Roofing Week in Chicago
January 18-20, 2023

Steep-slope technical update

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

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Topics

- Roofing industry market conditions
- Imported lumber and sheathing concerns
- Synthetic underlayment
- Other topics and questions

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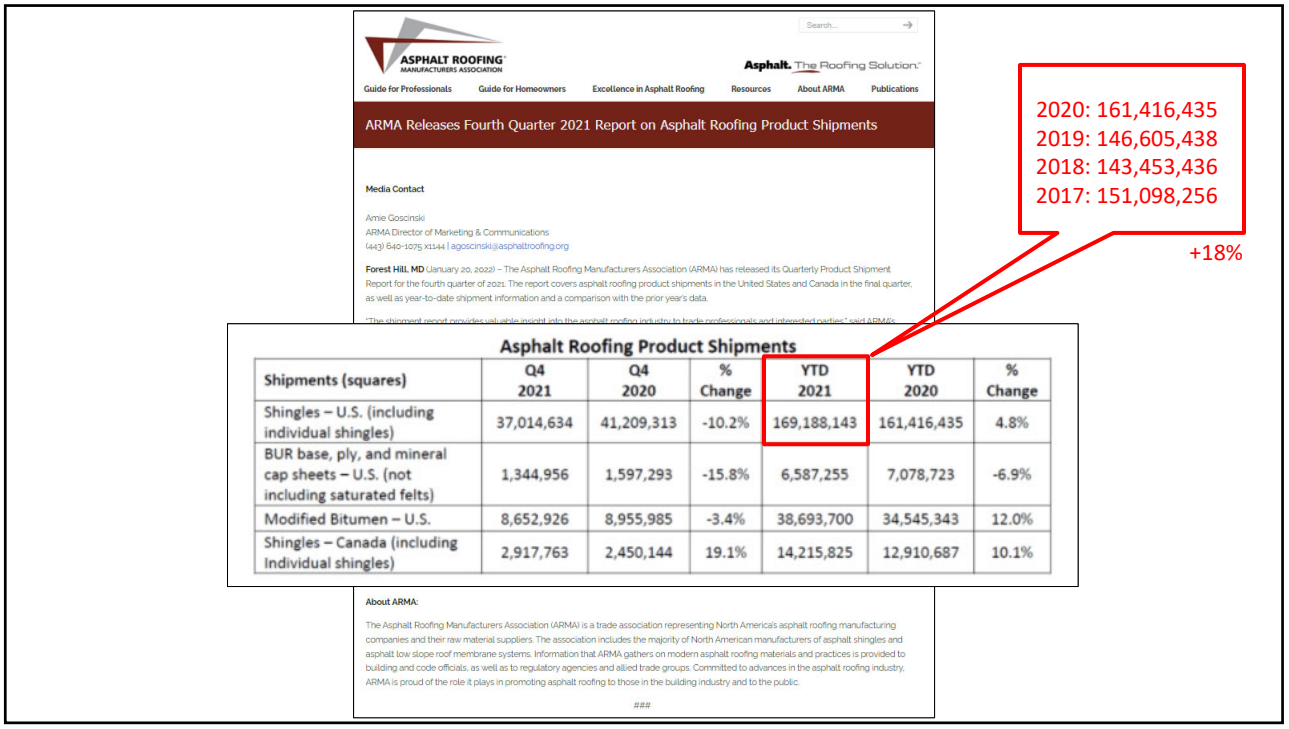
ASPHALT ROOFING MANUFACTURERS ASSOCIATION
Asphalt. The Roofing Solution.
Guide for Professionals
Guide for Homeowners
Excellence in Asphalt Roofing
Resources
About ARMA
Publications
ARMA Releases Fourth Quarter 2021 Report on Asphalt Roofing Product Shipments
Media Contact
Amie Goscinski
ARMA Director of Marketing & Communications
(443) 640-1075 x1144 | agoscinski@asphaltroofing.org
Forest Hill, MD (January 20, 2022) – The Asphalt Roofing Manufacturers Association (ARMA) has released its Quarterly Product Shipment Report for the fourth quarter of 2021. The report covers asphalt roofing product shipments in the United States and Canada in the final quarter, as well as year-to-date shipment information and a comparison with the prior year's data.
2020: 161,416,435
2019: 146,605,438
2018: 143,453,436
2017: 151,098,256
+18%
Asphalt Roofing Product Shipments
Shipments (squares) | Q4 2021 | Q4 2020 | % Change | YTD 2021 | YTD 2020 | % Change
Shingles – U.S. (including individual shingles) | 37,014,634 | 41,209,313 | -10.2% | 169,188,143 | 161,416,435 | 4.8%
BUR base, ply, and mineral cap sheets – U.S. (not including saturated felts) | 1,344,956 | 1,597,293 | -15.8% | 6,587,255 | 7,078,723 | -6.9%
Modified Bitumen – U.S. | 8,652,926 | 8,955,985 | -3.4% | 38,693,700 | 34,545,343 | 12.0%
Shingles – Canada (including Individual shingles) | 2,917,763 | 2,450,144 | 19.1% | 14,215,825 | 12,910,687 | 10.1%
About ARMA:
The Asphalt Roofing Manufacturers Association (ARMA) is a trade association representing North America's asphalt roofing manufacturing companies and their raw material suppliers. The association includes the majority of North American manufacturers of asphalt shingles and asphalt low slope roof membrane systems. Information that ARMA gathers on modern asphalt roofing materials and practices is provided to building and code officials, as well as to regulatory agencies and allied trade groups. Committed to advances in the asphalt roofing industry, ARMA is proud of the role it plays in promoting asphalt roofing to those in the building industry and to the public.
