Tame the Flame
A Close Look at Exterior Wall Flammability
Introducing

Dwayne Sloan
Director, Principal Engineers and Regulatory Services
Building & Life Safety Technologies

Background

Dwayne Sloan is responsible for directing the activities of a team of Principal Engineers and Regulatory Specialists responsible for building materials, sprinklers, fire suppression products, extinguishing products and systems, fire containment, smoke and fire alarms, indicating equipment, and life safety products.
What UL Does for Today’s Challenges

- TESTING
- INSPECTION
- CERTIFICATION
- AUDITING
- VALIDATION
- TRAINING
INTRODUCTION

Tame the Flame

UL’s Latin Motto

“Ignis Servus Non Dominus”

“Fire should be our servant and never our master!”
INTRODUCTION
Tame the Flame

- Education
- Testing
- Regulation
- Certification
PRESENTATION OBJECTIVES

Understand building challenges and fire concerns with exterior walls and façades

Identify US Code requirements and recent changes coming in the UAE Codes related to exterior walls and façades

Obtain an overview of NFPA 285 and its applications

Understand the differences between NFPA 285 and other reactions to fire and fire test methods

Provide an overview of UL’s Certification Program for exterior wall components and systems

Explain how Third-Party Certification can help identify compliant assemblies and components in exterior walls
BUILDING CONSTRUCTION FACTORS

• New materials introduced into the marketplace
• Exterior wall assemblies – compounding effects of various combinations

Example

2 types of gypsum +
3 types of insulation +
2 weather barriers +
2 ACM exterior cladding =

24 ASSEMBLIES
BUILDING ENVELOPE PERFORMANCE

- Thermal
- Air Leakage
- Water Infiltration

- Control moisture accumulation
- Control humidity – lead to mold and sick buildings
- Control air leakage
- Maintain indoor comfort
- Conserve energy
- Deter or alleviate water leakage
BUILDING ENVELOPE PERFORMANCE

Building Envelope Performance
(Relatively new to Codes)

Traditional Fire Testing
(Well established within Codes)
FACTORS DRIVING SUSTAINABILITY, ENERGY EFFICIENCY, & ENVIRONMENTAL INITIATIVES

STANDARDS & INITIATIVES

- LEED
- IgCC
- IECC
- ICC 700 (National Green Building Standard)
- ASHRAE 189.1 and 62.1
- GPMCS (Green Plumbing and Mechanical Code Supplement)

- UL Environment Standards
- ASTM Sustainability Efforts (E06, D08)
- DOE’s Energy Star
- EPA Energy Star
- ANSI’s Energy Efficiency Standardization Coordination Collaborative (EESCC)
IMPACT OF ENERGY EFFICIENCY & ENVIRONMENTAL INITIATIVES IN FIRE SAFETY

Claims / Declarations / Certifications

Green Washing – Self-Declared Environmental Claims
Sustainable Product Certifications (SPC)
Environmental Claims Validation (ECV)
Environmental Product Declarations (EPD)
Life Cycle Analysis (LCA)

“Hey – I’m Green!”
FIRES HAPPEN

• BBQ grill fires
• Trash can fires
• Welding activities
• Fire works
• Cigarette butts disposal
• Electrical fires
• Arson
EXTERIOR WALL SYSTEMS
Why We Test?

A broad range of combustible components are very common and have been effective in exterior wall construction

- Insulation (foam plastic, batts and blankets, continuous)
- Metal composite cladding (MCM)
- Aluminum composite panels (ACM)
- Exterior Insulation Foam System (EIFS)
- Polycarbonate panels (PEWFS)
- High pressure laminates (HPL)
- Water resistive barriers (WRB)
- Air barriers
EXTERIOR WALL SYSTEMS

Why We Test?

Monte Carlo Casino Fire – Las Vegas
- January 2008
- Damage – est. $100 million
EXTERIOR WALL SYSTEMS
Why We Test?

Mermoz Tower
• France (2012)
• Example of Leap-frogging
EXTERIOR WALL SYSTEMS
Why We Test?

Grozny-City Towers, Grozny, Chechnya
• April 2013
EXTERIOR WALL SYSTEMS

Why We Test?

Torch Tower
- Dubai, February 2015

- Rapid burning of aluminum cladding containing combustible core and high winds
EXTERIOR WALL SYSTEMS
Why We Test?

Address Hotel Fire
• Dubai, December 2015
• ACM tested to ASTM E119?
EXTERIOR WALL SYSTEMS

Why We Test?

