1

Course Description

- Provides insight into hazards associated with interior finishes, decorative materials and foam plastic
- Will address provisions from Chapter 8 *Interior Finishes*, Chapter 4 *Special Uses*, and Section 2604, *Foam Plastic Insulation*

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Objectives

- Participant will be able to:
  - List the hazards associated with interior finishes, decorative materials and trims.
  - Explain the differences in terminology
  - List the various options for providing increased flame resistance
  - Identify appropriate tests used to determine the safety of interior finishes

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Scope of Presentation

- Scope of seminar to include:
  - Interior finish concepts
  - Fire dynamics
  - Interior wall and ceiling finishes
  - Interior floor finishes
  - Applicable tests to achieve compliance
  - Decorative materials and trim
  - Special interior finish provisions in Chapter 4
  - Foam plastic insulation

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Concepts of Interior Finish Regulation

- Initial regulation of many interior finishes due primarily to disastrous event (Cocoanut Grove Nightclub fire in 1942)
- For many years, lack of proper control over interior finishes (and resulting rapid spread of fire) second only to vertical fire spread through openings in floors as cause of life loss due to fire in buildings

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Concepts of Interior Finish Regulation

- Dangers of unregulated interior finish are twofold:
  - Rapid spread of the fire itself so that it blocks the use of exitways, and
  - Production of large quantities of dense, black smoke (such as smoke created by certain plastic materials), which obscures the exit path and exit signs
- Additionally, unregulated interior finishes have potential for adding fuel to the fire
  - Increases fire intensity and shortens time available for occupants to egress safely

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Fire Dynamics

Module 2

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General Information

Check Your Knowledge

- What is more rapid, apt to occur, or hazardous?
  - Vertical or horizontal flame spread?

Vertical


  - Ceiling flame spread or floor flame spread?

Ceiling


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General Information Check Your Knowledge

What is more rapid, apt to occur, or hazardous?

- Larger room or smaller room?

Smaller Room

- Material on wall or same material on ceiling?

Material on Wall

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General Information

Other Factors

- Surface area to mass ratio affects ability to ignite
- Burning characteristics of a material
- Assemblies versus a single material – i.e., foam plastic with or without a thermal barrier

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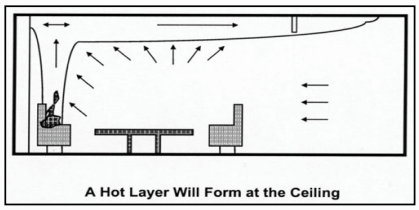
Progression of a Compartment Fire to Flashover

- Two-zone concept, with hot gases in the zone on top that thickens and cooler air in the bottom
- A hot layer will spill out to the next compartment



A Hot Layer Will Form at the Ceiling

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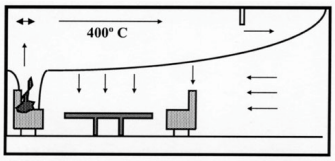
Progression of a Compartment Fire to Flashover

- Radiation heats material in lower area of room
- Small arrows show air flow, large arrow shows radiation



Radiation From Ceiling Moves Heat Down

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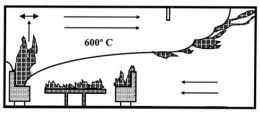
Progression of a Compartment Fire to Flashover

- Radiation heats materials in the room to their critical ignition temperatures
- Flashover is the transition from a fuel-controlled fire to a ventilation-controlled fire



Flashover!

Definition you Should Know

Ventilation controlled: Fire that is only restricted by amount of air available as a result, one tends to find smaller compartment fires.

Fuel controlled: Fire has plenty of air and is only restricted by the amount of fuel available.

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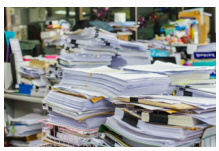
Fuel Load Comparisons

- Fuel load:
  - Potential fire energy per unit weight (Btu/lb or kj/kg) also known as Heat of Combustion
  - Plastics tend to have a much higher heat of combustion than celluloses (fabric, paper, etc.)



Cellulosic – 8,000 Bu/lb.

Plastics – 16,000 to 24,000 Bu/lb.