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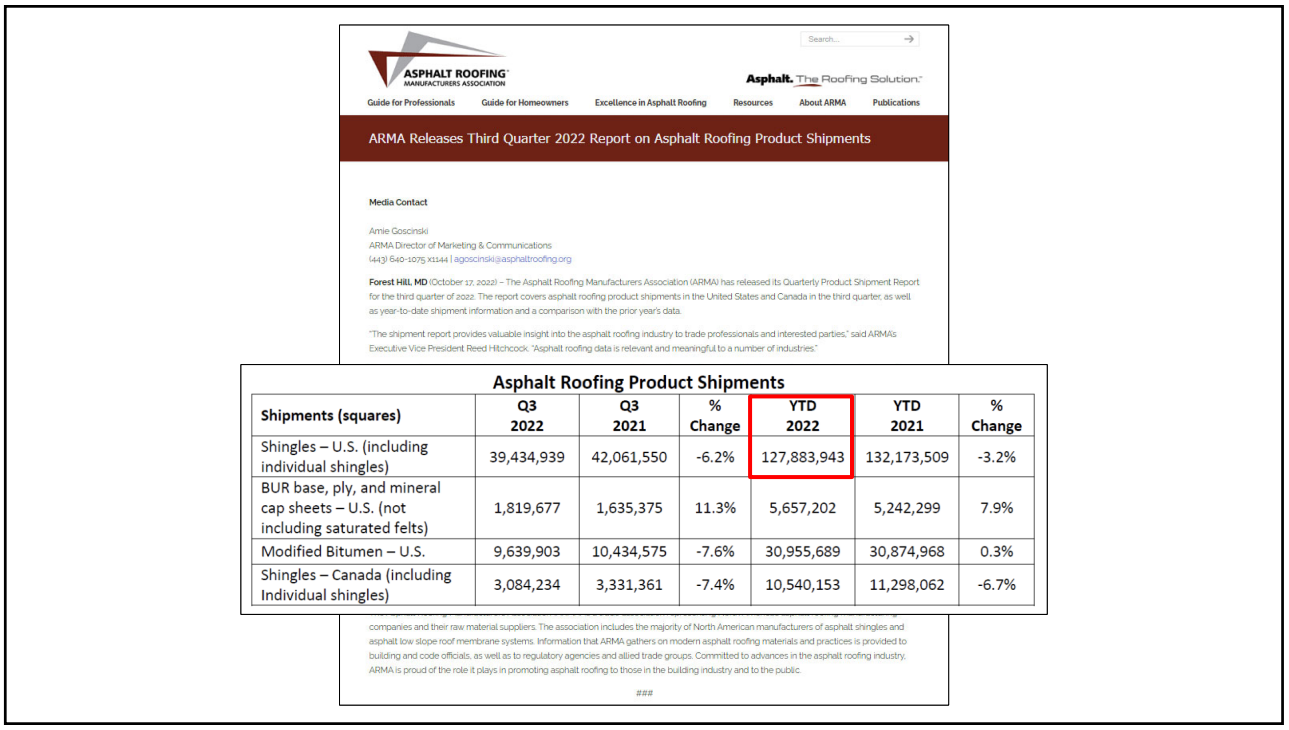
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Forest Hill, MD (October 17, 2022) – The Asphalt Roofing Manufacturers Association (ARMA) has released its Quarterly Product Shipment Report for the third quarter of 2022. The report covers asphalt roofing product shipments in the United States and Canada in the third quarter, as well as year-to-date shipment information and a comparison with the prior year's data.
"The shipment report provides valuable insight into the asphalt roofing industry to trade professionals and interested parties," said ARMA's Executive Vice President Reed Hitchcock. "Asphalt roofing data is relevant and meaningful to a number of industries."
Asphalt Roofing Product Shipments
Shipments (squares) | Q3 2022 | Q3 2021 | % Change | YTD 2022 | YTD 2021 | % Change
Shingles – U.S. (including individual shingles) | 39,434,939 | 42,061,550 | -6.2% | 127,883,943 | 132,173,509 | -3.2%
BUR base, ply, and mineral cap sheets – U.S. (not including saturated felts) | 1,819,677 | 1,635,375 | 11.3% | 5,657,202 | 5,242,299 | 7.9%
Modified Bitumen – U.S. | 9,639,903 | 10,434,575 | -7.6% | 30,955,689 | 30,874,968 | 0.3%
Shingles – Canada (including Individual shingles) | 3,084,234 | 3,331,361 | -7.4% | 10,540,153 | 11,298,062 | -6.7%
companies and their raw material suppliers. The association includes the majority of North American manufacturers of asphalt shingles and asphalt low slope roof membrane systems. Information that ARMA gathers on modern asphalt roofing materials and practices is provided to building and code officials, as well as to regulatory agencies and allied trade groups. Committed to advances in the asphalt roofing industry, ARMA is proud of the role it plays in promoting asphalt roofing to those in the building industry and to the public.
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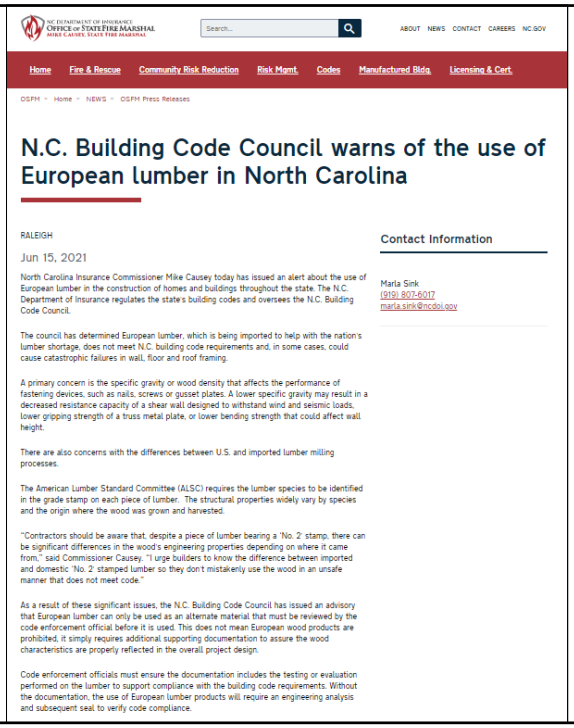
What to expect in 2023…

