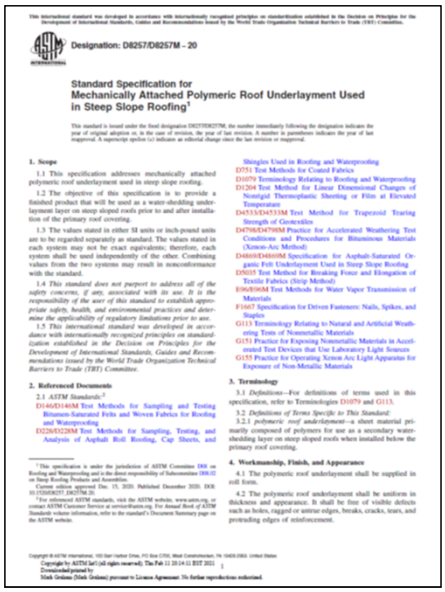

Designation: D8257/D8257M - 20

Standard Specification for
Mechanically Attached Polymeric Roof Underlayment Used
in Steep Slope Roofing[1]

ASTM D8257, "Standard Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing"

Published in December 2020

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RESEARCH+TECH

A new standard

Guidelines for synthetic underlayments

by Mark S. Graham

After more than eight years in development, in December 2020 ASTM International published the first U.S. product standard applicable to synthetic, steep-slope underlayment products. If you are involved with the design or installation of steep-slope roof systems, I encourage you to become familiar with this standard and begin to use it when specifying and procuring steep-slope underlayment products.

ASTM D8257

ASTM D8257, "Standard Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing," addresses mechanically attached synthetic underlayment used in steep-slope roof systems.

The standard defines polymeric underlayment as a sheet material primarily composed of polymers for use as a secondary water-shedding layer on steep-slope roofs when installed below a primary roof covering.

The standard's objective is to provide a finished product that will be used as a water-shedding underlayment layer before and after the installation of a primary steep-slope roof covering.

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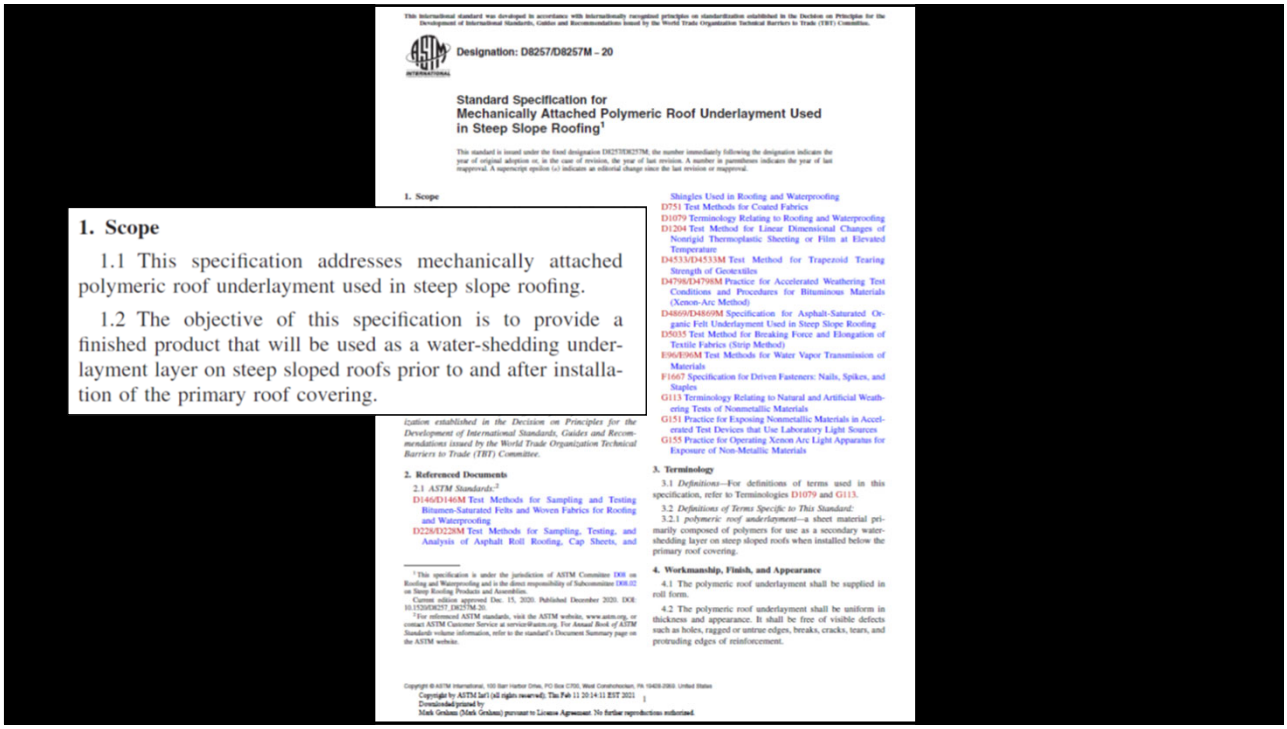

Designation: D8257/D8257M – 20

Standard Specification for
Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing[1]

1. Scope

1.1 This specification addresses mechanically attached polymeric roof underlayment used in steep slope roofing.

1.2 The objective of this specification is to provide a finished product that will be used as a water-shedding underlayment layer on steep sloped roofs prior to and after installation of the primary roof covering.

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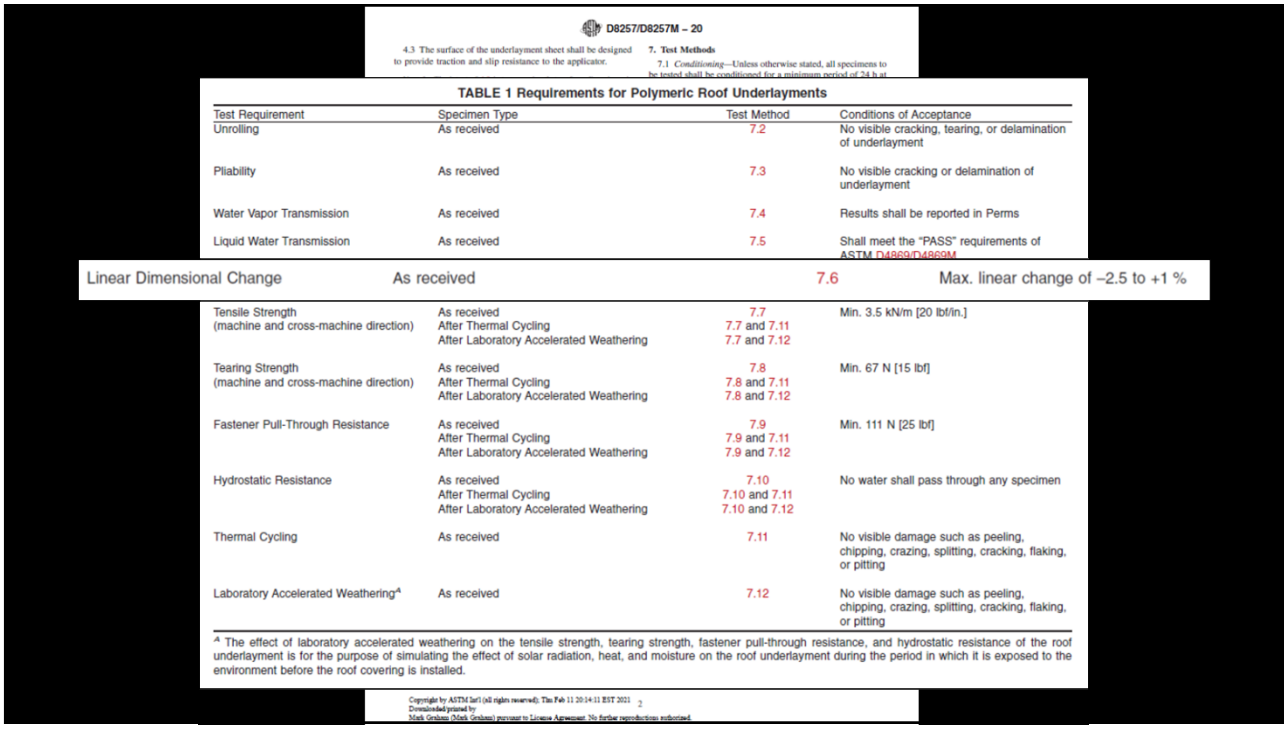

D8257/D8257M – 20

TABLE 1 Requirements for Polymeric Roof Underlayments

Test Requirement	Specimen Type	Test Method	Conditions of Acceptance
Unrolling	As received	7.2	No visible cracking, tearing, or delamination of underlayment
Pliability	As received	7.3	No visible cracking or delamination of underlayment
Water Vapor Transmission	As received	7.4	Results shall be reported in Perms
Liquid Water Transmission	As received	7.5	Shall meet the "PASS" requirements of ASTM D4869/D4869M
Linear Dimensional Change	As received	7.6	Max. linear change of –2.5 to +1 %
Tensile Strength (machine and cross-machine direction)	As received After Thermal Cycling After Laboratory Accelerated Weathering	7.7 7.7 and 7.11 7.7 and 7.12	Min. 3.5 kN/m [20 lbf/in.]
Tearing Strength (machine and cross-machine direction)	As received After Thermal Cycling After Laboratory Accelerated Weathering	7.8 7.8 and 7.11 7.8 and 7.12	Min. 67 N [15 lbf]
Fastener Pull-Through Resistance	As received After Thermal Cycling After Laboratory Accelerated Weathering	7.9 7.9 and 7.11 7.9 and 7.12	Min. 111 N [25 lbf]
Hydrostatic Resistance	As received After Thermal Cycling After Laboratory Accelerated Weathering	7.10 7.10 and 7.11 7.10 and 7.12	No water shall pass through any specimen
Thermal Cycling	As received	7.11	No visible damage such as peeling, chipping, crazing, splitting, cracking, flaking, or pitting
Laboratory Accelerated Weathering[A]	As received	7.12	No visible damage such as peeling, chipping, crazing, splitting, cracking, flaking, or pitting

[A] The effect of laboratory accelerated weathering on the tensile strength, tearing strength, fastener pull-through resistance, and hydrostatic resistance of the roof underlayment is for the purpose of simulating the effect of solar radiation, heat, and moisture on the roof underlayment during the period in which it is exposed to the environment before the roof covering is installed.