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Fuel Load Comparisons

- Burning Characteristics
  - Rate of heat release
  - How fast heat content is released
- The same material in different forms will have different fire hazards:
  - Example: Expanded vs. Unexpanded plastic

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Fuel Load Comparisons

NIST

National Institute of Standards and Technology
Technology Administration
U.S. Department of Commerce

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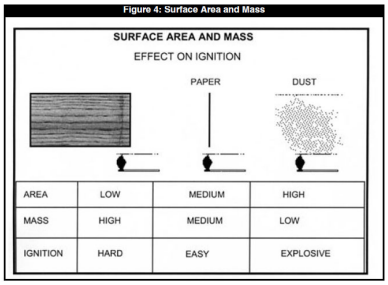
Surface Area to Mass Ratio

Figure 4: Surface Area and Mass



AREA	LOW	MEDIUM	HIGH
MASS	HIGH	MEDIUM	LOW
IGNITION	HARD	EASY	EXPLOSIVE

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Surface Area to Mass Ratio

Very important for ignition potential

- Dust can be explosive

- Paper easier to ignite than a 2-inch by 4-inch block of wood

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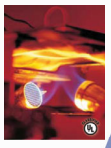
Fire Resistance vs. Flame Resistance

NOT THE SAME THING

- Fire resistance – it is addressed in Chapter 7 and typically focuses on the spread of fire after flashover. (ASTM E119)

- Flame resistance – it is addressed in Chapters 8 and 26. These chapters focus on the initial developing fire within a compartment or area of a building. The strategy is to reduce the potential of flashover.



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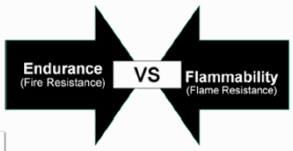
Fire Resistance vs. Flame Resistance

The difference between fire resistance and flame resistance can be summarized as:
Endurance vs. Flammability



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Flame Retardant and Flame Resistance

- Sometimes used to enhance flame-resistance properties
- Strategies
  - Slow ignition
  - Control combustion

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Flame Retardant and Flame Resistance

Available methods include:

- **Thermal** - Reduce thermal buildup.
- **Coating** - Block materials from the combustion process.
- **Gas** - Release nonflammable gases, such as carbon dioxide.
- **Chemical** - Forms fewer liquids and more solids during combustion process of cellulosic materials.

A gas-phase treatment plant, one of the processes used to administer boron.

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Flame Retardant and Flame Resistance

- Does not make materials flameproof or fireproof
- Noncombustible differs from flame-resistance. Therefore, flame-resistant materials should NOT be used as direct replacement of noncombustible materials.
- Materials with treatments must meet the testing requirements found in Chapter 8 for flame spread (ie., ASTM E84, NFPA 286 or NFPA 265).

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Methods of Flame Resistance

- Chemical
- Impregnation
- Coatings
- Pressure Impregnation

Pressure treatment plant.

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Flame Retardant and Flame Resistance

Method of Flame Resistance	Appropriate Use	Application	Other Information
Chemical	Synthetics; Plastics	Part of chemical formula	Actual chemical changes occur. Changes the behavior of materials.
Impregnation	Absorbent materials; NOT wood (too dense)	Immersion or in the field by spray	Sometimes done at wet pulp stage (paper, natural fibers, acoustical tile and building panels)
Coatings	Nonabsorbent materials Christmas trees	In the field Actively inhibits flame	A spread or simply provides a noncombustible barrier.
Pressure Impregnation	Dense, nonabsorbent materials such as wood	Only during manufacturing	Replaces air pockets with fire-retardant solution. Chemical deposits while drying. Vacuum pressure methods are used to impregnate materials.

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Fire Dynamics

- Briefly describe in three sentences how a compartment fire progresses to flashover.

1. A layer of hot gas will form at the ceiling with cooler air on the bottom.
2. Radiation from the ceiling will move the heat down.
3. The radiation will heat materials to their critical ignition temperatures and flashover will occur.

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Fire Dynamics

- What makes it more difficult to ignite a piece of paper versus dust?

A smaller surface to area ratio (i.e., less of the material is exposed to air, which makes it harder to ignite).

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Fire Dynamics

- What is one difference between fire resistance and flame resistance?

Fire resistance focuses upon the spread of fire once flashover has been reached and flame resistance focuses on the initial developing fire within a compartment or area of a building.

