FCIA 2024 Webinar Series

Reaction to Fire Versus Fire Resistance

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FREE STUFF – REQUEST FROM:

Info@FCIA.org

December 18, 2024

FCIA

Firestop Contractors International Association

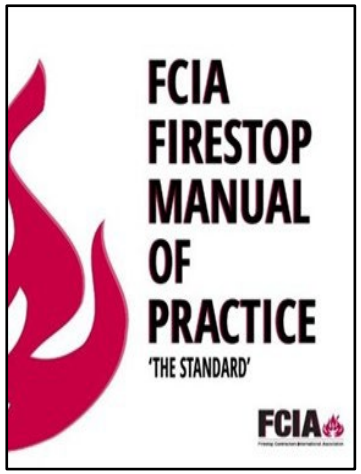
FCIA – Firestop Contractors International Association

- **Fire Exits??**

- **Thanks to FCIA Members**
  - Firestop Contractors
  - Manufacturers, Consultants
  - Firestop Distributors, Reps, Friends

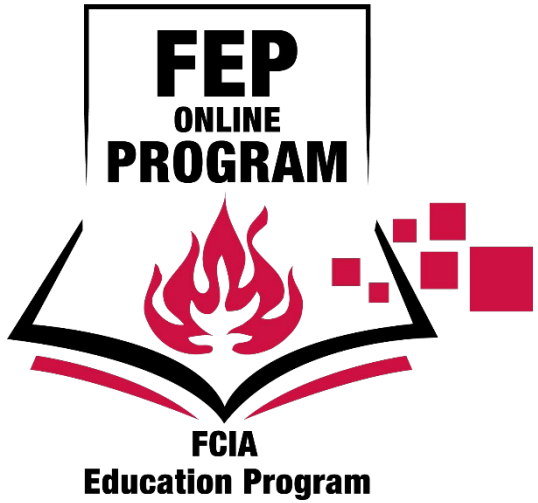
FREE RESOURCES

- ***Info@FCIA.org - REQUEST*** **FREE STUFF**
  - **FREE Life Safety Digest**
  - **FREE MOP, if you Qualify….**
  - **Firestopping DIIM™ Story – www.FCIA.org/About**



FCIA's NEWEST PROGRAM –

- ***Accreditation***
- ***Apprenticeship***
- ***Code***
- ***Standards***
- ***Inspection***
- ***Marketing/Membership***

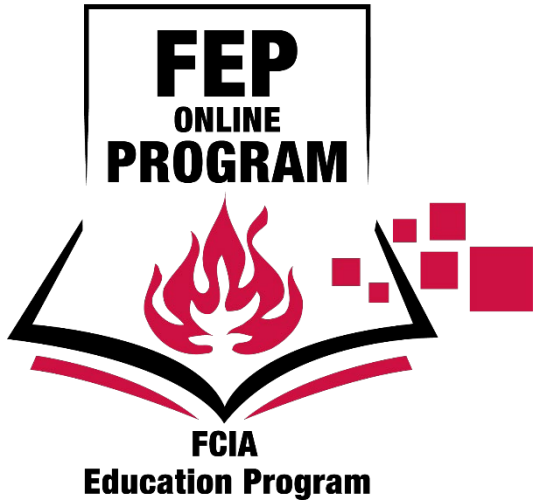


FCIA's NEWEST PROGRAM –

- ***Education for Firestopping Careers!!***

- ***FCIA's Firestop Education Program (FEP)***
  - ***3.5 Hours Level 1 – LAUNCHED***
  - ***16.5 Hours Level 2 – LAUNCHED***
  - ***4.0 Hours Level 3 – LAUNCHED***
  - ***? Hours Level 0 – Soon!***
  - ***3.5 Hours Level 1 Spanish – Soon!***

- ***24+ Hours Education…***
- ***30++ Hours = Education & Exams –***
  - ***Members – Unlimited Subscription***
  - ***Non-Members – Visit FCIA.org***
  - ***SPECIFIERS, Code Officials, Fire Marshals – FREE Level 1***



FCIA – Firestop Contractors International Association

- **FCIA @ ASTM, ICC, NFPA, UL & ULC TC's, more…**
- **Tools @ FCIA.org …**
  - Specifiers, Facility Directors
  - AHJ's, Building Owners
  - Firestop Contractors & Inspection Agencies
- **Advocacy….**