Ajman One Complex
• March 2016

NFPA Fire Test Committee
NFPA 285
GRENFELL TOWER
14 June 2017
What have we heard?

- North Kensington, London
- 24 story public housing flat
- 120 - 1 & 2 bedroom units
- 80 presumed dead (CNN & other outlets)
- Possible cause – refrigerator - fourth floor?
- Rapid fire spread on the exterior appeared to be accelerated by exterior cladding

Grenfell Tower Inquiry
www.grenfelltowerinquiry.org
TORCH TOWER
4 August 2017

A second time
• Cause unknown
• No reported injuries or deaths
• Rapid fire spread on the exterior appeared to be accelerated by exterior cladding

Photo courtesy of:
Fire Hazards of Exterior Wall Assemblies Containing Combustible Components

Final Report

Prepared by:
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CSIRO
Highton, VIC, Australia

Michael Delichatzis
FireSERT, University of Ulster
Jordans, Northern Ireland

© June 2014 Fire Protection Research Foundation
UNIQUE BURNING BEHAVIOR

Exterior Wall Fires

- Vertical orientation
- Walls with combustible materials
- Usually involves windows
- Passive protection is limited
- Active protection (sprinklers) is limited
- Wind / outside environment
- Variety of possible ignition insults
EXTERIOR WALL SYSTEMS
Exterior Cladding

Metal Composite Materials
Benefits:

- Aesthetically Attractive
- Sustainable
- Climate Control
- Economical
- Versatile
- Retrofit
- Low Maintenance
- Diverse Choices
EXTERIOR WALL SYSTEMS
Exterior Cladding

![Diagram showing the comparison between Regular ACM and Fire Retardant ACM in terms of fire spread and safety measures.]

**Regular ACM**
- While glass breakage/fallout allows fire to enter/exit, cladding allows/prevents spread.

**Rapid Fire Spread**
- Fire spreads upwards due to a combustible cladding, thereby contributing to the fire.
- Fire breaks in & cut through glass.
- Flames break out, smoke / fumes build up.
- Initial fire develops and flashes over.
- Internal or External Fire Incident.

**Fire Retardant ACM**
- Fire spread is restricted due to a FIRE RETARDANT or NON-COMBUSTIBLE cladding material and system.

**Restricted Fire Spread**
- No droplets falling down to avoid further spread and hazard to people.
- No smoke / toxic fumes.

Image: Courtesy of 3A Composites
EXTERIOR WALL SYSTEMS
Combustible Cladding

Typical Example:

0.5 mm (0.02 in.) aluminum facings chemically bonded to a plastic core - approximately 3 to 6 mm (0.12-0.24 in.) total thickness

Skins: aluminum, zinc, copper, stainless steel, and titanium
EXTERIOR WALL SYSTEMS
Combustible Cladding

Metal Composite Panels
On various metal framing systems, furring, tracks, gasketing, joints, etc.
NFPA RISK ASSESSMENT TOOL
EXTERIOR FACADE FIRE EVALUATION & COMPARISON TOOL (EFFECT™)

Understanding and managing the fire hazards of exterior walls containing combustible components
# EXTERIOR WALL SYSTEMS
A Global Concern

<table>
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<th>Country</th>
<th>Methods</th>
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<td>International</td>
<td>• ISO 13785, Part 2 / FM 4880</td>
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<td>Germany</td>
<td>• DIN 4102 (Draft)</td>
</tr>
<tr>
<td>UK</td>
<td>• BS 8414, Part 1</td>
</tr>
<tr>
<td>France</td>
<td>• LEPIR II</td>
</tr>
<tr>
<td>Sweden</td>
<td>• SP Fire 105</td>
</tr>
<tr>
<td>USA</td>
<td>• NFPA 285 / FM 4880</td>
</tr>
<tr>
<td>Canada</td>
<td>• CAN/ULC S134</td>
</tr>
</tbody>
</table>
NFPA 285

Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall assemblies Containing Combustible Components

2012 Edition
Intermediate Scale Multi-Story Apparatus
NFPA 285 – FIRE PROPAGATION

- Test room at first and second story
- Each test room open at the front
- Constructed of concrete slabs and walls
- Each test room is approximately 3 x 3 x 2 m high (10 x 10 x 7 ft.)
- Complete assembly (representative of end-use application, including external cladding, insulation, framing, and internal wall)
- Window opening 762 mm high × 1981 mm wide; sill located 762 mm above the top of the first-story test room slab
- Two gas-fired burners
  - One inside the first story room
  - One outside the first story window opening of the wall assembly
NFPA 285 – FIRE PROPAGATION

Procedure

• Burners are ignited to deliver specified temperatures and heat fluxes over a 30 minute test duration.

