What’s in a name?
The FM Global Solution
• Risk Identification

• Risk quantification

• Share recommendations and agree on solutions

• Assist in implementation
What do we FM APPROVALS do?

Approval Standard

Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies

Understanding the Benefit

FM Approved Insulated Panels (Exterior Building Panels)

The Hazard

Combustible insulations, bonding agents, face coatings, and finish materials contained in exterior building panels (walls, ceilings, and roof assemblies) may exhibit self-propagating behavior in the event of even a small fire. The fast combustion of some exterior building panels may result in the requirement of fire-propagation limiting tools such as an active sprinkler system (products tested to Approval Standard-4920). Additionally, products of combustion, smoke developed, and also combustible insulation (limit installation is several inches in thickness) products tested to Approval Standard-4920.

In addition, exterior wall building panels designed with a face that is exposed to the combustion is subjected to a number of natural hazards such as wind, hail, and hurricane follow debris. Damage to a building’s outer layer compromises its ability to provide the functions it was designed to deliver. Compromised exterior walls can pose the way for serious damage to the building structure and its contents and cause costly underwater effects and business interruption.

Exterior Wall Building Panels that receive FM Approval have been evaluated to provide assurance that they will perform their intended functions and maintain the integrity of the building envelope for the stated design condition. FM Approvals is the only organization that tests these products for fire performance as well as their ability to withstand natural hazards without compromising the building structure.
In June 1897, the Inspection Department of the Associated Factory Mutual Fire Insurance Companies Approved its first Electrical Fittings.
FM Approval’s Strategy

Reduce barriers to property loss prevention for our clients

• Expanding the availability of FM Approved products locally available and serviced, and accepted by local jurisdictions

• Offering clients choices in these products (wide availability)

• Influencing product testing standards in Europe and Asia.

• Enhancing relationships with other certification organizations.

• Offering technical support to local FM Global Operations.
FM Approvals responsibilities in Europe

- Notified Body under the ATEX Directive & Construction Products Directive
- EOTA member for innovative CPD products.
- IECEx Certification Body
- UKAS Accredited Certification Body
- Member of Standards Committees & Industry Groups
- Undertaking FM Approval projects for US, Canadian, European & International Markets
- Conducting Facilities and Procedures Audits.
## Building Insulations - Walls and Ceilings

**Product** | **Primary Class of Work** | **Listing Country** | **Height Restriction** | **Certification Type**
---|---|---|---|---
Xlam Core | 4680-Wall/Ceiling/Roof Ins, Assm. | New Zealand | Maximum 30 ft (9.1 m) | FM Approved

**Buchs AG**
A-5451 Michelhausen, Rusterstrasse 33, Austria

**Product** | **Primary Class of Work** | **Listing Country** | **Height Restriction** | **Certification Type**
---|---|---|---|---
FP façade | 4680-Wall/Ceiling/Roof Ins Assm. | Austria | Maximum 30 ft (9.1 m) | FM Approved
WP | 4680-Wall/Ceiling/Roof Ins Assm. | Austria | Maximum 30 ft (9.1 m) | FM Approved

**Butler Manufacturing a Div of BlueScope Buildings North America Inc**
Research Center, 15800 Botta Rd, Grandview, Missouri 64020-2097, USA

**Product** | **Primary Class of Work** | **Listing Country** | **Height Restriction** | **Certification Type**
---|---|---|---|---
TextureWall, Thermawall Flat, Thermawall Fine Line, Thermawall Plated | 4680-Wall/Ceiling/Roof Ins Assm. | United States of America | No Height Restriction | FM Approved

