Designing for Fire Safety

Complying with NFPA 285 Test Standard for Exterior Walls

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ECS Mid-Atlantic, LLC

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COURSE DESCRIPTION

When considering the building enclosure, fire safety is an important design factor and needs to be considered hand-in-hand with energy code requirements. The NFPA 285 "Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components" is a common consideration with modern building assemblies that use combustible materials.

This presentation will review the history and scope of the NFPA 285 test standard, and its adoption within the International Building Code (IBC). It will outline the criteria for compliance, as well as identify triggers and contributors under the standard. The presentation will review how the selection building components such as insulation, air/water resistive barriers and claddings, can affect the fire performance of an assembly, and identify solutions and common paths for compliance.

LEARNING OBJECTIVES

After attending this presentation, participants will be able to:

01 **Discuss the importance of fire and safety design considerations as it relates to the building enclosure;**

02 **Discuss the history, scope and testing procedure outlined in the NFPA 285 test standard;**

03 **Understand the requirements of NFPA 285 compliant assemblies and the implications of building materials selection;**

04 **Identify passive design solutions to achieve compliance and resources available with compliant designs.**

AUDIENCE SURVEY

1. Who has specified or participated in projects requiring NFPA 285?
2. Have you had plan review comments regarding NFPA 285?
3. Do you see NFPA 285 as a liability issue for Owners, Architects, or Contractors?

AGENDA

01 Introduction

02 Why Are We Here?

03 A Brief History

04 The Test Standard

05 Model Code Adoption

06 Local Adoptions

07 Compliance Paths

08 Non-Combustible Construction

WHY ARE WE HERE?

IT'S NOT NEW

Energy Crisis:
Leads to increased exterior insulation applications

1988:
Uniform Building Code adopts UBC 17-6

1997:
Uniform Building Code adopts UBC 26-9

2000:
IBC begins requiring NFPA 285 testing

1970's → 1980's → 1990's → 2000's → 2010's

Late 70's:
SPI develops full-scale test

Full-scale Fire Test
UBC 17-6 / UBC 26-4

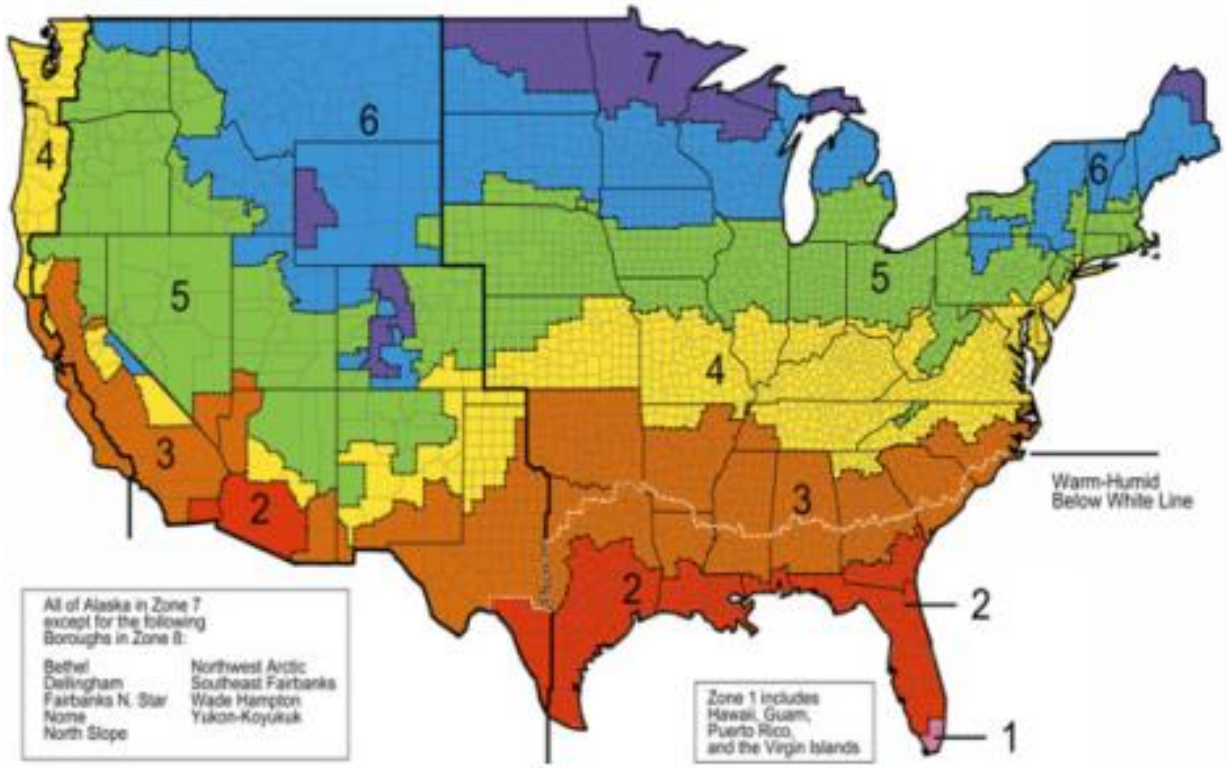
1998:
NFPA adopts UBC 26-9 as NFPA 285

Reduced-scale Fire Test
UBC 26-9 / NFPA 285

2012:
IBC expands NFPA 285 testing to WRB

ENERGY CATCHES FIRE

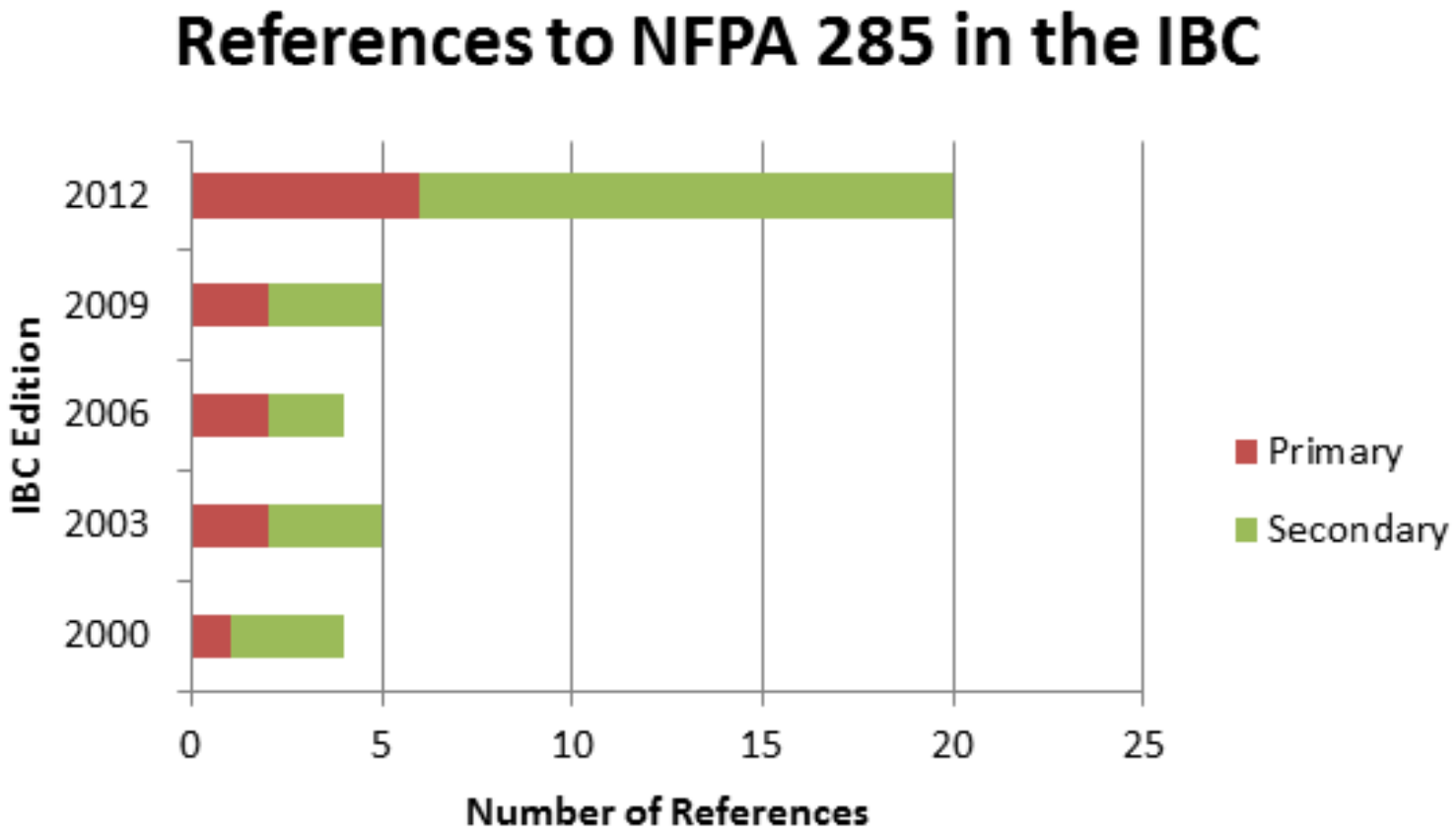
Increasing Mandatory use of Continuous Insulation (ci) in EVERY climate zone



Climate Zone	IECC 2009	IECC 2012
8	R13 + R7.5ci	R13 + R7.5ci
7	R13 + R7.5ci	R13 + R7.5ci
6	R13 + R7.5ci	R13 + R7.5ci
5	R13 + R7.5ci	R13 + R7.5ci
4	R13 + R7.5ci	R13 + R7.5ci
3	R13 + R3.8ci	R13 + R5ci
2	R13	R13 + R5ci
1	R13	R13 + R5ci

Climate Zone	ASHRAE 90.1 2010	ASHRAE 90.1 2012
8	R13 + R7.5ci	R13 + R18.8ci
7	R13 + R7.5ci	R13 + R12.5ci
6	R13 + R7.5ci	R13 + R12.5ci
5	R13 + R7.5ci	R13 + R10ci
4	R13 + R7.5ci	R13 + R7.5ci
3	R13 + R3.8ci	R13 + R5ci
2	R13	R13 + R3.8ci
1	R13	R13

TRIGGERS ARE GROWING



COST OF TESTING

A “BRIEF” HISTORY

A BRIEF HISTORY

The Coconut Grove Fire

28 November 1942 | Boston, MA

"The Coconut Grove club was the scene of the deadliest nightclub fire in history, killing **492 people**."

A BRIEF HISTORY

La Salle Street Hotel Fire

5 June 1946 | Chicago, IL

"…a fire broke out in the hotel, killing **61 people**, many of them children.

The fire began on the lower floor before ascending stairwells and shafts. The fire started either in the walls or in the ceiling…

A BRIEF HISTORY

Winecoff Hotel Fire

7 Dec 1946 | Atlanta, GA

In 1913, the "**absolutely fireproof**" Winecoff Hotel was designed and built without sprinklers, fire escapes, or even an alarm system.

In 1946 **119 people** lost their lives.

A BRIEF HISTORY

What do these events have in common?

- Lack of alarm to notify occupants of first responders
- Lack of Interior Fire Separation
- Lack of Fire Suppression
- Lack of Egress
- Lack of Closure and Pressurization/Ventilation of Stairwells
- **Interior finish and material combustibility and smoke development**


San Luis Obispo Telegram-Tribune

DEATH TOLL IN BOSTON FIRE MOUNTS TO 479

Complete Inquiry Launched

Russians Bite Deeper Into German Lines

Mad Panic in Fire Told by Survivors

Italians Urged To Revolt

Third Big Offensive Started

State-wide Hunt Continues For Two Escaped Prisoners

A BRIEF HISTORY

The Response

"The magnitude of the fire fatalities in each of these fires was directly related to the rapid **flame spread and smoke development** of the interior finish materials…"

A BRIEF HISTORY

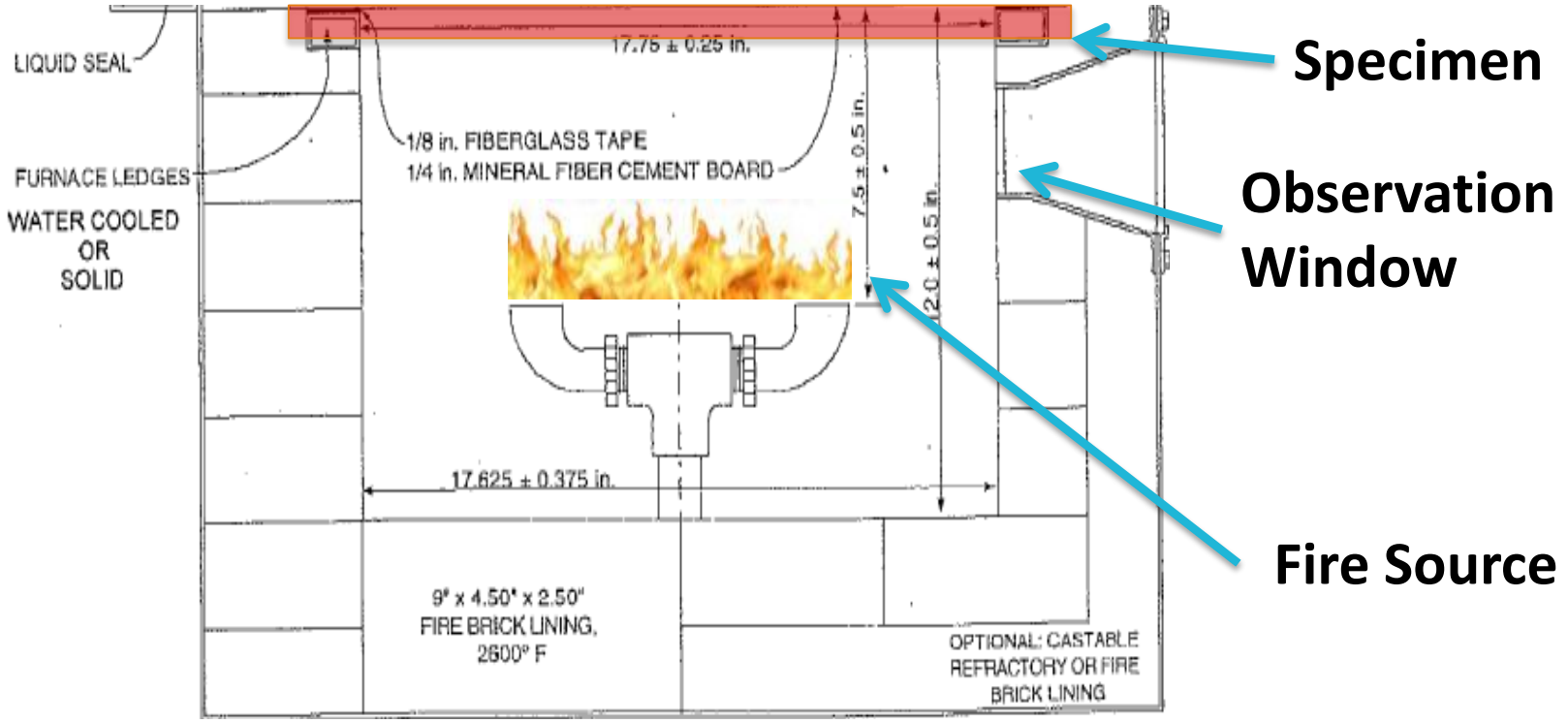
"Steiner Tunnel Test" - ASTM E84

Adapted to address rapid flame spread over a surface of interior finishes

- "Flame Spread"
- "Smoke Developed"
- Fiber-Cement Board = 0/0
- Red Oak Flooring = 100/100