• The window burner is ignited 5 minutes into the test
• Temperatures at exterior of wall must not exceed 538°C (1000°F) at a height of 3 m (10 ft.) above the window opening

• Exterior flames must not extend vertically more than 3 m (10 ft.) above the window opening

• Exterior flames must not extend horizontally more than 1.5 m (5 ft.) from the centerline of the window opening
NFPA 285 – FIRE PROPAGATION

Conditions of Acceptance

- 1000 F at a height of 10 ft. above the window opening

- Vertically more than 10 ft. above the window opening

- Horizontally more than 5 ft. from the centerline of the window opening
NFPA 285 – FIRE PROPAGATION
NFPA 285 – FIRE PROPAGATION

Fire Spread Through Cavities

Window Detail
NFPA 285 – Fire Propagation

Address Hotel - Dubai December 2015 and NFPA 285 OVERVIEW
CAN / ULC S134 - Canada

Standard Method of Fire Test of Exterior Wall Assemblies

Key Test Parameters
• Three story apparatus
• No window burner
• Furnace size is larger compared to NFPA 285
• Flame exposures and test times are different
• Sample sizes are different
• Window is larger
• Window location higher relative to the first floor
• Pass - No flame spread beyond 5 m
• Pass - Heat flux @ 3.5 m < 35 kW/m²

Photo: From NRC
UK

BS 8414
Part 1

Fire performance of external cladding systems. Test methods for non-loadbearing external cladding systems applied to the face of a building.

BS 8414
Part 2

Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems fixed to and supported by a structural steel frame.
BS 8414
Parts 1 & 2

Key Test Parameters
• Corner configuration (wing wall)
• Slightly larger window opening (2 m x 2 m)
• Window location at floor
• Timber crib (1.5 x 1 x 1 m)
• Heat flux = app. 75 kW/m² at 1 m above window
• Test time 30 minutes
• Fail - Any TC @ Level 2 > 600C (external or internal)
• Part 2 Pass - No burn through the façade
FM4880
International

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

25-ft High Corner Test (for approval up to 30 ft.)

50-ft High Corner Test (for approval greater than 30 ft.)

Figure E.1. 50 ft (15.2 m) Corner Test Structure
FM4880

Approval Standard for Class 1 Exterior Wall Systems - includes testing to FM4880

Key Test Parameters
- Corner configuration (wing wall)
- No window openings
- 340 kg wood crib (1.5 x 1 x 1 m)
- Test time 15 minutes
- Pass - No fire spread to the limits of the test structure
ISO 13785 PART 2

International

Reaction-to-fire tests for façades
Part 2: Large-scale test

Key Test Parameters
- Corner configuration (wing wall)
- Slightly larger window opening
- Different window location
- Series of propane burners
- 4 - 6 minute growth & decay
- Test time 23 - 27 minutes
- Slightly higher heat flux values
- No pass/fail criteria
## TEST METHODS
Across the Globe

### EXTERIOR WALL TEST METHODS

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Country</th>
<th>Fire Source</th>
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</thead>
<tbody>
<tr>
<td>BS 8414-1</td>
<td>UK</td>
<td>Wood crib; app. 75 kW/m² @ 1 m height above the opening</td>
</tr>
<tr>
<td>NFPA 285</td>
<td>US</td>
<td>Gas burner; up to 40 kW/m² @ 1 m height above the opening</td>
</tr>
<tr>
<td>LEPIR II</td>
<td>France</td>
<td>600 kg wood crib</td>
</tr>
<tr>
<td>SP Fire 105</td>
<td>Sweden/Denmark</td>
<td>60 liters of heptane</td>
</tr>
<tr>
<td>ISO 13875-2</td>
<td>International</td>
<td>Propane; 55 kW/m² @ 0.6 m height above the window</td>
</tr>
<tr>
<td>CAN/ULC S134</td>
<td>Canada</td>
<td>Gas burner; 45 kW/m² @ 0.5 m height above the window</td>
</tr>
<tr>
<td>FM 4880</td>
<td>International</td>
<td>340 kg wood crib; no opening</td>
</tr>
</tbody>
</table>
ENGINEERING ANALYSIS

ASTM E1354 Cone Calorimeter

- Time to ignition (s)
- Peak heat release rate (kW/m²)
- Time to Peak heat release rate (s)
- Average heat release rates (kW/m²)
- Effective heat of combustion (MJ/kg)
- Total heat released (MJ/m²)
Codes Have Come A Long Way!