ASTM INTERNATIONAL

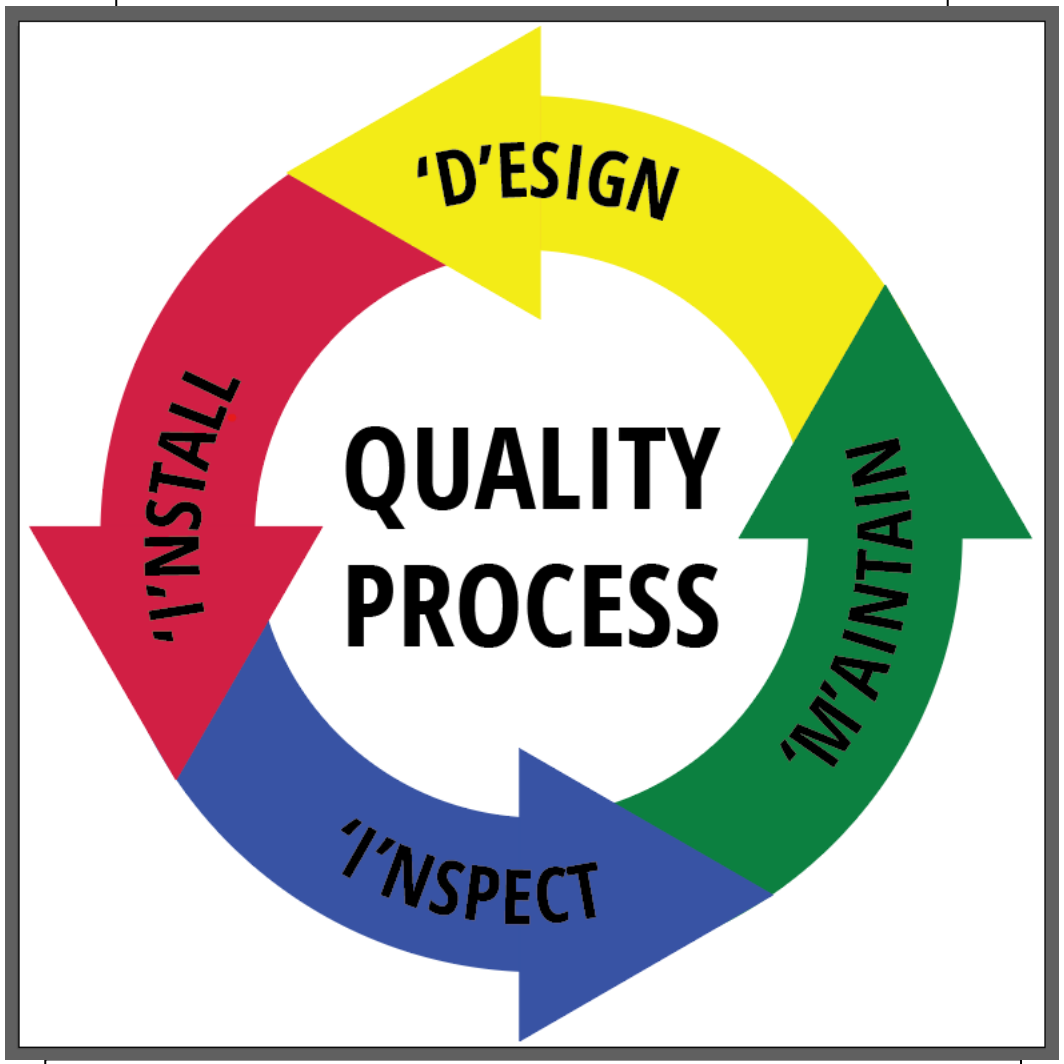
UL Standards & Engagement

FCIA – Firestop Contractors International Association

- India
- United Arab Emirates
- Qatar - Doha
- Canada
- Mexico –
- Saudi Arabia
- Australia/New Zealand–Far East

FCIA's DIIM™

DESIGN
Specs, Code



INSTALLATION
FM 4991/UL QFCP
Programs AND
Mfr. Education

PFP/BARRIERS
MAINTAIN
PROTECTION
Fire Codes

INSPECTION
IBC Ch. 17 -NFPA 80 - NFPA 1

FCIA

“TOTAL FIRE PROTECTION”

- Effective Compartmentation
  - Fire Barriers, Fire Walls, Floors, Smoke Barriers
  - Firestopping, Fire Dampers, Swinging and Rolling Fire Doors, Fire-Rated Glazing
  - Fire-Resistive Protection for Ductwork
- Detection & Alarm Systems
- Sprinkler Suppression Systems
- Education & Egress –
  - Building Owners & Managers, Building Occupants and Firefighters

FCIA Webinar Series

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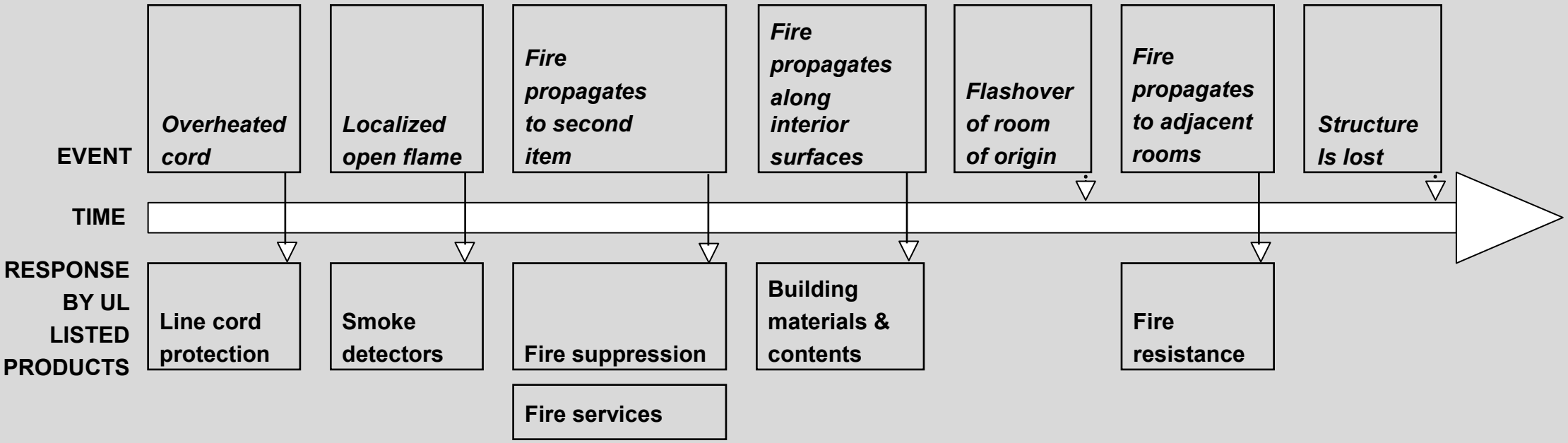
Reaction to Fire Versus Fire-Resistance

FCIA
Firestop Contractors International Association

Fire Event Timeline



Reaction to Fire vs Fire-Resistance What's the Difference???

- Reaction to Fire
  - Reaction to fire standards address keeping a small fire small
  - Evaluates flame propagation over the surface of the material – i.e. surface flammability
  - Based on the requirements of the following Chapters of the International Building Code:
    - Chapter 8 – Interior Finishes
    - Chapter 15 – Roofing Assemblies and Rooftop Structures
    - Chapter 26 – Plastics
    - Perhaps others

Fire-Resistance vs Reaction to Fire What's the Difference???

- Fire-Resistance
  - Assumes you already have a post-flashover fire condition
  - Evaluates the ability of the materials and methods of construction to resist the long-term impact of fire
  - Intended to contain the fire to the room or floor or origin and to maintain structural integrity of the building

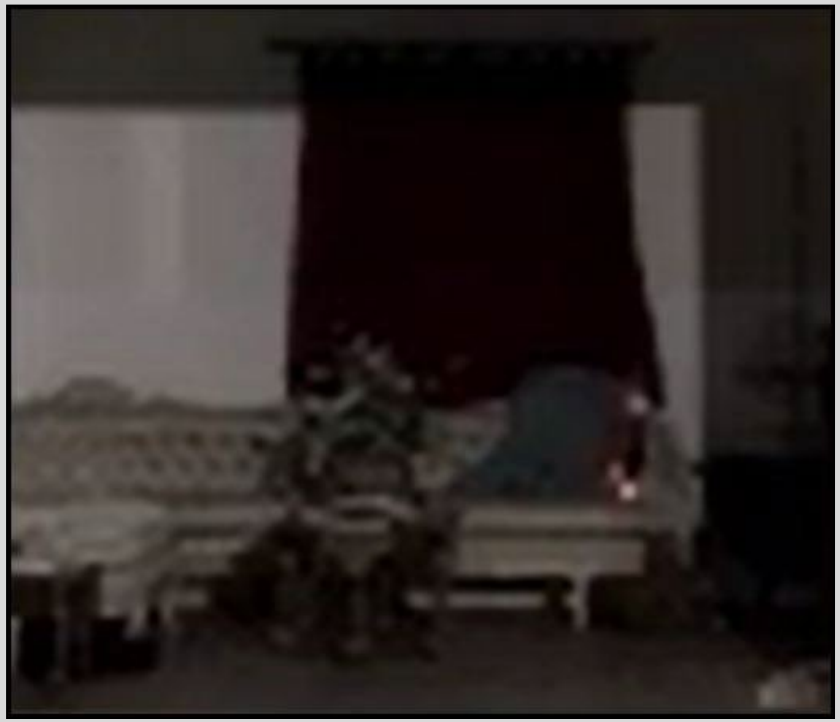
Fire-Resistance vs Reaction to Fire What's the Difference???