**Centria**
1606 Beaver Grade Rd, Moon Township, Pennsylvania 15108, USA

**Product** | **Primary Class of Work** | **Listing Country** | **Height Restriction** | **Certification Type**
---|---|---|---|---
Aluminum Formwork Dimension Series/PR Core, Aluminum Formwork D... | 4680-Wall/Ceiling/Roof Ins Assm. | United States of America | No Height Restriction | FM Approved
Aluminum Formwork Dimension Series/PR Core, Aluminum Formwork D... | 4680-Wall/Ceiling/Roof Ins Assm. | United States of America | Maximum 30 ft (9.1 m) | FM Approved
Formwork Dimension Series/PR Core, Formwork Dimension Series-T/PR Core, | 4680-Wall/Ceiling/Roof Ins Assm. | United States of America | No Height Restriction | FM Approved
Approval Standards

Over 150 FM Approvals Standards

All publicly available through the website.

Approval Standard for
Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies

Class Number 4882

June 2010
Building Materials – “Passive”

- Roofing Products
- Insulated and non-insulated walls and ceilings
- Clean Room Materials
- Cooling Towers and Air handling Equipment
- Pipe Insulation and Ducts
- Cables
- Fire Stopping Materials
- Explosion Venting and Construction
- Fire Doors and Frames
- Less Flammable Hydraulic Fluids
2009 FM Global Research Campus

- Natural Hazards Lab
- EQ Lab
- Hydraulics Lab
- Electrical Lab
- Training Lab
- Fire Technology Lab
- Multimedia Center
- Materials Lab
From small to large scale fire tests
FM Approval Standards for Sandwich panels:

Fire & Natural Hazards
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4471</td>
<td>Class 1 Panel Roofs</td>
</tr>
<tr>
<td>4880</td>
<td>Class 1 Insulated Wall and Ceiling Panels - Fire</td>
</tr>
<tr>
<td>4881</td>
<td>Class 1 Exterior Wall systems</td>
</tr>
<tr>
<td>4882</td>
<td>Class 1 Interior Wall and ceiling systems – Smoke Sensitive occupancies</td>
</tr>
</tbody>
</table>
FM Standards - Roofs and Walls
Approval Standard for Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems

Class Number 4880

May 2010
FM 4880 Fire Performance of internal wall, roof and ceiling panels – developed in 1970’s

- Witness production & sample selection
- Flammability characterisation of core (FPA)
- Large scale 25ft or 50ft corner test
- Large scale room test (UBC 26-3 or ISO 9705)
- Small scale identification tests

Result is Class 1 approval:

‘limited combustibility’
FM 4880 25ft Corner Test

• Developed in the 1970’s to evaluate fire spread performance of various assemblies

• Full scale, **not** “modeling” test

• 15.2 x 11.5 x 7.6 m high (50 x 38 x 25 ft)

• 15 minute test and 750lbs (340kg) conditioned oak pallets
FM Approvals 25ft Corner Test
FM Approvals 25ft Corner Test
# 4880: CLASS 1 Test Route

**Combustible Core**

- **9.1m Approval**
  - Flammability test on Core FPA
  - 25ft corner Test Exception 1: dependant on FSPc value
  - Room Test UBC 26-3 or ISO9705
  - Small scale “code” Tests e.g. ASTM E84

**Combustible Core Unlimited Height or 15.2m Approval**

- Satisfy the 30ft tests
- 50ft corner Test Exception 2: Parallel Panel Test
- No Height Restriction
- Ignition of the ceiling shall not occur

**Non-combustible Core Unlimited Height Approval**

- Room Test UBC 26-3 or ISO9705
- ASTM D482 (ash content)
- E2058 (core combustion)
- ISO 1716 (heat of combustion)
Fire Propagation Apparatus: FPA
Used to determine FSPc value

