FM Approvals Role in Property Loss Prevention

Mark D. Tyrol, P.E.
Senior Engineer, FM Approvals
Today’s Agenda

1. Introduction to FM - Property Loss Prevention Through Engineering

2. Firestop Contractor Approvals (FM 4991)

3. Testing and Product Approvals
   - Roofing
   - Wall Panels
   - HVAC Duct
   - Fire Doors
   - Firestopping
Today’s Agenda

1. **Introduction to FM - Property Loss Prevention Through Engineering**

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   - HVAC Duct
   - Fire Doors
   - Firestopping
Who is FM Global?

Property Insurance Company – (largest in world)

- Founded 1835 - 178 year old company
- Commercial & Industrial Properties
- Headquartered in USA
- Typical policy coverage
  - Property damage
  - Business Interruption
FM Global

- Largest *industrial and commercial* insurance company in the world
- $5.5 billion in annual premiums
- $7.9 billion in reserves
- 5,000+ employees, 1,800+ engineers
- 130,000+ insured locations in ≈ 200 countries
- Insure 27% of the world's commercial and industrial facilities
- Invested over $150 million in the FM Global Research Campus – a world-renown research and testing laboratory
- Since 1835 – *business model works!*
- Belief that loss is preventable through engineering

- Mutual ownership: over $2.0 billion returned in membership credits since 2001

- Financial strength (545 in Fortune 1000)

- Underwriting Expertise (Bundled engineering & underwriting)

- Bet on our engineering
FM Global’s Structure

Research

Engineering

FM APPROVALS

Research Campus
FM Global Research Campus
• 1,800+ Engineers
• 60,000+ facilities inspected
• 130,000+ facilities globally
• 200+ countries
FM Approvals

- 200+ employees, Offices worldwide
- Nationally Recognized Testing Laboratory (NRTL)
- Notified Body (CE) and Member of EOTA
- Solely focused on Approving Products that promote Property Loss Prevention
- Develops and publishes Approval Standards
- 50,000+ products Approved
- Publish on-line in Approval Guide and RoofNav
FM Approvals Certification Marks

- FM APPROVED
- CE
- FM APPROVED
- QUALITY SYSTEM REGISTRATION

FM Approvals
What do we Approve?

Building Materials

Roofing, Siding, Insulation (of all types and uses)
Heat & Smoke Vents, Explosion Venting Construction
Fire Protective Coatings, Fire Stops, Fire Doors,
Windstorm Resistant Fenestration
Cooling Towers, Air Handling Systems, Components
Pipe & Duct Insulation
Plastic Pallets
Firestop Contractors

Also Fire Protection and Electrical
Once You Are FM Approved

Products and assemblies are added to RoofNav and / or Approval Guide

www.roofnav.com

www.approvalguide.com
What do FM Global Engineers do?

Perform inspections of FM Global insured locations to identify opportunities to reduce the risk of property loss and business interruption.

Recommend the use of FM Approved products that can reduce or eliminate the risk of Property Loss.
FM Global business model:

Loss is preventable
FM APPROVED PRODUCTS

Products *engineered to prevent loss*
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THE APPROVAL OF FIRESTOP CONTRACTORS

APPROVAL STANDARD 4991

Symbol of Excellence
Approval Standard for Approval of Firestop Contractors

Class Number 4991

May 2001
CO-OPERATIVE EFFORT

- FM APPROVALS and FIRESTOP CONTRACTORS INTERNATIONAL ASSOCIATION (FCIA)
  Bill McHugh, Executive Director

- APPROVAL STANDARD ISSUED YEAR 2000

- FIRST APPROVAL OF DESIGNATED RESPONSIBLE INDIVIDUALS
PURPOSE

• IMPROVE THE PERFORMANCE & INSTALLATION OF FIRESTOP SYSTEMS AND COMPONENTS

• ACCOMPLISHED BY EXAMINING & QUALIFYING CONTRACTORS INVOLVED IN THEIR INSTALLATION
FIRESTOP SYSTEMS

- DESIGNED TO PROTECT OPENINGS IN
  - WALLS
  - FLOORS
  - CONSTRUCTION JOINTS
  - FLOOR/WALL SLAB EDGE CONDITIONS
FIRESTOP SYSTEMS

• ONLY PRODUCTS SHOWN IN PUBLISHED LISTINGS

• INSTALLED PER MANUFACTURER’S INSTRUCTIONS & INDUSTRY PRACTICES
FIRESTOP SYSTEMS

- ENTIRE SYSTEM IN JEOPARDY IF ANY COMPONENT IS
  - OMITTED
  - IMPROPERLY INSTALLED
  - UNAUTHORIZED SUBSTITUTION OF COMPONENTS
FM APPROVED FIRESTOP CONTRACTOR