- Based on the requirements of Chapter 7 of the International Building Code covering Fire and Smoke Protection Features
  - Structural fire resistance
  - Containment of the fire
- Requires the protection of all breaches in the barriers
  - Penetrations
  - Joints and Voids
  - Opening Protectives
  - Duct and Air Transfer Openings

Reaction to Fire vs Fire-Resistance
What Should Not Happen

Reaction to Fire
What Should Not Happen

Legacy Room
(Natural Materials)



Modern Room
(Synthetic Materials)

120 seconds

New vs Old Room Fire Rev 1.avi

Interior Finishes – IBC Chapter 8

- Referenced Standards
  - Steiner Tunnel
    - UL 723 / ASTM E84 – Test for Surface Burning Characteristics of Building Materials
  - Room Corner Tests
    - NFPA 286 – Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
    - NFPA 265 – Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

Interior Finishes – IBC Chapter 8 Cont.

- Flooring Testing
  - ASTM E648 / NFPA 253 – Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
  - DOC FF-1 / ASTM E2859 – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials

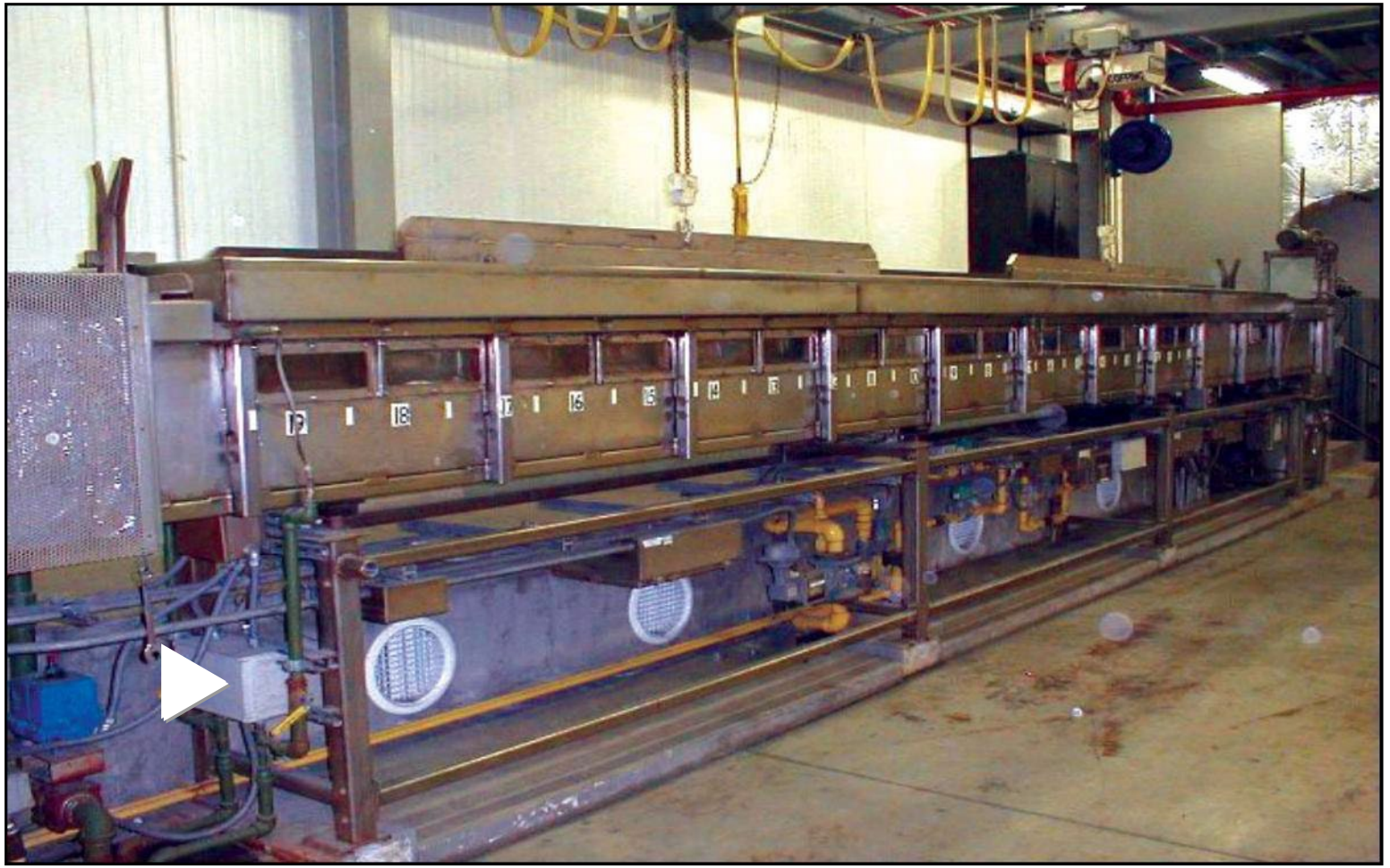
UL 723 / ASTM E 84 (Steiner Tunnel) Test

