NFPA 285 – Use and Applications

Presented to

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By

Jesse J. Beitel

Senior Scientist / Principal

HUGHES ASSOCIATES, INC.

FIRE SCIENCE & ENGINEERING

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Learning Objectives

- History of NFPA 285 Requirements
- Requirements and conduct of tests to NFPA 285
- Application of NFPA 285 in International Building Code
- Applicability and Use of NFPA 285

Why The Interest in NFPA 285??

Energy / CI & New Exterior Wall Building Technology (air/vapor/water management)

History

- In mid 1970's – use of foam plastic on or in noncombustible exterior walls was proposed.
  - EIFS & Steel/Foam/Steel Panels
- Problems with use:
  - **Exterior walls of Type I, II, III or IV Construction must be noncombustible construction.**
  - Foam plastic is combustible & past history
  - Issues raised over potential for vertical and horizontal fire spread due to the combustible foam plastic insulation

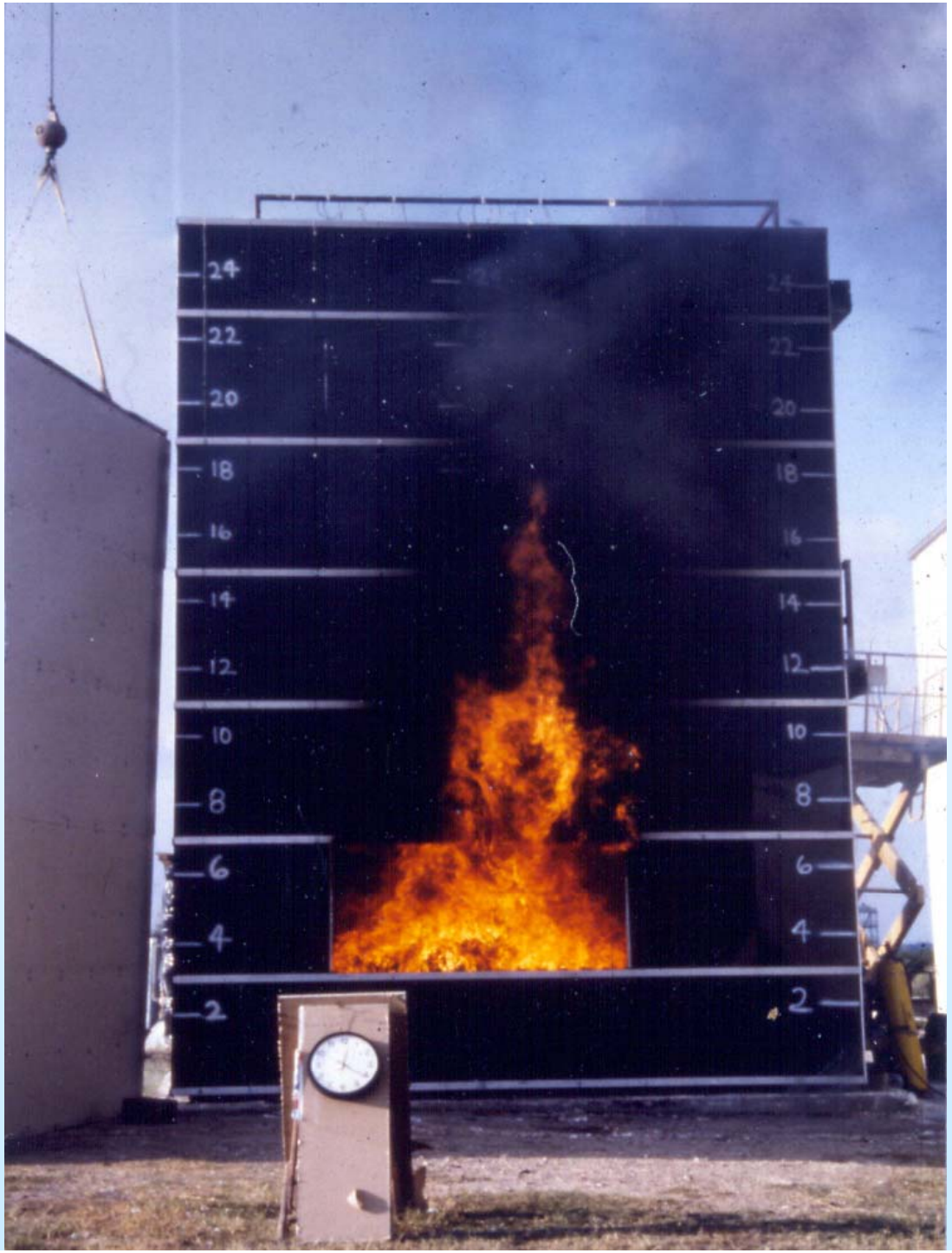
History (continued)

- SPI began work in Codes and testing.
- Discussions w/ Code & Fire Officials.
- Drafting of Code language.
- Testing program
  - Testing was to determine efficacy of proposed wall systems to resist flame spread.
  - Provide realistic size & exposure

Objectives of Multi-Story Fire Test

- Can the wall covering/panel resist:
  - Flame propagation over face of the wall covering
  - Vertical flame propagation within the combustible core or components
  - Flame propagation over interior surface from one floor to the next
  - Lateral Flame propagation to adjacent compartments
- Does not address floor-line joint per se.