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Case Studies

- These four tragedies involved fire associated with the use of hazardous interior finishes, decoration and trim. In all four cases, there were other complicating factors, however the presence of noncomplying finishes were viewed as a major contribution to fire growth and fire spread:

Name of Facility	Location	Date	Fatalities
Coconut Grove	Boston, MA	11/28/42	492
Beverly Hills Supper Club	Southgate, KY	5/28/77	164
Happy Land Social Club	Bronx, NY	3/25/90	87
Station Night Club	West Warwick, RI	3/20/03	100

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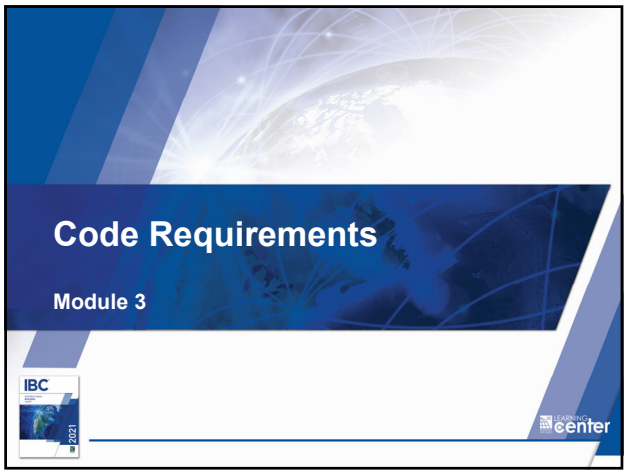

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Purpose of Code Requirements

- Focuses on the flame spread of interior finishes
- Main goal is to reduce the likelihood of flashover
- Interior finishes, decorative materials and trim can either contribute or be the cause of fire hazards, flame spread and movement

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IBC Chapter 8: Interior Finishes

- 801 General
- 802 Definitions
- 803 Wall and Ceiling Finishes
- 804 Interior Floor Finishes
- 805 Combustible Materials in Types I and II Construction
- 806 Decorative Materials and Trim

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801 Scope

- Defines scope and applicability of chapter
- IBC only addresses new construction; and IFC Chapter 8 provisions address existing buildings.
- IBC does not address furnishings, simply materials that are physically part of walls, ceilings and floors. Interior finish and trim. Also a certain amount of decorative materials (draperies).

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Interior Finish Requirements

- Purpose is to limit flame spread and smoke development.
  - < 0.036 inches thick applied directly to surface of walls and ceilings not required to be tested (Sec. 803.2)
  - Exposed heavy timber of Type IV construction not regulated for interior finish requirements in other than interior exit stairways and exit passageways (Sec. 803.3)
  - Combustible materials are acceptable as finish for walls, ceilings, floor and other interior surfaces (Sec. 802.5)
  - Decorative materials are restricted by combustibility, fire performance and flame propagation performance criteria per Section 806 (Sec. 803.2)
  - The focus is on combustibility and flame resistance in terms of ability to propagate flame

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Interior Finish Requirements

- Trim Requirements
  - Minimum flame spread ratings
  - Limitation on percent of wall and ceilings covered
- Foam Plastic Requirements
  - Fairly Restrictive
  - Interior Finish and Trim regulated by Section 2604.
  - Foam Plastic Insulation regulated by Section 2603

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803 Interior Wall and Ceiling Finishes

- Primary hazard is Flame Spread
- Two primary categories
  - Textiles
  - Non-textiles
- Materials restricted by occupancy and location

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803 Wall and Ceiling Finishes

- Three tests are selectively applicable in the regulation of interior wall and ceiling finishes
  - ASTM E84, Tunnel Test ~ Non Textiles and Textiles with Sprinklers
  - NFPA 286, Room Corner Test ~ Non Textiles and Textiles
    - Considered equivalent to Class A under ASTM E84
    - More conservative than NFPA 265
    - Can be used with textiles and nontextiles
  - NFPA 265, Room Corner Test ~ Textiles Only
    - Limited to textiles
    - Not considered equivalent to ASTM E 84 Class A

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803.1 Wall and Ceiling Finishes

- Except as shown in Sections 803.1.3 through 803.1.15, interior wall and ceiling finish materials to be classified for fire performance in accordance with either:
- Section 803.1.1. Tested in accordance with NFPA 286
  - Comply with acceptance criteria of Section 803.1.1.1
  - Considered to also comply with requirements for Class A
- Section 803.1.2. Tested in accordance with ASTM E84 or UL 723
  - Such finish materials to be grouped according to flame spread and smoke-developed indices
    - Class A
    - Class B
    - Class C