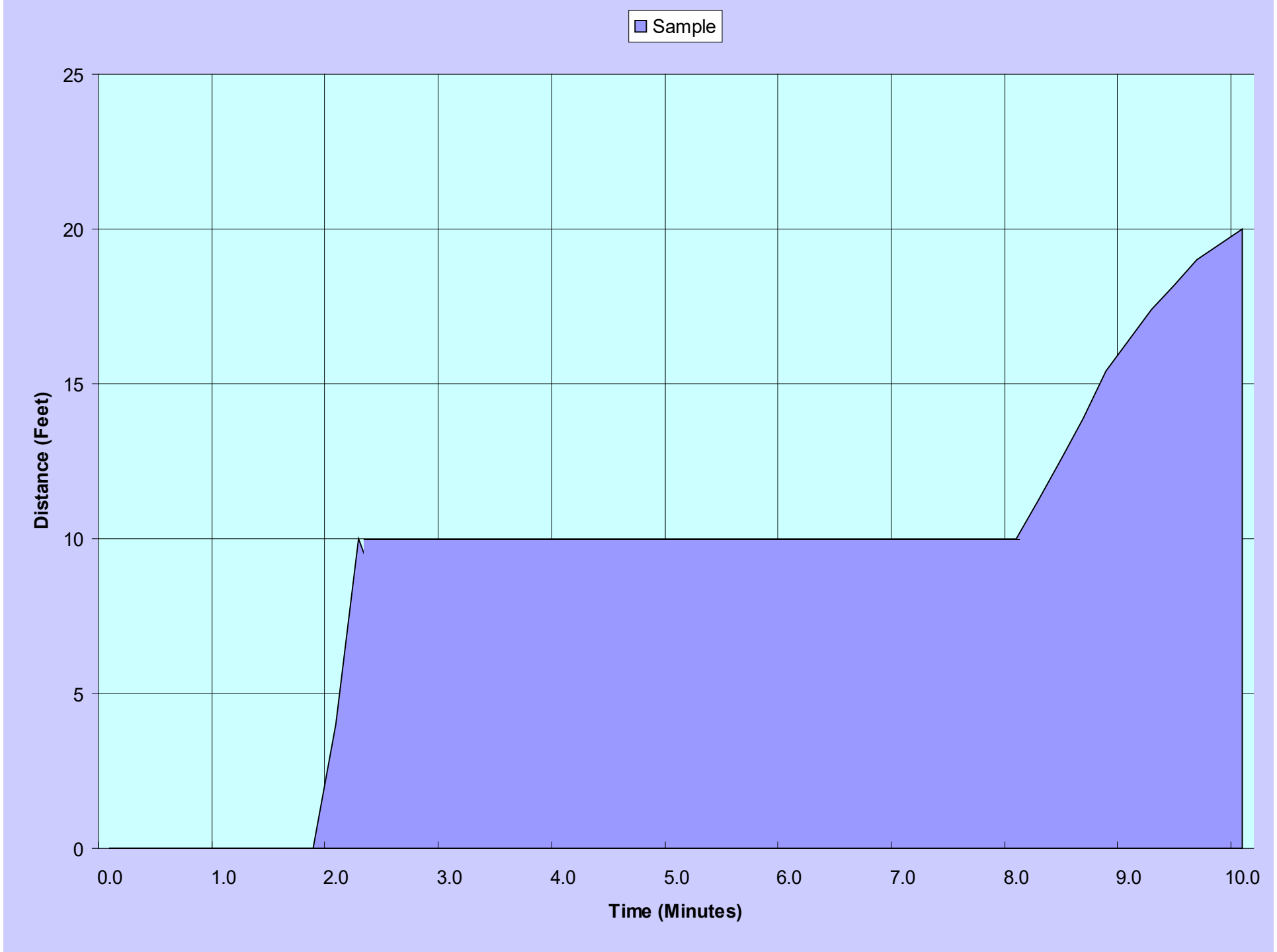
- Measures ***Surface Burning Characteristics***
  - Flame Spread Index (FSI)
  - Smoke Developed Index (SDI)
- Measures performance of material under test relative to comparative samples of:
  - Inorganic reinforced cement board (FSI / SDI = 0)
  - Red oak (FSI / SDI = 100)

UL 723 / ASTM E 84 (Steiner Tunnel) Test Cont.

- IBC requires Class A, B or C performance based on occupancy and the use of sprinklers
  - Class A – FSI of 0 to 25, SDI of 0 to 450
  - Class B – FSI of 26 to 75, SDI of 0 to 450
  - Class C – FSI of 76 to 200, SDI of 0 to 450

Steiner Tunnel Video

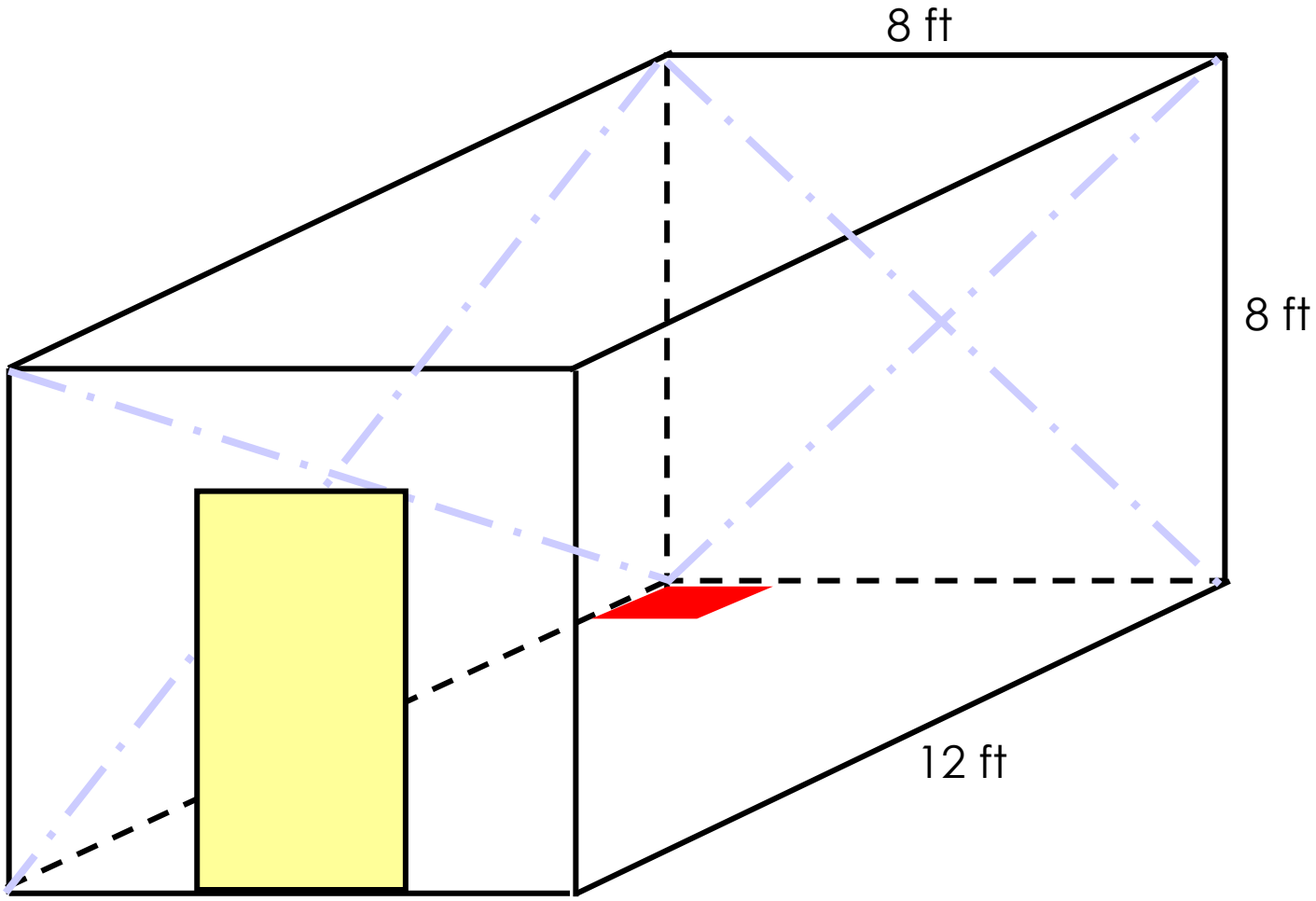



Sample
25
20
15
10
5
0
Distance (Feet)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Time (Minutes)

NFPA 286

- Evaluates surface flammability of wall, ceiling, or wall and ceiling interior finish materials other than textiles
- Considered one of four enclosed corner tests
- Developed as a spin-off NFPA 265
- Advantage of corner testing over Steiner Tunnel testing is ability to determine if material will stay in place on wall and/or ceiling
- Standard is a test method only
- Acceptance criteria detailed in code based on test method specified in Standard

NFPA 286 Cont.