5

Lumber concerns

6



NC Department of Insurance
Office of State Fire Marshal
Mike Causey, State Fire Marshal

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N.C. Building Code Council warns of the use of European lumber in North Carolina

RALEIGH

Jun 15, 2021

North Carolina Insurance Commissioner Mike Causey today has issued an alert about the use of European lumber in the construction of homes and buildings throughout the state. The N.C. Department of Insurance regulates the state's building codes and oversees the N.C. Building Code Council.

The council has determined European lumber, which is being imported to help with the nation's lumber shortage, does not meet N.C. building code requirements and, in some cases, could cause catastrophic failures in wall, floor and roof framing.

A primary concern is the specific gravity or wood density that affects the performance of fastening devices, such as nails, screws or gusset plates. A lower specific gravity may result in a decreased resistance capacity of a shear wall designed to withstand wind and seismic loads, lower gripping strength of a truss metal plate, or lower bending strength that could affect wall height.

There are also concerns with the differences between U.S. and imported lumber milling processes.

The American Lumber Standard Committee (ALSC) requires the lumber species to be identified in the grade stamp on each piece of lumber. The structural properties widely vary by species and the origin where the wood was grown and harvested.

"Contractors should be aware that, despite a piece of lumber bearing a 'No. 2' stamp, there can be significant differences in the wood's engineering properties depending on where it came from," said Commissioner Causey. "I urge builders to know the difference between imported and domestic 'No. 2' stamped lumber so they don't mistakenly use the wood in an unsafe manner that does not meet code."

As a result of these significant issues, the N.C. Building Code Council has issued an advisory that European lumber can only be used as an alternate material that must be reviewed by the code enforcement official before it is used. This does not mean European wood products are prohibited, it simply requires additional supporting documentation to assure the wood characteristics are properly reflected in the overall project design.

Code enforcement officials must ensure the documentation includes the testing or evaluation performed on the lumber to support compliance with the building code requirements. Without the documentation, the use of European lumber products will require an engineering analysis and subsequent seal to verify code compliance.

Contact Information

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(919) 807-6017
marla.sink@ncdoi.gov

Link

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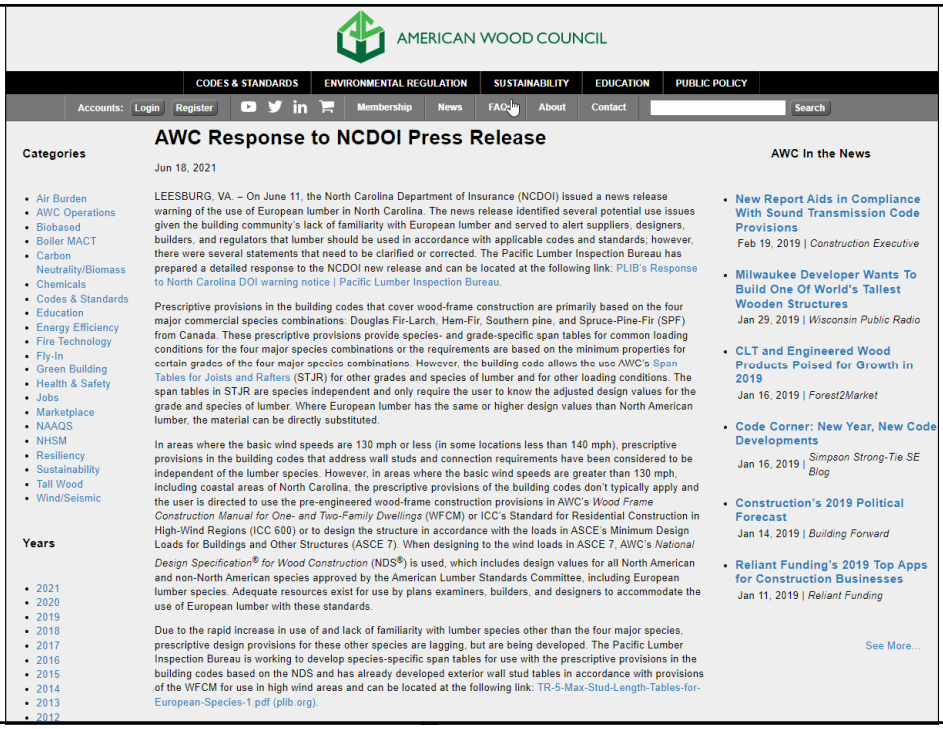

AMERICAN WOOD COUNCIL

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- Sustainability
- Tall Wood
- Wind/Seismic

Years

- 2021
- 2020
- 2019
- 2018
- 2017
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- 2014
- 2013
- 2012

AWC Response to NCDOI Press Release

Jun 18, 2021

LEESBURG, VA. – On June 11, the North Carolina Department of Insurance (NCDOI) issued a news release warning of the use of European lumber in North Carolina. The news release identified several potential use issues given the building community's lack of familiarity with European lumber and served to alert suppliers, designers, builders, and regulators that lumber should be used in accordance with applicable codes and standards; however, there were several statements that need to be clarified or corrected. The Pacific Lumber Inspection Bureau has prepared a detailed response to the NCDOI new release and can be located at the following link: PLIB's Response to North Carolina DOI warning notice | Pacific Lumber Inspection Bureau.

Prescriptive provisions in the building codes that cover wood-frame construction are primarily based on the four major commercial species combinations: Douglas Fir-Larch, Hem-Fir, Southern pine, and Spruce-Pine-Fir (SPF) from Canada. These prescriptive provisions provide species- and grade-specific span tables for common loading conditions for the four major species combinations or the requirements are based on the minimum properties for certain grades of the four major species combinations. However, the building code allows the use AWC's Span Tables for Joists and Rafters (STJR) for other grades and species of lumber and for other loading conditions. The span tables in STJR are species independent and only require the user to know the adjusted design values for the grade and species of lumber. Where European lumber has the same or higher design values than North American lumber, the material can be directly substituted.

In areas where the basic wind speeds are 130 mph or less (in some locations less than 140 mph), prescriptive provisions in the building codes that address wall studs and connection requirements have been considered to be independent of the lumber species. However, in areas where the basic wind speeds are greater than 130 mph, including coastal areas of North Carolina, the prescriptive provisions of the building codes don't typically apply and the user is directed to use the pre-engineered wood-frame construction provisions in AWC's *Wood Frame Construction Manual for One- and Two-Family Dwellings* (WFCM) or ICC's Standard for Residential Construction in High-Wind Regions (ICC 600) or to design the structure in accordance with the loads in ASCE's Minimum Design Loads for Buildings and Other Structures (ASCE 7). When designing to the wind loads in ASCE 7, AWC's *National Design Specification® for Wood Construction* (NDS®) is used, which includes design values for all North American and non-North American species approved by the American Lumber Standards Committee, including European lumber species. Adequate resources exist for use by plans examiners, builders, and designers to accommodate the use of European lumber with these standards.