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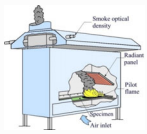
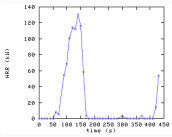
803.1. Tested to NFPA 286

- Allows use of NFPA 286
- Sets acceptance criteria as:
  - During 40 kW exposure, flames cannot spread to ceiling
  - Flames cannot spread to the outer extremity of the sample
  - Flashover, as defined by NFPA 286, cannot occur
  - Peak Rate of heat release is 800 kW.
  - Smoke production is limited to 1,000 m2
- Considered to be compliant as Class A





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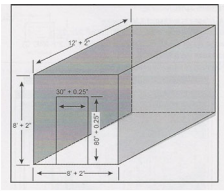
NFPA 286: Room Corner Test

- Fire source located in the corner
- Generally more conservative than ASTM E84
- More realistic indicator of hazard than ASTM E84
- Material sample placed on three walls and the ceiling
- Total heat release is determined



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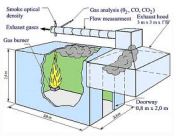
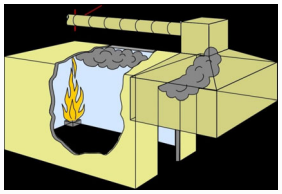
NFPA 286: Room Corner Test





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NFPA 286: Room Corner Test

- Fire exposure is stepped up over time:
  - 40 kW for 5 minutes
  - 160 kW for 10 minutes
- The code defines pass/fail criteria
- Closely linked to fire behavior in realistic fires

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NFPA 286: Room Corner Test

Defines flashover as:

- Heat release in excess of 1 MW
- Heat flux at the floor in excess of 20 kw/m^2
- Average upper layer temperature in excess of 1112°F (600°C)
- Flames exit the doorway
- Autoignition of paper target on the floor

Figure 803.1.2(2)
FLAME IN ROOM CORNER TEST

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NFPA 286: Room Corner Test

Defines flashover as:

- Heat release in excess of 1 MW
- Heat flux at the floor in excess of 20 kw/m^2
- Average upper layer temperature in excess of 1112°F (600°C)
- Flames exit the doorway
- Autoignition of paper target on the floor

Figure 803.1.2(2)
FLAME IN ROOM CORNER TEST

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803.1.2 Tested to ASTM E84 or UL 723

- Requires compliance with ASTM E84 or UL 723
- Provides hazard classification based on flame spread
  - Class A: Flame spread 0-25
  - Class B: Flame spread 26-75
  - Class C: Flame spread 76-200

  (Smoke-Developed Index Range for each is 0-450)

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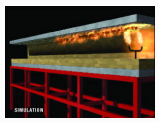
ASTM E84: Tunnel Test

- ASTM E84: *Standard Test Methods for Surface Burning Characteristics of Building Materials*
  - Commonly referred to as the Steiner Tunnel Test
  - UL 723 also accepted as a comparable test method
- For wall and ceiling finishes
- Tested in a horizontal configuration
  - 25-foot long sample
- 10 minutes exposure to heat source



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ASTM E84: Tunnel Test

Three hazard classifications:

- Class A: Flame spread index 0-25 (lowest hazard)
- Class B: Flame spread index 26-75 (medium hazard)
- Class C: Flame spread index 76-200 (highest hazard)

Smoke Developed Index 0-450

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Tunnel Test "Weaknesses"

- Only establishes a "relative" hazard or ranking
- Ranking (based upon Red Oak) not closely related to realistic fires
- Plastics may drip, causing an inaccurate indication of the hazard
- Sample size may also be too small to provide a clear indication of the hazard

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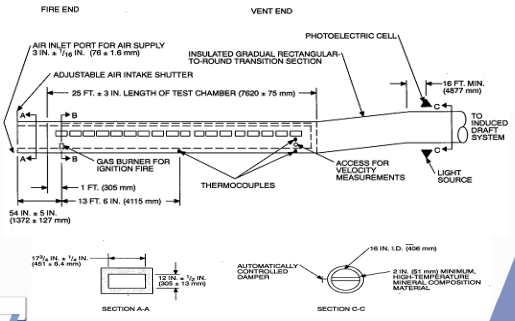
Figure 8.1.1 Tunnel Test