UBC 17-6 / UBC 26-4 Test In Progress



Multi-Story Fire Test Code Development

- Test program completed in late 1980
- Code change to Plastics Section adopted in 1988 UBC
- Versions adopted by NBC and SBC
- Full-scale test was also adopted as UBC 17-6. Used by all ESs.
- In 1994 edition of UBC – reorganization moved plastics to Chapter 26 and test method became UBC 26-4.

Multi-Story Fire Test
2nd Generation

- Recognized that problems existed with full-scale test:
  - Weather
  - Timing – construction on building
  - Costs
- In early 1990's, SPI started a test program to create a reduced-scale version of test.
- Intermediate-scale test developed in 1993

UBC 26-9 /
NFPA 285

Multi-Story Fire Test
2nd Generation – Code Adoption

- New test adopted as UBC 26-9 in 1997 edition of the UBC
- NFPA 285 “Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-load-bearing Wall Assemblies Containing Combustible Components”
- ICC IBC specifies NFPA 285 in 2000, 2003, 2006, 2009 and 2012 editions

NFPA 285

“Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-load-bearing Wall Assemblies Containing Combustible Components”

NFPA 285 Test Apparatus

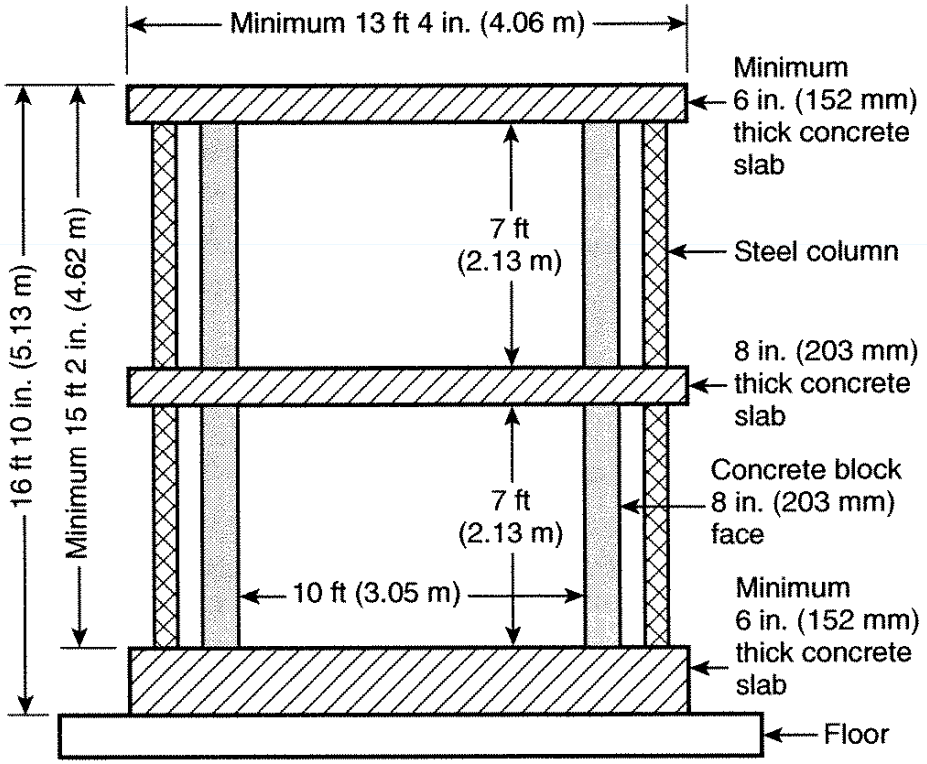


FIGURE 4.2.3 Front View of Test Apparatus Structure (not to scale).