Due to the rapid increase in use of and lack of familiarity with lumber species other than the four major species, prescriptive design provisions for these other species are lagging, but are being developed. The Pacific Lumber Inspection Bureau is working to develop species-specific span tables for use with the prescriptive provisions in the building codes based on the NDS and has already developed exterior wall stud tables in accordance with provisions of the WFCM for use in high wind areas and can be located at the following link: TR-5-Max-Stud-Length-Tables-for-European-Species-1.pdf (plib.org).

AWC In the News

- **New Report Aids in Compliance With Sound Transmission Code Provisions**
  Feb 19, 2019 | *Construction Executive*
- **Milwaukee Developer Wants To Build One Of World's Tallest Wooden Structures**
  Jan 29, 2019 | *Wisconsin Public Radio*
- **CLT and Engineered Wood Products Poised for Growth in 2019**
  Jan 16, 2019 | *Forest2Market*
- **Code Corner: New Year, New Code Developments**
  Jan 16, 2019 | *Simpson Strong-Tie SE Blog*
- **Construction's 2019 Political Forecast**
  Jan 14, 2019 | *Building Forward*
- **Reliant Funding's 2019 Top Apps for Construction Businesses**
  Jan 11, 2019 | *Reliant Funding*

See More...

Link

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Element of a Grade Stamp

Mill number

Grading Agency Symbol

Lumber is graded based on the quality and appearance of the wood. No. 2 lumber is the most common grade for framing. However, lumber with the same No.2 grade could have different wood properties.

Indicates the species or combination of species of lumber.

For species imported from outside North America, the grade stamp will include the designation "(I)", indicating imported".

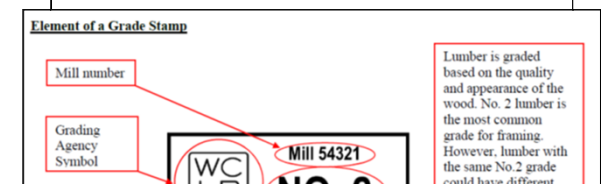
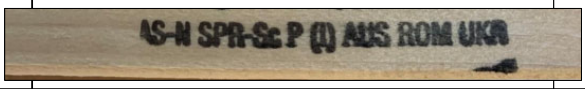


Photo #2 Lumber Grade Stamp



NORWAY SPRUCE ROMANIA & UKRAINE	N SPR (I) ROM; UKR	0.38

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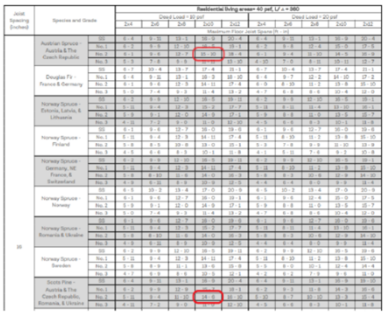
Example:

What is the code allowable span for this European 2x10 floor joist spaced 16 inches on center?

Design Criteria:
10 psf Dead Load
40 psf Live Load (Table R301.5)
Live Load Deflection limit = L/360 (Table R301.7)

From PLIB *Simplified Span Tables for Light Frame Construction Imported Species:*



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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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Plywood and OBS roof deck concerns

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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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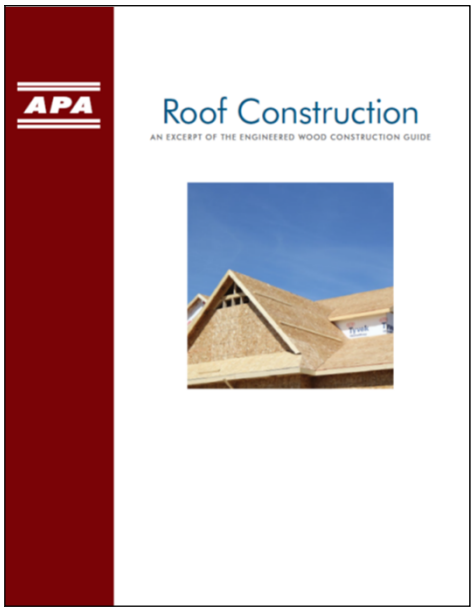

Link

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

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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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Concerns with Brazilian plywood


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Lawsuit highlights inferior Brazilian plywood and false certification

The suit was filed by U.S. Structural Plywood Integrity Coalition, which includes nine family-owned plywood manufacturers. The group alleged that PFS-TECO designated PS 1 certification for the plywood despite failing to meet U.S. standards. The lawsuit claimed negligence, false advertising and loss of revenue.

PS 1 certification indicates structural integrity for plywood panels used in floors, roofs and walls of commercial and residential buildings. After its production, PFS-TECO inspected the plywood and stamped it PS 1 before it was made available in the U.S.; however, the plywood had substantial failure rates during American Plywood Association testing and evaluation from other laboratories. Unfortunately, the plywood in question has been used throughout the U.S. for new construction projects, as well as for reconstruction in Florida, Puerto Rico and other areas affected by hurricanes.

The suit alleges that dating to Jan. 1, 2016, the inspection services "made false statements of fact through certifications that authorized 35 Brazilian plywood producers to export plywood into Florida" they either knew or should have known "did not meet" a voluntary industry standard.

Applies to product shipped from January 1, 2016 through early 2022

Link

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PFS Corporation d/b/a PFS TECO
An Employee-Owned Company

NEWS RELEASE

For Immediate Release

For more information, contact:

Scott Drake
Office: (608) 839-1013
scott.drake@pfsteco.com

Court-Issued Permanent Injunction related to Brazilian Plywood

Cottage Grove, WI (May 31, 2022) — In September 2019, a group of US plywood manufacturers filed a complaint in the Southern District of Florida concerning PFS TECO's work as an accredited third-party agency in Southern Brazil. The complaint alleged that the PFS TECO certification mark should be considered false advertising because their group believes it is not possible for plywood made from pine grown in Southern Brazil to meet the requirements of US DOC Product Standard 1 (PS 1).

PFS TECO has tested and certified plywood in Brazil for over 20 years. PFS TECO has been accredited and reaccredited by International Accreditation Services, Inc. as an inspection and testing agency and Standards Council of Canada as a certification agency. The third-party certification system for building products involves the manufacturer taking responsibility for their product while the third-party agency's role is to be the impartial link between the manufacturer and the local building official's review of the application of the product. The certification mark is intended to inform the building official that the manufacturer has demonstrated they have the capability to comply with the product standard and they had third-party oversight at the time the product was manufactured. The referenced product type and grade in the mark are then used during the building official's inspection.