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Flame in Tunnel Test

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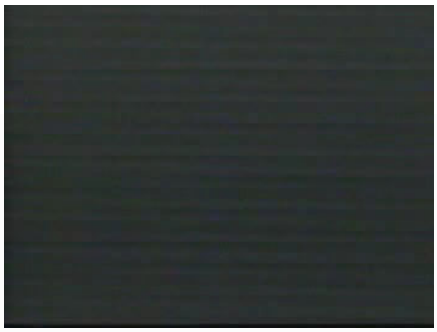
ASTM E 84



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ASTM E 84

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Typical Flame Spread of Common Materials

Material	Flame spread
Glass-fiber sound-absorbing blanks Mineral-fiber sound-absorbing panels Shredded wood fiberboard (treated) Sprayed cellulose fibers (treated)	15 to 30 10 to 25 20 to 25 20
Aluminum (with enamel finish on one side) Asbestos-cement board	5 to 10 0
Brick or concrete block Cork Gypsum board (with paper surface on both sides) Northern pine (treated)	0 175 10 to 25 20
Southern pine (untreated) Plywood paneling (untreated) Plywood paneling (treated)	130 to 190 75 to 275 100
Carpeting Concrete	10 to 600 0

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803.2 – Thickness Exemption

- Materials having a maximum thickness of 0.036 inch applied directly to the surface of ceilings or walls is not required to be tested.

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803.3 – Heavy Timber Exemption

- Exposed portions of building elements complying with the requirements for buildings of heavy timber construction in Section 602.4 or Section 2304.11 shall not be subject to interior finish requirements.

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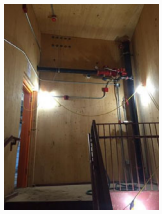
803.3 – Heavy Timber Exemption

- Exemption from the interior finish requirements for exposed portions of heavy timber building elements does not apply to:
  - Interior exit stairways
  - Interior exit ramps
  - Exit passageways



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803.4 – Foam Plastics

- Foam plastics are not to be used as interior finish materials unless specifically permitted by Section 2603.9
- Provisions of Section 2609.3 applicable to:
  - Exposed foam plastics, and
  - Foam plastic used in conjunction with a textile or vinyl facing or cover
- Section 2603.9 addresses use of large-scale tests to allow for special approval of foam plastic use
  - Testing to be related to actual end-use configuration and performed on finished manufactured foam plastic assembly

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803.5 - Textile Wall Coverings

- Textiles wall coverings are regulated in a different manner than other types of interior finishes.
- Textile coverings can be either woven or nonwoven, and can be:
  - Napped
  - Tufted
  - Looped
  - Carpet
  - Similar textile materials

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803.5 - Textile Wall Coverings

- Three test methods are available for the approval of textile materials to be used as interior wall finishes
- Such methods are established in:
  - Sec. 803.1.1 NFPA 286
  - Sec. 803.5.1 NFPA 265, Method B protocol
  - Sec. 803.5.2 ASTM E84 or UL 723

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803.5 – NFPA 286: Room Corner Test

- Textile wall coverings tested in accordance with NFPA 286 are permitted as established in Section 803.1.1, based on the specified acceptance criteria

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803.5.1 NFPA 265: Room Corner Test

- Textile wall coverings and expanded vinyl wall coverings are permitted where meeting acceptance criteria for NFPA 265, Room Corner Test
- NFPA 265 takes an approach similar to that of NFPA 286 but less conservative
  - The heat release rate exposure is less
  - Gas burners 2 inches from wall versus flush against the wall in NFPA 286
  - Sample only mounted on the walls. NFPA 286 requires the walls and ceilings
  - Flashover conditions are the same as NFPA 286
  - The code defines pass/fail criteria

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NFPA 265 vs. NFPA 286

- NFPA 265 differences from NFPA 286
  - Fire exposure is less severe
    - 40kW for 5 minutes
    - 150 kW for 10 minutes (286-140 kW – 10 minutes
  - For textiles only
  - Sample on walls only
  - Two test methods
    - Test Protocol A (Small Scale)
    - Test Protocol B (Large Scale)

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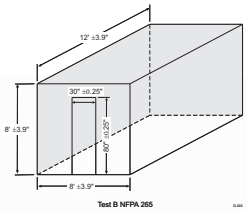
Method B Protocol of NFPA 265