NFPA 285 – Side View

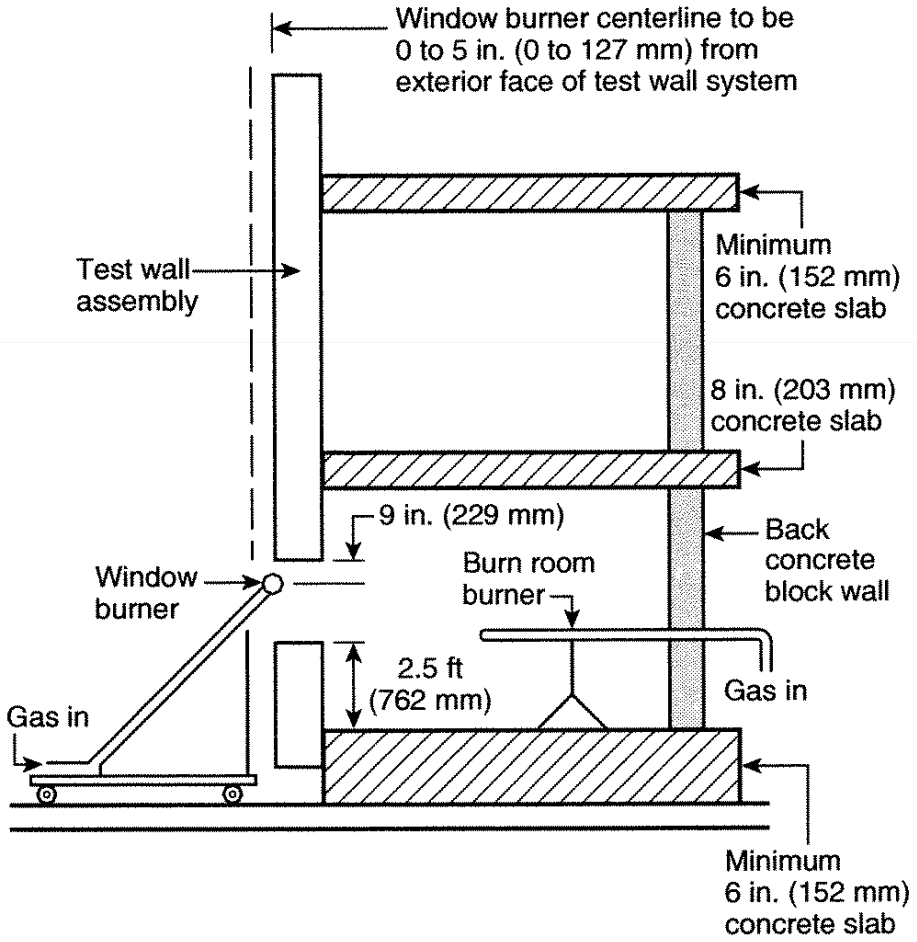
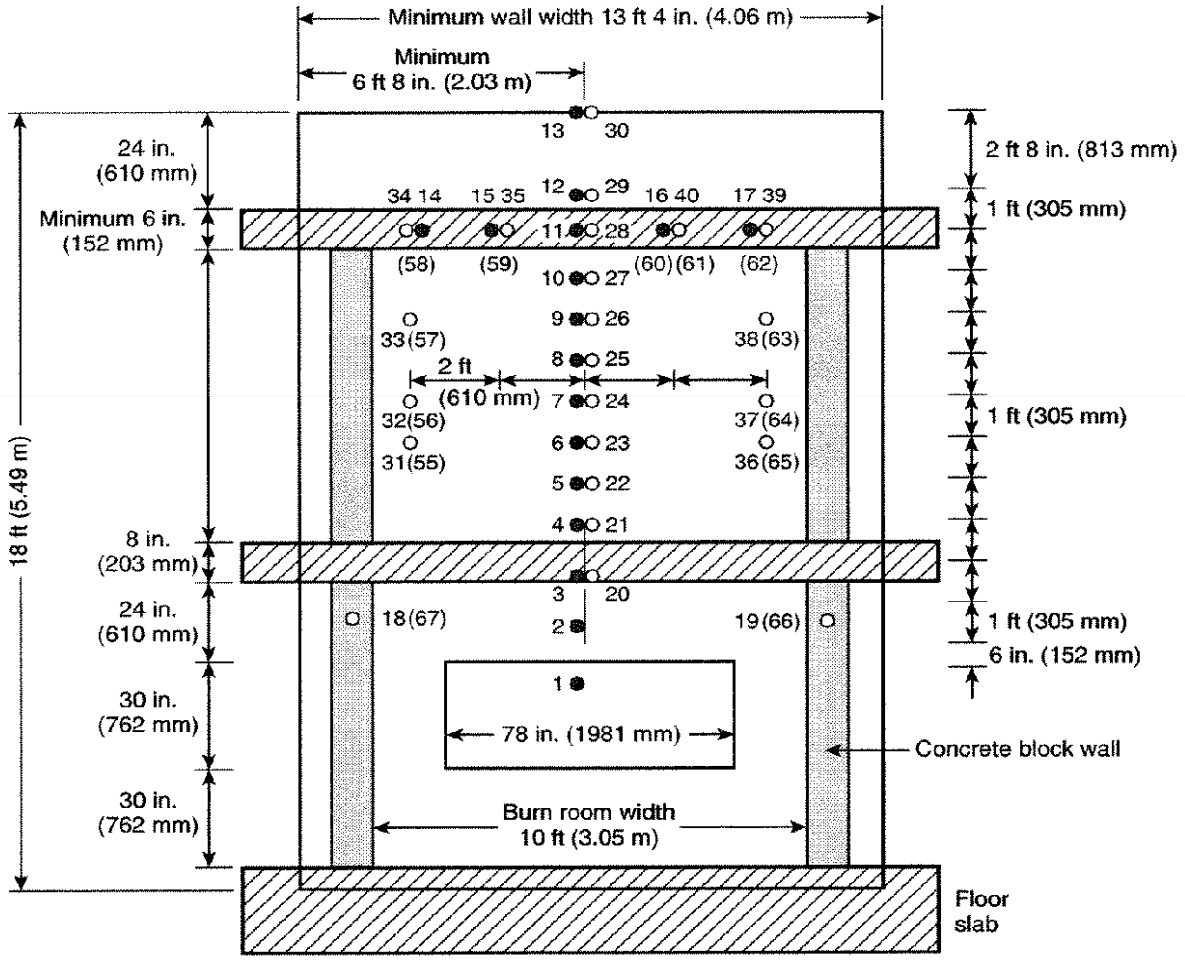


