



Monthly teleconference

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Technical Discussion

presented by



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FM Approvals' revision of FM 4470

- FM 4470 provides the basis for FM's classification of roof assemblies (e.g., 1-60, 1-90)
- Previous edition dated 1992 (April 1986)
- New edition published in June 2012 with an effective date of January 1, 2013

Code requirements

IBC 2006 and previous editions

1504.3.1 Other roof systems. Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single ply, through fastened metal panels and other types of membrane roof coverings shall also be tested in accordance with FM 4450, FM 4470, UL 580 or UL 1897

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Code requirements

IBC 2009 and IBC 2012

1504.3.1 Other roof systems. Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single ply, through fastened metal panels and other types of membrane roof coverings shall also be tested in accordance with FM 4474, UL 580 or UL 1897

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Revisions to FM 4470

June 2012

- Adds NFPA 276
- Changes conditions of acceptance for wind uplift and hail damage resistance testing
- Adds alternative test methods for fastener corrosion resistance
- Changes to methods on how steel roof decks are evaluated
- Adds optional tests for dynamic puncture resistance, noncombustible core insulation and solar reflectance

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Revisions to FM 4470

Evaluation of steel roof decks

- Allowable stresses per AISI S100
- Deflection based upon 200 lb. point load
- Deck design based upon 0.7-mm-thick (< 22 ga.)
- Fasteners tested for “pull over” of the deck material
- Stress calcs. on decks and fastener heads; lower value controls

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Effective date

FM 4470, Section 1.6

- Effective date is December 31, 2012
- “...Products FM Approved under a previous edition shall comply with the new version by the effective date or else forfeit Approval...”

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So, what does all this mean?

- FM has re-evaluated pre-12/31/12 classifications:
 - Reduce deck span, increase deck thickness and/or grade (33 ksi to 80 ksi) to maintain wind rating and existing RoofNav number
 - Re-evaluate assemblies, lower wind rating and create a new RoofNav number
- FM classifications likely have changed

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Deck span limitations

22 ga. wide rib deck, spanning 6 ft. with fully-adhered roof membranes:

- 33 ksi deck limited to Class 1-165
- 80 ksi deck limited to Class 1-300

Mechanically-attached roof membranes have varying ratings based upon row spacing

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An example

Sika Sarnafil Roofing Technical Bulletin #08-12, dated December 19, 2012

System description:

S327 membrane, 9'6" row spacing, attached with XP/XPN fasteners at 6" o.c. to 22 ga. steel roof deck

Pre-12/31/12 wind rating:

120 psf

New wind ratings:

- 90 psf using 80 ksi steel deck
- 90 psf using 22 ga., 33 ksi steel deck and 6' membrane row spacing

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Suggestions

- Be careful!
- Work closely with manufacturers
- For current projects, notify and seek clarification from A/E/C, GC/CMs and/or building owners.



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TECH TODAY

Changes reduce some FM classifications

FM 4470 has been revised, resulting in different uplift resistance criteria

by Mark S. Graham

FM Approvals has revised its criteria for determining the uplift resistance of membrane and liquid applied roof assemblies. Because most roofing professionals rely on FM Approval classifications when designing and specifying low-slope roof assemblies, you should be aware of the changes made and their effect on specific roof assembly classifications.

FM 4470
 FM 4470, "Approval Standard for Single-Ply Polymer Modified Membrane Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Systems for use in Class 1 and Nonconformable Roof Deck Construction," is the basis for FM Approval classifications of 1-1/2, 1-1/4, 1-1/8, etc. classifications used for low-slope membrane and liquid applied roof assemblies.

In June 2012, FM Approvals revised FM 4470; the effective date of the new standard was Dec. 31, 2012. The revision includes adding NF19, EN, "Standard Method for the Test for Determining the Tensile Behavior of Roofing Membranes with Composite One-Plane Deck Roofing Components," as a dynamic variability before the roof deck, changes to the conditions of acceptance for wind uplift and ball damage resistance testing and adding an alternative method for determining barrier membrane resistance.

One of the more significant changes to FM 4470 is how roof deck are evaluated. With the revised standard, roof deck classes cannot exceed the allowable stress provided for in ASCE 1005, "Basic American Specifications for the Design of Cold Formed Steel Structural Members." The maximum allowable deflection for roof deck decks is based on a 100-pound point load, previously a 500-pound point load was used. Also, maximum design of roof deck decks now are based on a maximum 0.7 mm-thick (lighter than 22 gage), 15-ksi yield strength steel. Previously, maximum 0.75 mm-thick (22 gage) steel complying with the ASTM International specification was used for evaluation.