- Larger scale
- Materials applied on three walls (excluding the wall with the opening)
- More expensive than Test A



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Results of the Room Corner Test (both NFPA 286 & 265)

- Extent of fire growth on the sample
- Maximum peak of heat release rate
- Total heat released
- Time to flashover
- Time to flame extension to the door

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Results of the Room Corner Test

- Total incident heat flux to the floor (important indicator of flashover conditions)
- Upper level gas temperature (another flashover indicator)
- Amount of carbon dioxide released
- Emissions of other gases

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803.6 Textile Ceiling Coverings

- Two options provided for compliance of textile ceiling coverings applied to ceilings
  - NFPA 286 w/ acceptance criteria
  - ASTM E84 UL 723 Class A rating with sprinklers

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803.6 ASTM E84 or UL 723 Test

- Textile materials applied to a ceiling permitted where:
  - Coverings have a Class A flame spread index in accordance with ASTM E84 or UL 723, and
  - Building protected throughout with NFPA 13 or 13R, where applicable, sprinkler system

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803.6 NFPA 286: Room Corner Test

- NFPA 286 (Room Corner Test)
  - More conservative test
  - Allows manufacturer to test once
  - Same pass fail criteria as follows:
    - During 40 kW exposure, flames cannot spread to ceiling
    - During 160 kW exposure:
      - Flames cannot spread to outer extremity of the sample
      - Flashover as defined by NFPA 286 cannot occur
    - Maximum peak heat release rate 800 kW
    - Smoke production is limited to 1000 m^2

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803.7 Expanded Vinyl Wall Coverings

- Expanded vinyl wall coverings to be tested in same manner as textile wall coverings
- Allows use of
  - ASTM E84/UL 723 with sprinklers
  - NFPA 265
  - NFPA 286

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803.8 Expanded Vinyl Ceiling Coverings

- Expanded vinyl ceiling coverings to be tested in same manner as textile ceiling coverings
- Tested in manner intended for use
- Using product mounting system, including adhesive
- Concealed and exposed
- ASTM E84/NFPA 723, or NFPA 286

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803.9 High-Density Polyethylene and Polypropylene

- Where high-density polyethylene (HDPE) and polyethylene (PP) are used as interior finish materials, compliance with Section 803.1.1 is required
  - Materials to be tested in accordance with NFPA 286

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803.10 Site-Fabricated Stretch Systems

- By definition, site-fabricated stretch systems consist of three parts:
  - Fabric or vinyl
  - Frame
  - Infill core material
- Where used as interior wall or ceiling finish materials, such systems to comply with:
  - Section 803.1.1 (NFPA 286), or
  - Class A per Sec. 803.1.2 (ASTM E84/UL 723)

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803.11 Factory-Produced Laminated Products with a Wood Substrate

- Where laminated products with a wood substrate are produced in a factory, they shall meet on of two conditions where applied as an interior finish:
  - Meet criteria of Section 803.1.1.1 when tested in accordance with NFPA 286, using the product-mounting system, including adhesive, or
  - Have a Class A, B or C flame-spread and smoke-developed index when tested in accordance with UL E84 or UL 723

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803.12 Facings and Wood Veneers Applied on Site Over a Wood Substrate

- Where facings and wood veneers are applied over a wood substrate on the site, and then utilized as interior finishes, the facing and veneers shall comply in the same manner as set forth in Section 803.11:
  - Meet criteria of Section 803.1.1.1 when tested in accordance with NFPA 286, using the product-mounting system, including adhesive, or
  - Have a Class A, B or C flame-spread and smoke-developed index when tested in accordance with UL E84 or UL 723

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803.13 Interior Finish Requirements Based on Occupancy

- Interior wall and ceiling finishes to have classification based on flame-spread index and smoke-developed index no greater than that set forth in Table 803.13
- Such classifications to be based on testing per ASTM E84 or UL 723, or alternately, NFPA 286
- Where meeting the NFPA 286 test and acceptance criteria of Section 803.1.1.1, interior finish materials are permitted to be used where a Class A material is required
- Class A materials are permitted in all locations and all conditions regulated by Table 803.13

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803.13 Interior Finish Requirements Based on Occupancy

- Interior wall and ceiling finish requirements of Table 803.13 based on:
  - Occupancy classification of the room space
  - Location of finish material within the building
  - Whether location of finish material is sprinklered or nonsprinklered
    - Sprinkler system not required throughout entire building to apply sprinkler allowance