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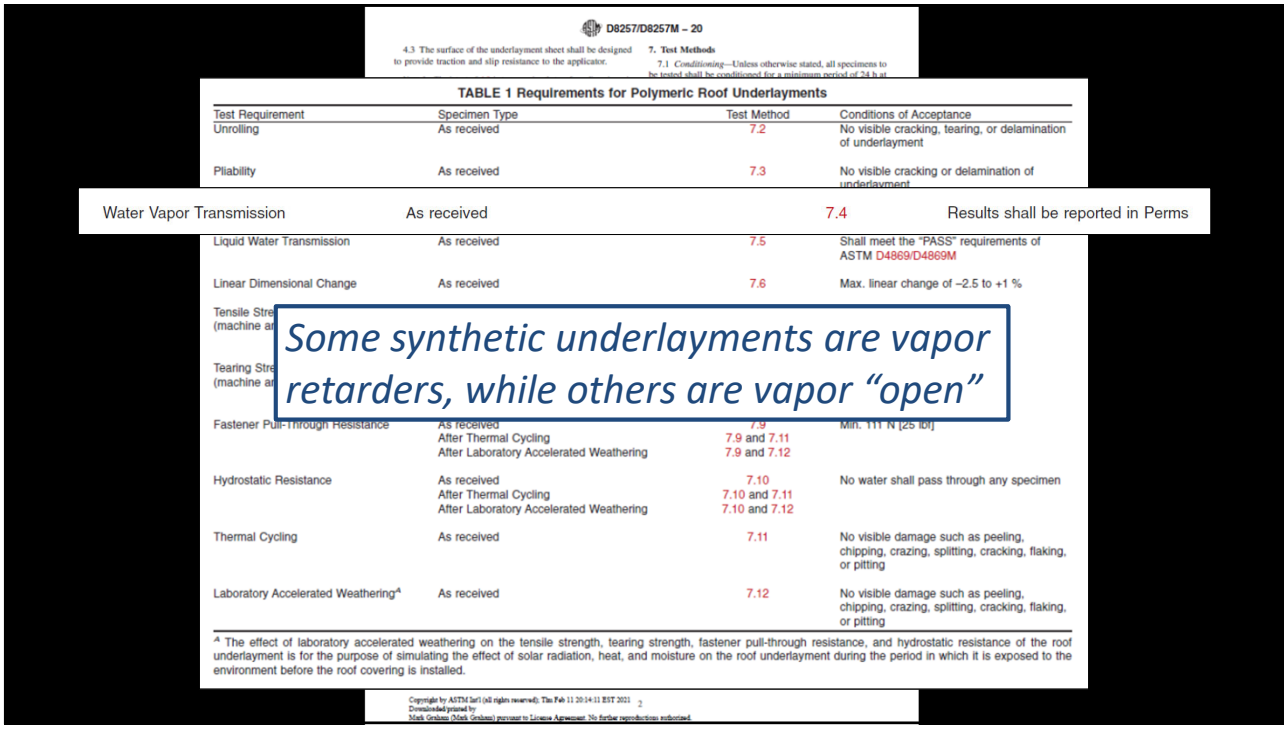

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Where would a "breathable" underlayment be preferred over an "non-breathable" underlayment?

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Conclusions and recommendations

Synthetic underlayments

- Specify, select and purchase synthetic underlayments based upon ASTM D8257
- Beware of specific products' vapor retarder or vapor "open" characteristics
- ASTM D8257 will first be introduced into IBC 2024 and IRC 2024
  - Until then, code official "acceptance" is still needed

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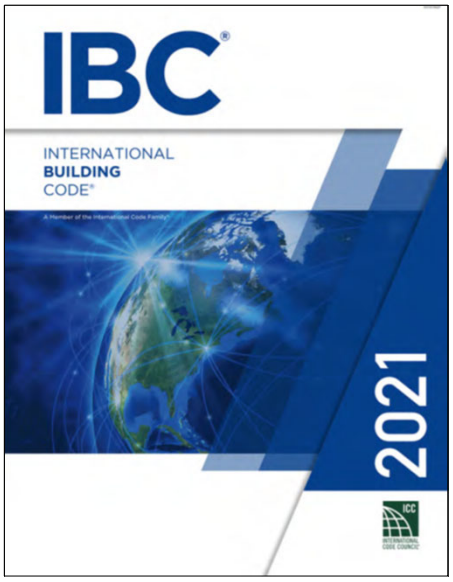
2021 IBC



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Edge metal testing

Changes in IBC 2021, Section 1504-Performance Requirements

1504.6 Edge systems for low-slope roofs. Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems having a slope less than 2 units vertical in 12 units horizontal (2:12) shall be designed and installed for wind *loads* in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except basic design *wind speed*, V, shall be determined from Figures 1609.3(1) through 1609.3(12) as applicable.

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Gutter testing

Changes in IBC 2021, Section 1504-Performance Requirements

1504.6 Edge systems for low-slope roofs. Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems having a slope less than 2 units vertical in 12 units horizontal (2:12) shall be designed and installed for wind *loads* in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except basic design *wind speed*, V, shall be determined from Figures 1609.3(1) through 1609.3(12) as applicable.

1504.6.1 Gutter securement for low-slope roofs. Gutters that are used to secure the perimeter edge of the roof membrane on low-slope (less than 2:12 slope) built-up, modified bitumen, and single-ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

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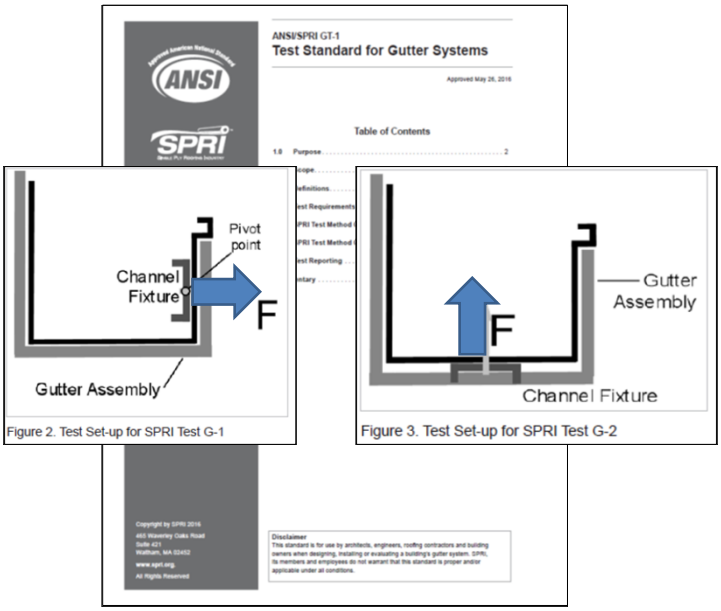
ANSI/SPRI GT-1



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Aggregate surfacing

Changes in IBC 2021, Section 1504-Performance Requirements

1504.9 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.9.

TABLE 1504.9
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS[a, b, c]

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																	
		Exposure B									Exposure C[d]								
		≤ 95	100	105	110	115	120	130	140	150	≤ 95	100	105	110	115	120	130	140	150
ASTM D1863 (No. 7 or No. 67)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No. 6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.
a. Interpolation shall be permitted for mean roof height and parapet height.
b. Basic design wind speed, *V*, and wind exposure shall be determined in accordance with Section 1609.
c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.
d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

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Roof coatings

Changes in IBC 2021, Section 1509-Roof Coatings (new)

SECTION 1509
ROOF COATINGS

1509.1 General. The installation of a *roof coating* on a *roof covering* shall comply with the requirements of Section 1505 and this section.

1509.2 Material standards. Roof coating materials shall comply with the standards in Table 1509.2.

TABLE 1509.2
ROOF COATING MATERIAL STANDARDS

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Asphaltic emulsion coating	ASTM D1227
Asphalt coating	ASTM D2823
Asphalt roof coating	ASTM D4479
Aluminum-pigmented asphalt coating	ASTM D2824
Silicone coating	ASTM D6694
Moisture-cured polyurethane coating	ASTM D6947

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Liquid-applied membrane roof systems

Changes in IBC 2021, Section 1507.14-Liquid-applied Roofing

1507.14 Liquid-applied roofing. The installation of liquid-applied roofing shall comply with the provisions of this section.

1507.14.1 Slope. Liquid-applied roofing shall have a design slope of not less than $^1/_4$ unit vertical in 12 units horizontal (2-percent slope).