The Code of Hammurabi
(1800 B.C)
The world’s first Building Code

Code of Hammurabi
Section 229

If a builder builds a house for someone, and does not construct it properly, and the house which he built falls in and kills its owner, then that builder shall be put to death.
Exterior nonbearing walls tested in accordance with, and meeting the conditions of acceptance of, **NFPA 285** shall be permitted.

<table>
<thead>
<tr>
<th>Combustible Item</th>
<th>Current IBC Code Section</th>
<th>App. Year Added</th>
<th>Qualifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foam Plastic</td>
<td>2603.5.5</td>
<td>1988</td>
<td></td>
</tr>
<tr>
<td>Metal Composite Materials / Aluminum Composite Materials</td>
<td>MCMs / ACMs</td>
<td>1407.10.4</td>
<td>2000</td>
</tr>
<tr>
<td>High Pressure Laminates</td>
<td>HPLs</td>
<td>1409.10.4</td>
<td>2009</td>
</tr>
<tr>
<td>Exterior Insulation Finish Systems</td>
<td>EIFS</td>
<td>1408.2</td>
<td>2009 By way of ASTM E2568</td>
</tr>
<tr>
<td>Fiber Reinforced Polymers</td>
<td>FRPs</td>
<td>2613.5</td>
<td>2009 Invokes Section 2603.5 for exterior use</td>
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<tr>
<td>Water Resistive Barriers</td>
<td>WRBs</td>
<td>1403.5</td>
<td>2012 Over 40 ft. High Type I, II, III, IV Construction</td>
</tr>
</tbody>
</table>

In 2012, the IBC was updated to specifically require water resistive barriers to be tested to NFPA 285.
Weather Barriers

**Vapor barriers** - materials used to slow or reduce the movement of water vapor through a material. Installed **on the warm side of the insulation in a building assembly**.

**Water resistive barriers** - materials on the exterior of a building which are intended to resist liquid (bulk) water that has leaked, penetrated or seeped past the exterior cladding from absorbing into the exterior sheathing or concrete wall and further into the wall assembly.

**Air barrier materials** - used to stop the movement of air into or out of the conditioned space.
2012 IBC change requires NFPA 285

1402.5 Exterior walls on buildings of Type I, II, III or IV construction that are greater than 40 feet in height above grade plane and contain a combustible water-resistive barrier shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

Significance of this change is that WRBs are tested as a system.
1402.5 Vertical and lateral flame propagation.

Exception 1:

Walls in which the water-resistive barrier is the only combustible component and the exterior wall has a wall covering of brick, concrete, stone, terra cotta, stucco or steel with minimum thicknesses in accordance with Table 1404.2.
1402.5 Vertical and lateral flame propagation.

Exception 2: Has three criteria

1) Walls in which the water-resistive barrier is the only combustible component and

2) The wrb has:
   • Peak Heat Release Rate of less than 150 kW/m²
   • Total Heat Release of less than 20 MJ/m²
   • Effective Heat of Combustion of less than 18 MJ/kg as determined in accordance with ASTM E1354 @50 kW/m² flux and

3) has a flame spread index of 25 or less and a smoke-developed index of 450 (ASTM E84 or UL 723).
US CODES DRIVE SAFETY
IBC (Ch. 14) / NFPA 5000

Type I, II, III, or IV Buildings

- Yes
  - Foam Plastic Insulation
    - No
      - Combustible veneers over 40 ft.
        - No
          - 2012 IBC?
            - Yes
              - Combustible WRBs over 40 ft.
                - Yes
                  - NFPA 285 Required
                - No
                  - NFPA 285 Not Required
            - No
              - NFPA 285 Not Required
    - Yes
      - Type I, II, III, or IV Buildings

- No
  - NFPA 285 Not Required
US CODES DRIVE SAFETY
IBC / NFPA 5000

- Sign-in or register to use the Decoding Exterior Wall Requirement tool.
- Fact sheet on the fire hazards of combustible exterior walls.
UAE NEW CODE
To Restrict Flame Spread on Exterior Façade

Most recent “draft” we have per the Civil Defense

Chapter 1 Construction
Section 4. Façade and Exterior Wall Covering Systems
### UAE NEW CODE