A BRIEF HISTORY

ASTM E84 and ASTM D1692 - “Non-Burning” Plastic Building Products



Section View of Apparatus

A BRIEF HISTORY

Childress Home Fire

Clack County, Missouri (1969)

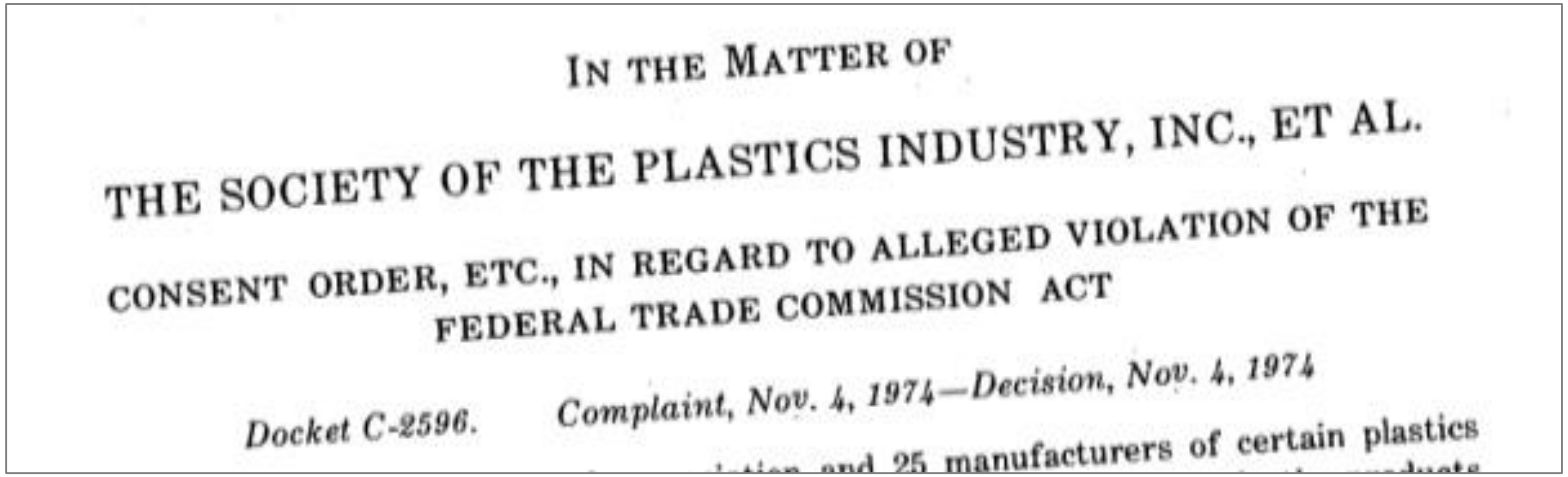
- A home with exposed Foam Plastic
- Foam Plastic sold as “non-burning” or “self-extinguishing”
- Fire killed two children
- Parents won a suit against the manufacturer, which was appealed and upheld

The Federal Trade Commission (FTC) filed a complaint against the Society of the Plastics Industry and ASTM as well as 25 Manufactures of Foam Plastic marketing the product as “non-burning” or “self-extinguishing.”

A BRIEF HISTORY

1974 Federal Trade Commission Ruling

- A Consent Decree including 25 Manufactures and SPI, requiring:
  - Notification of prior purchasers of their foams
  - Sponsoring product research ($5M)
  - Resulted in a 1980 Final Report of the Products Research Committee



IN THE MATTER OF

THE SOCIETY OF THE PLASTICS INDUSTRY, INC., ET AL.

CONSENT ORDER, ETC., IN REGARD TO ALLEGED VIOLATION OF THE FEDERAL TRADE COMMISSION ACT

Docket C-2596. *Complaint, Nov. 4, 1974—Decision, Nov. 4, 1974*

and 25 manufacturers of certain plastics

A BRIEF HISTORY

Energy Crisis: Leads to increased exterior insulation applications

1988: Uniform Building Code adopts UBC 17-6

1997: UBC adopts UBC 26-9

2000: IBC adopts NFPA 285

1970's → 1980's → 1990's → 2000's → 2010's

Full-scale Fire Test
UBC 17-6 / UBC 26-4

1998: NFPA adopts UBC 26-9 as NFPA 285

Reduced-scale Fire Test
UBC 26-9 / NFPA 285

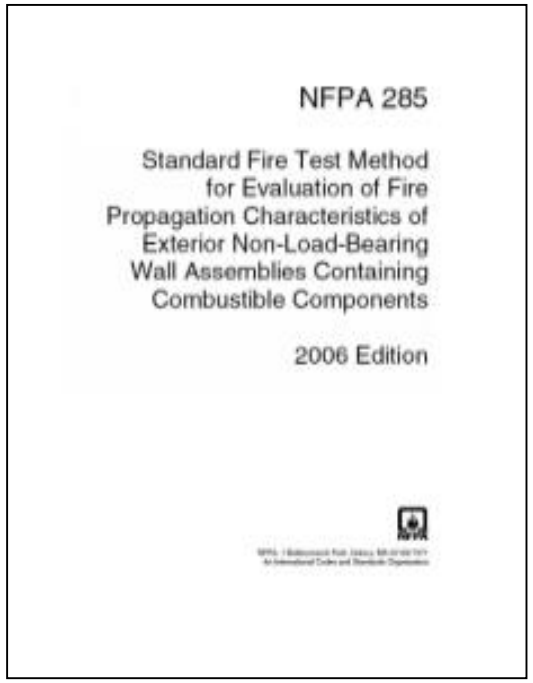
2012: IBC expands NFPA 285 testing to WRB

- Southwest Research Institute (SWRI) provided the research that lead to the development of the **UBC 17-6 the "Full Scale Test"**
- **1988** UBC 17-6 was first incorporated into a model building code
- In the 1990's "**indoor, intermediate scale, multi-story test apparatus**" renumbered **UBC 26-9** due to reorganizations of the UBC
- **In 1998 NFPA adopted the NFPA 285** which is similar to UBC 26-9
- NFPA 285 was incorporated into the **2000 IBC** in Chapter 26 for Foam Plastics

THE TEST STANDARD

THE TEST STANDARD

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


NFPA 285

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

2006 Edition

THE TEST STANDARD…AN "INTERMEDIATE SCALE TEST"

An **"Intermediate Scale Test"** at just under 18ft tall;
UBC 17-6 was a "Full Scale" version test at 25ft tall

UBC 17-6 "Full Scale"
25 feet tall

NFPA 285-2006
17'-6" Minimum

THE TEST STANDARD…A TEST TO REPRESENT FLASHOVER

- A “reduced scale” at 18ft tall
- Simulates “flash over” + 25 min.
  - 1 Ton of Maple Wood +/-
  - Suppression has failed
  - The temperature in the room spontaneously ignites all flammable materials

THE TEST STANDARD…AN ASSEMBLY TEST

- A “reduced scale” at 16ft tall
- Simulates “flash over”
- An Assembly Test
  - This is important!
  - Includes multiple specific and necessary materials
  - Includes details in compliant specimen
  - Details in the specimen may or may not match “manufacturers standard” details

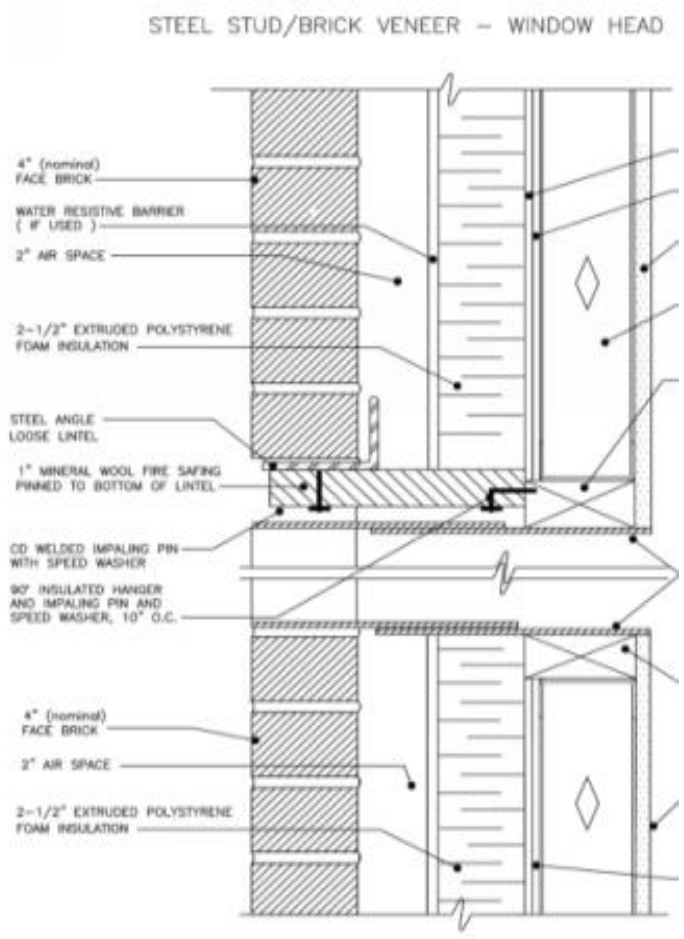
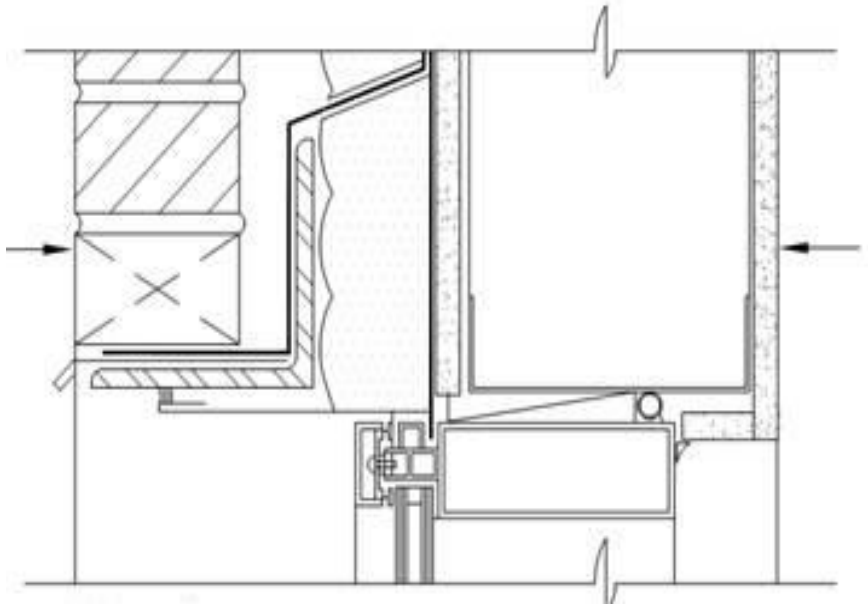