FIGURE A.4.4.8 Side View of Burner Placement in First-Story Test Room (not to scale).

NFPA 285 – TCs & Wall

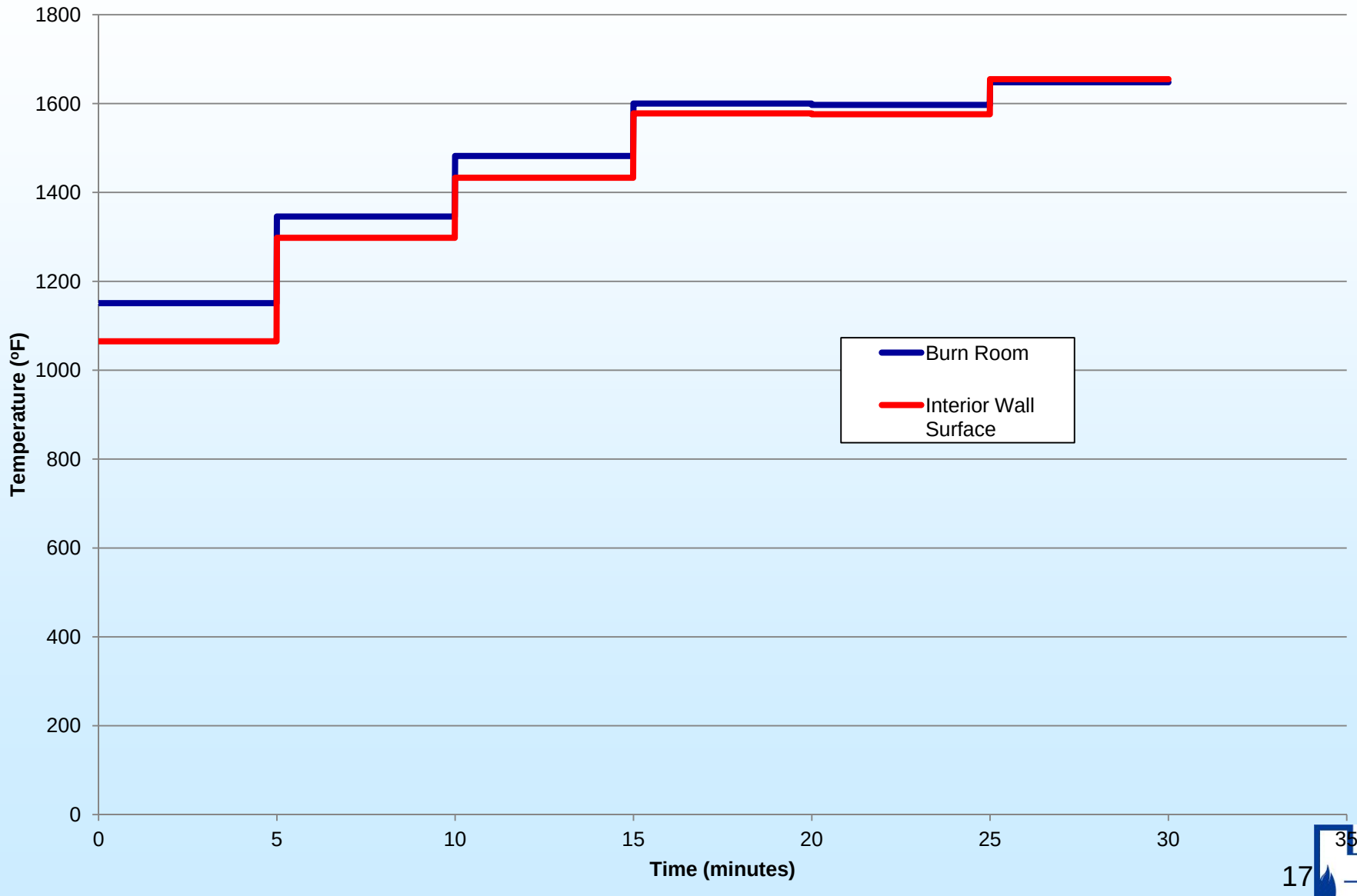


● Thermocouples — 1 in. (25 mm) from exterior wall surface