On May 23, 2022, PFS TECO and the U.S. Structural Plywood Integrity Coalition agreed on the terms of a permanent injunction to settle the ongoing dispute between them. On the following day, according to the terms agreed by the parties, the Judge issued a permanent injunction under which PFS TECO exits the certification market for PS 1 rated plywood in Southern Brazil. The case was settled before the jury trial took place and/or the Court has made any determination on the case's merits. Therefore, the federal district court has not made any determination concerning the accuracy of the plaintiffs' allegations concerning the "strength" of the Brazilian plywood bearing the PFS TECO stamps or what "wholesalers and retailers" must or should do regarding existing stocks of the labeled product.

Indeed, the injunction does not prohibit, limit, or restrain the sale and/or use of the products labeled with PFS TECO mark on or before May 31, 2022. The Injunction entered by the Court addresses only the future actions of PFS TECO. The Injunction was made without any findings of fact about the products that have been labeled. The injunction specifically does not order the removal or obliteration of any label applied to the product on or before May 31, 2022. The relevant injunction language states:

> "IT IS ORDERED AND ADJUDGED that, within seven (7) days of the entry of this Judgment, PFS TECO is ordered to revoke all of the PS 1 certificates and grade stamps that PFS TECO has issued to plywood mills located in southern Brazil by emailing a notice of PS 1 certificate revocation to each Brazilian licensee and to remove all revoked PS 1 certificates from the PFS TECO website."

608.839.1013 · 1507 Matt Pass · Cottage Grove, WI 53527
WWW.PFSTECO.COM

PFS TECO TESTED
MARKS YOU CAN BUILD ON

PFS-TECO New Release

May 31, 2022

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Conclusions and recommendations

Concerns with imported lumber and plywood and OSB sheathing

- Be cautious of newly-installed lumber and plywood and OSB
- You may want to check grade stamps
- Limit your acceptance of the roof deck
- Prepare yourself for more roof deck replacement

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Synthetic underlayment

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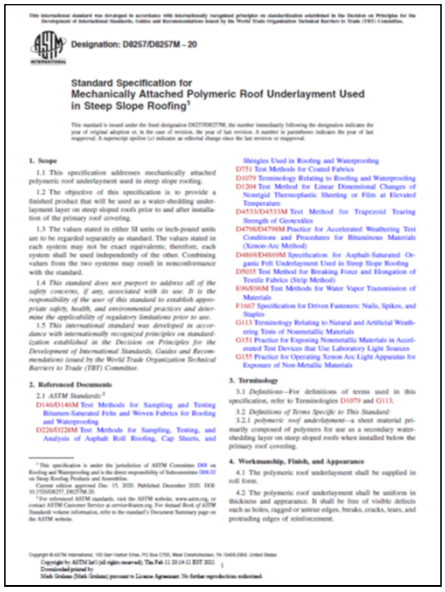

Designation: D8257/D8257M - 20

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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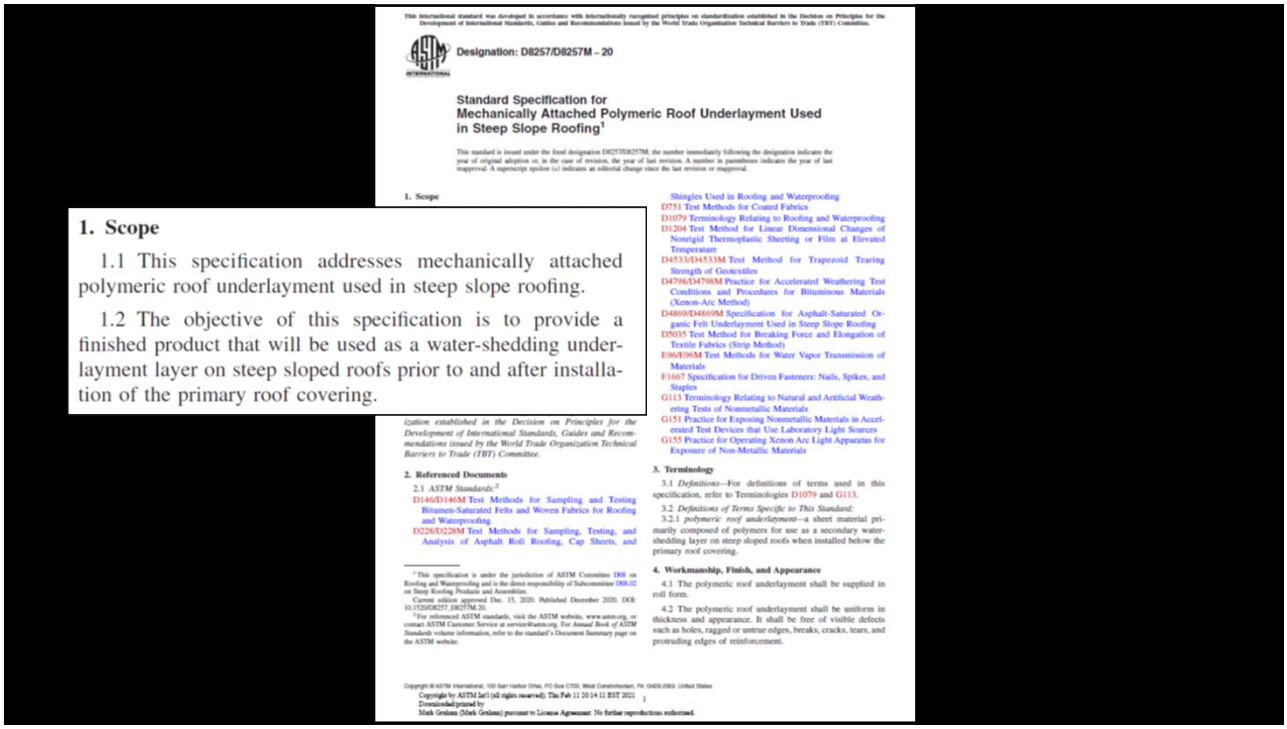