1507.14.2 Material standards. Liquid-applied roofing shall comply with ASTM C836, ASTM C957 or ASTM D3468.

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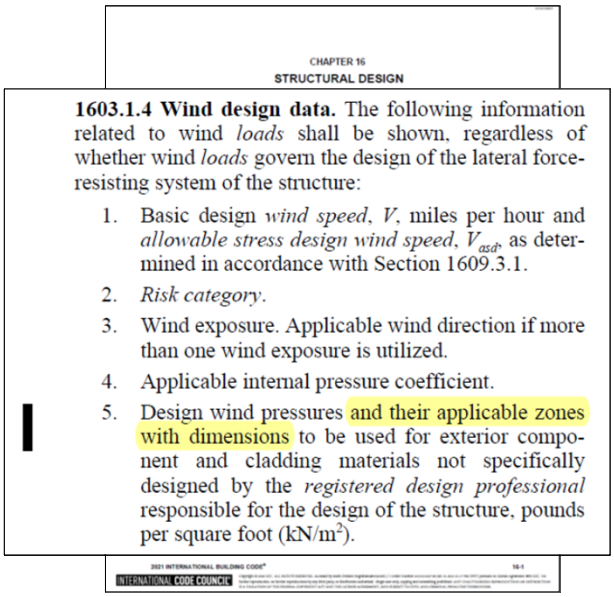
Roof zones

Changes in IBC 2021, Section 1603-Construction Documents



CHAPTER 16
STRUCTURAL DESIGN

1603.1.4 Wind design data. The following information related to wind *loads* shall be shown, regardless of whether wind *loads* govern the design of the lateral force-resisting system of the structure:

1. Basic design *wind speed*, V, miles per hour and *allowable stress design wind speed*, V_{asd}, as determined in accordance with Section 1609.3.1.
2. *Risk category*.
3. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
4. Applicable internal pressure coefficient.
5. Design wind pressures and their applicable zones with dimensions to be used for exterior component and cladding materials not specifically designed by the *registered design professional* responsible for the design of the structure, pounds per square foot (kN/m^2).

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INTERNATIONAL CODE COUNCIL

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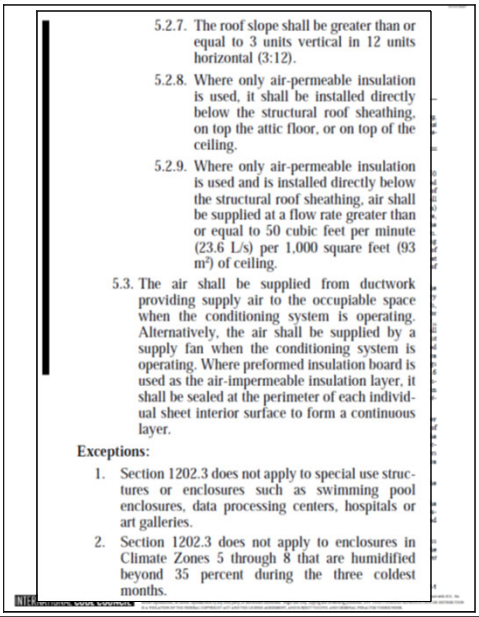
Attic ventilation

Changes in IBC 2021, Section 1203-Unvented Attics and Unvented Enclosed Rafter Spaces



5.2.7. The roof slope shall be greater than or equal to 3 units vertical in 12 units horizontal (3:12).

5.2.8. Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing, on top the attic floor, or on top of the ceiling.

5.2.9. Where only air-permeable insulation is used and is installed directly below the structural roof sheathing, air shall be supplied at a flow rate greater than or equal to 50 cubic feet per minute (23.6 L/s) per 1,000 square feet (93 m^2) of ceiling.

5.3. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

Exceptions:

1. Section 1202.3 does not apply to special use structures or enclosures such as swimming pool enclosures, data processing centers, hospitals or art galleries.
2. Section 1202.3 does not apply to enclosures in Climate Zones 5 through 8 that are humidified beyond 35 percent during the three coldest months.

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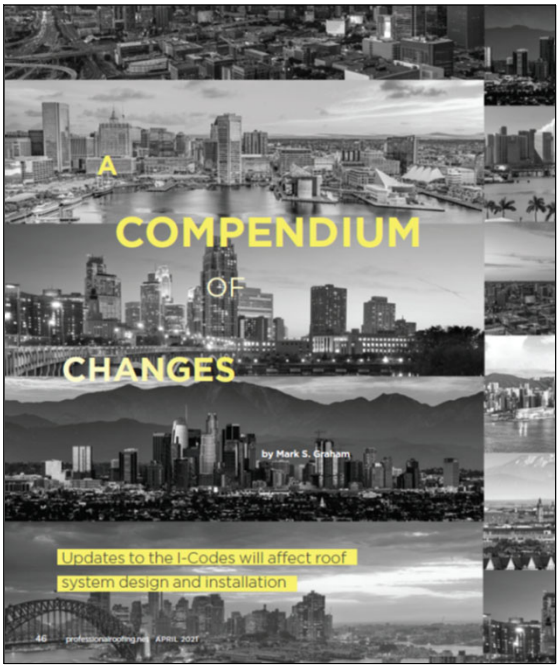

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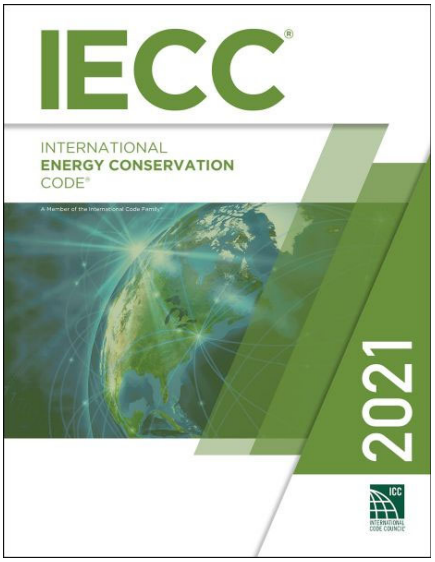

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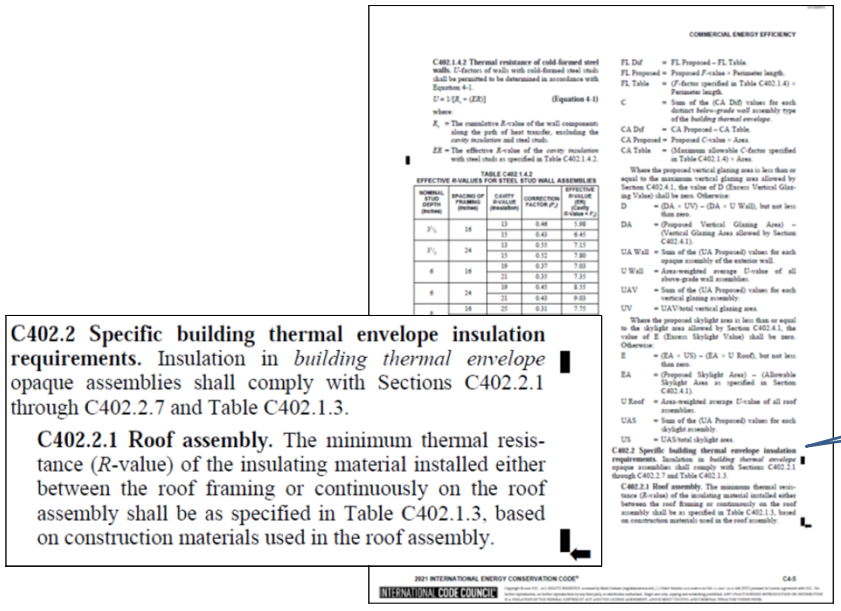

C402.2 Specific building thermal envelope insulation requirements. Insulation in *building thermal envelope* opaque assemblies shall comply with Sections C402.2.1 through C402.2.7 and Table C402.1.3.

C402.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly.

Prescriptive approach

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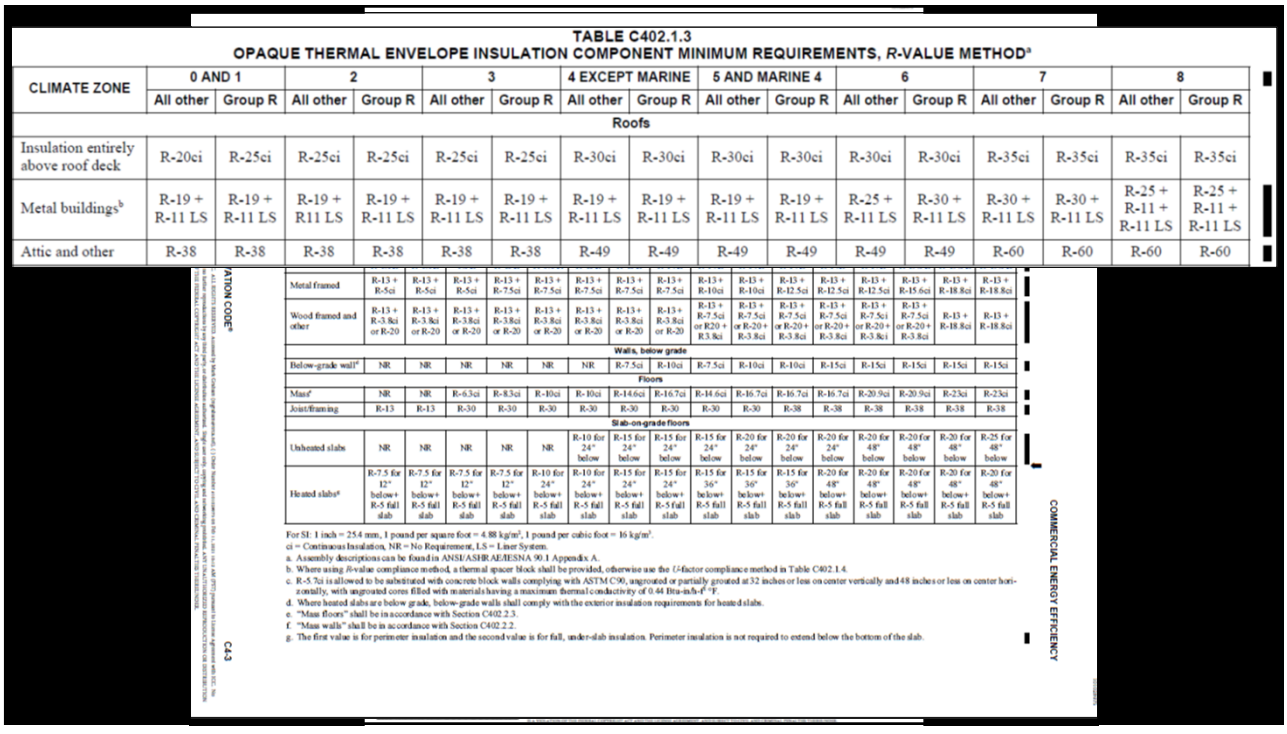