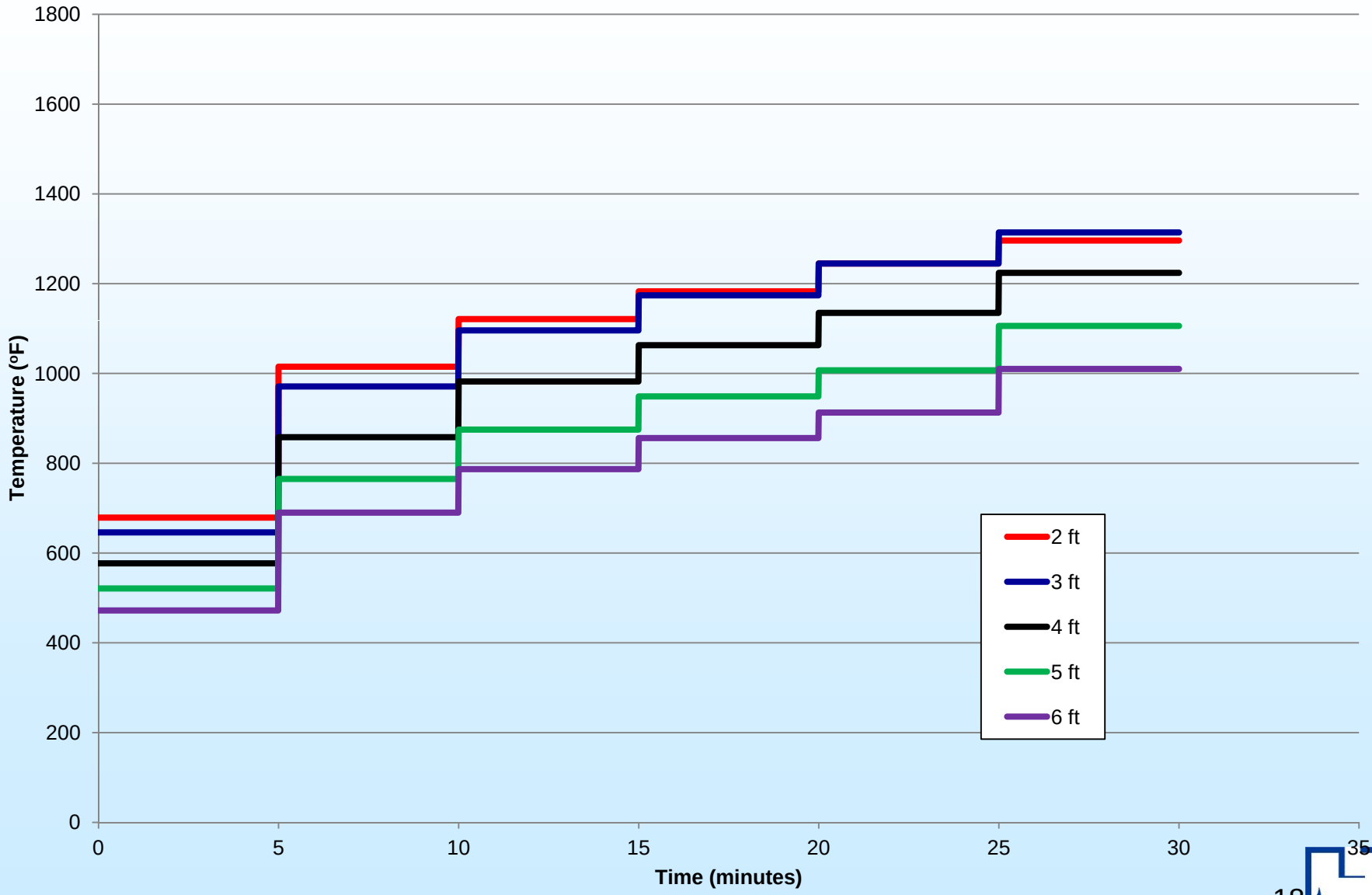
○ Thermocouples — In core/air space [see Figure 6.1(b)]
(Thermocouples) — Additional thermocouples [see Figure 6.1(b), Part C]

FIGURE 6.1(a) Exterior Face of the Test Specimen. Instrumentation arrangement.