Designation: D8257/D8257M – 20

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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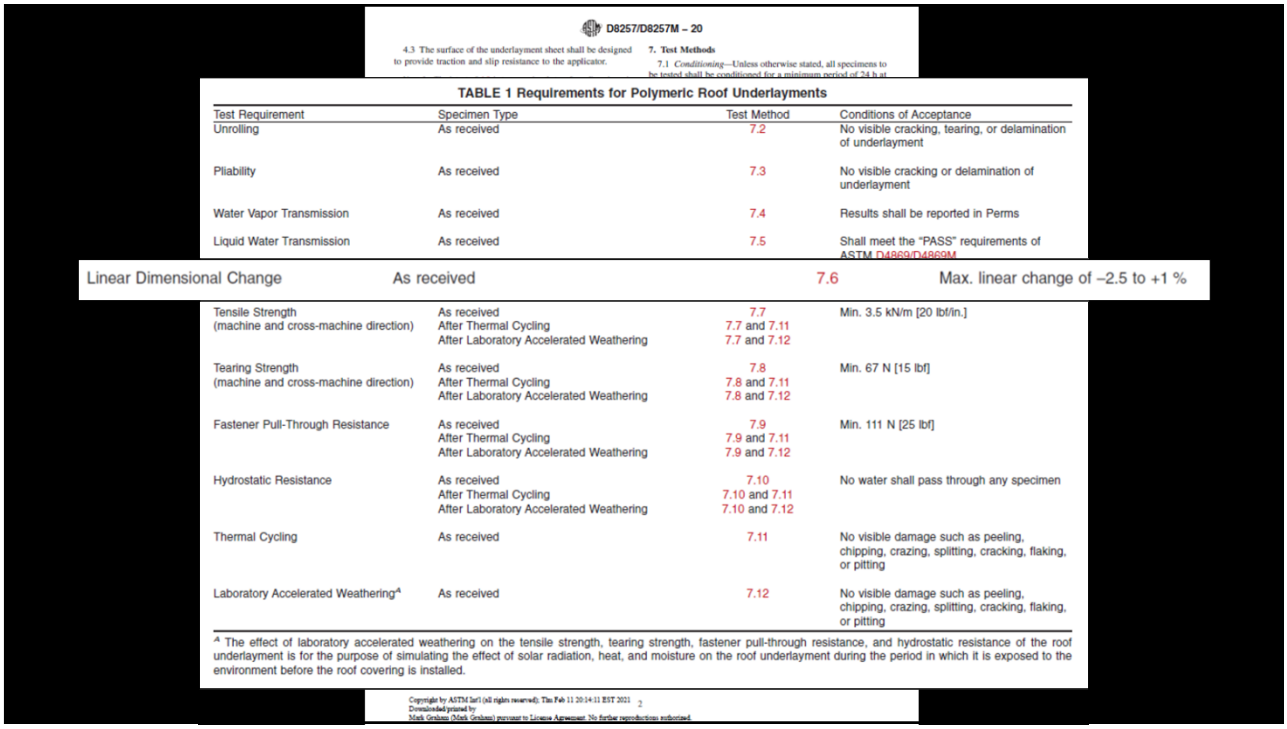

D8257/D8257M – 20

4.3 The surface of the underlayment sheet shall be designed to provide traction and slip resistance to the applicator.

7. Test Methods

7.1 *Conditioning*—Unless otherwise stated, all specimens to be tested shall be conditioned for a minimum period of 24 h at

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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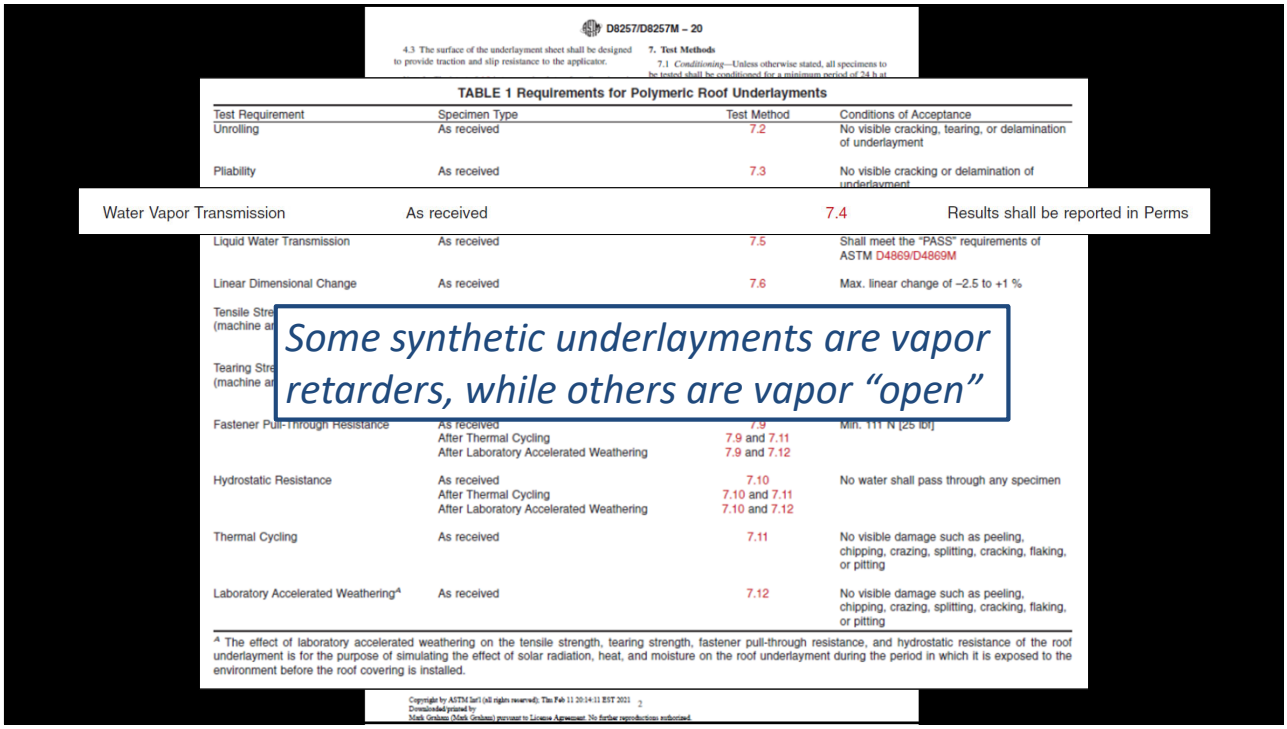

D8257/D8257M – 20

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Tensile Stre (machine ar			
Tearing Stre (machine ar			
Fastener Pull-Through Resistance	As received	7.9	Min. 111 N [25 lbf]
	After Thermal Cycling	7.9 and 7.11	
	After Laboratory Accelerated Weathering	7.9 and 7.12	
Hydrostatic Resistance	As received	7.10	No water shall pass through any specimen
	After Thermal Cycling	7.10 and 7.11	
	After Laboratory Accelerated Weathering	7.10 and 7.12	
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.