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, *R*-VALUE METHOD[a]

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-25 + R-11 + R-11 LS	R-25 + R-11 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60	R-60	R-60
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-10ci	R-13 + R-10ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-15.6ci	R-13 + R-18.8ci	R-13 + R-18.8ci	
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R20 + R3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-18.8ci	R-13 + R-18.8ci
Walls, below grade																
Below-grade wall[c]	NR	NR	NR	NR	NR	NR	NR	R-7.5ci	R-10ci	R-7.5ci	R-10ci	R-10ci	R-15ci	R-15ci	R-15ci	R-15ci
Floors																
Mass[e]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-14.6ci	R-16.7ci	R-14.6ci	R-16.7ci	R-16.7ci	R-16.7ci	R-20.9ci	R-20.9ci	R-23ci	R-23ci
Joist/framing	R-13	R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38
Slab-on-grade floors																
Unheated slabs	NR	NR	NR	NR	NR	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below	R-20 for 24" below	R-20 for 48" below	R-20 for 48" below	R-20 for 48" below	R-25 for 48" below	
Heated slabs[d]	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-10 for 24" below + R-5 full slab	R-10 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 36" below + R-5 full slab	R-15 for 36" below + R-5 full slab	R-15 for 36" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous Insulation, NR = No Requirement, LS = Liner System.
a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA 90.1 Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft²-°F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.
f. "Mass walls" shall be in accordance with Section C402.2.2.
g. The first value is for perimeter insulation and the second value is for full, under-slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

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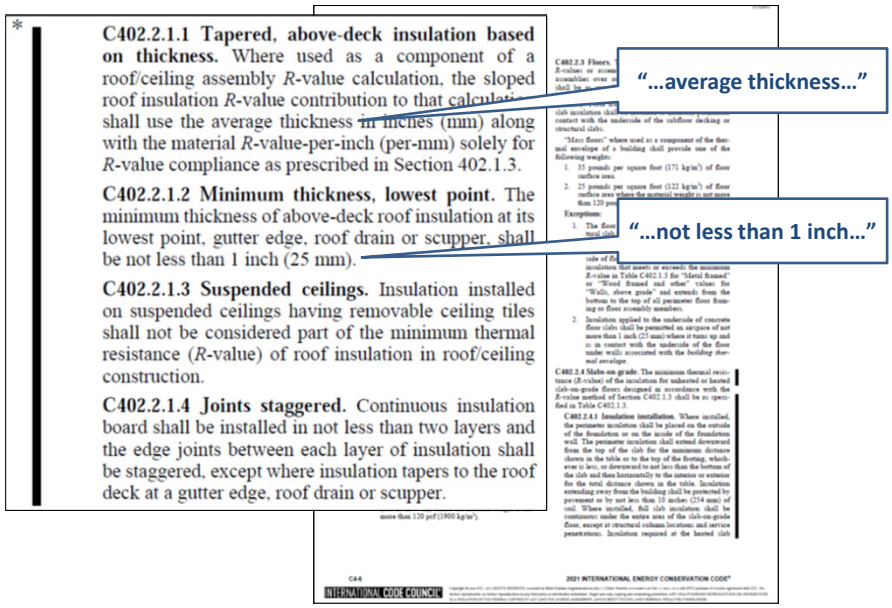
2021 IECC Commercial – Tapered insulation



C402.2.1.1 Tapered, above-deck insulation based on thickness. Where used as a component of a roof/ceiling assembly *R*-value calculation, the sloped roof insulation *R*-value contribution to that calculati… shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) solely for *R*-value compliance as prescribed in Section 402.1.3.

C402.2.1.2 Minimum thickness, lowest point. The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be not less than 1 inch (25 mm).

C402.2.1.3 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (*R*-value) of roof insulation in roof/ceiling construction.

C402.2.1.4 Joints staggered. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered, except where insulation tapers to the roof deck at a gutter edge, roof drain or scupper.

"…average thickness…"

"…not less than 1 inch…"

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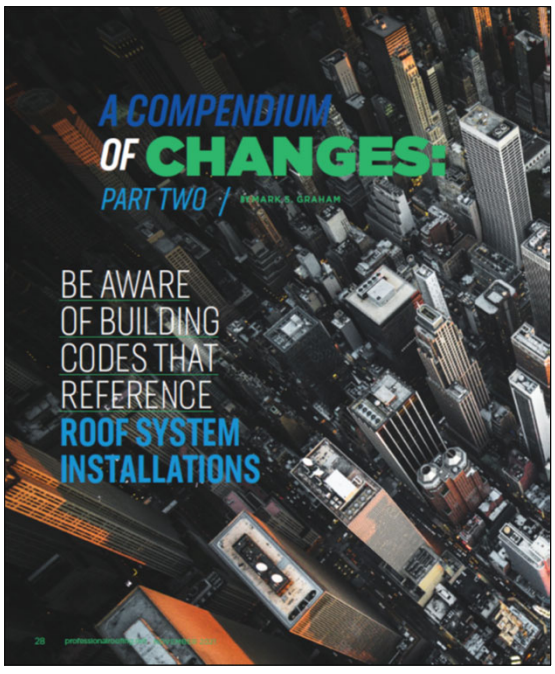

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November 2021

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Be aware whether and, if so, when your state and local jurisdictions will be adopting the 2021 I-codes

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FM Global-insured roofing project process

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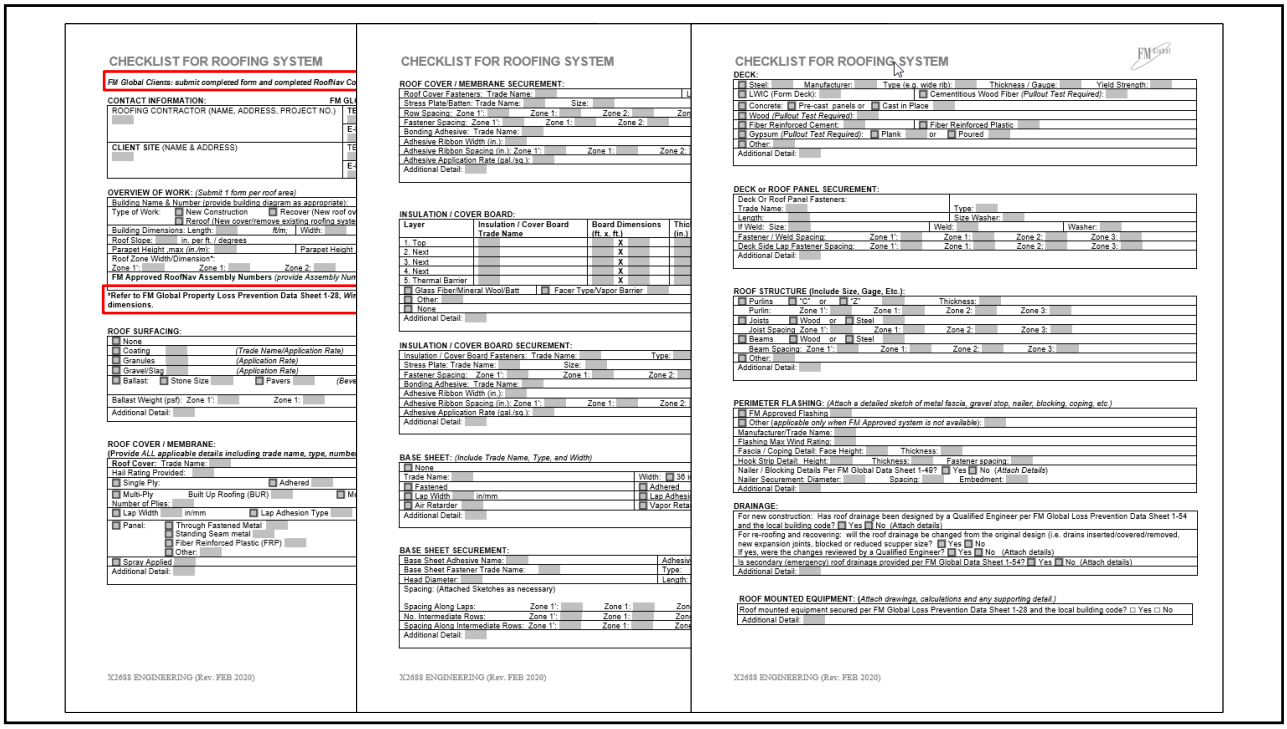

CHECKLIST FOR ROOFING SYSTEM

FM Global Clients: submit completed form and completed RoofNav Co

CONTACT INFORMATION: FM GL

ROOFING CONTRACTOR (NAME, ADDRESS, PROJECT NO.) TE

CLIENT SITE (NAME & ADDRESS) TE

OVERVIEW OF WORK: *(Submit 1 form per roof area)*

Building Name & Number (provide building diagram as appropriate):

Type of Work: ☐ New Construction ☐ Recover (New roof ov ☐ Reroof (New cover/remove existing roofing syste

Building Dimensions: Length: ft/m; Width:

Roof Slope: in. per ft. / degrees

Parapet Height ,max (in./m): Parapet Height

Roof Zone Width/Dimension*:

Zone 1': Zone 1: Zone 2:

FM Approved RoofNav Assembly Numbers *(provide Assembly Num*

*Refer to FM Global Property Loss Prevention Data Sheet 1-28, Wir dimensions.