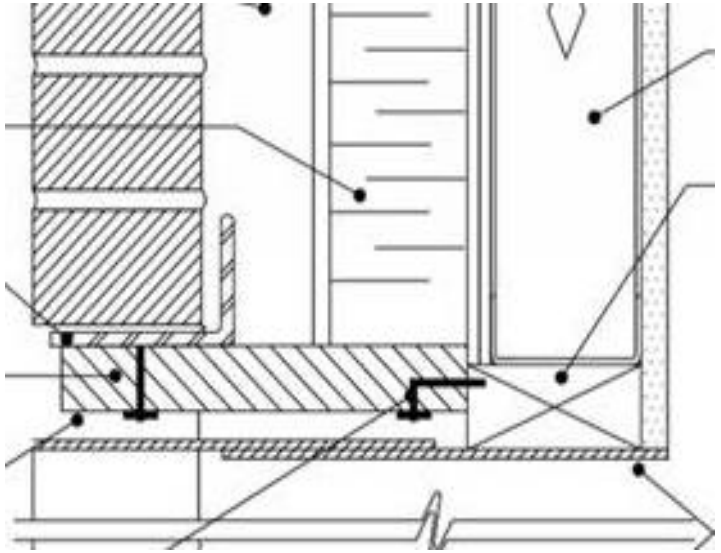
Figure 1 – Window / Door Opening Detai

THE TEST STANDARD…AN ASSEMBLY TEST

Product Literature



NFPA 285 Compliance



Window Head Detail

THE TEST STANDARD – THE *APPARATUS* AND SPECIMENT

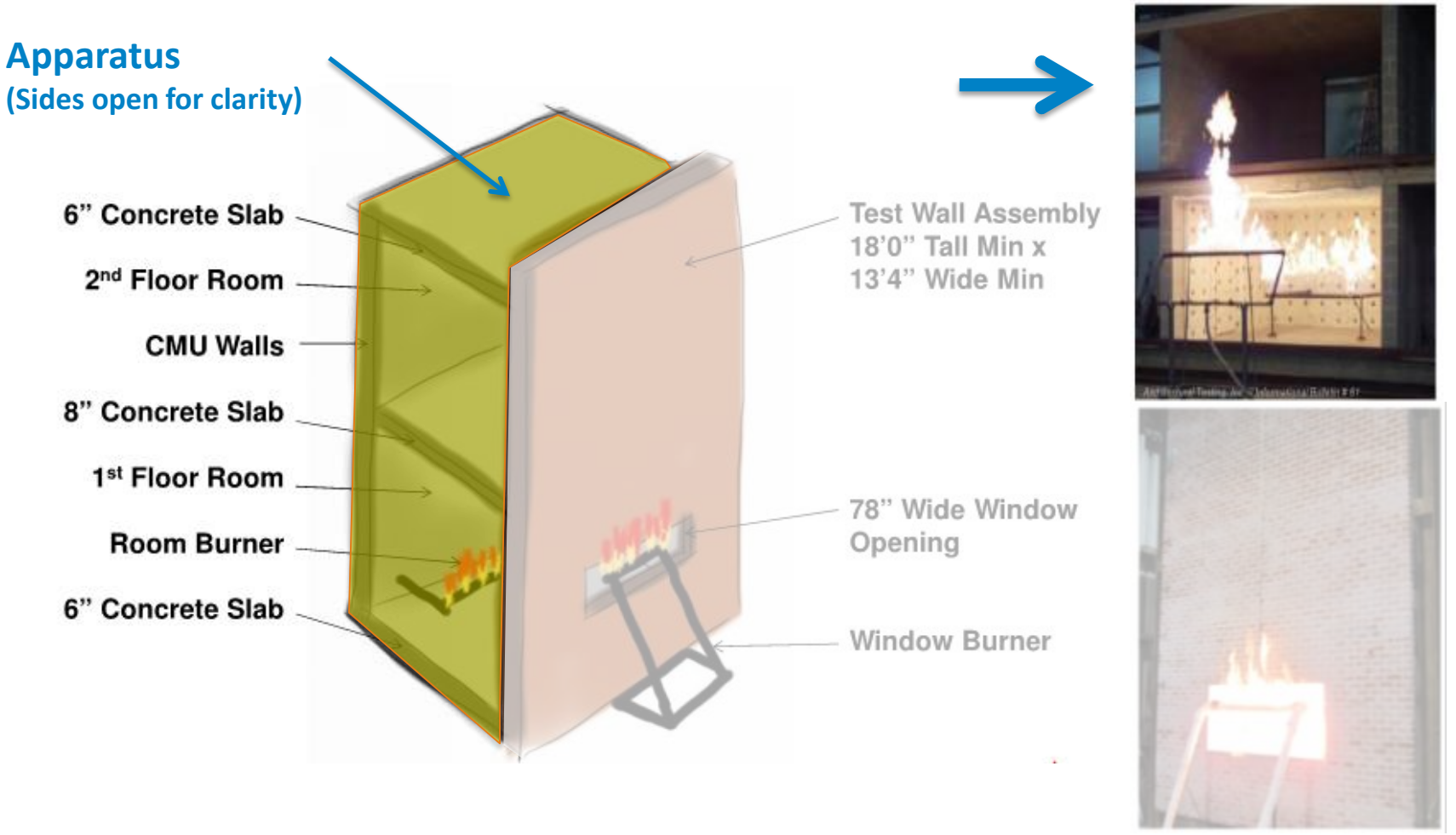


Image courtesy of DuPont Building Innovations

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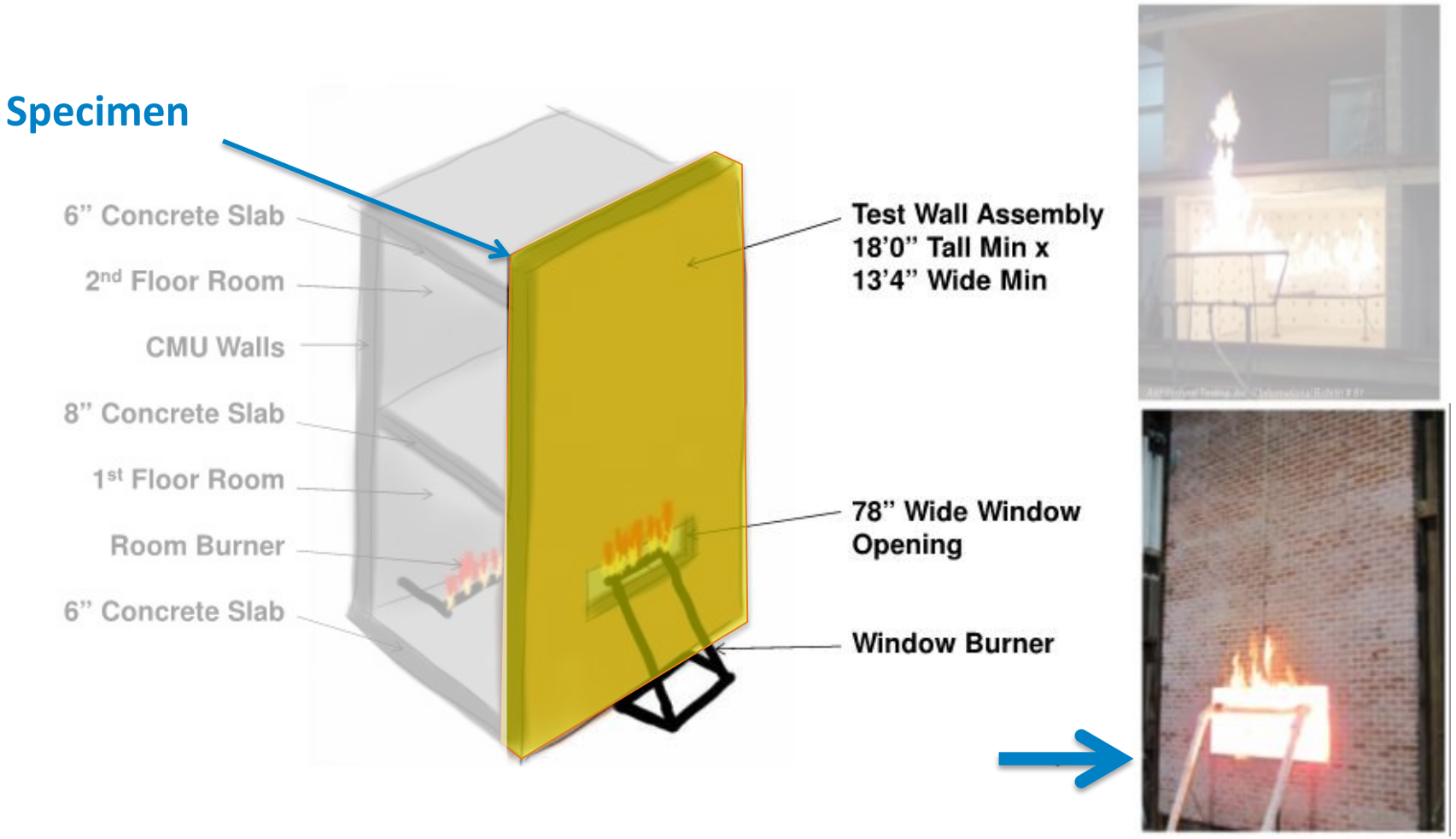


Image courtesy of DuPont Building Innovations

THE TEST STANDARD – NFPA 285 FIRE TEST - COMPONENTS

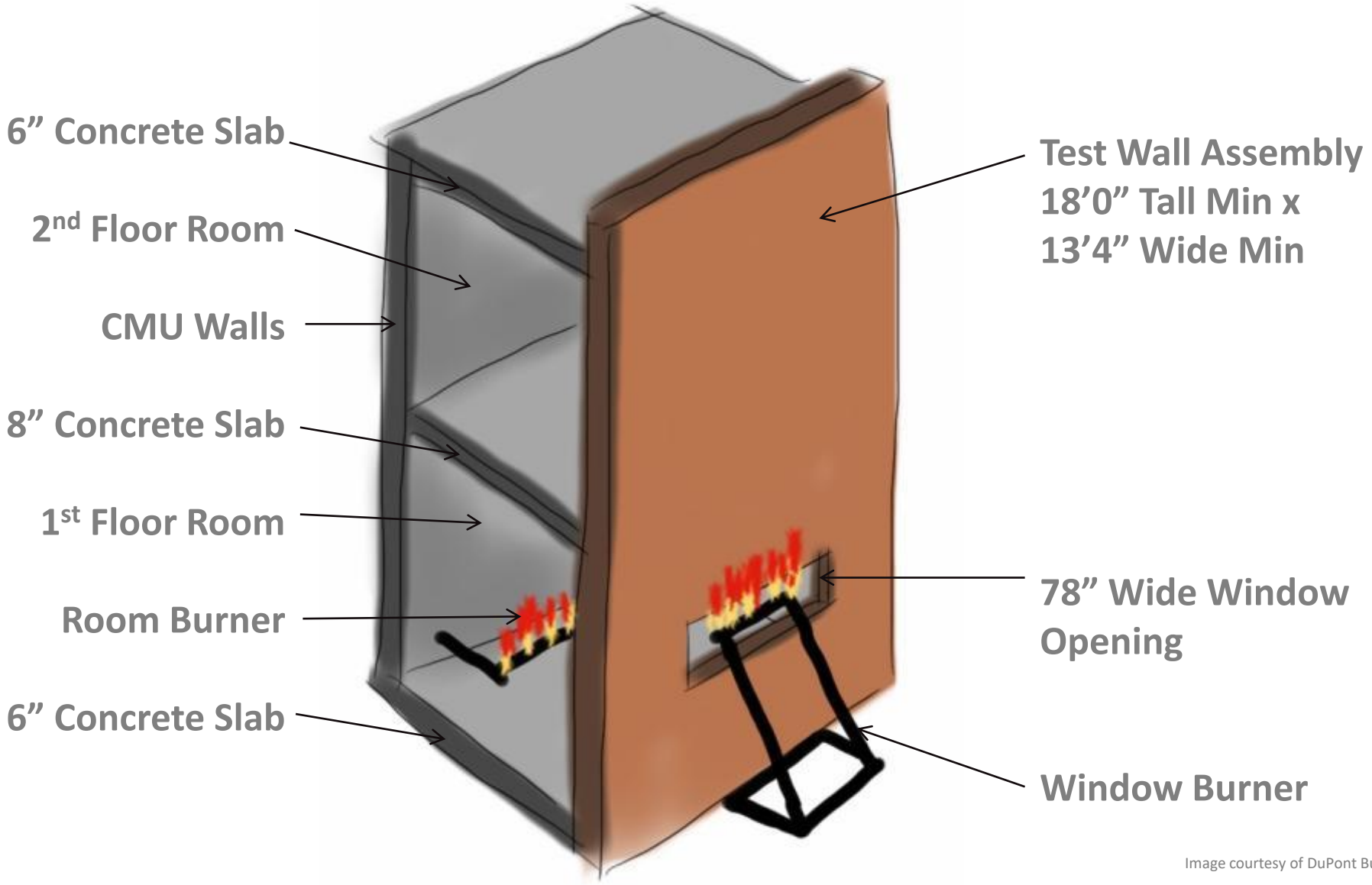


Image courtesy of DuPont Building Innovations

THE TEST STANDARD

Test Procedure

00:00 Ignition of Room Burner

- Represents Ignition of Contents Uncontrolled by Suppression
- 39,000 Increasing to 51,500 BTU/min

05:00 Ignition of Window Burner

- Represents Flashover of Room Contents
- 9 inches below and 4.5 inches from the window head
- 10,000 increasing to 22,500 BTU/min
- Burns for 25 minutes

30:00 Burners Extinguished

- Continued Observation for Flame and Temp Propagation

40:00 Termination of Test

THE TEST STANDARD

Application: To Evaluate Flame Propagation Characteristics specified in the following:

- resist flame propagation over the **exterior face of the wall assembly**
- resist vertical flame propagation **within the combustible core**
- resist vertical flame propagation over the **interior surface** of the wall assembly from one story to the next
- resist lateral flame propagation from the **compartment of fire origin** to adjacent compartments

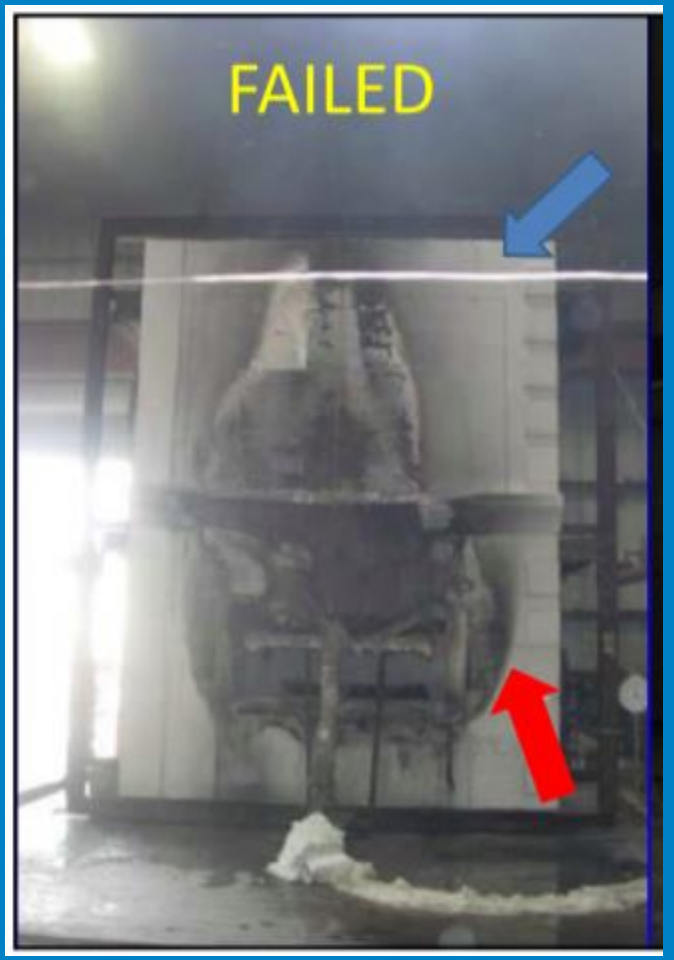


Image courtesy of DuPont Building Innovations

THE TEST STANDARD

No flame propagation
in 2nd floor room

Image courtesy of DuPont Building Innovations

THE TEST STANDARD

Externally, Flames shall not reach 10’ above the window’s top

Externally, Flames shall not reach 5’ laterally from the window’s centerline

Image courtesy of DuPont Building Innovations

THE TEST STANDARD

Inside wall assembly, Thermocouples shall not exceed 1000 ºF during the test.

Image courtesy of DuPont Building Innovations

THE TEST STANDARD …WHAT IT ISN'T!