#### MCM & ACP

<table>
<thead>
<tr>
<th>Occupancy Type</th>
<th>Core &amp; Panel as a Product</th>
<th>Wall Assembly</th>
</tr>
</thead>
</table>
| Super High-Rise, High-Rise, High Risk (malls, schools, hospitals, assembly) | • EN13501-1 A1 or A2-s1-d0, and  
• ASTM D1929, ignition temp (≥ 343°C) | • BS 8414 -1 or -2 with pass of BRE 135, or  
• NFPA 285, or  
• FM4881, or  
• ISO 13785-2 |
| Low-Rise, Mid-Rise, High Risk, Warehouse, Industrial | Same as above except EN13501 B-s1-d0 | Same as above |
**UAE NEW CODE**

Exterior Insulation Foam System / Exterior Insulation Composite System

<table>
<thead>
<tr>
<th>Occupancy Type</th>
<th>EIFS / ETICS as a Product</th>
<th>EIFS / ETICS as a Wall Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Types</strong></td>
<td>• All components Class A (flame spread 25, smoke developed 450) per ASTM E84, and • NFPA 268</td>
<td>• BS 8414 -1 or -2 with pass of BRE 135, or • NFPA 285, or • FM4881, or • ISO 13785-2</td>
</tr>
</tbody>
</table>
OTHER FIRE TEST METHODS THAT MAY NOT FULLY ADDRESS HAZARD

- EN 13823 - SBI
- UL 723 / ASTM E84
- NFPA 286 / UL 1715
- ASTM E119 / UL263 / ISO 834
EXAMPLE OF A MISAPPLICATION OF A TEST METHOD

Rhode Island Nightclub Station Fire

- February 20, 2003
- Deadliest nightclub fire in US history
- 100 deaths

Acoustical Egg Crate Material
UL94 Rating: HF-1
Not per Code
SIGNIFICANCE OF THIRD PARTY CERTIFICATION

• Code Officials rely on Testing and Certification Organizations to conduct an evaluation – evidence of compliance

• Some manufacturers make it a company policy to obtain UL certification - minimizes the possibility of non-acceptance by AHJs
<table>
<thead>
<tr>
<th>UAE CODE REQUIRES THIRD PARTY LISTING</th>
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<tr>
<td><strong>4.6.3.2. MCM/ACPs</strong></td>
</tr>
<tr>
<td><strong>4.7.3.2. EIFS and ETICS</strong></td>
</tr>
</tbody>
</table>
SIGNIFICANCE OF THIRD PARTY CERTIFICATION

- Being UL Certified means a product has been evaluated, complies with UL’s requirements, and is manufactured under UL’s Follow-Up Service Program – not just tested by UL.
UL’S FOLLOW-UP SERVICE PROGRAM

Proprietary Information

UL respects our client’s proprietary manufacturing and marketing information. Details on product construction, product manuals, test results, and ongoing investigation status cannot be divulged to outside parties.

Certification information published in the UL Online Certifications Directory can be disclosed.
FACTORY SURVEILLANCE

- Periodic inspections of certified products
- UL Marks are only applied at authorized factories
PRODUCT CERTIFICATIONS – FWFO ASSEMBLIES

NFPA 285 UL Assemblies (FWFO)
EWS0001 through EWS0035
• Noncombustible veneers
• ACM panels
• EIFS
• Fluid applied weather barriers
• Various foams & insulation

Search results

You may choose to Refine Your Search.

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<th>Link to File</th>
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<tr>
<td>Guide Information</td>
<td>Exterior Wall Systems</td>
<td>FWFO.GuideInfo</td>
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UL ONLINE CERTIFICATIONS DIRECTORY

www.ul.com/database
- No charge to access
- No passwords
- Updated daily
- Searchable
  - Keyword
  - Manufacturer
  - UL File Number
- Standard used for evaluation
**UL ONLINE CERTIFICATIONS DIRECTORY**

### BEGIN A BASIC SEARCH

To begin a search, please enter one or more search criteria in the parameters below.

- **Company Name (options)**: [xyz company]
- **City**
- **US State**: Select a state
- **US Zip Code**
- **Country**: Select a country
- **Region**: Select a region
- **Postal Code**
- **UL Category Code (options)**: [FV0D]
- **UL File Number (help)**
- **Keyword**

### ABOUT THE ONLINE CERTIFICATIONS DIRECTORY

You can use the UL Online Certification Directory to:

- Verify a UL Listing, Classification, or Recognition
- Verify a UL Listed product use
- Verify a UL Recognized component use
- Verify a product safety standard

Looking for ULC certifications? Go to the [ULC Online Directories](#).