ROOF SURFACING:

☐ None

☐ Coating *(Trade Name/Application Rate)*

☐ Granules *(Application Rate)*

☐ Gravel/Slag *(Application Rate)*

☐ Ballast: ☐ Stone Size ☐ Pavers *(Beve*

Ballast Weight (psf): Zone 1': Zone 1:

Additional Detail:

ROOF COVER / MEMBRANE:

(Provide ALL applicable details including trade name, type, numbe

Roof Cover: Trade Name:

Hail Rating Provided:

☐ Single Ply: ☐ Adhered

☐ Multi-Ply Built Up Roofing (BUR) ☐ M

Number of Plies:

☐ Lap Width in/mm ☐ Lap Adhesion Type

☐ Panel: ☐ Through Fastened Metal ☐ Standing Seam metal ☐ Fiber Reinforced Plastic (FRP) ☐ Other:

☐ Spray Applied

Additional Detail:

X2688 ENGINEERING (Rev. FEB 2020)

CHECKLIST FOR ROOFING SYSTEM

ROOF COVER / MEMBRANE SECUREMENT:

Roof Cover Fasteners: Trade Name:

Stress Plate/Batten: Trade Name: Size:

Row Spacing: Zone 1': Zone 1: Zone 2:

Fastener Spacing: Zone 1': Zone 1: Zone 2:

Bonding Adhesive: Trade Name:

Adhesive Ribbon Width (in.):

Adhesive Ribbon Spacing (in.): Zone 1': Zone 1: Zone 2:

Adhesive Application Rate (gal./sq.):

Additional Detail:

INSULATION / COVER BOARD:

Layer	Insulation / Cover Board Trade Name	Board Dimensions (ft. x ft.)	Thic (in.)
1. Top		X	
2. Next		X	
3. Next		X	
4. Next		X	
5. Thermal Barrier		X	

☐ Glass Fiber/Mineral Wool/Batt ☐ Facer Type/Vapor Barrier

☐ Other:

☐ None

Additional Detail:

INSULATION / COVER BOARD SECUREMENT:

Insulation / Cover Board Fasteners: Trade Name: Type:

Stress Plate: Trade Name: Size:

Fastener Spacing: Zone 1': Zone 1: Zone 2:

Bonding Adhesive: Trade Name:

Adhesive Ribbon Width (in.):

Adhesive Ribbon Spacing (in.): Zone 1': Zone 1: Zone 2:

Adhesive Application Rate (gal./sq.):

Additional Detail:

BASE SHEET: *(Include Trade Name, Type, and Width)*

☐ None

Trade Name: Width: ☐ 36 i

☐ Fastened ☐ Adhered

☐ Lap Width in/mm ☐ Lap Adhesi

☐ Air Retarder ☐ Vapor Reta

Additional Detail:

BASE SHEET SECUREMENT:

Base Sheet Adhesive Name: Adhesiv

Base Sheet Fastener Trade Name: Type:

Head Diameter: Length:

Spacing: (Attached Sketches as necessary)

Spacing Along Laps: Zone 1': Zone 1: Zon

No. Intermediate Rows: Zone 1': Zone 1: Zon

Spacing Along Intermediate Rows: Zone 1': Zone 1: Zon

Additional Detail:

X2688 ENGINEERING (Rev. FEB 2020)

CHECKLIST FOR ROOFING SYSTEM

DECK:

☐ Steel Manufacturer: Type (e.g. wide rib): Thickness / Gauge: Yield Strength:

☐ LWIC (Form Deck): ☐ Cementitious Wood Fiber *(Pullout Test Required)*:

☐ Concrete: ☐ Pre-cast panels or ☐ Cast in Place

☐ Wood *(Pullout Test Required)*:

☐ Fiber Reinforced Cement: ☐ Fiber Reinforced Plastic

☐ Gypsum *(Pullout Test Required)*: ☐ Plank or ☐ Poured

☐ Other:

Additional Detail:

DECK or ROOF PANEL SECUREMENT:

Deck Or Roof Panel Fasteners: Type:

Trade Name: Size Washer:

If Weld: Size: Weld: Washer:

Fastener / Weld Spacing: Zone 1': Zone 1: Zone 2: Zone 3:

Deck Side Lap Fastener Spacing: Zone 1': Zone 1: Zone 2: Zone 3:

Additional Detail:

ROOF STRUCTURE (Include Size, Gage, Etc.):

☐ Purlins ☐ "C" or ☐ "Z" Thickness:

Purlin: Zone 1': Zone 1: Zone 2: Zone 3:

☐ Joists ☐ Wood or ☐ Steel

Joist Spacing: Zone 1': Zone 1: Zone 2: Zone 3:

☐ Beams ☐ Wood or ☐ Steel

Beam Spacing: Zone 1': Zone 1: Zone 2: Zone 3:

☐ Other:

Additional Detail:

PERIMETER FLASHING: *(Attach a detailed sketch of metal fascia, gravel stop, nailer, blocking, coping, etc.)*

☐ FM Approved Flashing

☐ Other *(applicable only when FM Approved system is not available)*:

Manufacturer/Trade Name:

Flashing Max Wind Rating:

Fascia / Coping Detail: Face Height: Thickness:

Hook Strip Detail: Height: Thickness: Fastener spacing:

Nailer / Blocking Details Per FM Global Data Sheet 1-49? ☐ Yes ☐ No *(Attach Details)*

Nailer Securement: Diameter: Spacing: Embedment:

Additional Detail:

DRAINAGE:

For new construction: Has roof drainage been designed by a Qualified Engineer per FM Global Loss Prevention Data Sheet 1-54 and the local building code? ☐ Yes ☐ No (Attach details)

For re-roofing and recovering: will the roof drainage be changed from the original design (i.e. drains inserted/covered/removed, new expansion joints, blocked or reduced scupper size? ☐ Yes ☐ No

If yes, were the changes reviewed by a Qualified Engineer? ☐ Yes ☐ No (Attach details)

Is secondary (emergency) roof drainage provided per FM Global Data Sheet 1-54? ☐ Yes ☐ No (Attach details)

Additional Detail:

ROOF MOUNTED EQUIPMENT: *(Attach drawings, calculations and any supporting detail.)*

Roof mounted equipment secured per FM Global Loss Prevention Data Sheet 1-28 and the local building code? ☐ Yes ☐ No

Additional Detail:

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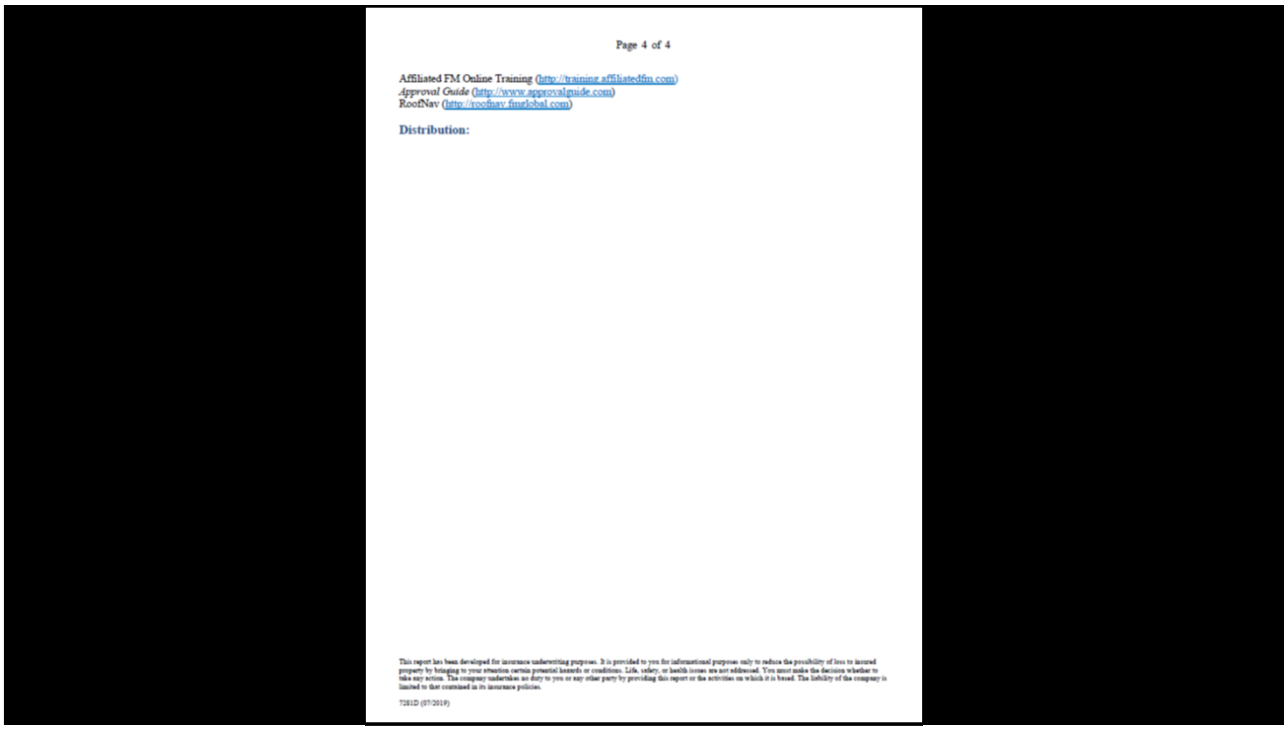

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Affiliated FM Online Training (http://training.affiliatedfm.com)
Approval Guide (http://www.approvalguide.com)
RoofNav (http://roofnav.fmglobal.com)

Distribution:

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7281D (07/2019)