Calibration Average Temperatures for Burn Room and Interior Wall



Calibration Average Temperatures for Elevations Above Window



NFPA 285 – Limits

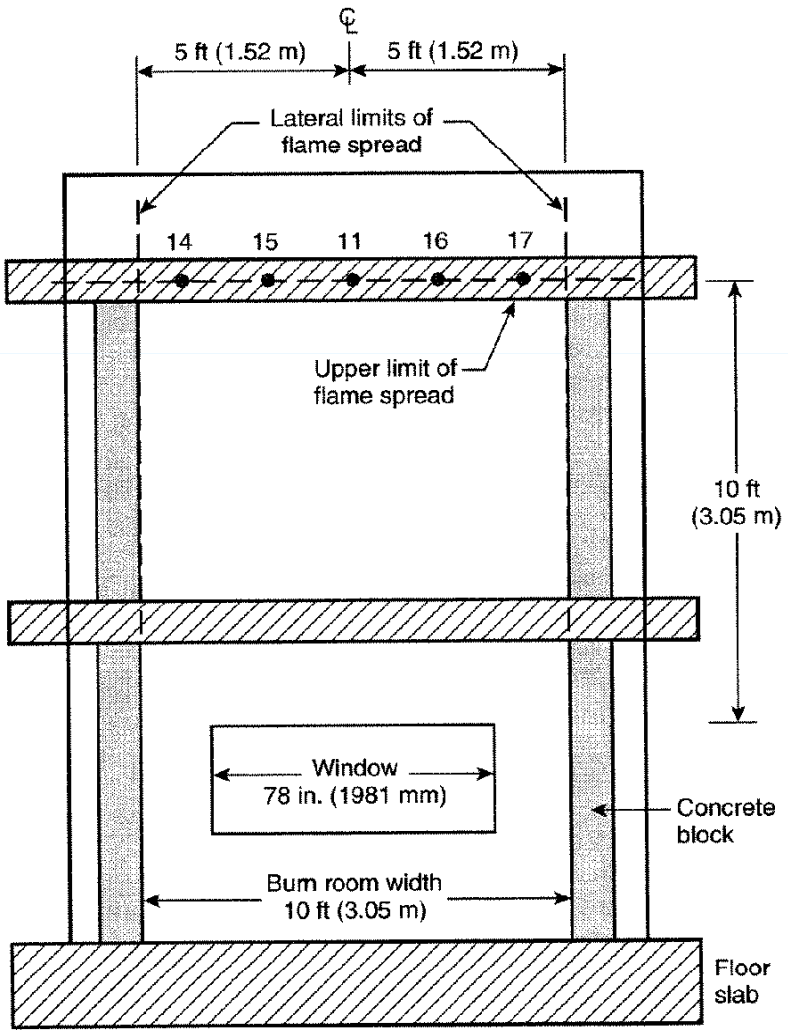


FIGURE 10.2.1.2 Limits of Flame Propagation (not to scale).

Applications Of NFPA 285 In IBC

- Foam Plastics – any height - §2603.5.5 (~1988)
- Combustible Veneers – For use over 40 ft.
  - MCMs & ACMs - §1407.10 (~2000)
  - HPLs – §1409.10 (~2009)
  - EIFS - §1408.2 (~2009)
  - FRPs - §2612.5 (~2009)
- Water-resistive barriers - For use over 40 ft. - §1403.5 (2012)
- Why? – Combustible materials on/in exterior walls
  - Passes & Failures

Applicability of NFPA 285

- 285 applies to any exterior wall assembly where required by Code
- 285 is a test of a complete wall assembly & applies only to the tested construction – similar to ASTM E119
- Appropriate extension of tested configurations is possible but within limits