- **MUST EMPLOY AT LEAST ONE (1) DESIGNATED RESPONSIBLE INDIVIDUAL (DRI)**
  - DEMONSTRATED ABILITY TO UNDERSTAND
    - APPROVAL STANDARD REQUIREMENTS
    - FCIA MANUAL OF PRACTICE (MOP)
- **CONTRACTOR MUST BE IN THE FIRESTOP INSTALLATION BUSINESS FOR 2 YEARS**
FM APPROVED FIRESTOP CONTRACTOR

- **WRITTEN QUALITY CONTROL MANUAL**
- **SUCCESSFUL AUDITS**
  - OFFICE
  - JOB-SITE
FM APPROVED FIRESTOP CONTRACTOR

- DRI MUST PASS TWO (2) WRITTEN EXAMS
- MINIMUM SCORE OF 80% ON EACH EXAM
  - EXAM 1  GENERAL INFORMATION
  - EXAM 2  DESIGN SELECTION
FM APPROVED FIRESTOP CONTRACTOR

• **MAINTAIN APPROVAL**
  – CONTINUE TO EMPLOY A DRI
  – SUCCESSFUL JOB-SITE AND OFFICE QUALITY CONTROL AUDITS EACH YEAR
  – PASS A WRITTEN RE-EXAM EVERY THREE (3) YEARS
  – OBTAIN 6 CEUs EVERY THREE (3) YEARS
WRITTEN EXAMINATION TOPICS

• **KNOWLEDGE OF**
  – CONSTRUCTION MATERIALS
  – LISTING AGENCIES & LISTED SYSTEMS
  – T, F AND L RATINGS
  – AUTHORITIES HAVING JURISDICTION
  – SPECIFICATIONS, ESTIMATING & BIDDING
  – NON-CONFORMANCES
WRITTEN EXAMINATION TOPICS

• **KNOWLEDGE OF**
  – TERMINOLOGY
  – HOURLY RATINGS
  – TYPES OF SYSTEMS
  – DEFINITIONS
  – BUILDING CODES
  – QUALITY CONTROL
WRITTEN EXAMINATION TOPICS

- CONTINUING EDUCATION REQUIREMENTS
- APPROVAL MARKINGS
- FIRE RATED SYSTEM SELECTION
- ENGINEERING JUDGEMENTS
EXAMINATION RESULTS

- **1ST EXAMS – NOVEMBER 2000**
- **53 PEOPLE TOOK THE EXAM**
- **MINIMUM SCORE OF 80% IS REQUIRED ON EACH OF TWO (2) EXAMS**
- **ONLY 39 PEOPLE PASSED BOTH EXAMS**
- **STILL TODAY – LESS THAN 2 OUT OF 3 PASS EXAMS**
FM APPROVED FIRESTOP CONTRACTORS

- **CURRENTLY 101 COMPANIES ARE APPROVED WORLDWIDE**
- **SEVERAL COMPANIES HAVE MORE THAN ONE (1) LOCATION**
- **EACH LOCATION MUST HAVE A DRI**
- **OFFICE and/or JOBSITE AUDITED ANNUALLY**
- **MORE THAN 128 DRI's EMPLOYED BY APPROVED CONTRACTORS**
### Firestop Contractor Approvals

- **1st Exams – November 2000**
  - Location: Boston, MA
- **Approval Guide**

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<td>2010</td>
<td>79</td>
<td>118</td>
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<td>2013</td>
<td>101!</td>
<td>128+</td>
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United Arab Emirates

**INTHERPRO LLC**
Al Ghurair Center-Deria, Box 89244, Dubai

**FSIME Construction LLC**
Nasser Lootah Warehouse #4, Off Sheik Zyd Rd, Dubai

**Al Swiss Insulation Co LLC**
Box 20554, Plot No. 70, Al Jurf Industrial Area, Ajman

**Shoeb Fire Fighting Equipment Trading**
Box 25007, Nasser Abdulla Hussain, Office No B34, Ground Level, Al Towar, Ghusais, Near Airport Free Zone, Deira

**Rise & Shine Insulation Contracting Co**
Box 69381, Sharjah
United Arab Emirates

*Al Shadid Technical Contracting*
*Buteena, Bldg No. 7, 4th Floor, Flat No. 9, P.O. Box 70438, Sharjah,*

*Chronicle Interiors LLC*
*Al Shaffar Building, 2nd Floor, Suite 202, Trade Center Rd, Karama Dubai*
Qatar

Rise & Shine Trading & Contracting WLL
CR No. 41567, Box 30806, Bin Mahmood, Doha

Firestop Insulation Technologies Company, WLL
AL Wakra St, Box 5131, Barwa Village, Doha, Qatar

Narang Projects
Al Mashreq Bank Building, 1st Floor #6, Next to Ramada Intersection, PO Box 7836, Doha

Dicotech Qatar, WLL
Al Sudan Area, 54 Ahlia St, Box 23106 Doha
USA

90 FM Approved Firestop Contractors

www.approvalguide.com
Survey by Global E & S

Global E & S conducted a survey of the firestopping in 70 different buildings. The survey was not solicited by FM. They randomly inspected the firestopping in 1000 openings.