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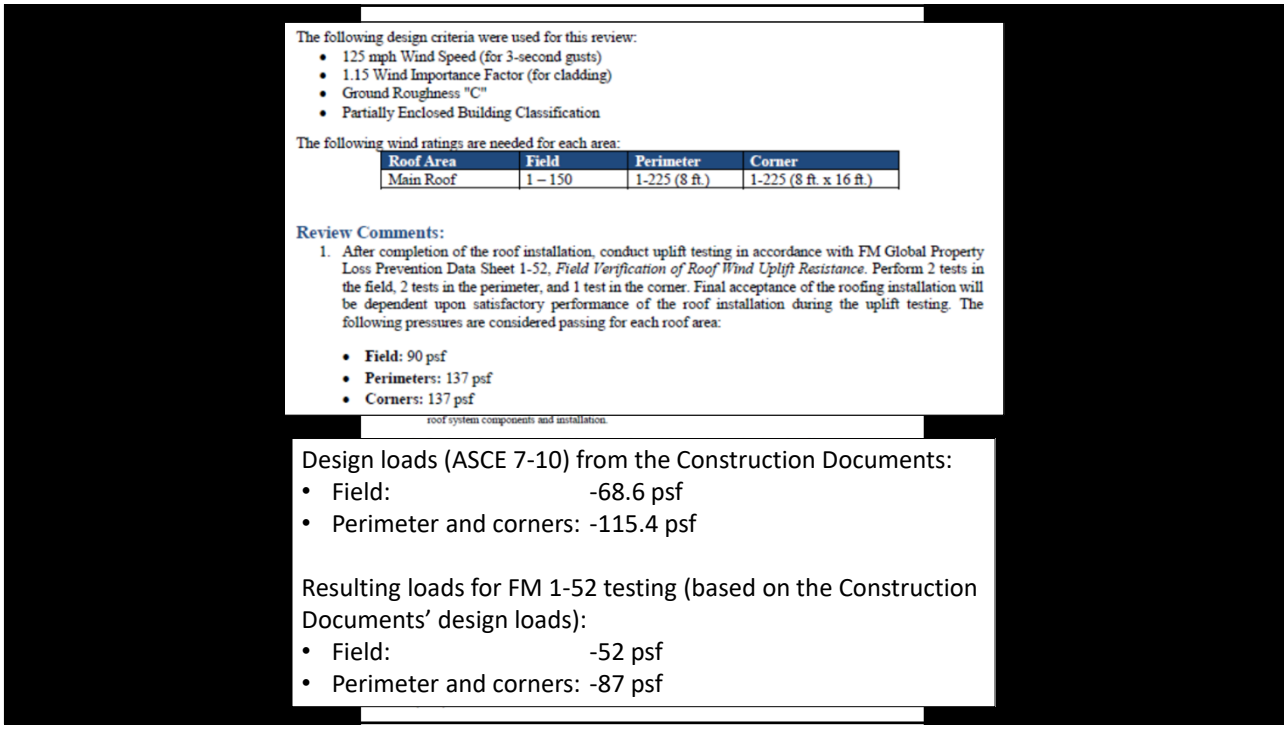

The following design criteria were used for this review:

- 125 mph Wind Speed (for 3-second gusts)
- 1.15 Wind Importance Factor (for cladding)
- Ground Roughness "C"
- Partially Enclosed Building Classification

The following wind ratings are needed for each area:

Roof Area	Field	Perimeter	Corner
Main Roof	1 – 150	1-225 (8 ft.)	1-225 (8 ft. x 16 ft.)

Review Comments:

1. After completion of the roof installation, conduct uplift testing in accordance with FM Global Property Loss Prevention Data Sheet 1-52, *Field Verification of Roof Wind Uplift Resistance*. Perform 2 tests in the field, 2 tests in the perimeter, and 1 test in the corner. Final acceptance of the roofing installation will be dependent upon satisfactory performance of the roof installation during the uplift testing. The following pressures are considered passing for each roof area:
   - **Field:** 90 psf
   - **Perimeters:** 137 psf
   - **Corners:** 137 psf

roof system components and installation.

Design loads (ASCE 7-10) from the Construction Documents:

- Field: -68.6 psf
- Perimeter and corners: -115.4 psf

Resulting loads for FM 1-52 testing (based on the Construction Documents' design loads):

- Field: -52 psf
- Perimeter and corners: -87 psf

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Conclusions and recommendations

FM Global-insured roofing project process

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

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Construction-generated moisture

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Reflective Roof Coverings: Experience and limited research has shown that non-adhered membrane roof systems with highly reflective roof surfaces can accumulate moisture while in service to a greater extent than roof systems without highly reflective roof surfaces. This phenomenon appears most pronounced in roof systems with only a single layer of rigid board insulation, which results in "thermal shorts" at the board joints through the thickness of the roof system.

A membrane roof system designed without a vapor retarder layer properly placed within the roof system's cross section may function as a "self-drying" roof assembly. That is, it will likely accumulate small amounts of moisture when the direction of moisture vapor flow is from the building's interior to its exterior and release that moisture or "dry down" toward the building's interior when the direction of vapor flow is from the building's exterior to its interior. Additional information regarding self-drying roof assemblies is provided in Section 2.2—Determining the Need for a Vapor Retarder.

In situations where a membrane roof system has a highly reflective roof surface, the membrane and the roof system's other layers will be cooler than a similar roof system without a highly reflective roof surface. As a result, roof systems with highly reflective roof surfaces will likely not dry down as quickly or to the same magnitude as roof systems without highly reflective roof surfaces.

To account for this phenomenon, NRCA recommends designers use a minimum of two layers of insulation in their membrane roof system designs and the two layers be installed with offset joints to minimize air leakage and movement and thermal shorts.

NRCA also suggests roof system designers consider the use of properly placed air retarders as components of roof systems with highly reflective roof surfaces. Additional information regarding air retarders in roof assemblies is provided in Chapter 4—Air Retarders for Roof Assemblies.

1.2 Principles of Moisture Vapor Movement

Phases: Water can exist in three phases: solid (i.e., ice), liquid (i.e., water) and gas (i.e., vapor). The phase in which water exists generally depends on its temperature and pressure. At atmospheric pressure conditions, water is generally:

- In its solid (crystalline) phase at temperatures below its freezing point, which is 32 F
- In its liquid phase between 32 F and 212 F
- In its gas phase at temperatures above its boiling point, which is 212 F

Water commonly moves from its liquid phase to its gas phase by evaporation even when the surrounding ambient temperature is less than the material's boiling point. At temperatures lower than the boiling point, heat energy can be transferred to water molecules and cause them to pass from the liquid phase into the gas phase. When water in its gas phase is cooled, it will lose energy and return to its liquid phase (i.e., condense).

When water passes from its liquid phase to its gas phase in the atmosphere, the water vapor is contained in air and it exerts a pressure that is measurable (i.e., vapor pressure).

Relative Humidity: The amount of water in its gas phase (i.e., moisture vapor) that can be contained within a given volume of air is a function of temperature. This quantity is described by the term "relative humidity," which is sometimes abbreviated RH and expressed as a percentage. Relative humidity is the ratio of the partial pressure of water vapor in an air-water mixture to the maximum—or saturated—water vapor pressure at the same temperature. Partial pressure is the pressure a substance in its gas phase would have if it alone occupied the available volume. When air at a given temperature has a relative humidity of 100 percent, it is said to be saturated; that is, it cannot hold any more water vapor unless its temperature is raised. Warm air can hold a larger quantity of water vapor than cold air.

For example, a given volume of air will have a relative humidity of 100 percent at 60 F (i.e., dry bulb temperature on psychrometric chart). That same volume of air will have a relative humidity of only about 50 percent if the air is heated from 60 F to 80 F. Using the Psychrometric Chart, this relationship temperature versus relative humidity is illustrated in Figure 1-1 (on page 188).

Condensation: When moisture-saturated air is cooled, some of the moisture vapor contained in the air condenses—that is, the moisture vapor returns to its liquid phase. The temperature at which air becomes saturated with moisture vapor and condensation begins to form is referred to as the air's dew-point temperature.

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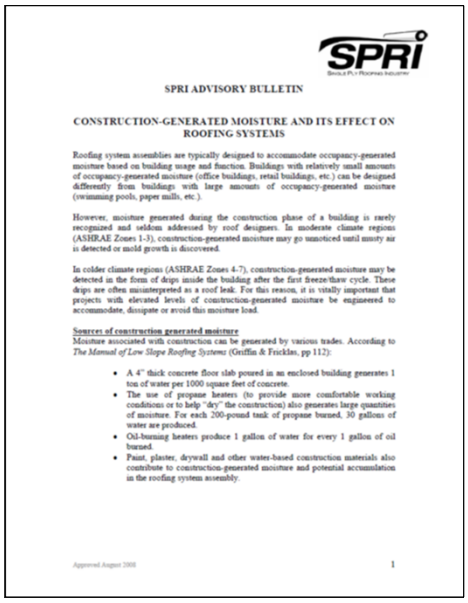

SPRI ADVISORY BULLETIN

CONSTRUCTION-GENERATED MOISTURE AND ITS EFFECT ON ROOFING SYSTEMS

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

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

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

Sources of construction generated moisture

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

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

Approved August 2008 1

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

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Some things we know…

Construction-generated moisture

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

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Some things we know (cont.)…

Construction-generated moisture

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

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Recommendations

Construction-generated moisture

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

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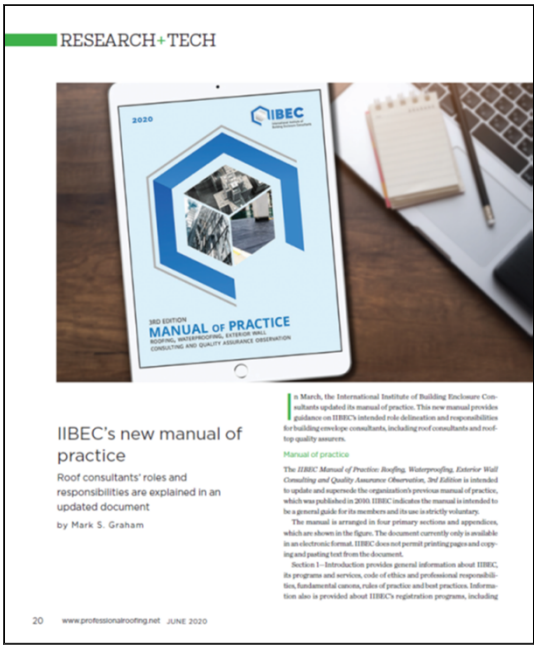
RESEARCH+TECH

IIBEC's new manual of practice

Roof consultants' roles and responsibilities are explained in an updated document

by Mark S. Graham

In March, the International Institute of Building Enclosure Consultants updated its manual of practice. This new manual provides guidance on IIBEC's intended role delineation and responsibilities for building envelope consultants, including roof consultants and roof-top quality assurers.