A substitution for additional fire protection requirements within the code

- Separations
- Egress
- Suppression
- Additional product fire resistance

A test to evaluate the impact of an exterior fire

- Construction Fire
- Dumpster Fire
- Errant Fireworks

MODEL CODE ADOPTION

MODEL CODE ADOPTION

Construction Types

(from IBC Chapter 5 and 6)

Combustible

Non-Combustible

Type V Combustible Construction

Type IV Heavy Timber Construction

Type III Non-Combustible Exterior

Type II Non-Combustible Exterior and Components

Type I Non-Combustible Materials and Structure

MODEL CODE ADOPTION

- Maximum Building Height (IBC Table 503)
- Including 1-story sprinkler system increase



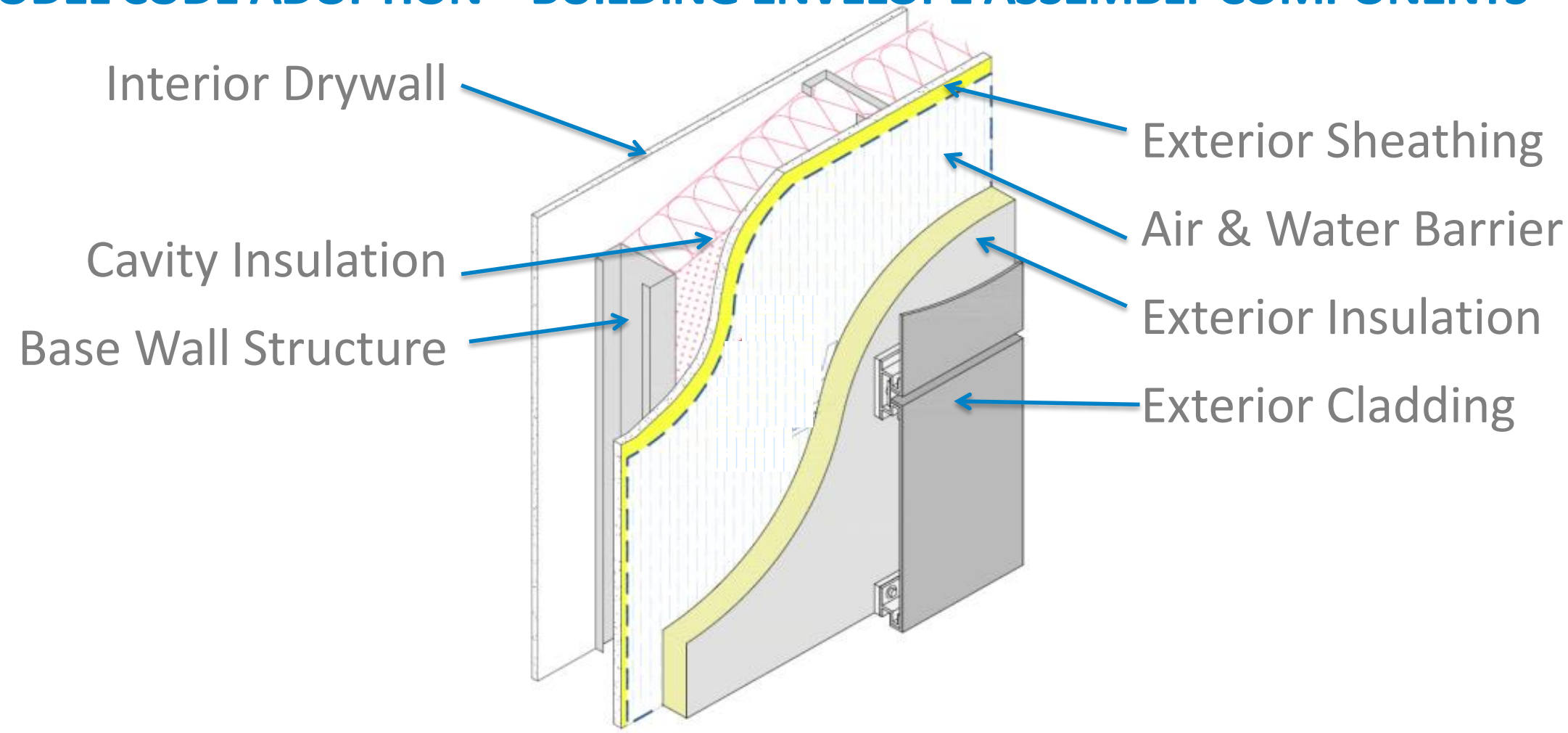


	Type V Combustible	Type IV Heavy Timber	Type III Non-Combustible Exterior	Type II Non-Combustible Components	Type I Fire-Rated Structure
Assembly***	3	4	4	4	Unlimited
Education	2	4	4	4	Unlimited
Business	4	6	6	6	Unlimited
Factory/Ind	4	6	5	6	Unlimited
High Hazard	4	6	6	6	Unlimited
Institutional	3	5	5	5	Unlimited
Mercantile	4	5	5	5	Unlimited
Residential	4	5	5	5	Unlimited
Storage	5	6	5	6	Unlimited
Utility	3	5	4	5	Unlimited

MODEL CODE ADOPTION

- Product Properties
  - **ASTM E84** Surface Burning Characteristics
  - **ASTM E1354** Cone Calorimeter Test
  - **ASTM E136** Combustible Materials
  - Evaluation Reports *(ICC-ES; CCR's, etc.)*
- Assembly Properties
  - **ASTM E 119** or **UL 263** Fire Rated Walls
  - **NFPA 268** Radiant Ignitibility of Assemblies
  - **NFPA 285** Walls With Combustible Components

MODEL CODE ADOPTION – BUILDING ENVELOPE ASSEMBLY COMPONENTS



MODEL CODE ADOPTION – IBC NFPA 285 TESTING

NFPA 285 REQUIRED

Foam Plastic Insulation (Ch. 26)

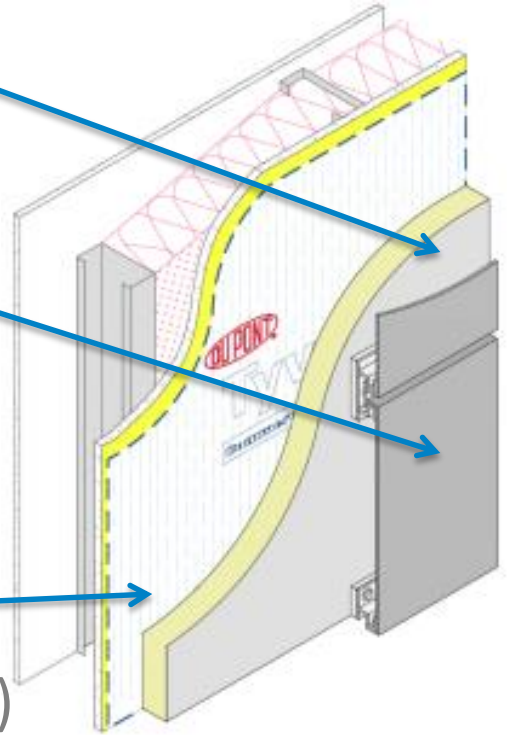
- Applies to Type I – IV construction (~1988)
- Applies to buildings of any height

Combustible Exterior Cladding (Ch. 14)

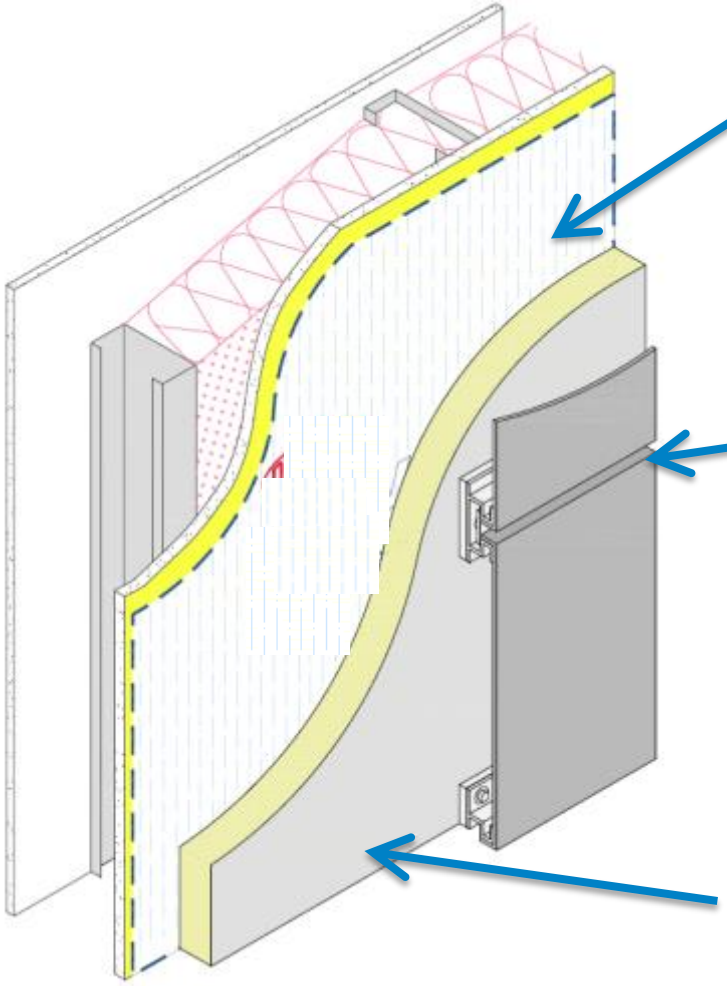
- EIFS - (~2000 IBC)
- MCMs - (~2003 IBC)
- FRPs - (~2009 IBC)
- HPLs - (~2012 IBC)

Water-Resistive Barriers (Ch. 14)

- Applies to Type I, II, III, IV buildings over 40 ft - (2012 IBC)
- Applies to combustible WRB's - (2012 IBC)



MODEL CODE ADOPTION – IBC COMBUSTIBLE COMPONENT REQUIREMENTS



Air & Water Barriers – §1403.5

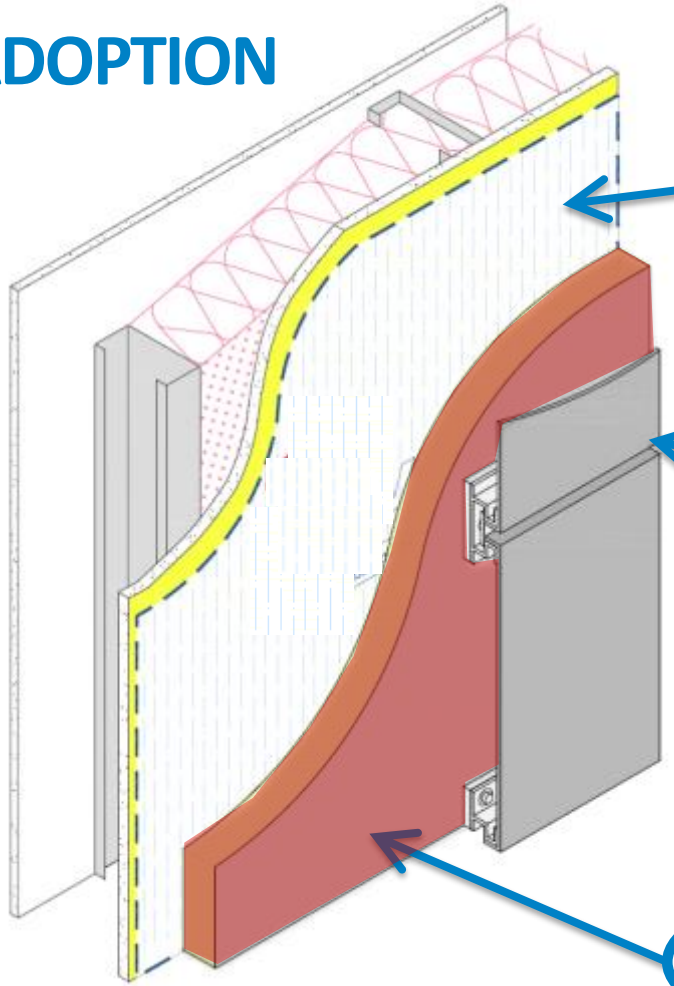
Combustible Claddings

- EIFS - § 1408.2
- MCM - § 1407.10
- FRP - § 2612.5
- HPL - § 1409.10

Foam Plastic Insulation – § 2603.5.5

MODEL CODE ADOPTION

Exterior Insulation



Air & Water Barriers –§1403.5

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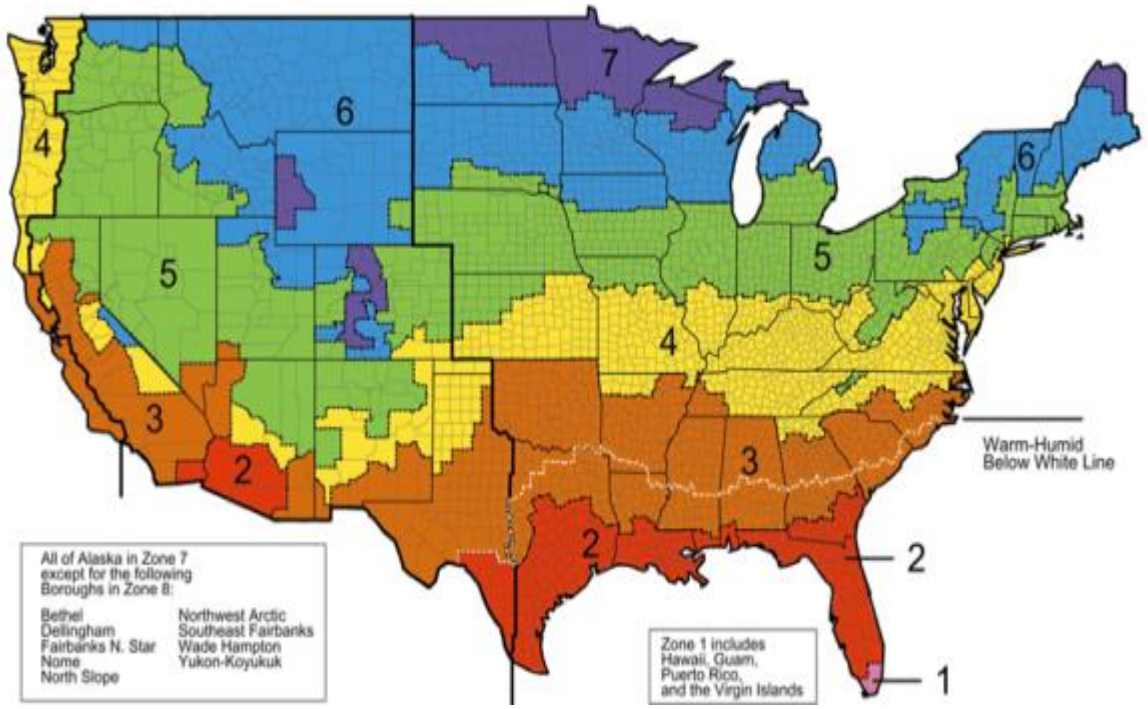
- HPL - § 1409.10

Foam Plastic Insulation – § 2603.5.5

MODEL CODE ADOPTION

Climate Zones & Continuous Insulation Requirements

Increasing Mandatory use of Continuous Insulation (ci) in EVERY climate zone



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3	R13 + R3.8ci	R13 + R5ci
2	R13	R13 + R5ci
1	R13	R13 + R5ci

Climate Zone	ASHRAE 90.1 2010	ASHRAE 90.1 2012
8	R13 + R7.5ci	R13 + R18.8ci
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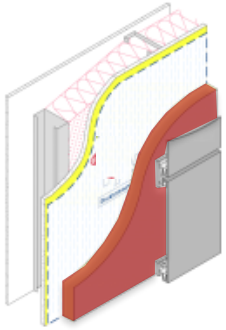
5	R13 + R7.5ci	R13 + R10ci
4	R13 + R7.5ci	R13 + R7.5ci
3	R13 + R3.8ci	R13 + R5ci
2	R13	R13 + R3.8ci
1	R13	R13

MODEL CODE ADOPTION



Common Insulation Types

Glass Fiber Batt

- R-value: ~3.3 R/in
- Permeability: 118 perm-in

Spray Polyurethane Foam

- R-value: ~6 R/in (high density)*
- Permeability: ~1.9 perm-in

EPS (Expanded Polystyrene)

- R-value: ~4 R/in
- Permeability: ~2.7 perm-in

XPS (Extruded Polystyrene)