Some synthetic underlayments are vapor retarders, while others are vapor "open"

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

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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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NRCA permeance testing of asphalt shingle roof assemblies

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Measurement of a vapor retarder's effectiveness

Classification	Permeance[1]
Class I vapor retarder	0.1 perm or less
Class II vapor retarder	1.0 perm or less and greater than 0.1 perm
Class III vapor retarder	10 perm or less and greater than 1.0 perm

[1] Permeance determined according to ASTM E-96 Test Method A (the desiccant method or dry cup method)

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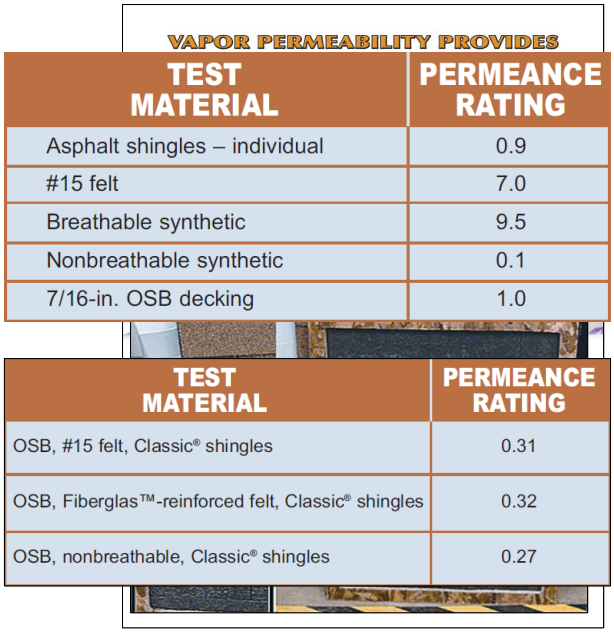

IIBEC (formerly RCI) *Interface*
December 2011

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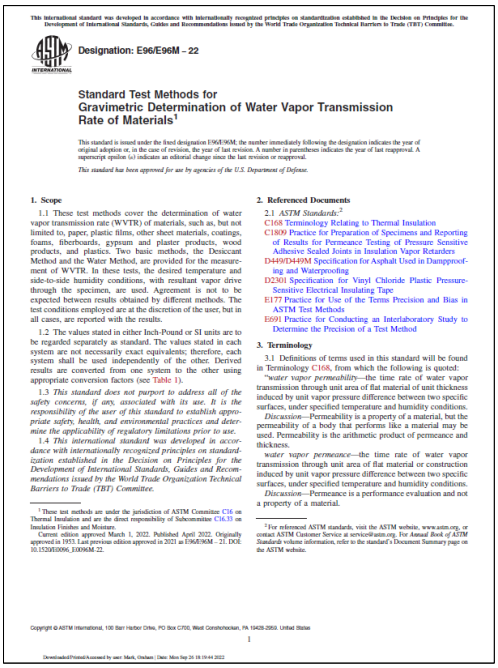

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: E96/E96M – 22

Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials[1]

This standard is issued under the fixed designation E96/E96M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 These test methods cover the determination of water vapor transmission rate (WVTR) of materials, such as, but not limited to, paper, plastic films, other sheet materials, coatings, foams, fiberboards, gypsum and plaster products, wood products, and plastics. Two basic methods, the Desiccant Method and the Water Method, are provided for the measurement of WVTR. In these tests, the desired temperature and side-to-side humidity conditions, with resultant vapor drive through the specimen, are used. Agreement is not to be expected between results obtained by different methods. The test conditions employed are at the discretion of the user, but in all cases, are reported with the results.

1.2 The values stated in either Inch-Pound or SI units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, each system shall be used independently of the other. Derived results are converted from one system to the other using appropriate conversion factors (see Table 1).

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

[1] These test methods are under the jurisdiction of ASTM Committee C16 on Thermal Insulation and are the direct responsibility of Subcommittee C16.33 on Insulation Finishes and Moisture.

Current edition approved March 1, 2022. Published April 2022. Originally approved in 1953. Last previous edition approved in 2021 as E96/E96M – 21. DOI: 10.1520/E0096_E0096M-22.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C168 Terminology Relating to Thermal Insulation

C1809 Practice for Preparation of Specimens and Reporting of Results for Permeance Testing of Pressure Sensitive Adhesive Sealed Joints in Insulation Vapor Retarders

D449/D449M Specification for Asphalt Used in Dampproofing and Waterproofing

D2301 Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 Definitions of terms used in this standard will be found in Terminology C168, from which the following is quoted:

"*water vapor permeability*—the time rate of water vapor transmission through unit area of flat material of unit thickness induced by unit vapor pressure difference between two specific surfaces, under specified temperature and humidity conditions.

Discussion—Permeability is a property of a material, but the permeability of a body that performs like a material may be used. Permeability is the arithmetic product of permeance and thickness.

water vapor permeance—the time rate of water vapor transmission through unit area of flat material or construction induced by unit vapor pressure difference between two specific surfaces, under specified temperature and humidity conditions.