The method of analyzing attachment of roof decks also has been revised. Deck fasteners are no longer treated as "pull-out" load strength of the deck material. Also, manufacturing are performed on both roof decks and barrier decks, and the base of the two values is used as the basis for classification.

FM 4470 also now include additional provisions allowing for optional testing for dynamic pressure resistance of roof components, nonconformable use for roof insulation and solar reflectance of roof surfaces.

All products tested after Dec. 31, 2012, are required to satisfy the new standard's requirements. Products FM Approval already approved under previous editions of FM 4470 also need to comply with the current edition by the effective date or further classification.

What this means
 If a specific classified assembly results in an unapproved roof deck, FM Approval has, upon consultation with the manufacturer, either changed the assembly's pressure to compensate for the deck, untested or allowed the assembly to wind rating (W) level when the deck is no longer unapproved. Assembly parameters likely changed include reducing the deck type and/or increasing the deck roof thickness and/or yield strength (from 15 to 18 ksi).

For assemblies where the wind rating has been reduced, the assembly's previous classification number has been withdrawn and new classification number needs to be established.

If you use the new version of FM 4470 for an approved roof assembly applied to a 15-ksi roof deck, 22 gage steel deck or a 4-ft diameter storm. FM Approvals has indicated maximum classifications are limited to 1-1/2 when using a 15-ksi steel deck and 1-1/4 when using an 18-ksi steel deck. The maximum mechanically attached single-ply membrane assemblies will vary based on assembly parameters and use factors now spacing, but generally classification will be naturally lower than with FM 4470's previous version.

Increased complexity
 Roof system designers and installers need to be aware of FM 4470's revision and its effect on assembly parameters, right energy and fasteners.

The roofing projects designed before the implementation date but that will be installed after the implementation date classification needs to be sought regarding which version of FM 4470 applies. If the current version applies, change to the roof assembly specification can be necessary and affect a project's cost.

I encourage roof system designers and specification writing contractors to work closely with manufacturers when determining changes to specific assembly parameters, right ratings and fastener numbers. ■

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

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New requirements for air barriers

International Energy Conservation Code, 2012 Edition
(Climate Zones 4-8)

- ASHRAE 90.1-10 alternative (All Climate Zones)

International Green Construction Code, 2012 Edition
(All Climate Zones)

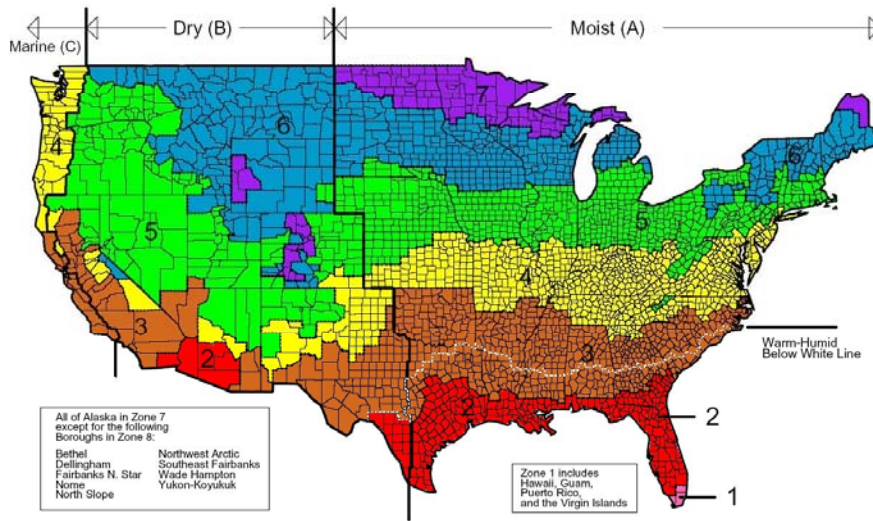
- ASHRAE 189.1-09 alternative (All Climate Zones)

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Climate zones

IECC 2012, Section C301—Climate Zones



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IECC 2012

Sec. C402.2-Air leakage (Mandatory)

- **Materials:**
 - 0.004 cfm/ft³ (0.02 L/s·m²) at 0.3 inches water gauge (75 Pa) using ASTM E2178
 - Deemed to comply options
- **Assemblies:**
 - 0.04 cfm/ft³ (0.2 L/s·m²) at 0.3 inches water gauge (75 Pa) using ASTM E2357, ASTM E1677 or ASTM E283
- **Whole buildings:**
 - 0.40 cfm/ft³ (2.0 L/s·m²) at 0.3 inches water gauge (75 Pa) using ASTM E779