- R-value: ~5 R/in
- Permeability: ~0.8 perm-in

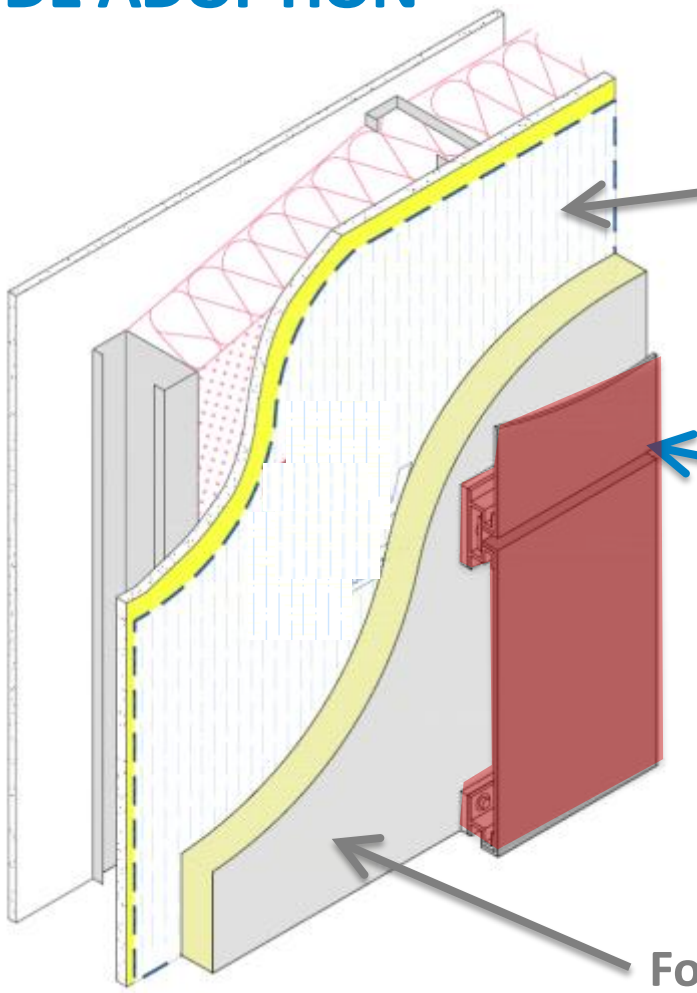
Polyisocyanurate

- R-value: ~6 R/in
- Permeability: ~0.75 perm-in

Mineral Fiber

- R-value: ~4 R/in
- Permeability: ~54 perm-in

MODEL CODE ADOPTION



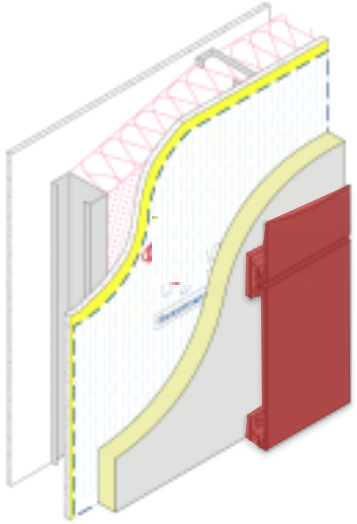
Air & Water Barriers –§1403.5

Combustible Claddings

- EIFS - § 1408.2
- MCM - § 1407.10
- FRP - § 2612.5
- HPL - § 1409.10

Foam Plastic Insulation – § 2603.5.5

MODEL CODE ADOPTION



COMBUSTIBLE

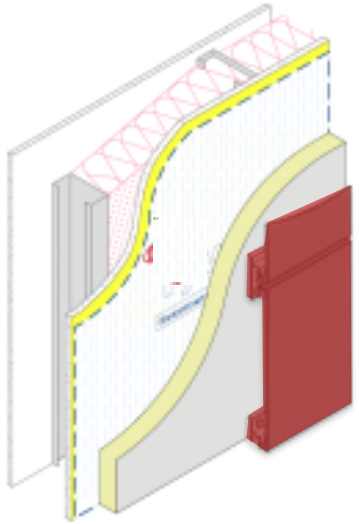
- Exterior Insulation Finishing Systems (EIFS)
- Metal Composite Materials (MCMs)
- Fiber Reinforced Plastics (FRPs)
- High Pressure Laminates (HPLs)

NON-COMBUSTIBLE

- Brick / Masonry / Stone / Terracotta
- Concrete / Cementitious Stucco
- Fiber Cement Boards / Panels

Image courtesy of DuPont Building Innovations

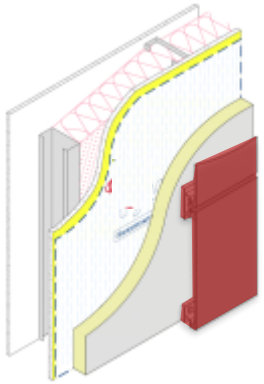
MODEL CODE ADOPTION

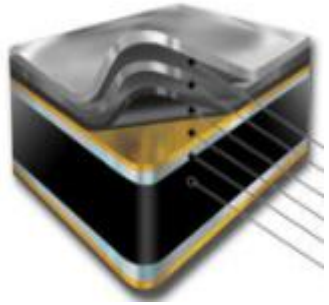


- **Exterior Insulation Finishing Systems (EIFS)**
  - IBC regulates under “Foam Plastic” Requirements
  - Meets the EIFS performance requirements of ASTM E2568
- **Metal Composite Materials (MCMs)**
- **Fiber Reinforced Plastics (FRPs)**
- **High Pressure Laminates (HPLs)**

Image courtesy of DuPont Building Innovations

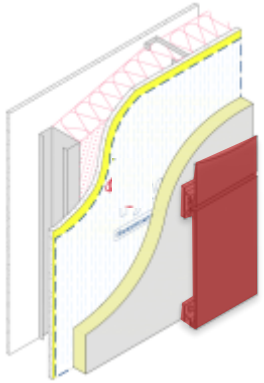
MODEL CODE ADOPTION





- **Exterior Insulation Finishing Systems (EIFS)**
- **Metal Composite Materials (MCMs)**
  - Excludes “Foam Plastic” core materials
  - Different core materials have different fire performance characteristics
  - Available in Open and Closed Joint Systems
  - Approximate 4mm-12mm panel thickness
- **Fiber Reinforced Plastics (FRPs)**
- **High Pressure Laminates (HPLs)**

MODEL CODE ADOPTION



http://www.cranecomposites.com

- **Exterior Insulation Finishing Systems (EIFS)**
- **Metal Composite Materials (MCMs)**
- **Fiber Reinforced Plastics (FRPs)**
  - Foam cores comply with “Foam Plastic” Req’s
  - Installations less than 40’ above grade
    - Limited to 10% area when separation <10’
    - Flame Spread Index ≤200 (ASTM E84)
    - Fireblocking Required
- **High Pressure Laminates (HPLs)**

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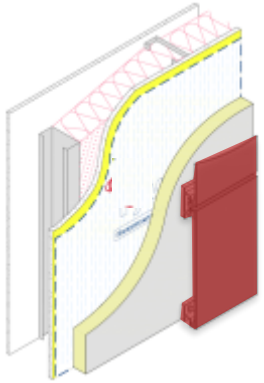

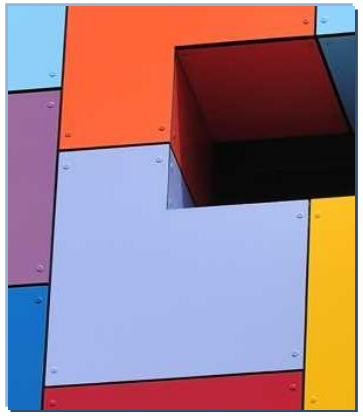

- Exterior Insulation Finishing Systems (EIFS)
- Metal Composite Materials (MCMs)
- Fiber Reinforced Plastics (FRPs)
- High Pressure Laminates (HPLs)
  - Available in Open and Closed Joint Systems
  - Approximate 4mm-12mm panel thickness
  - Different core materials have different fire performance characteristics
  - Installations less than 40’ above grade
    - Limited to 10% area when separation < 5’

http://www.trespa.com

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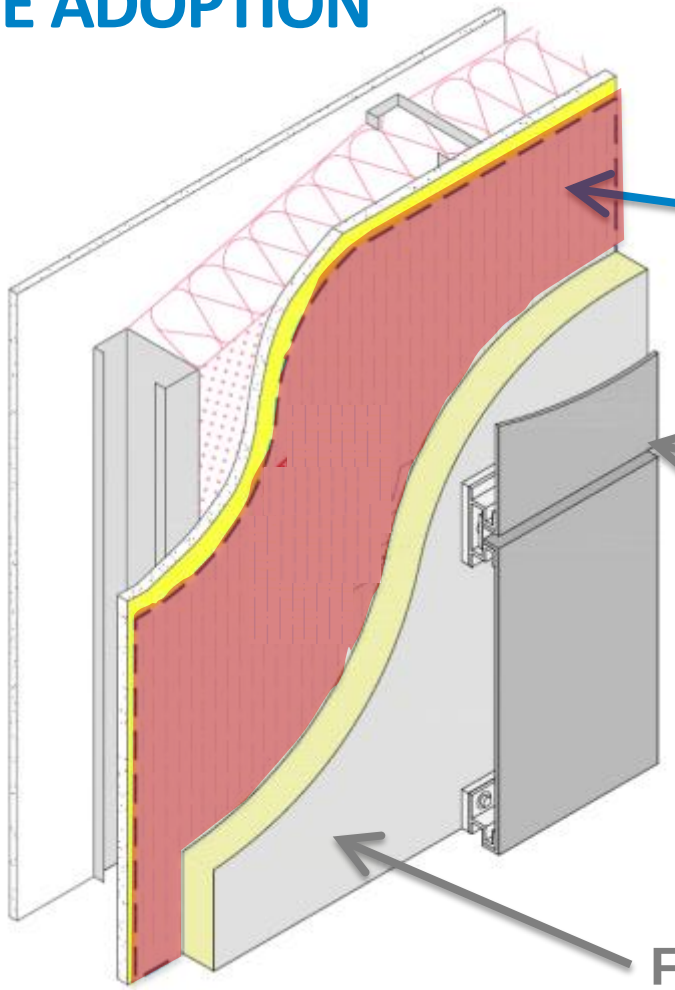

Air & Water Barriers –§1403.5

Combustible Claddings

- EIFS - § 1408.2
- MCM - § 1407.10
- FRP - § 2612.5
- HPL - § 1409.10

Foam Plastic Insulation – § 2603.5.5

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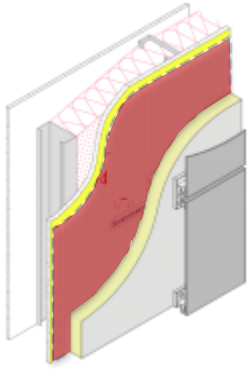

COMBUSTIBLE

- **Water Resistive Barriers (WRBs)**
  - Building Wraps
  - Self Adhered Building Wraps
  - Self Adhered Membranes
  - Fluid Applied Membranes

- 2012 IBC: Installations over 40’ above grade must meet the requirements of NFPA 285 (Type I, II, III, or IV)

2015 IBC has approved WRB exceptions based on material properties and fuel load potential

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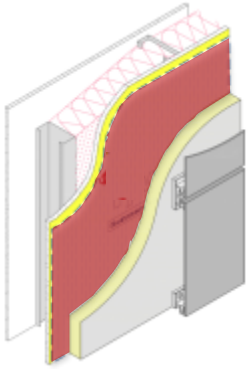

IBC NFPA 285 Test Requirements for WRBs

	Pre-2012	2012	2015
NFPA 285 Test Req's	None	Installations over 40' above grade must meet the requirements of NFPA 285 (Type I, II, III, or IV)	
Exceptions	N/A	None	**1.** WRB is the only combustible wall component and the wall has a non-combustible covering (Table 1405.2) **2.** WRB is the only combustible wall component and: -ASTM E84 Product Test: -flame spread index of 25 or less -smoke-developed index of 450 } Class A -ASTM E1354 (Cone Calorimeter)Product Test: -Incident radiant heat flux of 50 kW/m2. -Effective Heat of Combustion of less than 18 MJ/kg -Peak Heat Release Rate less than 150 kW/m2 -Total Heat Release of less than 20 MJ/m2 **3.** Windows and doors, and window/door flashings

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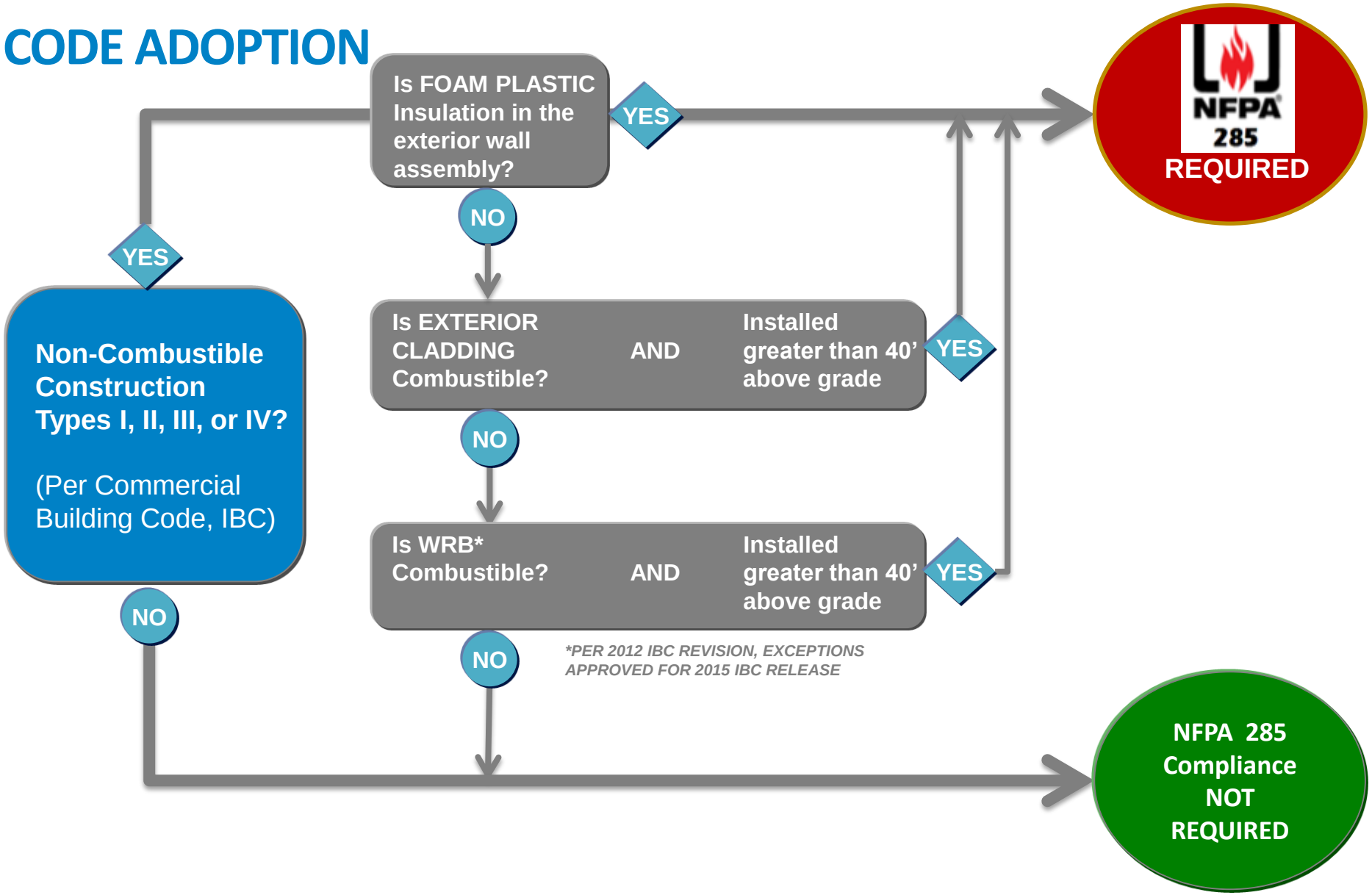