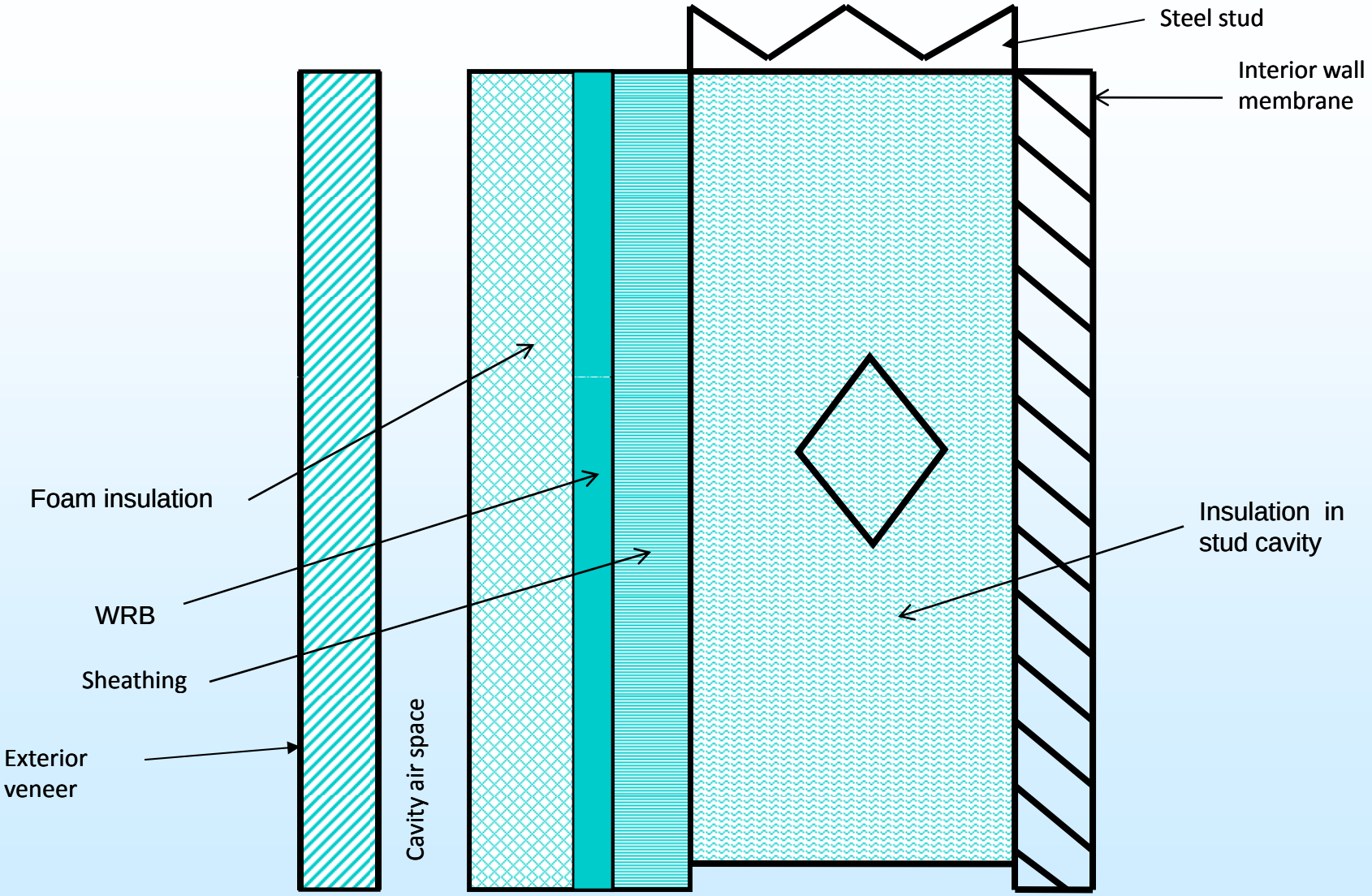
Example of an Extension of Results Analysis