NFPA 286 Cont.

- Test room constructed of steel studs / calcium silicate or gypsum board
- Material under tests installed on walls, ceiling, or walls and ceilings as specified by manufacturer
- Coatings installed on standard substrate
- Collection hood located above doorway to collect by-products of combustion

NFPA 286 Cont.

- Thermocouples installed at various points around room
- Paper flashover targets installed on floor at two locations
- Heat flux meter installed on floor
- Fuel provided by gas burner, calibrated in test room to provide rate of heat release of 40 kW and 160 kW

NFPA 286 Cont.

- Gas burner ignited and adjusted to provide 40 kW fire for 5 min
- Gas flow increased to provide 160 kW fire for an additional 10 min
- Condition of Acceptance from IBC
  - During the 40 kW exposure, flames shall not spread to the ceiling
  - The flame shall not spread to the outer extremity of the sample on any wall or ceiling
  - Flashover, as defined in NFPA 286, shall not occur
  - The peak heat release rate throughout the test shall not exceed 800 kW
  - The total smoke released throughout the test shall not exceed 1,000 m^2

NFPA 253 / ASTM E648

- NFPA 253 / ASTM E648 – Standard Method Test for Critical Radiant Flux of Floor Coverings Systems Using A Radiant Heat Energy Source (First Edition – 1978)
- Evaluates surface flammability of floor covering materials based on radiant heat exposure
- Original concept developed by the Armstrong Cork Company in 1966

NFPA 253 / ASTM E648 Cont.

- Test method developed by the National Bureau of Standards in the early 70s
- Standard is a test method only
- Acceptance criteria detailed in code based on test method specified in Standard

NFPA 253 / ASTM E648 Cont.

NFPA 253 / ASTM E648 Cont.

- Furnace calibrated to relate radiant flux to distance from radiant burner
- Furnace preheated using radiant panel burner for 1-1/2 hr
- Floor covering material installed on substrate placed at bottom of furnace chamber
- After 5 min, sample ignited using pilot burner
- Test continued until maximum flame propagation occurs

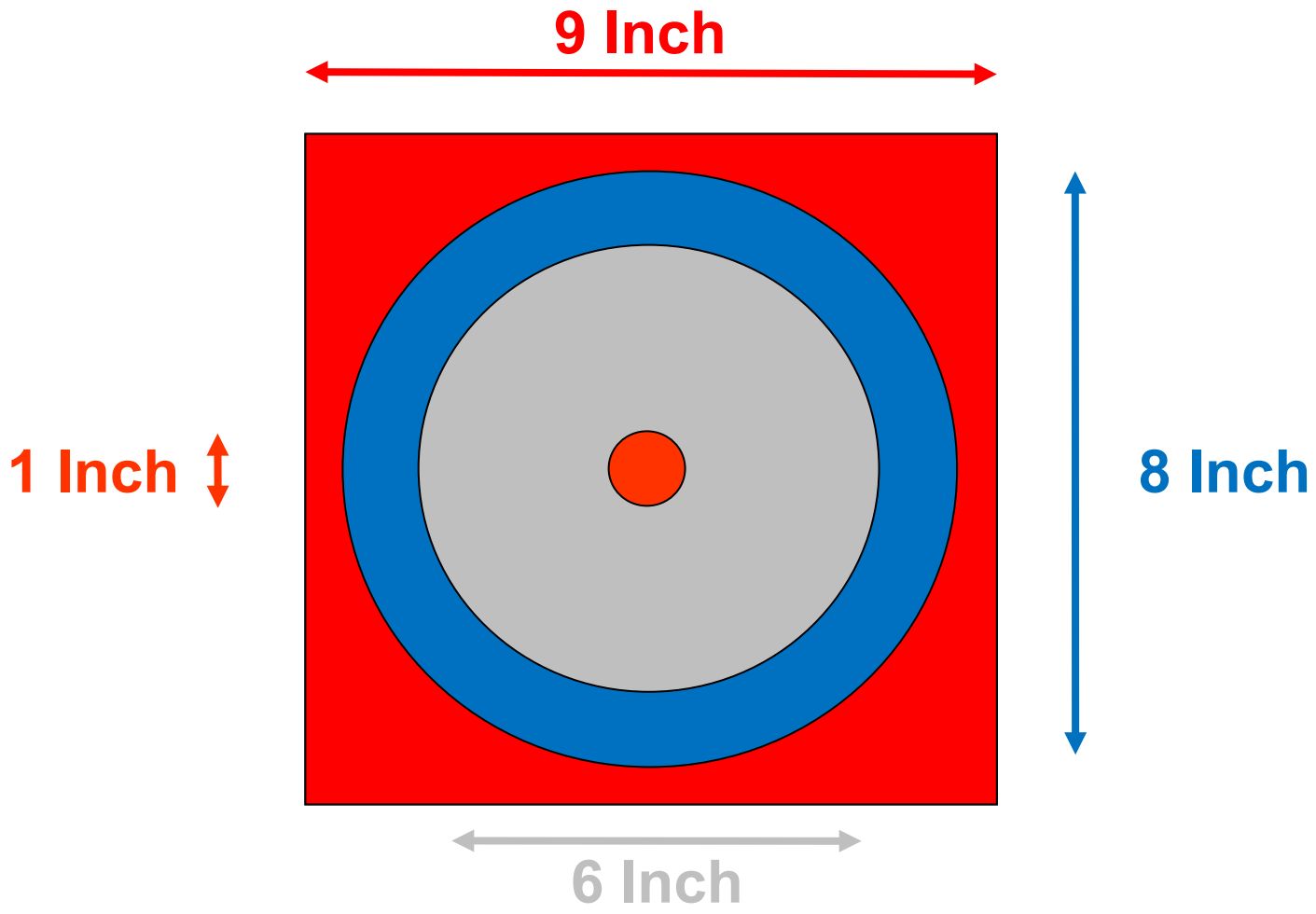
NFPA 253 / ASTM E648 Cont.

- Flame propagation distance recorded and critical radiant flux calculated based on calibration data
- Critical radiant flux is the radiant heat flux at which sample will not support combustion

DOC FF-1

- Department of Commerce Test DOC FF-1 – Standard for the Surface Flammability of Carpets and Rugs
- Developed by Department of Commerce many decades ago
- Conducted in a 12 in. by 12 in. by 12 in. chamber
- Uses Methenamine pill as ignition source

DOC FF-1 Cont.



DOC FF-1 Cont.

