

ARMA Update on FM Approvals and FM Global Data Sheets

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Discussion Topics

- *New/Revised Approval Standards*
 - 4470
 - PV Standard
 - Vegetative Roof Standard
- *DS 1-52 Revisions*

Approval Standard 4470 Revision

- ***Evolutionary, not revolutionary***
 - ARMA included in comment phase
- ***Same required ratings***
 - With limitations on deck stress
- ***Some new optional ratings***
 - Noncombustible core insulation
 - Dynamic puncture resistance

New title

- Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Systems for use in Class 1 and noncombustible Roof Deck Construction
- Incorporates Standard 4450 requirements
- Plan is to eliminate 4450

Retest of Failed Assemblies

- Following a test failure, a re-test of an identical or similar assembly shall be at the discretion of FM Approvals and with a technical justification of the conditions or reasons for the failure. When a test specimen fails to meet the Approval acceptance criteria for a given classification/rating, **two** successful test specimens of the same or similar construction must meet the Approval acceptance criteria to qualify for the given classification/rating.

Steel Deck Stress

- Following testing, stresses induced to steel roof decking shall be determined by rational analysis and shall not exceed the allowable stresses per the latest edition of the American Iron and Steel Institute Cold-Formed Steel Design Manual.
- These calculations will be conducted on assemblies which introduce highest stress and ratings reduced if needed

Noncombustible core (optional rating)

- Per ASTM D482 - minimum content of 90% ash.
- Per ASTM E2058 - visible flaming of the insulation core shall not occur during the entire test.
- Per ISO 1716:2002 - the insulation core shall have a maximum heat of combustion of 2.0 kJ/g (860 BTU/lb)
- Same as 4880 requirements

Dynamic Puncture Resistance (optional rating)

- The Energy Rating for the Dynamic Puncture Resistance Rating shall be the maximum energy attained for which three successive test specimens do not puncture when tested in accordance with ASTM D5635, *Standard Test Method for Dynamic Puncture Resistance of Roofing Membrane Specimens*.
- DS 1-29 will be revised to include recommendations on use.
- Currently only a prescriptive rec. is included in DS 1-29

Corrosion resistance

- *Second method now available*
- *Can now be met via CPD test in addition to DIN test*

Questions on 4470?

Flexible Photovoltaic Modules



Rigid Photovoltaic Modules



Approval Standard 4476 (Draft, 2009)

- *Flexible Photovoltaic Modules*
- *A Standard for rigid is also planned*
- *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

Approval Standard 4476 (Draft February 2009)

- ***Hail Damage Resistance***
 - Test Method
 - Measure electrical output pre-test
 - Subject specimen to hail test
 - Measure electrical output post-test
 - Minimum Class 1-MH
- ***Combustibility from Above the Roof Deck***
 - ASTM E108 Fire Test of Roof Coverings
 - Spread of Flame: Class A, B, C

Questions on PV?

Garden/Vegetative Roofs

- ***Vegetative or Garden Roofs***
 - Extensive – Up to 6 in. of growing media
 - Semi-intensive – 6-8 in. of growing media
 - Intensive – over 8 in.

Garden/Vegetative Roofs

- *Several layers make up system*
- *Layers of insulation, waterproofing, protection, drainage, filters, water retention, growing media and vegetation*
- *Some designs use mats or trays in systems which may interlock*
- *Use of gravel or paving stones at walkways and border zones*

Design Issues

- *Increased dead load requirements*
- *Unknown fire risk of dried and dead vegetation*
- *Unknown internal fire risk*
- *Wind uplift resistance of vegetation*
- *Growing media becoming wind-borne debris*

Current Standards

- ***FLL (Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau) – German guideline widely recognized as the premier design standard***
 - Little attention is paid to loss or risk prevention
- ***SPRI – Fire Design Standard for Vegetative Roofs***
 - Fairly limited in scope, still in review stages
 - Fire design recommendations limited to the use of fire protection and border zones
 - Incorporates many DS 1-35 recommendations
- ***FM Global Data Sheet 1-35***

FM Global 1-35 Design Recommendations

- *Roof assembly under vegetative system is FM Approved*
- *Use of engineered growth media as opposed to soil*
- *Minimum of 60% coverage with succulent plants such as Sedums*
- *Use of walkways and border zones as fire breaks*
- *Exposed membrane needs to be resistant to hail damage*
- *Class 1 internal fire rating of roof system*

FM Global 1-35 Key Points

- *Assembly under veg. roof must be FM Approved and installed per DS 1-28 and 1-29*
- *Exposed membrane needs to be hail resistant*
- *Parapets:*
 - Minimum 6 in. above vegetation
 - Minimum 30 in. for building heights greater than 150 ft.
- *Conservative recommendations for gravity and load calculations*
 - Dead loads include roof assembly at fully saturated conditions and including additional environmental loads such as snow or ice
 - Design dead load of growth media at a minimum 100 lb/ft³
 - In addition, increase specified depth of growth media by 15% to account for future growth of system
- *Seismic Loads*
 - Design around fully saturated conditions

FM Global 1-35 Limitations

- *Restricted from geographical locations where basic wind speed (3 second gust) does not exceed 100 mph, as determined by FM Global Data Sheet 1-28*
- *Due to the variables in vegetative systems, no classification of exterior fire exposure is made*
- *Enter: the need for a complete FM Approvals Standard to address vegetative roof assemblies*
 - FM Approvals Standard 4477 – Vegetative Roof Systems

FM Approvals Standard 4477 (Plan)

- *The roof system below the vegetative system shall meet FM Approvals Standard 4470*
- *The roof system shall be installed per FM Global Data Sheets 1-28, 1-29 and 1-35 recommendations*

FM Approvals Standard 4477 (Plan)

- ***In Addition:***
 - Internal fire classifications shall be determined by Calorimeter testing of the entire roof assembly
 - External fire classifications shall be determined by ASTM E-108 testing of the vegetation and growth media
 - Conditions of the vegetation, in terms of coverage and moisture content are to be determined
 - Wind uplift classifications will be determined by the FM Approved roof assembly below the vegetative assembly. The vegetative roof assembly will be installed per FM Global Data Sheet guidelines for ballast (Data Sheet 1-29)
 - Roof Membrane under vegetative system shall meet, foot traffic damage and leakage requirements of FM Approvals Standard 4470

Data Sheet 1-52 Changes

March, 2009

DS 1-52

- *No longer recommended for mechanically attached covers except nailed base sheets to LWIC*

Interpreting Test Results

- *If all test results indicate that all measured deflections are within the maximum recommended in this data sheet, the roof is acceptable from a wind uplift performance perspective.*
- *Areas where measured deflections exceed the maximum recommended are suspect*
 - Test cut down to the deck to determine if failure did occur. If no failure is evident, the roof is acceptable for wind uplift performance. **IE - Deflection alone is not a termination of failure**
- *If failure is verified from a roof cut, the roof area tested does not pass the test...*

DS 1-52

- *Advanced copy will be made available as soon as accepted and final draft complete*

RoofNav

- Use <http://roofnav.com> to register and take training
- Training has been updated to V3.0
- Second “quick steps” guide of search tips planned
- Please report discrepancies/errors to your engineer or the RoofNav Service Deck through the support link