Discussion—Permeance is a performance evaluation and not a property of a material.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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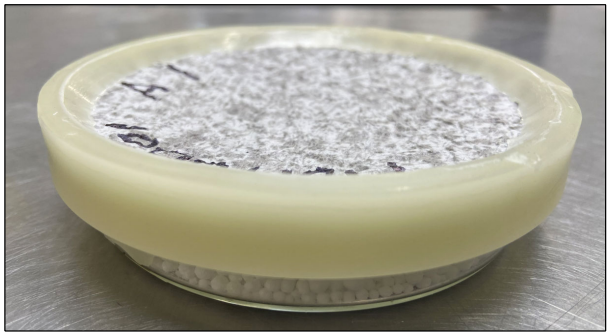
ASTM E96, "Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials"



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ASTM E96 Procedure A results

NRCA permeance testing of asphalt shingle roof assemblies

Sample	Water vapor permeance (Perms)
7/16" OSB sheathing	1.4
15/32" CDX plywood sheathing	0.9

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ASTM E96 Procedure A results -- continued

NRCA permeance testing of asphalt shingle roof assemblies

Sample	Water vapor permeance (Perms)
Non-breathable synthetic underlayment	0.02
Breathable synthetic underlayment	0.5

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ASTM E96 Procedure A results -- continued

NRCA permeance testing of asphalt shingle roof assemblies

Sample	Water vapor permeance (Perms)
Non-breathable synthetic underlayment over 7/16” OSB sheathing	0.03
Non-breathable synthetic underlayment over 15/32” CDX plywood sheathing	0.05
Breathable synthetic underlayment over 7/16” OSB sheathing	0.50
Breathable synthetic underlayment over 15/32” CDX plywood sheathing	0.22

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ASTM E96 Procedure A results -- continued

NRCA permeance testing of asphalt shingle roof assemblies

Sample	Water vapor permeance (Perms)
Laminated asphalt shingle over non-breathable synthetic underlayment over 7/16” OSB sheathing	0.05
Laminated asphalt shingle over non-breathable synthetic underlayment over 15/32” CDX plywood sheathing	0.04
Laminated asphalt shingle over breathable synthetic underlayment over 7/16” OSB sheathing	0.40
Laminated asphalt shingle over breathable synthetic underlayment over 15/32” CDX plywood sheathing	0.09

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ASTM E96 Procedure A results -- continued

NRCA permeance testing of asphalt shingle roof assemblies

Sample	Water vapor permeance (Perms)
Laminated asphalt shingle over non-breathable synthetic underlayment over 7/16” OSB sheathing	0.05 0.10 with nail
Laminated asphalt shingle over non-breathable synthetic underlayment over 15/32” CDX plywood sheathing	0.04 0.10 with nail
Laminated asphalt shingle over breathable synthetic underlayment over 7/16” OSB sheathing	0.40 0.50 with nail
Laminated asphalt shingle over breathable synthetic underlayment over 15/32” CDX plywood sheathing	0.09 0.18 with nail

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“Preliminary” conclusions

NRCA permeance testing of asphalt shingle roof assemblies

- There is a potential for condensation development at the roof deck level when using synthetic underlayment
- Functional below-deck ventilation is (even more) important for mitigating condensation development at the roof deck level when using synthetic underlayment

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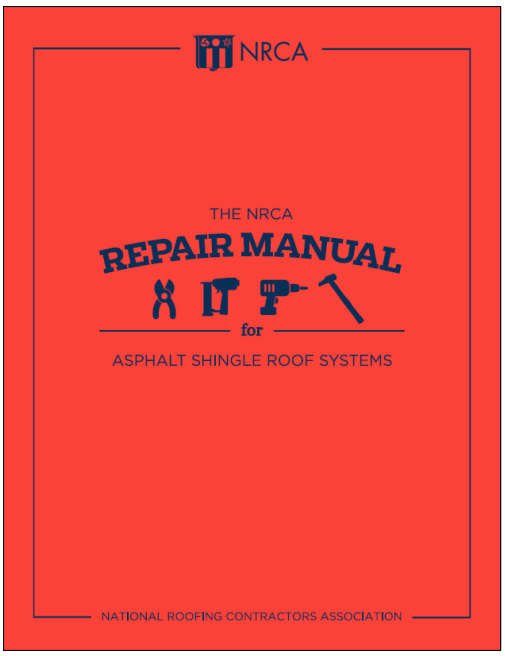

The NRCA Repair Manual for Asphalt Shingle Roof Systems

- 227 pages
- 31 step-by-step repair techniques
- Problem call info. sheet
- Service call report
- Service truck tools and materials checklist

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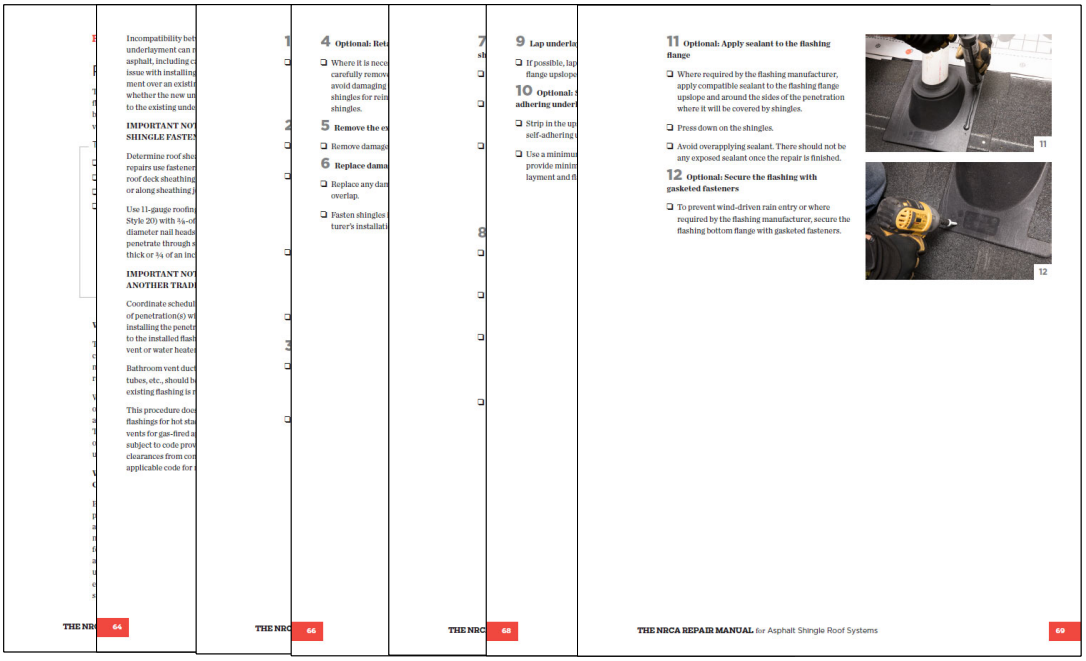

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The NRCA Repair Manual for Asphalt Shingle Roof Systems

- NRCA members: Free download
- Non-members: Can purchase from the NRCA Bookstore

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Questions… and other topics

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