Manual of practice

The *IIBEC Manual of Practice: Roofing, Waterproofing, Exterior Wall Consulting and Quality Assurance Observation, 3rd Edition* is intended to update and supersede the organization's previous manual of practice, which was published in 2010. IIBEC indicates the manual is intended to be a general guide for its members and its use is strictly voluntary.

The manual is arranged in four primary sections and appendices, which are shown in the figure. The document currently only is available in an electronic format. IIBEC does not permit printing pages and copying and pasting text from the document.

Section 1—Introduction provides general information about IIBEC, its programs and services, code of ethics and professional responsibilities, fundamental canons, rules of practice and best practices. Information also is provided about IIBEC's registration programs, including

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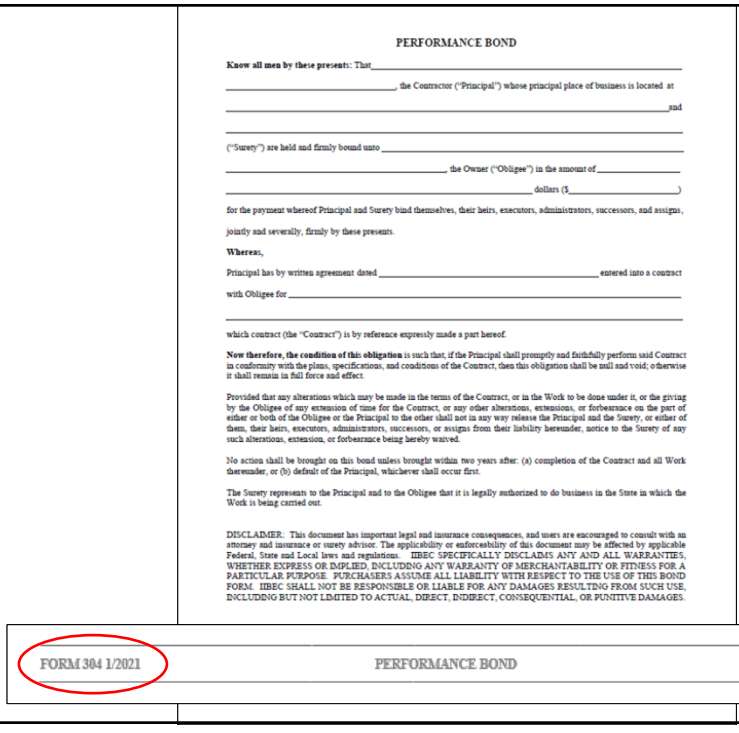

PERFORMANCE BOND

Know all men by these presents: That_____, the Contractor ("Principal") whose principal place of business is located at _____and _____ ("Surety") are held and firmly bound unto _____, the Owner ("Obligee") in the amount of _____ dollars ($_____) for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

Whereas,

Principal has by written agreement dated _____ entered into a contract with Obligee for _____ which contract (the "Contract") is by reference expressly made a part hereof.

Now therefore, the condition of this obligation is such that, if the Principal shall promptly and faithfully perform said Contract in conformity with the plans, specifications, and conditions of the Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Provided that any alterations which may be made in the terms of the Contract, or in the Work to be done under it, or the giving by the Obligee of any extension of time for the Contract, or any other alterations, extensions, or forbearance on the part of either or both of the Obligee or the Principal to the other shall not in any way release the Principal and the Surety, or either of them, their heirs, executors, administrators, successors, or assigns from their liability hereunder, notice to the Surety of any such alterations, extension, or forbearance being hereby waived.

No action shall be brought on this bond unless brought within two years after: (a) completion of the Contract and all Work thereunder, or (b) default of the Principal, whichever shall occur first.

The Surety represents to the Principal and to the Obligee that it is legally authorized to do business in the State in which the Work is being carried out.

DISCLAIMER: This document has important legal and insurance consequences, and users are encouraged to consult with an attorney and insurance or surety advisor. The applicability or enforceability of this document may be affected by applicable Federal, State and Local laws and regulations. IIBEC SPECIFICALLY DISCLAIMS ANY AND ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. PURCHASERS ASSUME ALL LIABILITY WITH RESPECT TO THE USE OF THIS BOND FORM. IIBEC SHALL NOT BE RESPONSIBLE OR LIABLE FOR ANY DAMAGES RESULTING FROM SUCH USE, INCLUDING BUT NOT LIMITED TO ACTUAL, DIRECT, INDIRECT, CONSEQUENTIAL, OR PUNITIVE DAMAGES.

FORM 304 1/2021 PERFORMANCE BOND Page 1 of 2

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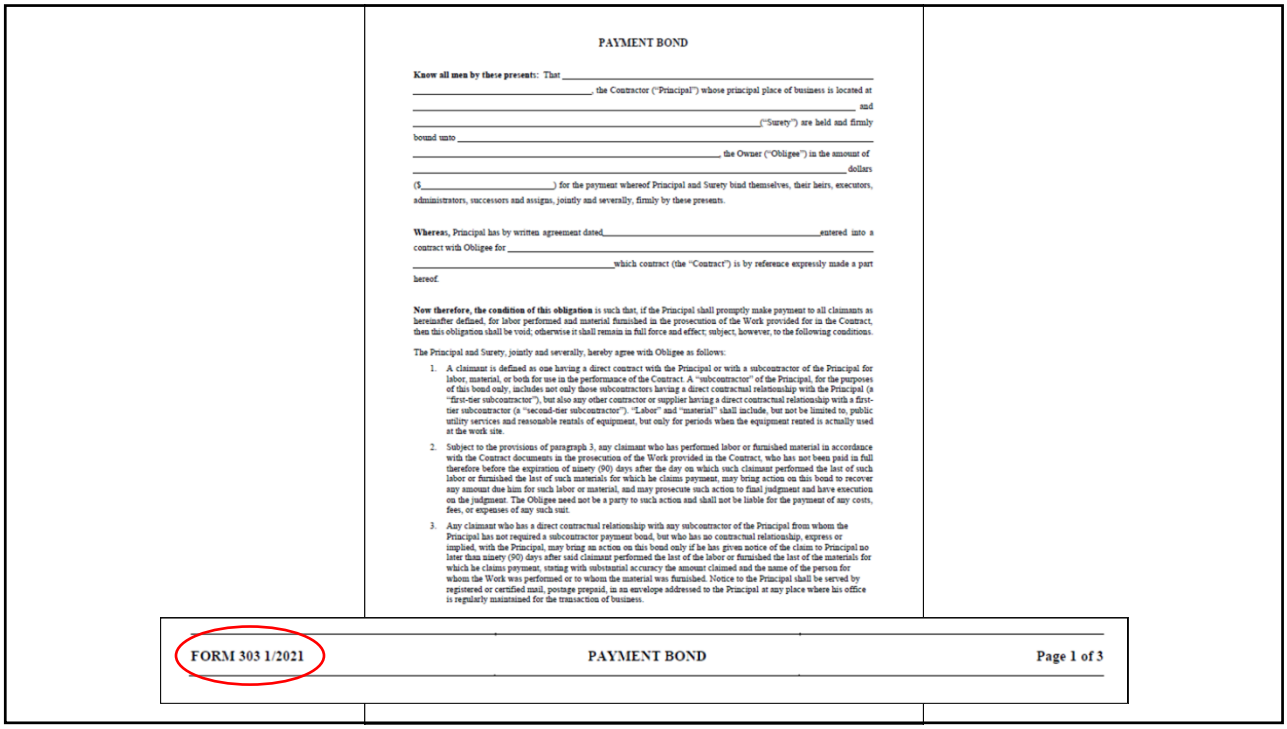

PAYMENT BOND

Know all men by these presents: That _____
_____, the Contractor ("Principal") whose principal place of business is located at
_____, and
_____("Surety") are held and firmly
bound unto _____
_____, the Owner ("Obligee") in the amount of
_____ dollars
($_____) for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Whereas, Principal has by written agreement dated_____entered into a contract with Obligee for _____
_____which contract (the "Contract") is by reference expressly made a part hereof.

Now therefore, the condition of this obligation is such that, if the Principal shall promptly make payment to all claimants as hereinafter defined, for labor performed and material furnished in the prosecution of the Work provided for in the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect; subject, however, to the following conditions.

The Principal and Surety, jointly and severally, hereby agree with Obligee as follows:

1. A claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, material, or both for use in the performance of the Contract. A "subcontractor" of the Principal, for the purposes of this bond only, includes not only those subcontractors having a direct contractual relationship with the Principal (a "first-tier subcontractor"), but also any other contractor or supplier having a direct contractual relationship with a first-tier subcontractor (a "second-tier subcontractor"). "Labor" and "material" shall include, but not be limited to, public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the work site.
2. Subject to the provisions of paragraph 3, any claimant who has performed labor or furnished material in accordance with the Contract documents in the prosecution of the Work provided in the Contract, who has not been paid in full therefore before the expiration of ninety (90) days after the day on which such claimant performed the last of such labor or furnished the last of such materials for which he claims payment, may bring action on this bond to recover any amount due him for such labor or material, and may prosecute such action to final judgment and have execution on the judgment. The Obligee need not be a party to such action and shall not be liable for the payment of any costs, fees, or expenses of any such suit.
3. Any claimant who has a direct contractual relationship with any subcontractor of the Principal from whom the Principal has not required a subcontractor payment bond, but who has no contractual relationship, express or implied, with the Principal, may bring an action on this bond only if he has given notice of the claim to Principal no later than ninety (90) days after said claimant performed the last of the labor or furnished the last of the materials for which he claims payment, stating with substantial accuracy the amount claimed and the name of the person for whom the Work was performed or to whom the material was furnished. Notice to the Principal shall be served by registered or certified mail, postage prepaid, in an envelope addressed to the Principal at any place where his office is regularly maintained for the transaction of business.