- Eight individual sample tested per construction of floor covering
- Acceptance Criteria
  - Charring shall not extend to within 1 in. of steel plate in 7 of 8 samples

Plastics – IBC Chapter 26

- Referenced Standards
  - Steiner Tunnel
    - UL 723 / ASTM E84 – Test for Surface Burning Characteristics of Building Materials
    - UL 1256 – Fire Test of Roof Deck Construction
  - Room Corner Tests
    - NFPA 286 – Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

UL 1256

- Measures flammability on underside of roof deck constructions using foamed plastic insulation on top of deck
- Sample incorporates a longitudinal seam in the roof deck along centerline of furnace chamber, which allows involvement of foam plastic
- Uses Steiner Tunnel furnace
- Maximum allowable flame propagation during 30 minute fire exposure
  - 10 feet in 10 min
  - 14 ft in 30 min

Roof Assemblies and Rooftop Structures – IBC Chapter 15

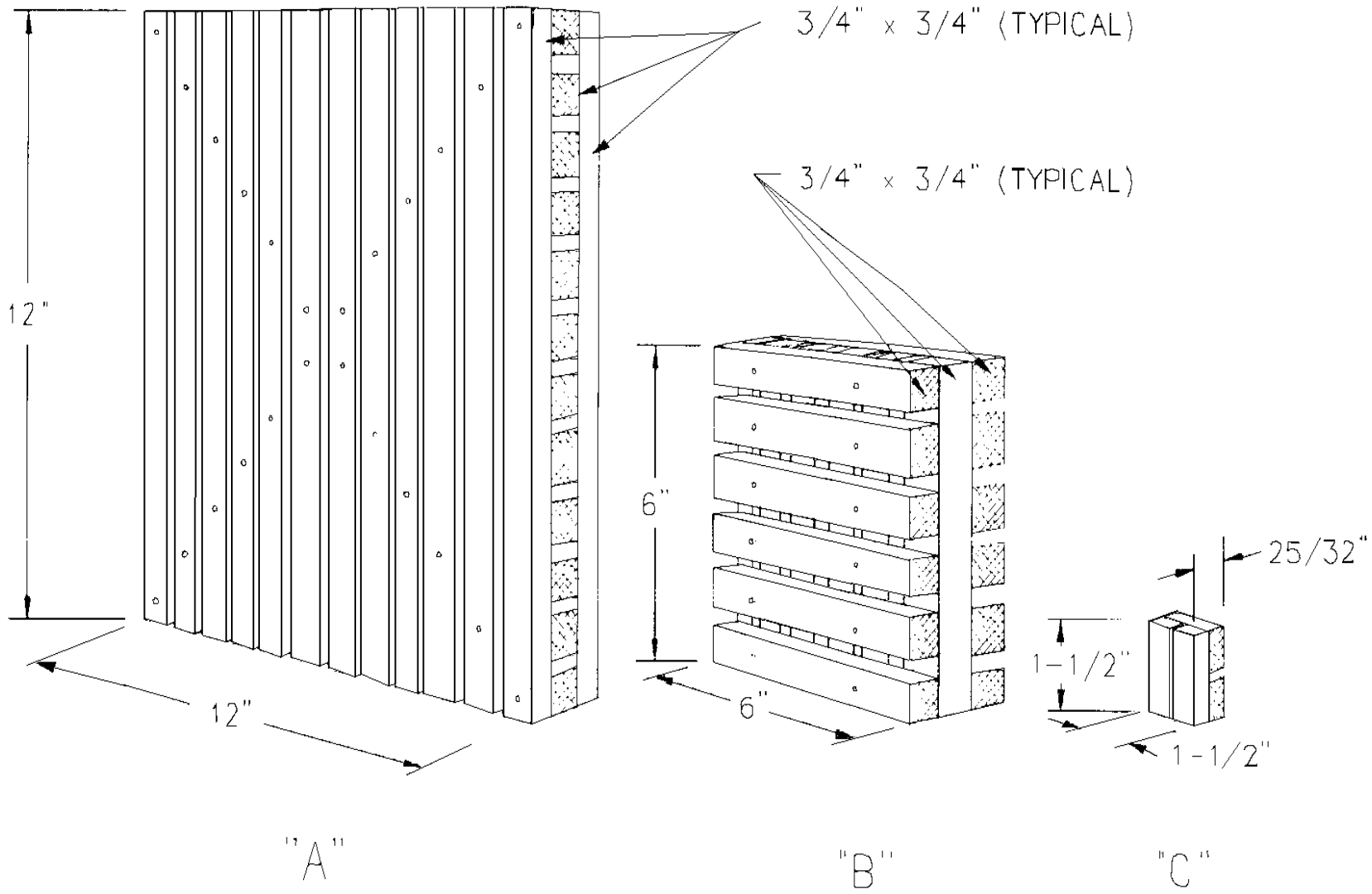
- Referenced Standards
  - Roofing Systems – Exterior Spread of Flame Over Roof Covering
    - UL 790 / ASTM E108 – Fire Tests of Roof Coverings

UL 790 / ASTM E108

- Measures
  - Spread of Flame over Roofing System based on an exterior fire exposure
  - Ability of Roofing System to prevent ignition on underside of combustible deck
  - Ability of Roofing System to resist ignition due to flaming embers

UL 790 / ASTM E108 Fire Test

Figure 8.1
"A," "B," and "C" brands



Fire-Resistance – What Reaction to Fire is NOT

Fire-Resistance-Rated Construction Cont.

- Assumes you already have a post-flashover fire condition
- Evaluates the ability of the materials and methods of construction to resist the long-term impact of fire
- Intended to contain the fire to the room or floor or origin and to maintain structural integrity of the building
- Based on the requirements of Chapter 7 of the International Building Code covering Fire and Smoke Protection Features

Building & Fire Code Requirements

- International Codes –
  - New and Existing Buildings – International Building Code – Chapter 7
  - Maintenance – International Fire Code – Chapter 7
- NFPA Codes –
  - New and Existing Buildings – NFPA 5000 & 101 – Chapter 8
  - Maintenance – NFPA 101 & 1
- Canadian Codes –
  - New and Existing Buildings – National Building Code of Canada
  - Maintenance – National Fire Code of Canada
- UAE Fire and Life Safety Code – Chapter 1, Section 21
- Other Worldwide Codes
- ***Minimum requirements*** - ***Construction*** & ***Maintaining Protection***