Firestopping was inspected per ASTM standards for inspecting firestops (ASTM E2174 and ASTM E2393).

Divided into 3 Groups:

1. Not FCIA members and not FM Approved [450 openings]
2. FCIA members but not FM Approved [450 openings]
3. FM Approved [100 openings]
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<th>% Acceptable Listed Designs</th>
<th>% Acceptable Engineering Judgment</th>
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<td>members of the FCIA</td>
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<tr>
<td>nor FM Approved</td>
<td>32%</td>
<td>12%</td>
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<td>of the FCIA but not FM</td>
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<td>73%</td>
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<td>Companies that are FM</td>
<td>96%</td>
<td>93%</td>
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   Wall Panels
   HVAC Duct
   Fire Doors
   Firestopping
FIRE DAMAGE

HOW DO YOU PREVENT THIS FROM OCCURRING?

GM Plant Fire in Livonia MI (1953)
3:45 pm: Sparks from a welder’s torch fell into a pan and compound in the pan burst into flame.

4:30 pm: Raging inferno engulfed the entire 34.5 acre facility.

Largest Industrial Loss on Record at That Time
150,000 m² destroyed in less than 1 hour
$50 - $55 M in Property Damage, $750 M in Business Interruption
32,000 Employees Laid Off
Large Scale Fire Test – Interior Fire

Research testing correlated to large loss
Small Scale Fire Test – Interior Fire

Correlated to large scale fire tests
Exterior Fire – ASTM E108
Exterior Fire – ASTM E108
Exterior Fire – ASTM E108
FM Approved Products and Assemblies
www.approvalguide.com
www.roofnav.com

FM Global Property Loss Prevention
Data Sheets
www.fmglobal.com

COMPLEMENTARY!
WIND DESIGN

INSUREDS OF FM GLOBAL SHOULD CONTACT THEIR LOCAL FM GLOBAL OFFICE BEFORE BEGINNING ANY ROOFING WORK.

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   - Roofing
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FIRE DAMAGE

HOW DO YOU PREVENT THIS FROM OCCURRING?
HOW DO YOU PREVENT THIS?

Must be resistant to fire internally and externally
NOT FM APPROVED WALL PANELS
FM Global
Property Loss Prevention Data Sheets
1-3
May 2008
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HIGH-RISE BUILDINGS

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PLASTICS IN CONSTRUCTION

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Some small scale fire tests of individual products do not tell the whole story.

Correlation to large scale tests of complete assemblies is required to understand risk.
Testing of Wall Panel Systems

Third party certification body

Examines wall products and assemblies to rigorous loss prevention standards, e.g.:

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<th>Code</th>
<th>Description</th>
<th>Authors</th>
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<td>Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings, and Exterior Wall Systems</td>
<td>Phil Smith; Michael Slocumb</td>
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<td>4881</td>
<td>Class 1 Exterior Wall Systems</td>
<td>Phil Smith; Michael Slocumb</td>
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<td>4882</td>
<td>Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies</td>
<td>Phil Smith; Michael Slocumb</td>
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Metal Wall Panel Systems (MWPS) examined for resistance to

- Combustibility (fire)
- Smoke generation
- Natural hazards (wind, wind blown debris)

Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish

4880
Materials or Coatings, and Exterior Wall Systems

Phil Smith; Michael Slocumb
Resistance to Combustibility

• Tests performed per Approval Standard 4880, Class 1 Fire Rating of Insulated Wall or Wall and Ceiling/Roof Panels

• Required:
  1. Combustibility characterization of core
  2. Mid or large scale fire test of entire assembly
Resistance to Combustibility or Fire

• Tests performed per Approval Standard 4880, Class 1
Fire Rating of Insulated Wall or Wall and Ceiling/Roof Panels

• Required:

1. Combustibility characterization of core

2. Mid or large scale fire test of entire assembly
Resistance to Combustibility

Combustibility characterization of core

Thermoset foam cores (e.g. PIR, PUR)

Flammability characterization

Non-combustible cores (e.g. mineral wool)

Small scale tests to prove non-combustibility

Thermoplastic core (e.g. EPS) or other combustible core

No characterization—straight to large scale tests of entire assembly
Resistance to Combustibility

Combustibility characterization of core

Thermoset foam cores (e.g. PIR, PUR)

Flammability characterization

Non-combustible cores (e.g. mineral wool)

Small scale tests to prove non-combustibility

Thermoplastic core (e.g. EPS) or other combustible core

No characterization—straight to large scale tests of entire assembly
Flammability characterization determined with Fire Propagation Apparatus (FPA)
Fire Propagation Apparatus

- Allows a small size sample to be tested ≈ 4 x 4 in.