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IECC 2012

Sec. C402.4.1.2.1-Materials

Deemed to comply options (roofing specific):

- SPF (closed cell), min. 1.5 pcf, min. 1½-inches thick
- Built up roof membrane
- Modified bituminous roof membrane
- Fully adhered single-ply roof membrane

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Roof systems requiring testing

- Mechanically-attached single-ply membranes
- Ballasted single-ply membranes
- Metal panels
- Steep-slope:
 - Asphalt shingles
 - Tile
 - Slate
 - Wood

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Survey of roof system manufacturers

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Preliminary conclusions

- New air barrier requirements applicable to “commercial” buildings
- Compliance may be a challenge
- Compliance may dictate roof system choices and detailing
- How will compliance be documented?
- Additional research and information is needed

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Interim recommendations

- Verify if IECC 2012 (or other requirements) is applicable
- The deemed to comply options provide some guidance for roof system selection.
- Details (transitions, joints, penetrations) are critical to performance
- Request for information
- Work closely with manufacturers
- Work closely with building officials

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TECH TODAY

Air barriers and the new energy code

IECC 2012's air barrier requirements could limit design options
by Mark S. Graham

The International Energy Conservation Code (IECC) 2012 follows IECC 2009 in including a new requirement mandating to look for leakage through building thermal envelopes, including roof assemblies. The requirement, a change from IECC 2009, will significantly affect air design and installation of various roof assemblies.

IECC 2012 Section C602.4 - Air Leakage (Manufactured) requires all commercial (non-residential) buildings, except those in climate zones 1 through 3, to include a continuous air barrier. Climate zones 1 through 3 include Alabama, Florida, Hawaii, Louisiana, Mississippi and South Carolina and portions of Arizona, Arkansas, California, Georgia, Nevada, New Mexico, North Carolina, Oklahoma, Tennessee, Texas and Utah.

The required air barrier is prohibited when located on the inside or outside of the building envelope, based on the manufacturer's instructions, the building envelope and any combination thereof. The air barrier is required to be across all joints and assemblies comprising the building envelope. Air barrier joints and seams need to be sealed including using caulk, tapes and other sealants. Special provisions are provided for sealing around lighting fixtures, air barrier penetrations, doors and access openings, and exhaust or intake air releases.

IECC 2012 provides for three compliance options for air barrier materials and assemblies: materials, assemblies or whole building testing.

Using IECC 2012's materials option, a manufacturer with an air permeability no greater than 0.004 cfm/ft² under a pressure differential of 0.3 inches water gauge tested according to ASTM E2107, "Standard Test Method for Air Permeance of Building Materials," complies. Also, a number of specific materials - including membranes to each thick plywood or oriented strand board minimum (to which extended polyurethane or full-board polyurethane membrane or gypsum or cement board can be placed and jointed) - and built-up, preformed metal decks and fully-adhered single-ply membranes - are allowed to comply provided their joints are sealed and materials are installed as instructed according to manufacturer's instructions.

The assemblies option allows assemblies of materials to comply with an average air leakage rate to exceed 0.014 cfm/ft² under a pressure differential of 0.3 inches of water gauge when tested according to ASTM E2107.

"Standard Test Method for Determining the Air Leakage of Air Barrier Assemblies," ASTM E2107, "Standard Specification for Air Barrier Material or System for Low-Rise Framed Buildings," is ASTM 28. "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimens."

The whole building testing option requires a single building to exceed the resulting air leakage rate not exceed 0.014 cfm/ft² under a pressure differential of 0.3 inches of water gauge when tested according to ASTM E2107. "Standard Test Method for Determining Air Leakage Rate by Fan Pressurization."

Considerations
Although some roof types exist, including built-up, preformed metal decks and

adhered single-ply membranes are allowed and allowed to comply with the new air barrier requirements, other roof types may require additional testing or additional compliance. These include mechanically attached and ballasted single-ply membranes, metal panels and slanted-type roof coverings.

The area of these roof systems types, it may be more practical to provide the necessary air barrier as an interior air barrier or at below the roof deck level by using a coat or glass or plastic membrane and fully adhere below the roof deck or a gypsum board ceiling. IECC 2012 includes specific details and thickness requirements for sheet and spray-on types. There is no requirement regarding overall and system manufacturers regarding how their specific roof system configurations function as air barrier according to IECC 2012's requirements. Also, roof system manufacturers should be consulted for specific penetration and protection sealing instructions to comply with IECC 2012's requirements. ■■

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

Did you know?
IECC 2012 is available in Spanish. For more information, visit www.nrcanet.org.

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Questions





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