Fire Resistance

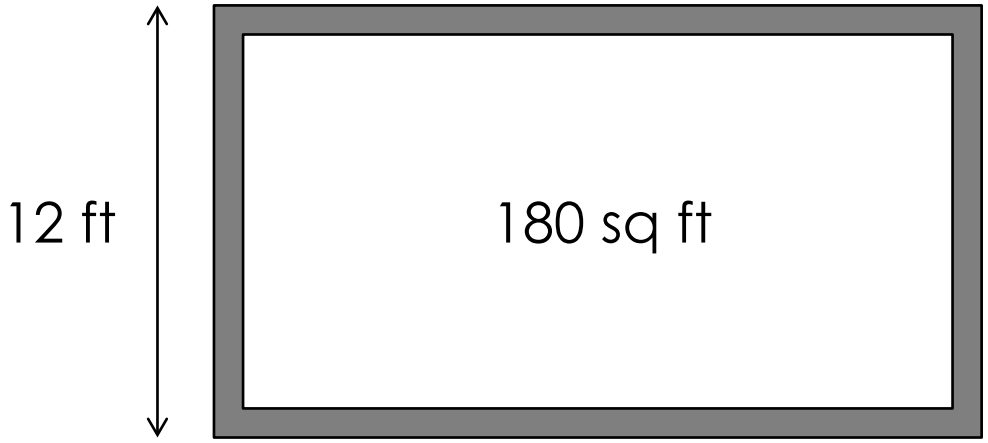
- **Products Become Designs, Systems & Assemblies Based on Testing**
  - **Fire & Smoke Barriers - Fire Separations** – ASTM E119 / UL 263 / ULC-S101
  - **Firestopping** – UL 1479 / ASTM E814 / ULC-S115, UL 2079 / E1966 / ULC-S115, E2307 / ULC-S115, E2837 **…**test methods…"
  - **Swinging/Rolling Fire Doors** – UL 10B, UL 10C, NFPA 252, ULC-S104. ULC-S105, ULC-S113
  - **Fire Rated Glazing** – UL 9 / NFPA 257 / ULC-S106, UL 263 / ASTM E119 / ULC-S101
  - **Fire/Smoke Dampers** – UL 555 / ULC-S112, UL 555S / ULC-S112.1, UL 555C / ULC-S112.2 / UL 263 / ASTM E119
- **All tests are conducted for some hourly time period**

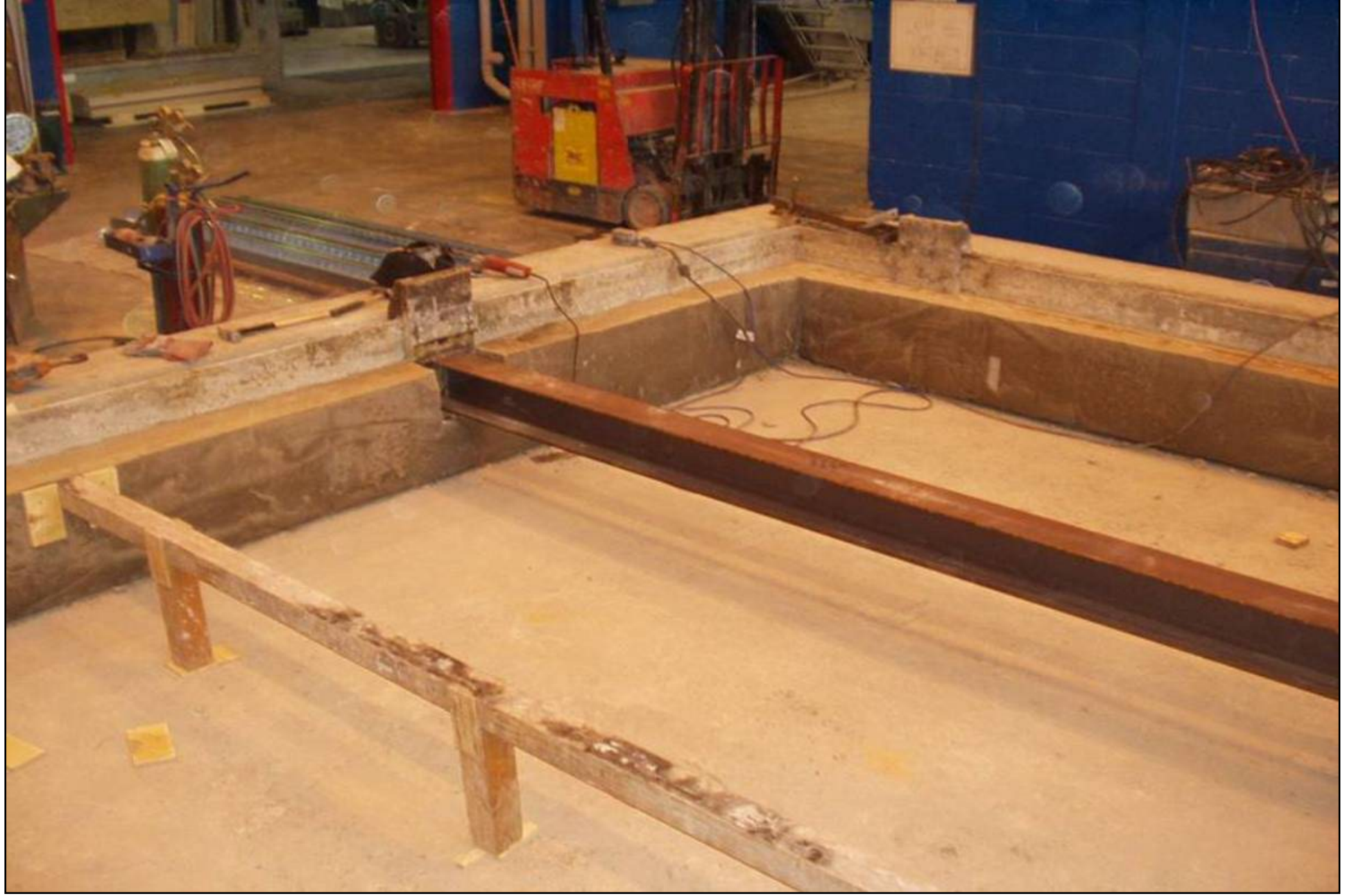
Fire Resistance

- Chapters 3, 4, 5, 6 and 10 establish the required ratings
- Chapter 7 establishes how the rating is determined
- Rating expressed as an Hourly Time Period
- Ratings range from 1/2 to 4 hours
- Contain Fire to Room or Floor of Origin and Maintain Structural Integrity