Table I. Walls Containing XPS Insulation and ??? Water-resistive Barriers

Wall Component	Materials
Base wall system – Use either 1, 2 or 3	1 – Concrete wall 2 – Concrete Masonry wall 3 – 1 layer – ⅝-inch thick, Type X, Gypsum wallboard on interior, installed over steel studs: minimum 3⅝-inch depth, minimum 20-gauge at a maximum of 24-inch OC with lateral bracing every 4 ft. vertically
Floorline Firestopping	4 lb/cu ft. mineral wool (e.g. Thermafiber or Roxul) in each stud cavity at each floorline – attached with Z-clips or equivalent
Cavity Insulation – Use either 1 or 2	1 – None 2 – Any noncombustible insulation (faced or unfaced)
Exterior sheathing – Use either 1 or 2	1 – ½-inch thick, exterior type gypsum sheathing 2 – ⅝-inch thick, Type X, exterior type gypsum sheathing
Water-resistive barrier applied to gypsum sheathing – Use either 1, 2 or 3	1 – ???? applied at a maximum 40 mils WFT 2 – ???? applied at a maximum 20 mils WFT 3 – ???? applied at a maximum 32 mils WFT
Exterior insulation	Extruded Polystyrene Foam Insulation (XPS) - Type IV per ASTM C578 – Maximum of 3-inch thickness Note: As an option, insulation joints may be covered with an asphalt or Butyl-based flashing tape – max. 4-inch width can be used.
Water-resistive barrier applied to exterior insulation – Use either 1 or 2	1 – None 2 – Any shown in Table II
Exterior Veneer – Use either 1, 2, 3, 4 or 5	1 – Brick - Standard nominal 4-inch thick, clay brick. Brick installed with standard type veneer anchors at maximum 24 inches OC vertically on each stud. Maximum 2-inch air gap between exterior insulation and brick 2 – Concrete – 2 inches thick or greater. Maximum 2-inch air gap between exterior insulation and concrete. 3 – Concrete masonry units – 4 inches thick or greater. Maximum 2-inch air gap between exterior insulation and CMU. 4 – Stone veneer – Minimum 2-inch thick, Limestone or natural stone veneer or minimum 1-1/2 inch thick cast artificial stone veneer. Any standard non-open-joint installation technique such as ship-lap, etc. can be used. 5 – Terracotta cladding – Use any terracotta cladding system in which terracotta is minimum 1-1/4 inch thick. Any non-open-joint installation technique such as ship-lap, etc. can be used.
Special Conditions	Use header treatment shown in Figure 1 for all window and door openings in wall.
Flashing of window, door and other exterior wall penetrations.	As an option, flash window, door and other exterior penetrations with limited amounts of asphalt, acrylic or butyl-based flashing tape – max. 12-inch width.

Applicability of NFPA 285 Part 2

- Substitutions of one material for another can (maybe) cause different test results
- Addition of combustibles (insulation, WRBs, etc.) can cause different test results
- Changes in configurations (air gaps, attachment systems, etc.) can cause different results



Potential Variations of Wall Systems

Applicability of NFPA 285 Part 3

- Wall systems made of a number of Class A (E84) materials does not ensure a successful NFPA 285 test
- Wall systems made of a number of previously NFPA 285 tested materials does not ensure a successful NFPA 285 test

Issues

- Need a public database of NFPA 285 complying assemblies - Provide easy access by specifiers
  - Currently – foam or veneer manufacturers hold the info
- Need more ASTM E1354 and/or NFPA 285 tests w/ WRBs
- Components (veneer/foam/WRB) will always have to be “married” to an assembly or assemblies
  - Some tested materials say they can be used anywhere?

What Have We Learned?

- All foam plastics are not the same
  - XPS, EPS, Polyiso, SPF
  - Within a family…not always the same
- All exterior veneers are not the same
  - Noncomb, combustible, melting, air gaps, attachment details
- All WRBs are not the same
  - Wraps, fluid applied, peel & sticks

This is NOT the performance you want in either a test or in real life!

Nor do you want this –

Brick Veneer

Wall system

w/ CI & WRB

WRB Code Requirement In 2012 IBC

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 combustible water-resistive barrier shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

WRB Code Requirement In 2015 IBC

- 3 Exceptions added

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 1405.2.

WRB Code Requirement In 2015 IBC

Exception 2 has 3 requirements to be met:

- WRB is the **only** combustible component in the wall
- WRB has the following performance in ASTM E1354:
  - Peak HRR <150 kW/m^2
  - Total HR <20 MJ/m^2
  - Effective Heat of Combustion <18 MJ/kg
- WRB has a Class A FSI/SDI

WRB Code Requirement In 2015 IBC

Exception 3:

Windows and doors and flashing for windows and doors shall not be considered to be part of a water resistive barrier for purposes of this section.

What Do the 2015 Changes mean?

- WRBs that meet exceptions can be used w/o 285 test
- If WRB is used with another combustible material in the wall such as foam plastic, combustible veneer, etc. then 285 probably required due to the requirements of the other combustible material

How Can WRBs Meet NFPA 285?

- There is no one test or test assembly to qualify a WRB for use in all assemblies
- Perform NFPA 285 test – WRB is one of several materials in assembly
- Limited engineering analysis based on NFPA 285 tests in conjunction w/ small-scale tests (ASTM E1354).

Summary

- NFPA 285 provides a determination of vertical fire performance of exterior wall assemblies.
- NFPA 285 performance verified by actual fire performance of exterior walls.
- NFPA 285 tested systems will reduce the potential for vertical flame spread by exterior walls.
- NFPA 285 data/results must be used in an appropriate manner.
- NFPA 285 systems/assemblies will increase and greater choices will be available

Thank You
and
Questions?

Jesse J. Beitel
Senior Scientist/Principal
Hughes Associates, Inc.
410/737-8677
jbeitel@haifire.com