TYPE III & NFPA 285

Maximum Building Height (IBC Table 503)

Including 1-story sprinkler system increase





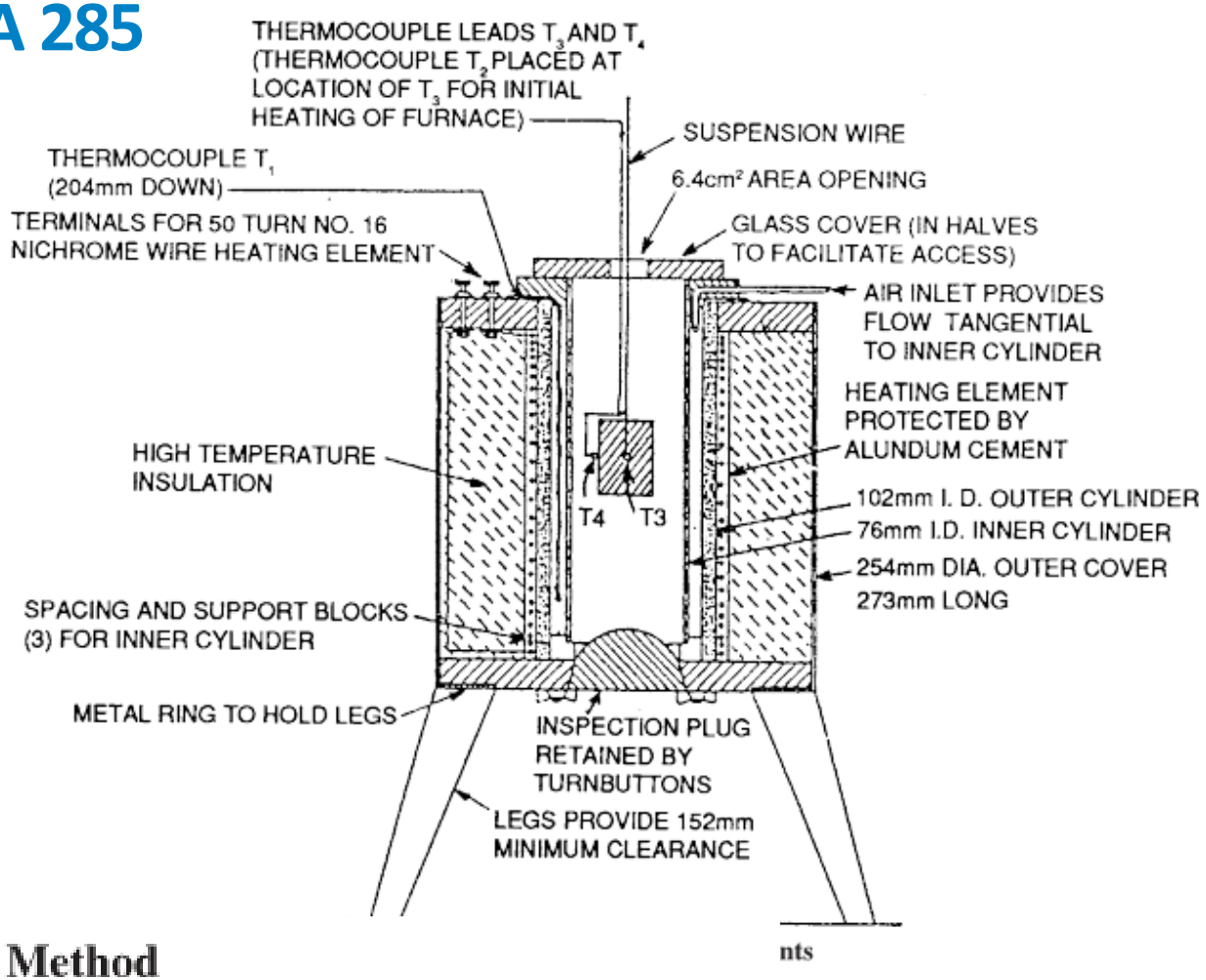
	Type V Combustible	Type IV Heavy Timber	Type III Non-Combustible Exterior	Type II Non-Combustible Components	Type I Fire-Rated Structure
Assembly***	3	4	4	4	Unlimited
Education	2	4	4	4	Unlimited
Business	4	6	6	6	Unlimited
Factory/Ind	4	6	5	6	Unlimited
High Hazard	4	6	6	6	Unlimited
Institutional	3	5	5	5	Unlimited
Mercantile	4	5	5	5	Unlimited
Residential	4	5	5	5	Unlimited
Storage	5	6	5	6	Unlimited
Utility	3	5	4	5	Unlimited

Source: 2012 International Building Code

TYPE III & NFPA 285

- **703.5 Noncombustibility tests.**
- **703.5.1 Elementary Materials**
- Materials required to be noncombustible shall be tested in accordance with ASTM E136.
- **703.5.2 Composite Materials**
- Materials having a structural base of noncombustible material as determined in accordance with Section 703.5.1 with a surfacing not more than 0.125 inch (3.18 mm) thick that has a flame spread index not greater than 50 when tested in accordance with ASTM E 84 or UL 723 shall be acceptable as noncombustible materials.

TYPE III & NFPA 285



4. Summary of Test Method

4.1 This test method uses a furnace to expose building materials to a temperature of 750°C (1382°F) until failure occurs or for at least 30 min.

TYPE III & NFPA 285

602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. *Fire-retardant-treated wood* framing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.

[BS] TREATED WOOD. Wood products that are conditioned to enhance fire-retardant or preservative properties.

Fire-retardant-treated wood. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire.

TYPE III & NFPA 285

2303.2 Fire-retardant-treated wood. *Fire-retardant-treated wood* is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E 84 or UL 723, a *listed* flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front shall not progress more than $10^{1}/_{2}$ feet (3200 mm) beyond the centerline of the burners at any time during the test.

TYPE III & NFPA 285

Type III Construction

Does this:

ASTM E84

Equal this:

ASTM E136

TYPE III & NFPA 285

Type III Construction

Does this:

ASTM E8

NO

RELATIVE TO NFPA 285 COMPLIANCE

Not this:

ASTM E136

TYPE III & NFPA 285

Type III Construction

602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. *Fire-retardant-treated wood* framing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.

The use of *fire-retardant treated wood* in Type III Construction is an allowance, not an equivalency.

TYPE III & NFPA 285

NFPA® 285

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

2012 Edition

1.1* Scope.

1.1.1* This standard provides a test method for determining the fire propagation characteristics of exterior non-load-bearing wall assemblies and panels used as components of curtain wall assemblies, that are constructed using combustible materials or that incorporate combustible components, and that are intended to be installed on buildings required to have exterior walls of non-combustible construction.

1.1.2* The fire propagation characteristics are determined for post-flashover fires of interior origin.

TYPE III & NFPA 285

1403.5 Vertical and lateral flame propagation. Exterior walls on buildings of Type I, II, III or IV construction that are greater than 40 feet (12 192 mm) 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. For the purposes of this section, fenestration products and flashing of fenestration products shall not be considered part of the *water-resistive barrier*.

Exceptions:

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 1405.2.
2. Walls in which the *water-resistive barrier* is the only combustible component and the *water-resistive barrier* has a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18 MJ/kg as determined in accordance with ASTM E 1354 and has a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

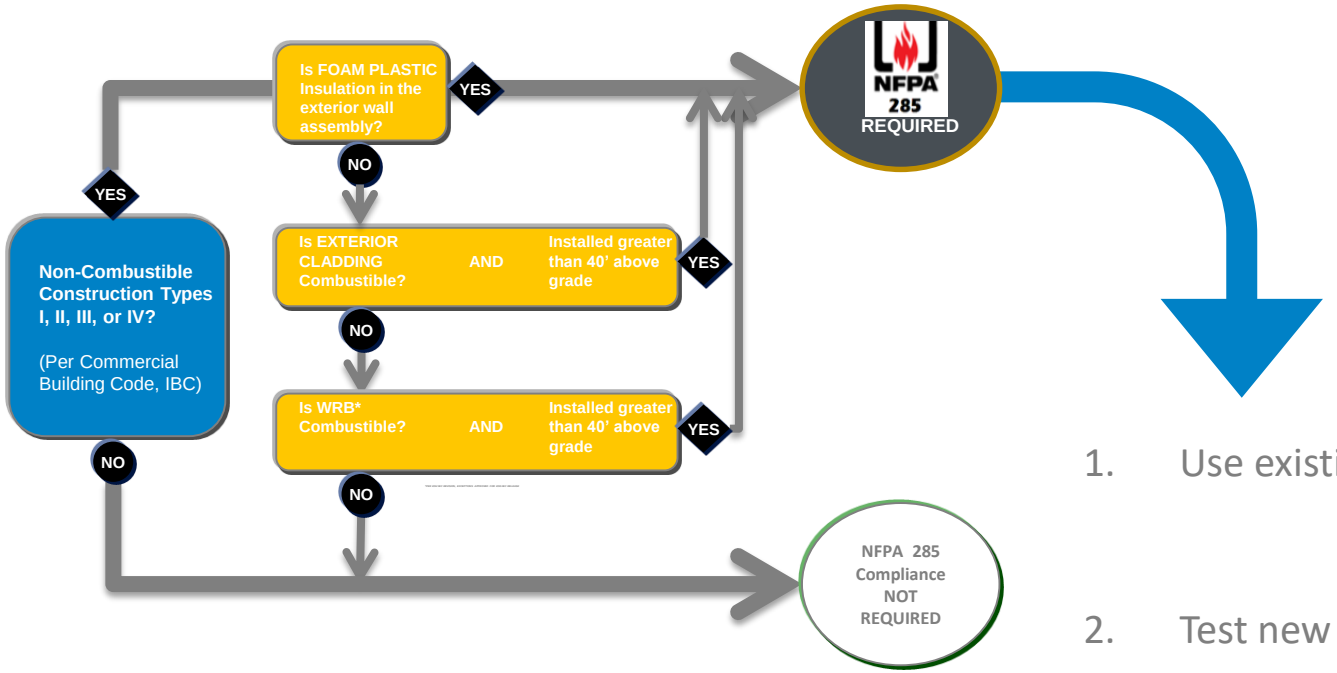
COMPLIANCE PATHS

COMPLIANCE PATHS

- Limited Testing Laboratory Availability
- Potential Costs
  - Testing Cost ~ $15-25K per test (Pass or Fail)*
  - Lead Time?
- Results are owned by the company paying for testing
  - Minimal Listings
  - No direct method for substituting assembly components
    - Engineering Judgments (EJ) ~ $3-5,000 each
    - EJ's require material testing to show equivalence

** Based on data provided in the JBED Summer 2012*

COMPLIANCE PATHS



1. Use existing NFPA 285 tested compliant system

OR

2. Test new assembly per NFPA 285

OR

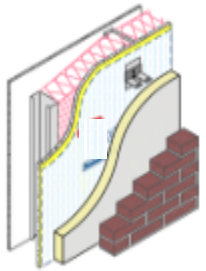
3. Modify an existing NFPA 285 compliant system with local Authority Having Jurisdiction (AHJ) approval, such as building officials

COMPLIANCE PATHS

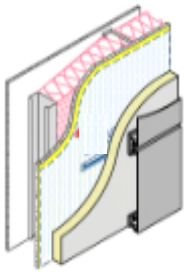
- Required for various components in all configurations
- For example, There is no one test or test assembly to qualify a WRB for use in all assemblies
- Changes in configurations (air gaps, attachment systems, etc.) can cause different results
- If a “New” combustible component is added in the wall assembly, then new testing required for all of the various configurations.

COMPLIANCE PATHS – VARIATIONS IN WALL ASSEMBLIES

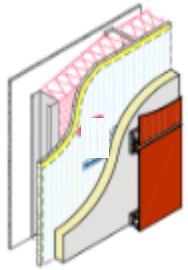
WRB / Polyiso / Brick



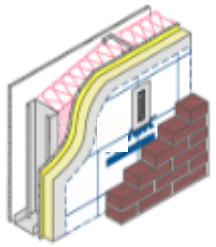
WRB / Polyiso / MCM



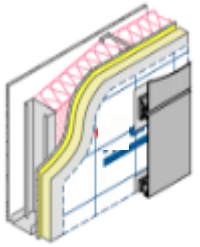
WRB / Polyiso / HPL



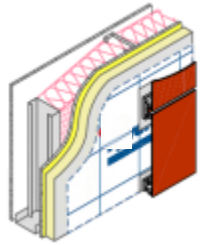
WRB Over / Polyiso / Brick



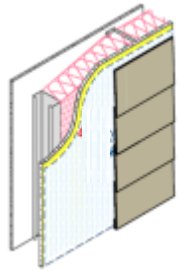
WRB Over / Polyiso / MCM



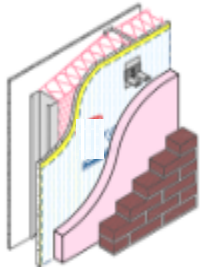
WRB Over / Polyiso / HPL



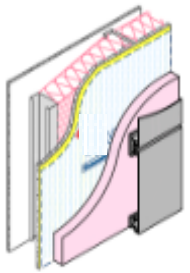
WRB / Fiber Cement



WRB / XPS / Brick



WRB / XPS / MCM



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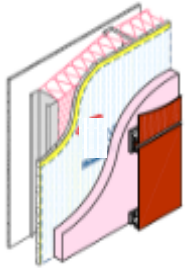
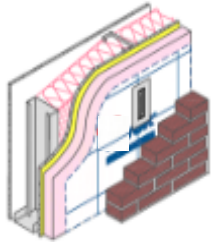
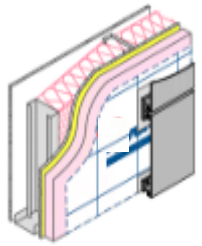


