FM Global
Approvals Update

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Today’s Discussion Points

- FM Approvals overview
- FM 4470 – Roof Covers
- FM 4435 – Perimeter Flashing
- FM 4476 – Flexible PV modules
- FM 4478 – Rigid Roof Mounted PV
- FM 4477 - Vegetative roof systems
- Q&A (through-out)
FM Approvals

- member of the FM Global Group
- product-testing and certification organization
- Headquartered in Norwood, Mass., USA
- Offices throughout Asia, Europe and North America

FM Approvals

- FM Approvals offers manufacturers a single source for global certification and direct access to critical markets

- Approval Guide, the authoritative source for more than 48,000 FM Approved products and services

- RoofNav™, a free Web-based roofing reference and configuration tool
Roof Approval Ratings & Installation Recommendations

- *RoofNav lists ratings for each system*
  - Fire, wind, hail, etc.
- *RoofNav describes where is system is recommended*
  - Which ratings are needed for a particular installation
- *Data Sheets also give:*
  - Design and Installation recommendations
- *Only 3rd party certification organization to supply both capacity (ratings) and load information.*
  - This data is designed to be used together

Roof System Approval Testing 4451 & 4470
No changes to:

- *Exterior combustibility*
- *Water leakage resistance*
- *Foot traffic resistance*
- *Noncombustible insulation core rating (optional)*
Roof System Approval Testing 4451 & 4470

Changes

- Interior combustibility (now references NFPA 276)
- Wind/Hail resistance – changes to failure criteria
- Corrosion resistance – 2nd test method offered
- (New) Optional solar reflectance test

Steel deck stress parameters
(Not a change from previous Standard)

- 3 span deck condition
- First row of cover fasteners @ midspan of the first span.
- All adhered covers and mech. attached covers with row spacing ≤ 1/2 the deck span are assumed fully distributed
- Stresses are determined using Allowable Strength Design (ASD). Cannot exceed AISI S100-2007 allowables
Steel deck stress parameters

- Similarly, deck fasteners are tested for pull through / pull over.
- Stress calcs of the deck/fasteners head are conducted and the lower value used as the basis of Approval.
- The steel deck deflection evaluation uses a 200 lbs load vs. 300 lb load previously used
- Min. design of 0.7 mm steel deck (slightly <22 ga). Previous min. was 0.75 mm (22 ga)
- Deck material specified as min 33 ksi rather than an ASTM spec.

What does all this mean to me?

- 22 ga, wide rib deck, spanning 6 ft with fully adhered covers
  - 33 ksi limited to Class 1-165 maximum
  - 80 ksi limited to Class 1-300 maximum

- Mech. attached covers have varying ratings based on row spacing.
How will current Approvals be updated?

- **PROPOSED** – “generic” decks in RN will be updated to include max wind ratings for various membrane spacings
  - All Approvals updated simultaneously
  - Allows manufacturers to then evaluate their own proprietary systems individually

Revised pass/fail criteria

- Previously, standard allowed no cracking of the insulation boards, nor delamination of adhered covers
- Change now allow some cracking at service load (ie ½ the rated load.
- Allowable minor areas of delam are better defined
Minor Delamination of Fully adhered cover


- *Divided into dependent and independent secured roof systems*
  - Dependent
    - roof cover relies on flashing for termination
  - Independent
    - roof cover is independently terminated within 1 ft of the flashing
  - For independent systems, it is assumed that no load from the cover is imparted to the flashing
ANSI/SPRI/FM 4435/ES1

- **FM 4435 will be revised to include testing per ANSI standard**
- **Difference from previous FM and SPRI standards include:**
  - Revise angle for membrane (25° vs. 45°)
  - Revised load on membrane now based on wind load, and membrane row width vs. fixed value in previous ANSI Standard
  - Revised loads on flashing
  - One industry wide accepted standard
  - Full scale sample and test

For Dependent Roof Covers
For Dependent and Independent Roof Covers

Copings (Wall Cap Flashings)
Test Equipment – 8 ft (2.4 m) sample

FM 4476 Flexible Photovoltaic Modules

- Adhered to or mechanically fastened through an FM Approved roof cover assembly

- Wind Uplift Resistance
  - 12 x 24 ft Simulated Wind Uplift Pressure Test
  - 2 x 2 ft Simulated Wind Uplift Pull Test
  - Minimum Class 1-60

- For PV applied to SSR’s wind evaluation after “flexing of the SSR under wind load”
FM 4476 Flexible Photovoltaic Modules

- **Hail Damage Resistance**
  - Test Method – Per 4470
  - MH and SH ratings available

- **Combustibility from Above the Roof Deck**
  - ASTM E108 Fire Test of Roof Coverings
    - Spread of Flame: Class A, B, C

- **Electrical Safety**
  - Must meet IEC/EN 61730-2 or ANSI/UL 1703.

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FM 4476 Flexible Photovoltaic Modules

- **Heat aging of covers**
  - Non asphaltic covers - FM Approvals Test Procedure, Tests for Measuring Heat Aging Affects of Flexible Photovoltaic Modules on Roof Coverings
  - Asphaltic covers must meet the compound stability test per ASTM D5147 - Standard Test Methods for Sampling and Testing of Modified Bituminous Sheet Material
  - No heat aging testing is required metal panel roof covers
E108 test of flexible PV

FM 4476 Flexible Photovoltaic Modules

- Currently there are two systems Approved:
  - Derbisolar by Derbigum Americas, Inc.
  - Photovoltaic Module Systems by Soprema Inc (USA)
Rigid Photovoltaic Modules

FM 4478 – Roof Mounted Rigid Photovoltaic Modules

- **External fire performance per ASTM E108**
- **Wind resistance**
- **Hail per FM 4473 (Ice Ball)**
- **Electrical evaluation per IEC 61730 or ANSI 1703 and IEC 61215**

- **Optional Earthquake rating**
FM 4478 - Wind

- **Two tests are used for secured panels**
- **Wind resistance: slope of panel = slope of roof**
  - Air bag placed between panel and roof cover (usually standing seam) conducted similar to FM 4471
  - Pressures used are 60, 75, 90... psf (2.9, 3.6, 4.3 kPa) for ratings of Class 1-60, 75, 90...
  - Structural tests of the clamps used to secure the PV panel
- **Wind resistance: slope of panel > slope of Roof**
  - Ratings are 80% of test not 100% as actual load on panels is greater when panel slope is greater than the roof slope

FM 4478

- **Wind resistance: non secured panels**
  - Standard contain prescriptive requirements for non secured panels
  - Research by FM Approvals and FM Global Research in 2013 is planned to develop performance based requirements
FM 4477 - Vegetative Roofs

- Cover assembly must meet FM 4470 except for UV, hail and external fire

- Interior combustibility (FM calorimeter, NFPA 276)

- Exterior combustibility (ASTM E108)

- Wind resistance
  - of cover per FM 4470
  - of vegetative portion per FM Global Data Sheet DS 1-35

FM 4477 - Vegetative Roofs

- While vegetative portion of the roof system must meet ASTM E108, FM Approvals has developed data for certain species

- Class A @ 2 in 12

- Manufacturers can use this data to meet this performance criteria
FM 4477 - Vegetative Roofs

- Currently 3 systems Approved from 2 manufacturers
- AVRS Tray by Columbia Green
- LiveRoof Deep Tray and LiveRoof Standard Tray by LiveRoof, LLC