ASTM E2058
ISO 12136

Now
BS ISO 12136:2011

Figure 1 — Photograph of fire propagation apparatus
Technical Innovation

Low smoke yield wall/ceiling panels

- Pharmaceutical warehouses
- Food warehouses
- Clean Rooms

Approval Standard for Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies

Class Number 4882
June 2010
## FM 4882 approval and test options

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Cleanrooms</th>
<th>Pharmaceutical, food prep. &amp; others</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class 1</strong></td>
<td>4880 Approval ht</td>
<td>4880 Approval ht</td>
</tr>
<tr>
<td><strong>Fire Propagation Index FPI</strong></td>
<td>≤ $6 \text{ (m/s}^{1/2})/(\text{K/m})^{2/3}$</td>
<td></td>
</tr>
<tr>
<td>Or 8ft Parallel panel test (60kW) [FM4910]</td>
<td>or Propagation ≤ 6ft</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max heat flux @4ft ≤ 40 kW/m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemical heat release rate decay ≥1/2 @1min. &amp; decay ≤ 25% @2min</td>
<td></td>
</tr>
<tr>
<td><strong>Smoke Development Index SDI</strong></td>
<td>≤ 0.4 [($m/s^{1/2}$)/(K/m)$^{2/3}$] [g/g]</td>
<td></td>
</tr>
<tr>
<td>Or 8ft Parallel panel test (60kW) [FM4910]</td>
<td>or Max. smoke generation ≤ 0.23g/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smoke generation @12min ≤ 0.07g/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total smoke generation ≤ 60g</td>
<td></td>
</tr>
<tr>
<td><strong>Avg Smoke emission rate $G_{\text{smoke}}$</strong></td>
<td>≤ 120mg/s</td>
<td>≤ 240mg/s</td>
</tr>
<tr>
<td>16ft parallel panel test (360 kW)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ASTM E84</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flame spread index FSI</td>
<td>≤ 25</td>
<td>≤ 25</td>
</tr>
<tr>
<td>Smoke Developed Index SDI</td>
<td>≤ 450</td>
<td>≤ 450</td>
</tr>
</tbody>
</table>
4882: 16 ft. (4.9 m) Parallel Panel
4882: 16 ft. (4.9 m) Parallel Panel
FM Approval Standards for Sandwich panels:

Wall Panels
Fire & Natural Hazards
FM 4881 External Walls


- Addresses ‘natural hazards’ other than fire for external walls

- Applicable to all areas of the world, whether a hurricane zone or not

- **Minimum rating** Class 1 Fire and 30psf (1.45kPa) in ward wind resistance.
Damage to wall panels from windstorm.
FM 4881(2005) Class 1 Exterior Walls

- Witness production & sample selection
- **Must satisfy FM 4880 for fire performance first**
- Simulated Hail resistance test
- Static & cyclic pressure tests (~4m x 5m sample)
- Cyclic pressure test for hurricane zones following missile impact
- Factory Audit
Insulation core has **failed** under simulated wind pressure.
• Customer will choose the pressure and pressure coefficient to test. See FM Global Property Loss Prevention Data Sheet 1-28.

• Calculation and wind maps are included in this document

• There are many factors that are used to find the design pressures including: ground roughness, building roof height, building width, etc. Data sheet 1-28 is considered by FM field engineers when determining building materials installation applicability.

• Minimum wall rating is - +30psf. (1.45kPa)

• 4880 Approval (fire) is a requirement of 4881.
• If you were to tell us, for example, to test your panels per FM Approval Standard 4881 at a pressure of 30 psf with a pressure coefficient of 1.4 and were successful, your Approved pressure rating would be:

• 30psf inward
• 42psf outward (30 x 1.4)
Wall panel being tested. Purlin thickness and spacing must be selected by customer.
Wall panel being pressure tested.
Wall panel tested to failure.
Wall panel tested to failure.
FM Approval Standards for Sandwich panels:

Roof Panels

Fire & Natural Hazards
FM Approval 4471 Roof Panels

- Interior Combustibility (4880)
- Exterior Combustibility (ASTM E108)
- Natural Hazards
Exterior fire: ASTM E108
FM Approval 4471 Roof Panels

• Interior Combustibility (4880)
• Exterior Combustibility (ASTM E108)

• Wind

• Hail

• Water Leakage

• Foot Traffic

• The minimum Windstorm Classification Class 1-60
  • = a minimum Uplift pressure 60 psf (2.9 kpa)
The Roof Field Area Design Pressure is calculated in Data sheet 1-28, based on wind speeds and design coefficients building heights etc.