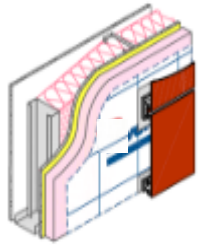
WRB Over / XPS / Brick



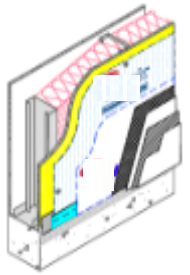
WRB Over / XPS / MCM



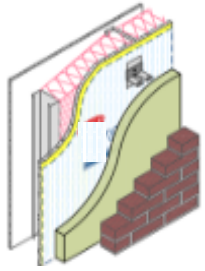
WRB Over / XPS / HPL



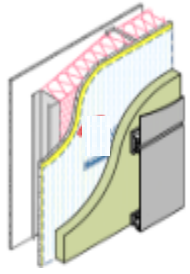
WRB / Stucco



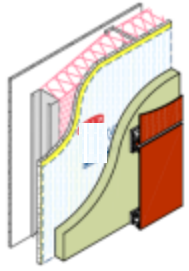
WRB / Mineral Fiber / Brick



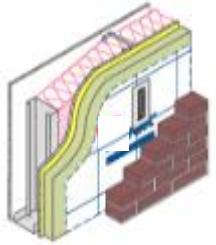
WRB/ Mineral Fiber / MCM



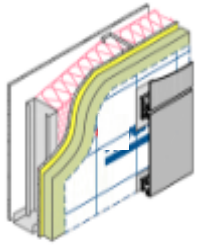
WRB/ Mineral Fiber / HPL



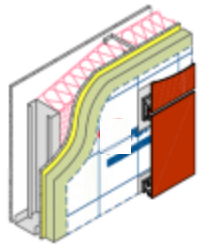
WRB Over / Mineral Fiber / Brick



WRB Over / Mineral Fiber / MCM



WRB Over / Mineral Fiber / HPL



WRB / EIFS

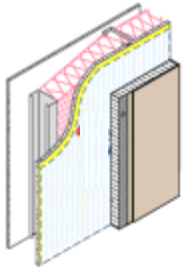
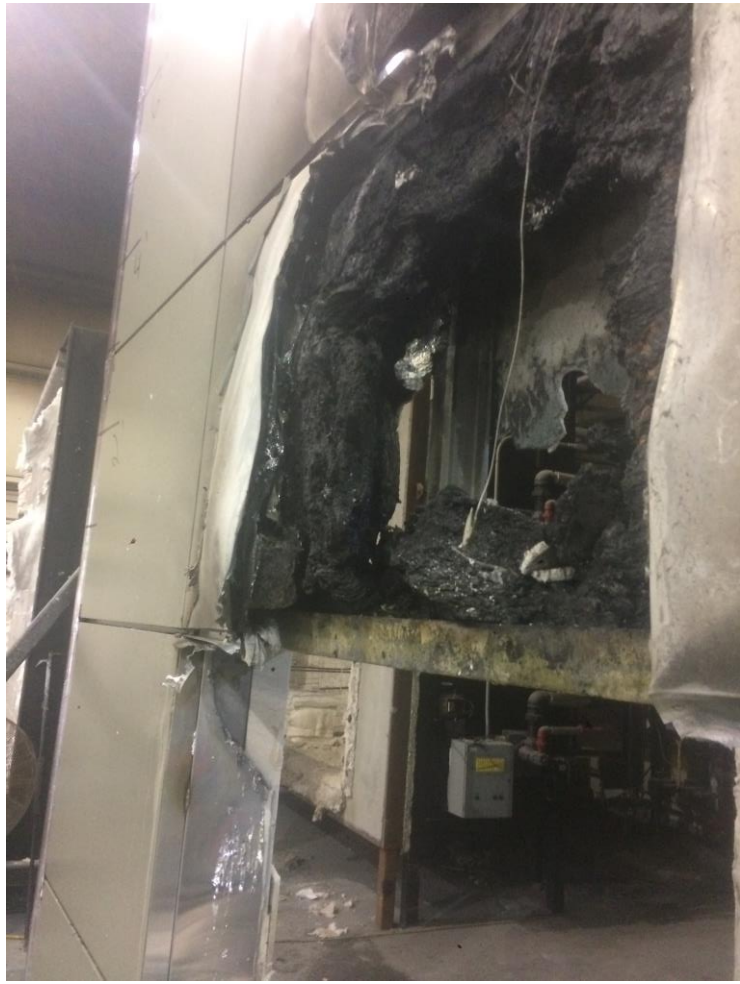


Image courtesy of DuPont Building Innovations

COMPLIANCE PATHS

- Substitutions of one material for another can cause different test results
- Addition of combustibles (insulation, WRBs, etc.) can cause different test results
- Wall systems made of a number of previously NFPA 285 tested materials does not ensure a successful NFPA 285 test
- Tests are required for many various claddings and other combustible wall components – insulation, WRBs



COMPLIANCE PATHS

Engineering Judgment Letter

- Written by a independent source,
  - approved by the building official
    - competent and experienced
      - in engineering principles of materials, methods or system analysis
- References Specific NFPA 285 “PASS” test results (owned by manufacturer)
- Specifies all corresponding wall components evaluated (structure, insulations, WRB, Claddings etc..)
- Outlines opening details and flashing conditions evaluated

Table I. NFPA 285 Complying Wall Assemblies

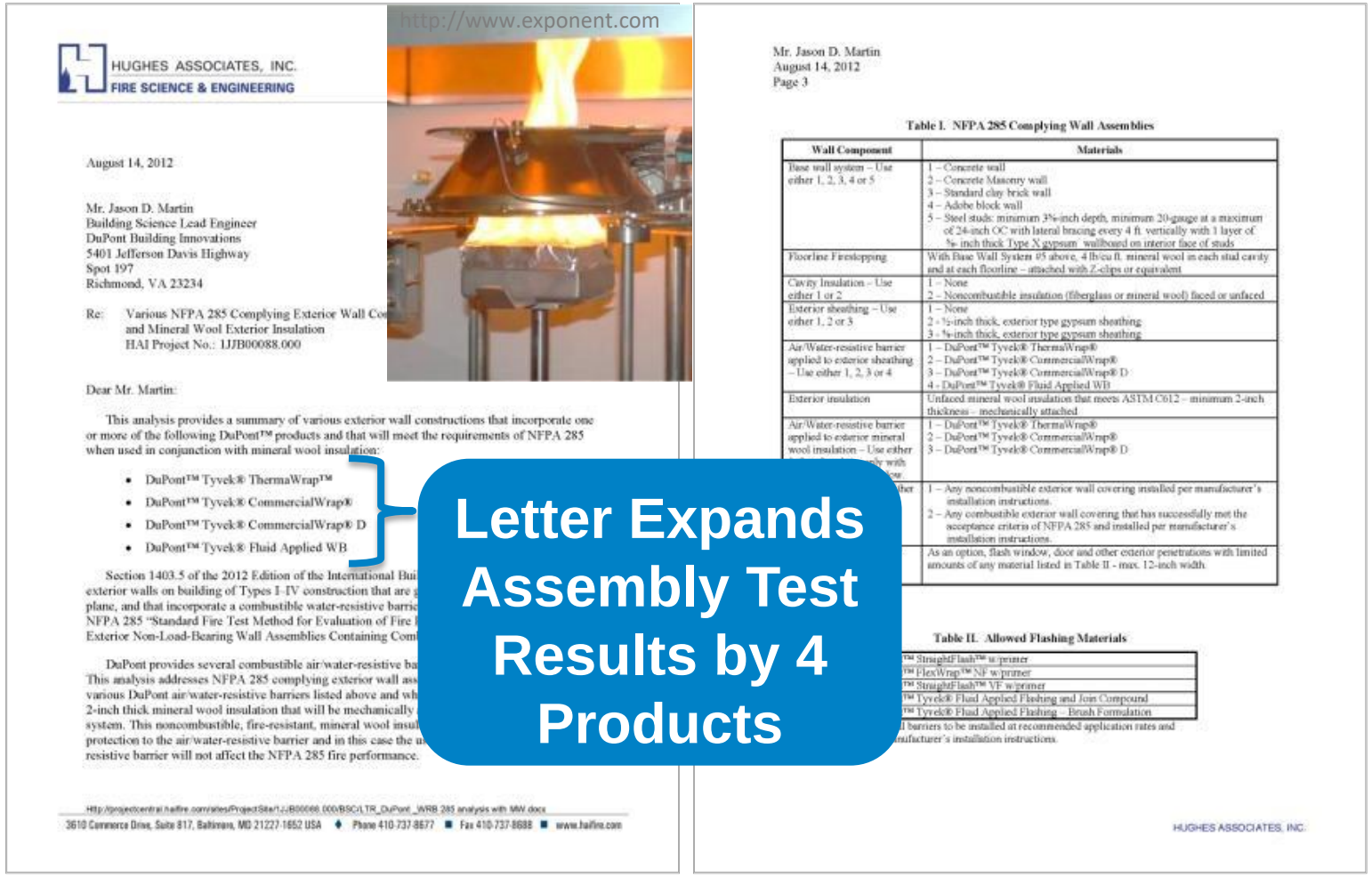
Wall Component	Materials
Base wall system – Use either 1, 2, 3, 4 or 5	1 – Concrete wall 2 – Concrete Masonry wall 3 – Standard clay brick wall 4 – Adobe block wall 5 – Steel studs: minimum 3⅝-inch depth, minimum 20-gauge at a maximum of 24-inch OC with lateral bracing every 4 ft. vertically with 1 layer of ⅝- inch thick Type X gypsum wallboard on interior face of studs
Floorline Firestopping	With Base Wall System #5 above, 4 lb/cu ft. mineral wool in each stud cavity and at each floorline – attached with Z-clips or equivalent
Cavity Insulation – Use either 1 or 2	1 – None 2 – Noncombustible insulation (fiberglass or mineral wool) faced or unfaced
Exterior sheathing – Use either 1, 2 or 3	1 – None 2 - ½-inch thick, exterior type gypsum sheathing 3 - ⅝-inch thick, exterior type gypsum sheathing
Air/Water-resistive barrier applied to exterior sheathing – Use either 1, 2, 3 or 4	1 – DuPont™ Tyvek® ThermaWrap® 2 – DuPont™ Tyvek® CommercialWrap® 3 – DuPont™ Tyvek® CommercialWrap® D 4 - DuPont™ Tyvek® Fluid Applied WB
Exterior insulation	Unfaced mineral wool insulation that meets ASTM C612 – minimum 2-inch thickness – mechanically attached
Air/Water-resistive barrier applied to exterior mineral wool insulation – Use either 1, 2 or 3 and use only with Exterior Veneer #3 below	1 – DuPont™ Tyvek® ThermaWrap® 2 – DuPont™ Tyvek® CommercialWrap® 3 – DuPont™ Tyvek® CommercialWrap® D
Exterior Veneer – Use either 1 or 2	1 – Any noncombustible exterior wall covering installed per manufacturer's installation instructions. 2 – Any combustible exterior wall covering that has successfully met the acceptance criteria of NFPA 285 and installed per manufacturer's installation instructions.
Flashing of window, door and other exterior wall penetrations	As an option, flash window, door and other exterior penetrations with limited amounts of any material listed in Table II - max. 12-inch width

Table II. Allowed Flashing Materials

DuPont™ StraightFlash™ w/primer
DuPont™ FlexWrap™ NF w/primer
DuPont™ StraightFlash™ VF w/primer
DuPont™ Tyvek® Fluid Applied Flashing and Join Compound
DuPont™ Tyvek® Fluid Applied Flashing – Brush Formulation

Note: all barriers to be installed at recommended application rates and per manufacturer's installation instructions.

COMPLIANCE PATHS



HUGHES ASSOCIATES, INC.
FIRE SCIENCE & ENGINEERING

http://www.exponent.com

August 14, 2012

Mr. Jason D. Martin
Building Science Lead Engineer
DuPont Building Innovations
5401 Jefferson Davis Highway
Spot 197
Richmond, VA 23234

Re: Various NFPA 285 Complying Exterior Wall Co
and Mineral Wool Exterior Insulation
HAI Project No.: 1JJB00088.000

Dear Mr. Martin:

This analysis provides a summary of various exterior wall constructions that incorporate one or more of the following DuPont™ products and that will meet the requirements of NFPA 285 when used in conjunction with mineral wool insulation:

- DuPont™ Tyvek® ThermaWrap™
- DuPont™ Tyvek® CommercialWrap®
- DuPont™ Tyvek® CommercialWrap® D
- DuPont™ Tyvek® Fluid Applied WB

Section 1403.5 of the 2012 Edition of the International Bui
exterior walls on building of Types I-IV construction that are
plane, and that incorporate a combustible water-resistive barri
NFPA 285 "Standard Fire Test Method for Evaluation of Fire
Exterior Non-Load-Bearing Wall Assemblies Containing Com

DuPont provides several combustible air/water-resistive ba
This analysis addresses NFPA 285 complying exterior wall as
various DuPont air/water-resistive barriers listed above and wh
2-inch thick mineral wool insulation that will be mechanically
system. This noncombustible, fire-resistant, mineral wool insul
protection to the air/water-resistive barrier and in this case the u
resistive barrier will not affect the NFPA 285 fire performance.

http://projectcentral.haifire.com/sites/ProjectSite/1JJB00088.000/BSC/LTR_DuPont_WRB 285 analysis with MW.docx
3610 Commerce Drive, Suite 817, Baltimore, MD 21227-1652 USA ♦ Phone 410-737-8677 ■ Fax 410-737-8688 ■ www.haifire.com

Letter Expands Assembly Test Results by 4 Products

Mr. Jason D. Martin
August 14, 2012
Page 3

Table I. NFPA 285 Complying Wall Assemblies

Wall Component	Materials
Base wall system – Use either 1, 2, 3, 4 or 5	1 – Concrete wall 2 – Concrete Masonry wall 3 – Standard clay brick wall 4 – Adobe block wall 5 – Steel studs: minimum 3⅝-inch depth, minimum 20-gauge at a maximum of 24-inch OC with lateral bracing every 4 ft. vertically with 1 layer of ⅝- inch thick Type X gypsum wallboard on interior face of studs
Floorline Firestopping	With Base Wall System #5 above, 4 lb/cu ft. mineral wool in each stud cavity and at each floorline – attached with Z-clips or equivalent
Cavity Insulation – Use either 1 or 2	1 – None 2 – Noncombustible insulation (fiberglass or mineral wool) faced or unfaced
Exterior sheathing – Use either 1, 2 or 3	1 – None 2 - ½-inch thick, exterior type gypsum sheathing 3 - ⅝-inch thick, exterior type gypsum sheathing
Air/Water-resistive barrier applied to exterior sheathing – Use either 1, 2, 3 or 4	1 – DuPont™ Tyvek® ThermaWrap® 2 – DuPont™ Tyvek® CommercialWrap® 3 – DuPont™ Tyvek® CommercialWrap® D 4 - DuPont™ Tyvek® Fluid Applied WB
Exterior insulation	Unfaced mineral wool insulation that meets ASTM C612 – minimum 2-inch thickness – mechanically attached
Air/Water-resistive barrier applied to exterior mineral wool insulation – Use either	1 – DuPont™ Tyvek® ThermaWrap® 2 – DuPont™ Tyvek® CommercialWrap® 3 – DuPont™ Tyvek® CommercialWrap® D
	1 – Any noncombustible exterior wall covering installed per manufacturer's installation instructions. 2 – Any combustible exterior wall covering that has successfully met the acceptance criteria of NFPA 285 and installed per manufacturer's installation instructions.
	As an option, flash window, door and other exterior penetrations with limited amounts of any material listed in Table II - max. 12-inch width.