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NRCA has concerns with IIBEC's Performance Bond (Form 304) and Payment Bond (Form 303) and suggest their use be avoided.

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NRCA has long supported the use of AIA Documents (and ConsensusDoc®), and we prefer their use over the IIBEC contract documents…

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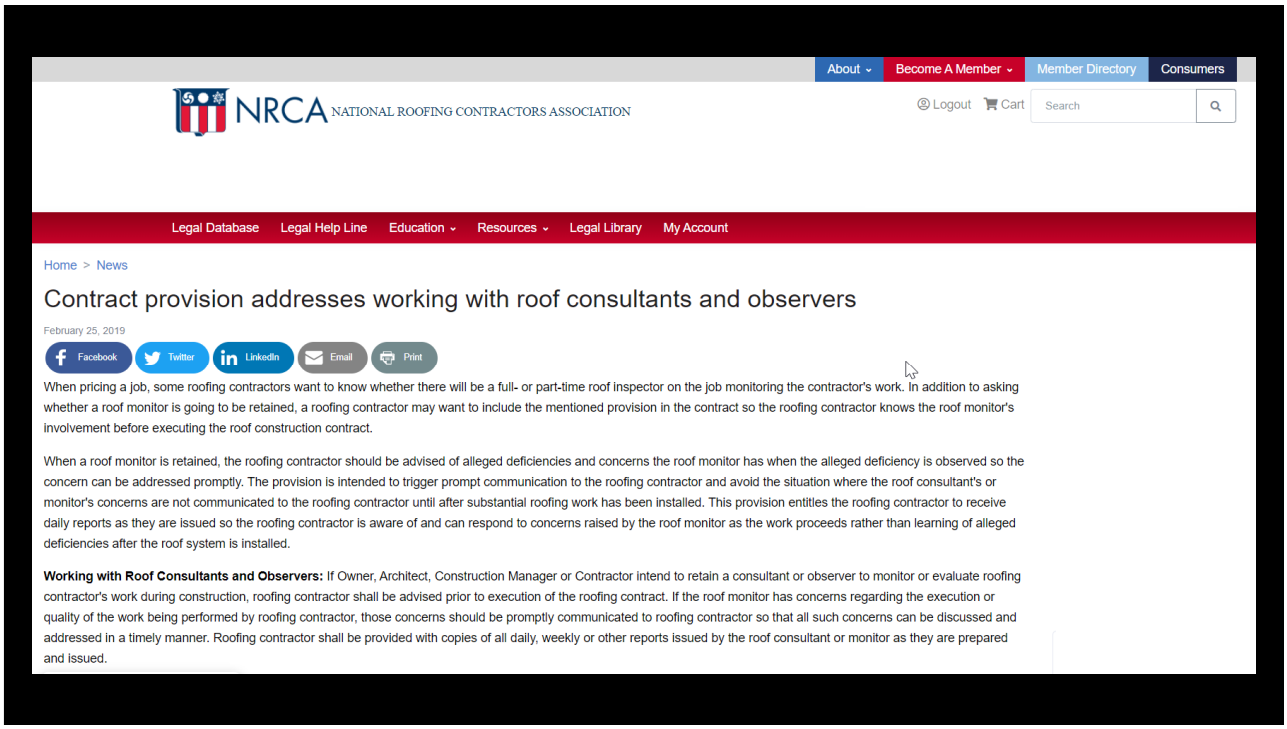

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Also, Contractors should consider seeking additional compensation if an observer is added to the project team without prior notification…

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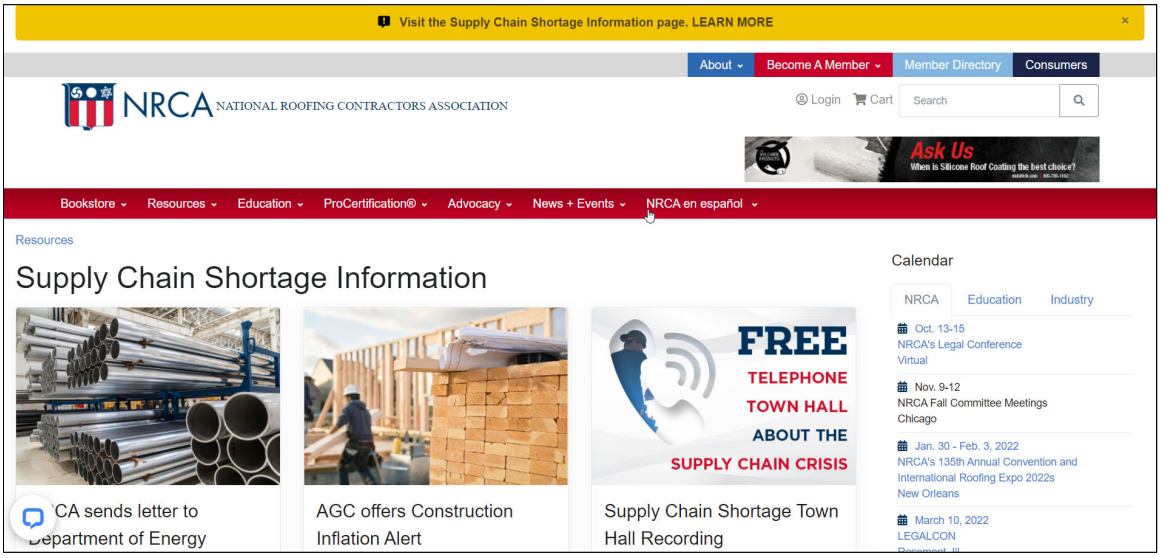
Material and product shortages and price volatility



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INDUSTRY ISSUE UPDATE

NRCA Member Benefit

Roofing material shortages and price volatility

September 2021

The U.S. roofing industry is experiencing unprecedented shortages of roofing materials and products and significant price volatility. NRCA is providing this Industry Issue Update to help its members with building owners, facility managers, general contractors and construction managers involved in roof purchasing decisions.

Although this information is intended to apply specifically to the U.S. roofing market, based on NRCA's communications with its affiliates and partners in Canada, Mexico and elsewhere worldwide, shortages of roofing materials and products and price volatility appear to be global issues.

BACKGROUND

Compared with other industries, the U.S. roofing industry is domestic in nature. With few exceptions, a vast majority of roofing products and materials used are manufactured in the U.S. from U.S.-sourced raw materials, delivered by U.S. suppliers and distributors, and installed by U.S. roofing contractor companies. Although the global economy has some effect on many purchasing decisions, the U.S. roofing industry is largely driven by the U.S. economy, interest rates and consumer sentiment.

During the past decade, the U.S. roofing industry has experienced a period of consistent, moderate growth. The roofing materials and products supply chain has expanded in capacity and roofing contractors have added field personnel and capability to fill this growing need. In many regions of the U.S., additional roofing industry growth has been limited by a lack of adequately trained field personnel.

At the same time, energy code requirements and sustainability incentive programs have resulted in a demand for more energy-efficient roof systems. For example, when reroofing a building, it is not unusual to replace an existing, aged roof system having an R-10 insulation value with a new roof system with an energy code mandated minimum R-20, R-25, R-30 or R-35 insulation value. Such increases in insulation value necessitate using greater amounts of and thicker insulation, usually in multiple layers, longer fasteners, more layers of insulation adhesive and additional material handling and installation labor.

The level of roofing material and product in inventory shrunk considerably

THE CURRENT SITUATION

The U.S. roofing industry responded and adapted to the onset of the COVID-19 pandemic remarkably well. The U.S. roofing industry quickly was considered "essential," and at the start of the pandemic, the roofing materials and products supply chain functioned with only minimal interruptions. Roofing contractors adapted to additional safe work practices necessary to perform work on occupied buildings during the pandemic.

By many measures, 2020 was a productive year for the U.S. roofing industry. For example, 2020 was a near historic record level year for asphalt shingle installations. Homeowners invested in reroofing and maintaining their homes during the pandemic, spurred in part by low interest rates and the availability of stimulus funding, and the roofing industry responded to several weather events involving high winds and hail. The institutional and industrial segments of the U.S. roofing industry also experienced similar levels of activity.

However, one noticeable change is the level of roofing material and product in inventory shrunk considerably. Roofing material suppliers and distributors reduced their material and product inventories. Since the start of the pandemic, far more roofing materials and products are being shipped on a job-specific basis. This especially is the case with roof insulation and roof covering products and certain specialty products, such as fasteners and adhesives. A few years ago, many roofing jobs often could be carried out with roofing materials and products held in inventory, but manufacturers now are shipping roofing materials and products on a job-specific basis with fewer roofing materials and products being stocked in inventory.

NRCA Industry Issue Update: Roofing Material Shortages and Price Volatility

Link

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RESEARCH+TECH

Considering substitutions

Be aware of potential consequences with product substitution

by Mark S. Graham

With ongoing shortages of building materials and products, substitutions have become more commonplace—but they can have unintended consequences. One issue that has arisen involves substituting European lumber for North American lumber, a decision that could result in unintended consequences.

The situation

At the start of the COVID-19 pandemic, wood product producers were operating under the same uncertainty as the rest of the world. Many mills curtailed production in anticipation of worker shortages and reduced demand. At the same time, many wholesale and retail lumber customers significantly reduced inventory levels. Also, because of the Great Recession, several mills had closed permanently. The American Wood Council reports between 2007 and 2017, mill closures in the South resulted in a lumber capacity loss between 1.7 to 2 billion board feet. Mill closures in the Pacific Northwest represented 10% of the area's mills.

Although the demand for wood products had dipped, it quickly rebounded during the pandemic because of increased remodeling projects and new housing starts spurred, in part, by low interest

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Questions… and other topics

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