2.2.7 Minimum Wind Rating for FM Approved Roof System

Based on the field of roof area design pressure previously obtained, use Table 8 to determine the minimum FM Approved wind classification rating needed for the entire roof assembly (deck and above-deck system).

Table 8. Recommended Rating of Field, Perimeter, and Corner areas for Enclosed Building² (Zones 1, 2, and 3)

<table>
<thead>
<tr>
<th>Roof Field Area Design Pressure, p, (psf)²</th>
<th>Minimum Wind Rating for FM Approved Deck/Above-Deck/Entire¹ Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Roof Field Area</td>
</tr>
<tr>
<td>15 &lt; p ≤ 20</td>
<td>60</td>
</tr>
<tr>
<td>20 &lt; p ≤ 25</td>
<td>60</td>
</tr>
<tr>
<td>25 &lt; p ≤ 30</td>
<td>60</td>
</tr>
<tr>
<td>30 &lt; p ≤ 37.5</td>
<td>75</td>
</tr>
<tr>
<td>37.5 &lt; p ≤ 45</td>
<td>90</td>
</tr>
<tr>
<td>45 &lt; p ≤ 52.5</td>
<td>105</td>
</tr>
<tr>
<td>52.5 &lt; p ≤ 60</td>
<td>120</td>
</tr>
<tr>
<td>60 &lt; p ≤ 67.5</td>
<td>135</td>
</tr>
<tr>
<td>67.5 &lt; p ≤ 75</td>
<td>150</td>
</tr>
</tbody>
</table>
Roof pressures
A picture is worth a thousand words ……
12 X 24 Simulated Wind Uplift Test
Joint Failure – cannot calculate
Impact testing
“There has not been a hurricane in North America in the last 25 years which would have damaged a building constructed in accordance with FM Global design guidelines.”
THE SOURCE FOR FM APPROVED ROOF ASSEMBLY DETAILS

• Ratings Calculator wizard that determines the required roof ratings for any building and roof area.

• An online database of FM Approved roof products and assemblies that meet specific criteria.

• FM Global Property Loss Prevention Data Sheets provide installation guidelines.

www.roofnav.com
- FM Approved Product Search
- FM Approved Assembly Search Tools
- Ratings Calculator
- Glossary
- FM Global Property Loss Prevention Data Sheets
- Approval Standards
- Project Files
- FREE Training
FM Approval Standards for Sandwich panels:

FM Approval and CE Marking
## FM Diamond and the CE Mark

<table>
<thead>
<tr>
<th>FM Diamond</th>
<th>CE Marking</th>
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<tbody>
<tr>
<td>Reaction to Fire</td>
<td>Reaction to Fire</td>
</tr>
<tr>
<td>Large Scale Tests</td>
<td>Small Scale Tests</td>
</tr>
<tr>
<td>• calorimeter</td>
<td>• EN 13501-1 classification (A1 to F)</td>
</tr>
<tr>
<td>• corner tests</td>
<td>• SBI test and others (small scale)</td>
</tr>
<tr>
<td>• room tests</td>
<td></td>
</tr>
<tr>
<td>F&amp;PA audit</td>
<td>FPC audit</td>
</tr>
<tr>
<td>Sample witnessing and selection by FM Approvals</td>
<td>Sample witnessing and selection depends on AoC system</td>
</tr>
</tbody>
</table>
FM Approvals Certification Marks

- FM APPROVED
- CE
- FM APPROVED
- QUALITY SYSTEM REGISTRATION
Reduce Clients’ Risks

Global Loss Prevention Solutions

Global Acceptance of FM Approved Products