Table II. Allowed Flashing Materials

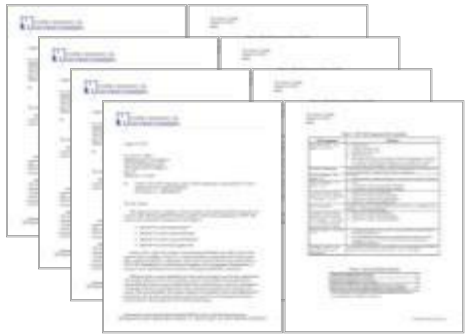
™ StraightFlash™ w/primer
™ FlexWrap™ NF w/primer
™ StraightFlash™ VF w/primer
™ Tyvek® Fluid Applied Flashing and Join Compound
™ Tyvek® Fluid Applied Flashing – Brush Formulation

l barriers to be installed at recommended application rates and nufacturer's installation instructions.

HUGHES ASSOCIATES, INC.

DESIGNING FOR FIRE SAFETY – COMPLYING WITH NFPA 285 TEST STANDARD FOR EXTERIOR WALLS

COMPLIANCE PATHS



NFPA 285 COMPLIANT WALL ASSEMBLIES WITH COMMERCIAL AIR AND WATER BARRIER SYSTEMS[1]

I. BASE WALL SYSTEM

1 **Concrete Wall**
2 **Concrete Masonry Wall (CMU)**
3 **Standard Clay Brick Wall**
4 **Adobe Block Wall**
5 **Steel Stud Framed Wall:** minimum 20-gauge, 3-5/8" studs, with lateral bracing every 4 feet vertically (24" on center maximum)
   a. Interior wallboard: minimum of 1 layer of 5/8" Type X gypsum wallboard on interior face of studs
   b. Interior vapor barrier (optional): 1 layer of maximum 6 mil thick polyethylene plastic or equivalent can be applied
   c. Cavity insulation: None or any noncombustible insulation (faced or unfaced)
   d. Floorline firestopping (where studs are outboard of the floor assembly): 4 lb./cu. ft. mineral wool (e.g. Thermafiber®) in each stud cavity and at each floorline – attached with Z-clips or equivalent
   e. Exterior sheathing: 1/2" or 5/8" thick, exterior type gypsum sheathing

II. AIR AND WATER BARRIER

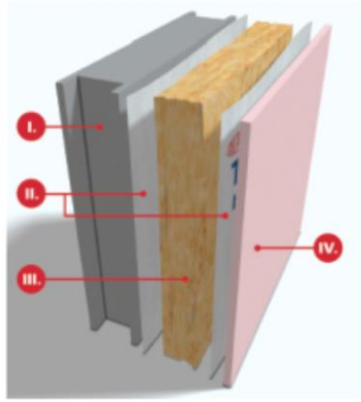
Applied to base wall OR over exterior insulation

1 **None**
2 **Commercial**
3 **Commercial** D
4 **Therma Wra**
5 **Fluid Applied Weather Barrier (WB):**
Nominal 25 wet mil thickness. NOT to be applied OVER exterior insulation.

NOTE: Any air and water barrier to be installed in accordance with manufacturer installation instructions. Flash windows, doors and other exterior penetrations with asphalt, acrylic or butyl-based flashing tape with a maximum 12" width. Use primer when applicable, unless otherwise noted by flashing manufacturer.

III. EXTERIOR INSULATION

1 **None**
2 **Any unfaced noncombustible insulation (fiberglass, mineral wool)**
3 **Dow Thermax™ Polyisocyanurate Rigid Insulation**
Total thickness to be a minimum of 5/8" a maximum of 3"
4 **Extruded Polystyrene Foam Insulation (XPS) -**
Type IV per ASTM C578: Total thickness to be a minimum of 1/2" to maximum of 3". On insulation joints, an asphalt or butyl-based flashing tape with a 4" maximum width can be used. Use any header treatment shown in NFPA 285 Window Head Detail Options, figures 1–6 for all window and door openings in the exterior wall.



IV. EXTERIOR CLADDING

1 **Brick**
Standard nominal 4" thick, clay brick. Use standard brick veneer anchors installed maximum 24" on center vertically on each stud with a 2" maximum air gap between exterior insulation and brick.

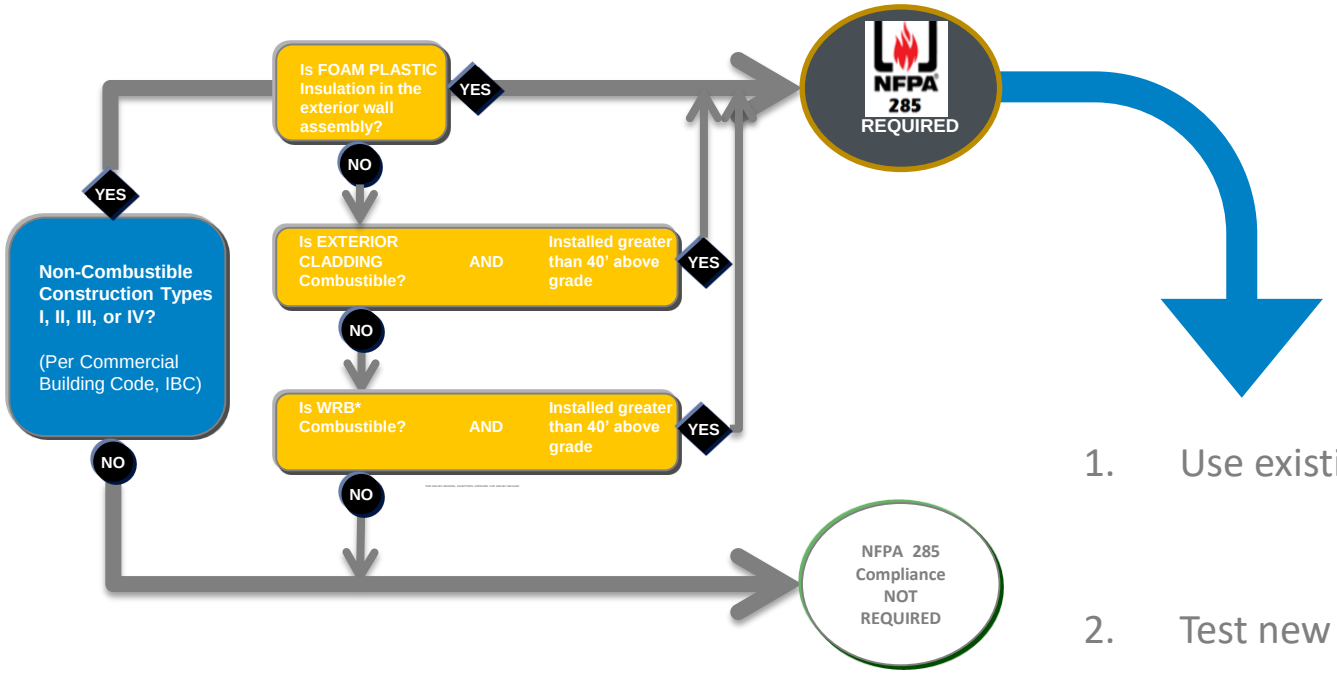
2 **Stucco**
Minimum 3/4" thick, exterior cement plaster and lath. An optional secondary water-resistive barrier can be installed between the exterior insulation and the lath. The secondary water-resistive barrier shall not be full-coverage asphalt or butyl- based self- adhered membranes. (Cannot be combined with Exterior Insulation: #4-XPS)

3 **Stone Veneer**
Minimum 2" thick, limestone or natural stone veneer or minimum 1-1/2" thick cast artificial stone veneer. Any standard installation technique can be used.

4 **Fiber Cement Siding or Panels**
Any standard installation technique can be used. (Cannot be combined with Exterior Insulation: #4-XPS)

5 **Metal Exterior Wall Coverings**
Including but not limited to steel, aluminum, and copper installed using standard installation techniques. (Cannot be combined with Exterior Insulation: #4-XPS)

COMPLIANCE PATHS



1. Use existing NFPA 285 tested compliant system

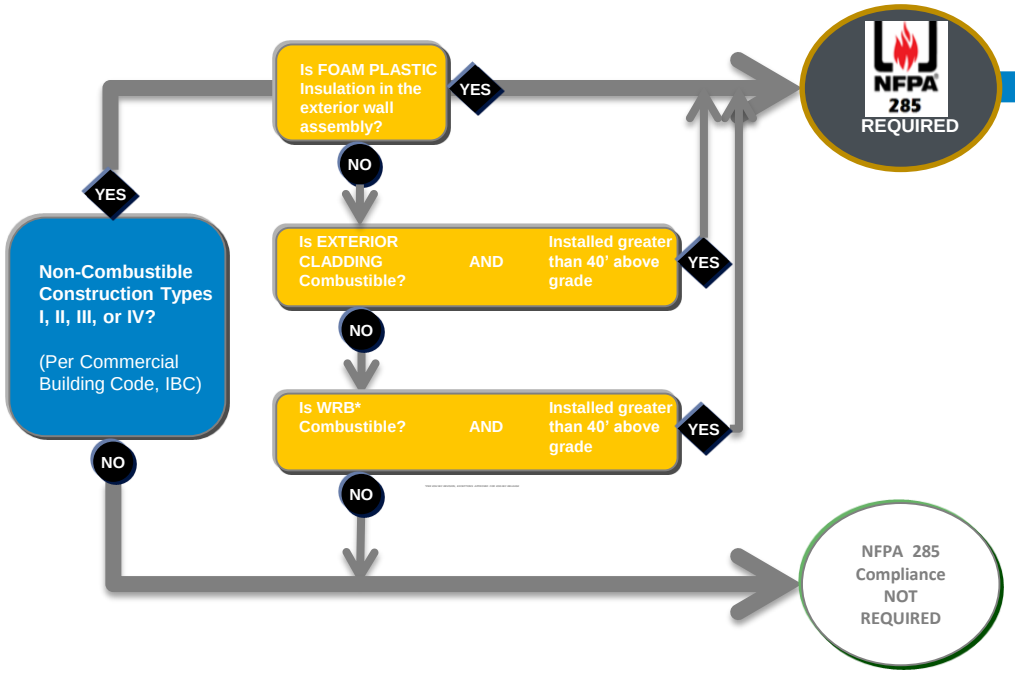
OR

2. Test new assembly per NFPA 285

OR

3. Modify an existing NFPA 285 compliant system with local Authority Having Jurisdiction (AHJ) approval, such as building officials

COMPLIANCE PATHS



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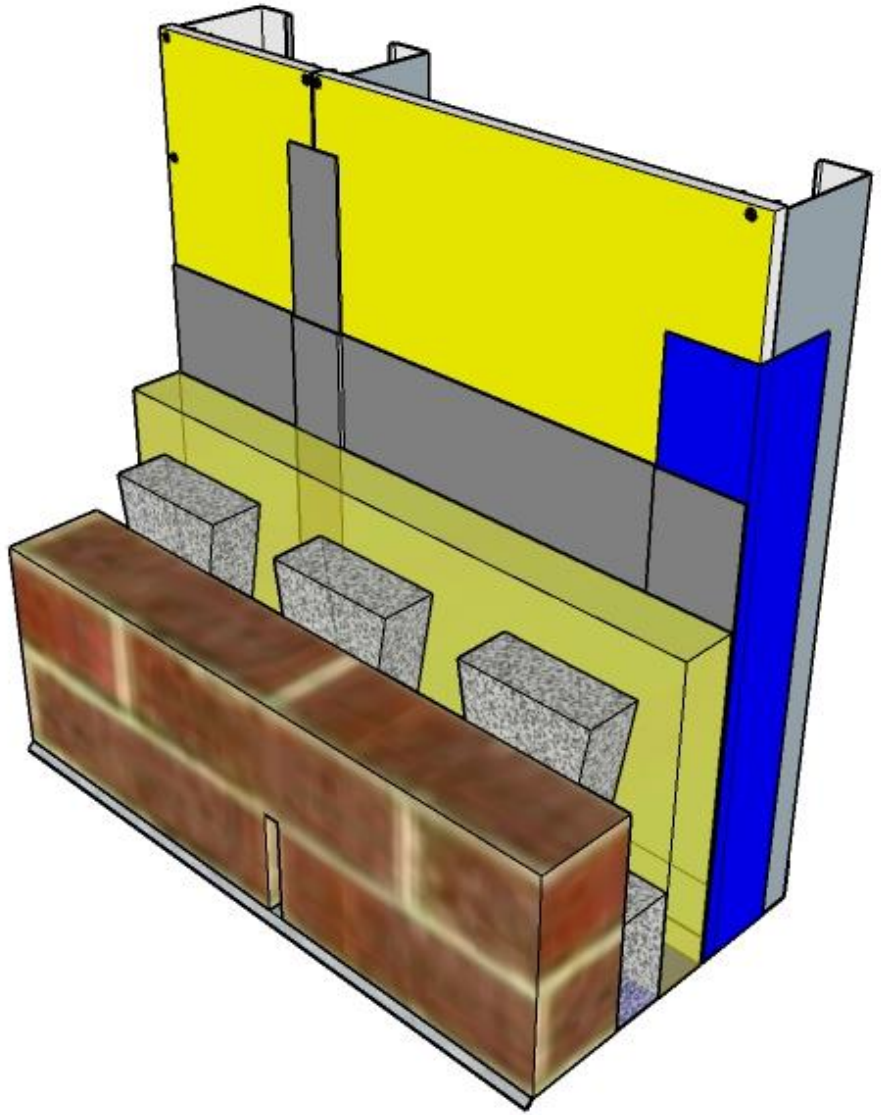
There is a 4th Way!!!

COMPLIANCE PATHS

The 4th Path to Compliance

Design wall assemblies sufficiently "non-combustible" to avoid NFPA 285 triggers, by:

- Eliminate FRT wood framing and sheathing;
- Choose a WRB which meets 2015 IBC 1403.5, Exception 2;
- Choose non-combustible insulation; AND
- Choose non-combustible claddings.



TAKE AWAYS

01 Discuss history and development of the NFPA 285 test and its predecessors

02 Discuss the current scope, process, and compliance requirements of NFPA 285 compliant assemblies

03 Describe the current IBC requirements for NFPA 285 compliance for foam plastics and WRB’s

04 Describe the current status of code modification proposals at the national and local levels with regard to NFPA 285 compliance for Foam Plastics and WRB’s

05 Discuss the inherent conflict with NFPA 285 and Type III wood framed construction and possible solutions

AUDIENCE SURVEY – TAKE 2

1. Who has specified or participated in projects requiring NFPA 285?
2. Have you had plan review comments regarding NFPA 285?
3. Do you see NFPA 285 as a liability issue for Owners, Architects, or Contractors?

QUESTIONS?

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