Learn more with the [Quick Guide to the Online Certifications Directory](#).

### SPECIFIC SEARCHES

Select a specific search:

### FEATURED LINKS

- **UL Alarm**
- **UL Code**
UL ONLINE CERTIFICATIONS DIRECTORY

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</tbody>
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System No. EWS0001

Exterior Wall System
1. **Steel Studs** — Min 3-5/8 in. (92 mm) deep, formed of min 16 ga. galv steel spaced max 16 in. (406 mm) OC. Additional studs to be used to completely frame window openings.

2. **Interior Gypsum Board (BWFR)** — Min 5/8 in. (16 mm) thick, 4 ft (1.2 m) wide, attached to steel studs with 1 in. (25 mm) long, Type S steel screws spaced max 8 in. (203 mm) OC. Joints oriented vertically and covered with paper tape and joint compound. Screw heads covered with joint compound.

   **UNITED STATES GYPSUM CO** — Type SCX

3. **Exterior Gypsum Sheathing (BWFR)** — Exterior-grade glass mat sheathing gypsum board, minimum 5/8 in. (16 mm) thick, attached to steel studs with 1 in. (25 mm) long, Type S steel screws spaced max 8 in. (203 mm) OC. Joints oriented vertically or horizontally. Additional sheathing to be used to line framed window openings.

   **UNITED STATES GYPSUM CO** — Type USGX

3A. **Exterior Wall System Component — Sealant** — (Not Shown) - Sealant applied to all exterior sheathing joints prior to application of air barrier sealant (Item 4).

   **TREMCO INC** — Tremiflex 834

4. **Exterior Wall System Component — Combustible Air Barrier Sealant** — Applied to completely cover the gypsum sheathing at a min thickness of 35 mil (0.9 mm) dry, 70 mil (1.8 mm) wet thickness.

   **TREMCO INC** — ExoAir 230
FWFX.R27656
Exterior Wall System Components

See General Information for Exterior Wall System Components

TREMCO INC
4475 E 175TH ST
CLEVELAND, OH 44128-3411 USA

Sealant designated ExoAir 230 for use in System Nos. EWS0001, EWS0002, EWS0003, EWS0004, EWS0005.

Sealant designated Tremflex 834 for use in System Nos. EWS0001, EWS0002, EWS0003, EWS0004, EWS0005.

Window flashing material designated Proglaze ETA for use in System Nos. EWS0001, EWS0002, EWS0003, EWS0004, EWS0005.

Sealant designated Spectren 1 for use in System Nos. EWS0001, EWS0002, EWS0003, EWS0004, EWS0005.

Last Updated on 2014-02-17
UL FAÇADE TESTING FACILITY
India, IIT Gandhinagar

• 4 full-scale tests
  - Test A1 – local market glass + ACP
  - Test A2 – standard glass + ACP
  - Test B – standard glass + MDF
  - Test C – standard glass (internal spread)
• Realistic furnishing used as fire load
• Fire allowed to grow until it reached floor level 3

<table>
<thead>
<tr>
<th>ACP</th>
<th>Aluminum Clad Panel</th>
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<tbody>
<tr>
<td>MDF</td>
<td>Medium Density Foam</td>
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</table>
TEST A1
Local Glass + ACP (Not Fire Rated)

2 min
Flames spread into Level-1 compartment. Curtains catch fire.

3 min
Max temperature at Level-2 reaches 550 °C. Glass panels begin to fall.

6 min
Local failure of cement board (beam protection) at Level-1. Fire spreads to level-2.

15 min
Fire load at level-1 almost fully consumed. Flashover at Level-2.

10 min
Flashover at level-1. Excessive façade failure. Fire services response time.

17 min
Fire spreads to Level-3.
SUMMARY OF OBSERVATIONS

- Glass usually falls out intact due to cladding frame failure
- Response time for fire fighters doubles when rated systems are used
- Standard material performs much better than local
- MDF responded better to fire than ACP
- Insulation filling of ACP is a major concern (can onset secondary fire)
- Workmanship of structural fire protection is important
- Rated fire stop materials very effective
- Treat the building as a system and not as component units
Questions & Answers

Who to Contact

1-877-UL-HELPS
FireSafetyQuote@ul.com
For more information, visit our website www.ul.com

Quoting
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Thank you!