- Measures
  - Thermal response parameter (TRP) = resistance to ignition
  - $Q_{\text{conv}} = \text{convective heat release rate}$
  - $F_{\text{SPc}} = \left(\frac{Q_{\text{conv}}}{\text{area}}\right) / \text{TRP}$
  - $F_{\text{SPc}} = \text{function of velocity of fire propagation}$
Fire Propagation Apparatus

small size sample correlated to large scale fire test

Figure C-2. Fire Propagation Length in FM Approvals 25-ft Corner Test Versus Convective Flame Spread Parameter
Fire Propagation Apparatus

small size sample correlated to large scale fire test

FSPc correlated to flame propagation length along eaves
Resistance to Combustibility

Combustibility characterization of core

Thermoset foam cores (e.g. PIR, PUR)

Flammability characterization

Non-combustible cores (e.g. mineral wool)

Small scale tests to prove non-combustibility

Thermoplastic core (e.g. EPS) or other combustible core

No characterization—straight to large scale tests of entire assembly
Non-combustible core?

Must prove core is non-combustible with

(1) ASTM D 482 ash content of core = minimum 90%
Non-combustible core?

Must prove core is non-combustible with (2) ASTM E2058 combustion test
Non-combustible core?

(2) ASTM E2058 combustion test
Sample installed in air enriched to 40% oxygen. Will sample ignite? No flaming = non-combustible
Non-combustible core

(2) ASTM E2058 combustion test

ignition

Not non-combustible!!
Non-combustible core?

(3) ISO 1716 heat of combustion in an oxygen bomb
maximum heat of combustion 2.0 kJ/g (860 BTU/lb).
Resistance to Combustibility

Combustibility characterization of core
Thermoset foam cores (e.g. PIR, PUR)
Flammability characterization
Non-combustible cores (e.g. mineral wool)
Small scale tests to prove non-combustibility

Thermoplastic core (e.g. EPS) or other combustible core
No characterization—straight to large scale tests of entire assembly
Resistance to Combustibility

Tests performed per Approval Standard 4880, Class 1

Fire Rating of Insulated Wall or Wall and Ceiling/Roof Panels

Required:

1. Combustibility characterization of core

2. Large scale fire test of entire assembly

Room Fire Tests UBC 26-3
Resistance to Combustibility

parallel panel fire test

measures heat release rate

25 mm Thick Marinite
13 mm Thick Plywood

Angle Iron Frame
Sand Burner

$d_f = 12$ in. (0.3 m)
Resistance to Combustibility

parallel panel fire test apparatus
Video – parallel panel fire tests
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   - **HVAC Duct**
   - Fire Doors
   - Firestopping
Lightweight air duct.
Lightweight air duct.
HVAC Duct Testing at FM Approvals

PF Pre-insulated Board Composite
Zinc-coated Steel
Horizontal duct test per FM 4922.
Fire should not spread to end of duct in 10 minutes.
Fan is drawing air into duct.
Exposure fire is pan of heptane, 10,000 BTU/min.
HVAC Duct Testing at FM Approvals
HVAC Duct Testing at FM Approvals

Test failure – burn through and fire propagation.
Test failed in only a few seconds.

If not <FM>, we have to assume this will be the performance.
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Fire exposure is a 1 foot square pan containing 2 in. of heptanes. This exposure yields 10,000 Btu/min.

HOSE STREAM TEST IS REQUIRED
Fire Door Testing at FM Approvals

Also Durability and Reliability Tests are Required.
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Approval Standard for Firestopping

Class Number 4990

December 2009
Firestop Testing at FM Approvals
Firestop Testing at FM Approvals
Firestop Testing at FM Approvals
HOSE STREAM TEST IS REQUIRED
Firestop Testing at FM Approvals
Firestop Testing at FM Approvals
In Summary

1. Introduction to FM - Property Loss Prevention Through Engineering

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LOSS CAN BE PREVENTED

Firestop + 4880
Small scale tests may not predict actual performance
FM Approved contractors, products, services and assemblies are engineered to help prevent loss.

FM has 180+ years of loss experience and engineering solutions.

We share this knowledge by publishing FM Global Property Loss Prevention Data Sheets.
Thank You!

Mark D. Tyrol
Senior Engineer, FM Approvals

Mark.Tyrol@fmapprovals.com

www.fmglobal.com
www.fmapprovals.com
www.approvalguide.com
www.roofnav.com