Floor/Ceiling or Roof/Ceilings

- Sample size – 180 sq ft / 12 ft
- Load applied – Per design





UL Image

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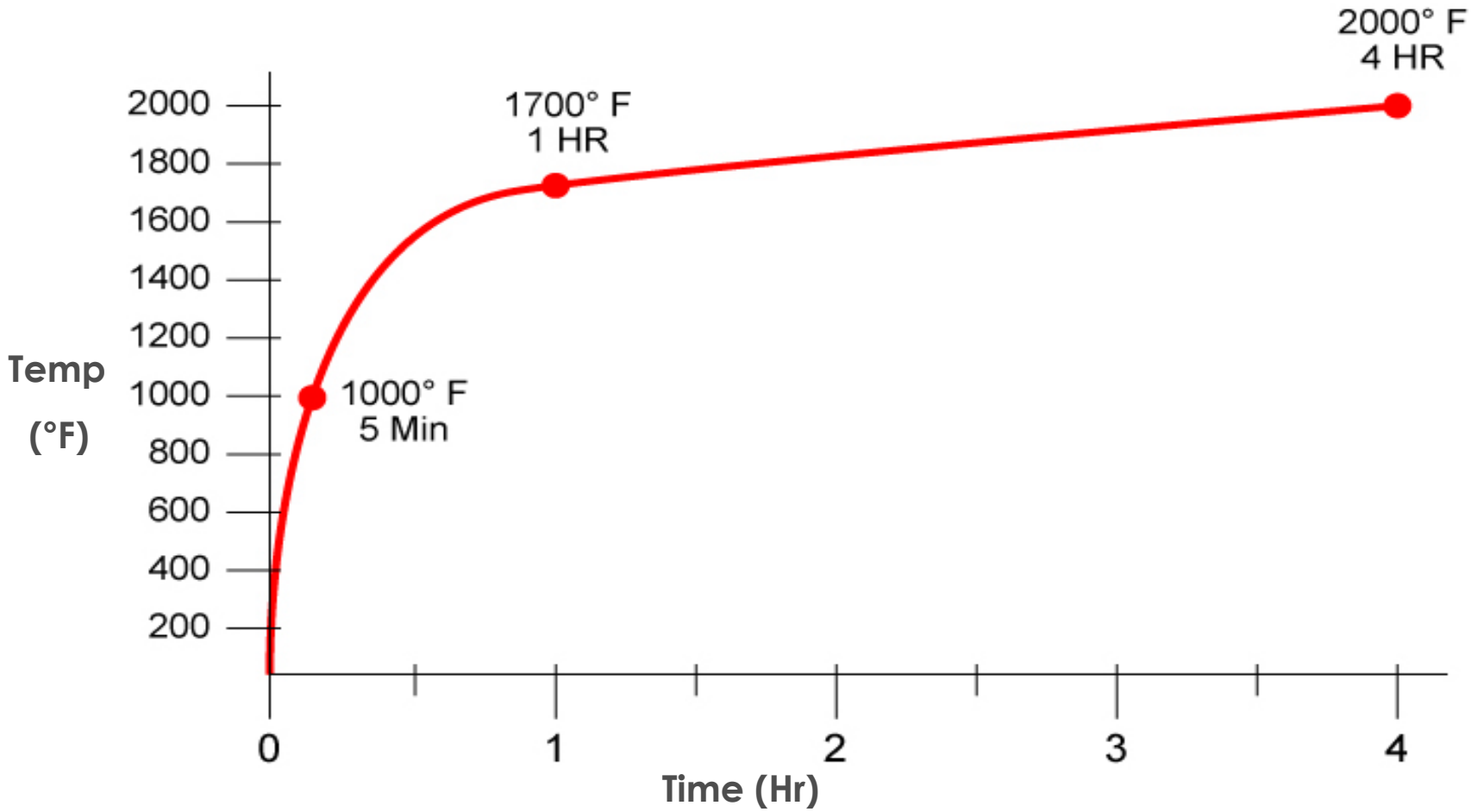
Time – Temperature Curve



Conditions of Acceptance
Floor/Ceilings or Roof/Ceilings

- Support load
- Flame passage
- 250ºF / 325ºF
- Support temperatures

Firestopping Penetrations for Continuity

- **Products become SYSTEMS Based on Testing**
- **'Field Erected Construction…Tested to…'**
  - Standards – UL 1479, ASTM E814, FM 4990, ULC-S115
  - US Ratings:
    - F Rating – Flame
    - T Rating – Temperature
    - L Rating – Smoke
    - W Rating – Water
    - M Rating – Movement

3M Photo

Firestopping Fire-Resistant Joints Systems for Continuity

- **Products become SYSTEMS Based on Testing**
- **'Field Erected Construction…Tested to…'**
  - Standards – UL 2079, ASTM E1966, ULC-S115
  - Assembly Rating – Flame & Temperature
  - L Rating – Smoke
  - W Rating – Water

Firestopping Perimeter Fire Containment Systems for Continuity

- **Products become SYSTEMS Based on Testing**
- **'Field Erected Construction…Tested to…'**
  - Standards – ASTM E2307, ULC-S115
  - F Rating – Flame
  - T Rating – Temperature
  - Integrity Rating – Flame
  - Insulation Rating – Temperature
  - L Rating – Smoke

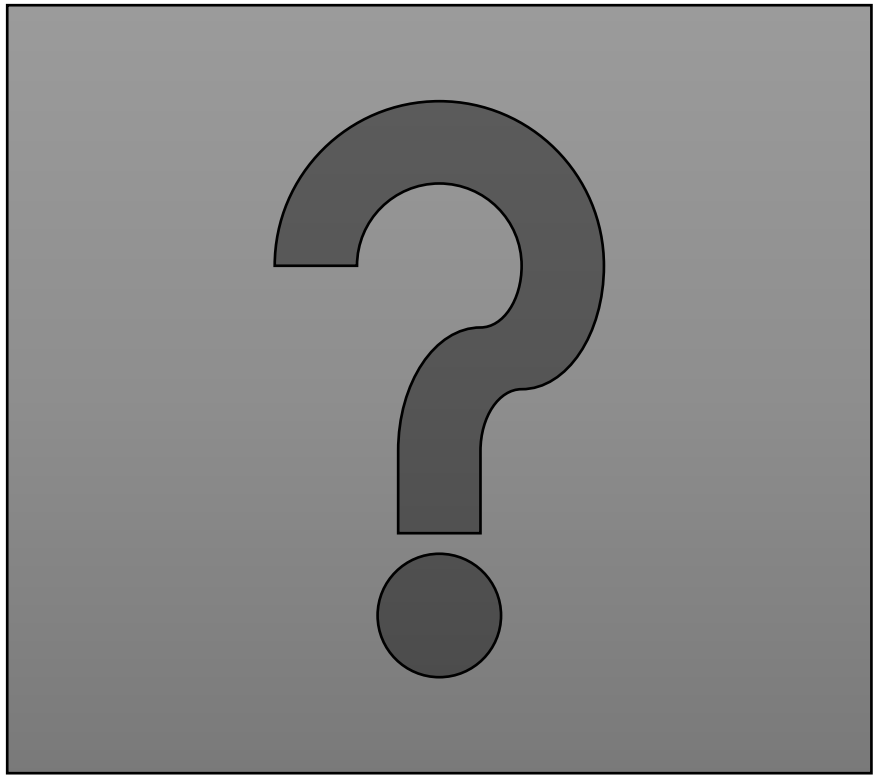
Summary

- Reaction to Fire
  - Reaction to fire standards address keeping a small fire small
  - Evaluates flame propagation over the surface of the material – i.e. surface flammability
- Fire-Resistance
  - Assumes you already have a post-flashover fire condition
  - Evaluates the ability of the materials and methods of construction to resist the long-term impact of fire

Summary Cont.

- Intended to contain the fire to the room or floor or origin and to maintain structural integrity of the building
- Requires the protection of all breaches in the barriers
  - Penetrations
  - Joints and Voids
  - Opening Protectives
  - Duct and Air Transfer Openings

Questions??



Thanks for Attending!!!

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