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803.13 Interior Finish Requirements Based on Occupancy

- Flame spread classification varies based on where the finish material is located within the means of egress system
  - Interior exit stairways and exit passageways (most restrictive)
  - Corridors (common areas of exit access)
  - Rooms and enclosed spaces (least restrictive)
- Exceptions provide many variations to base requirements of Table 803.13
  - Exceptions can selectively be more restrictive or less restrictive

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TABLE 803.13
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY[a]

GROUP	SPRINKLERED[j]			NONSPRINKLERED		
	Interior exit stairways and ramps and exit passageways[c,k]	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces[e]	Interior exit stairways and ramps and exit passageways[c,k]	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces[e]
A-1 & A-2	B	B	C	A	A[d]	B[g]
A-3[f], A-4, A-5	B	B	C	A	A[d]	C
B, E, M, R-1	B	C[m]	C	A	B	C
R-4	B	C	C	A	B	B
F	C	C	C	B	C	C
H	B	B	C[h]	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B[b,l]	A	A	B
I-3	A	A[i]	C	A	A	B
I-4	B	B	B[b,l]	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2.

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803.13 Interior Finish Requirements Based on Occupancy

a. Class C interior finish materials shall be permitted for wainscotting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fireblocked as required by Section 803.15.1.
b. In other than Group I-3 occupancies in buildings less than three stories above grade plane, Class B interior finish for nonsprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted in interior exit stairways and ramps.
c. Requirements for rooms and enclosed spaces shall be based on spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered to be enclosing spaces and the rooms or spaces on both sides shall be considered to be one room or space. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.
d. Lobby areas in Group A-1, A-2 and A-3 occupancies shall be not less than Class B materials.
e. Class C interior finish materials shall be permitted in places of assembly with an occupant load of 300 persons or less.
f. For places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be permitted.
g. Class B material is required where the building exceeds two stories.
h. Class C interior finish materials shall be permitted in administrative spaces.
i. Class C interior finish materials shall be permitted in rooms with a capacity of four persons or less.
j. Class B materials shall be permitted as wainscotting extending not more than 48 inches above the finished floor in corridors and exit access stairways and ramps.
k. Finish materials as provided for in other sections of this code.
l. Applies when protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
m. Corridors in ambulatory care facilities shall be provided with Class A or B materials.

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803.14 Stability

- Interior finish materials to be applied or fastened so that such materials will not readily become detached under elevated temperatures
- Ensures level of durability when exposed to heat
- Loose materials contribute to fire load and cause of fire spread
- Criteria > 200ºF for at least 30 minutes
- No standard methodology available to determine whether materials can withstand temperature exposure

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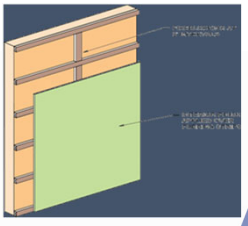
803.15 Application

- Fire-resistance-rated and noncombustible construction require specific installation
  - Material must be applied directly to the surface or on furring strips ≤ 1.75 inches
- Furred area must:
  - Contain inorganic or Class A material, or
  - Be fireblocked – 8 feet max. in every direction according to Section 718
  - Not required where materials used to construct concealed space are noncombustible



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803.15.2 Set Out Construction

- Where walls and ceilings to be of fire-resistive or noncombustible construction, and walls are set out or ceilings are dropped more than 1¾ inches:
  - Class A finish material must be used; or
  - Sprinkler protection provided on both sides, or
  - Finish materials attached to noncombustible backing or furring strips per Section 803.15.1.1, or
  - Combustible void filled with noncombustible material

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803.15.3 Heavy Timber Construction

- Wall and ceiling finishes of all classes as permitted where installed:
  - Directly against wood decking or planking of heavy timber construction, or
  - To furring strips applied directly to wood decking or planking and fireblocked per Section 803.15.1.1

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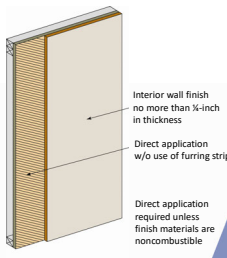
803.15.4 Thin Materials

- Combustible wall or ceiling finish material not more than 1/4-inch-thick must be applied directly onto wall, ceiling or structural element, unless:
  - It is Class A material, and
  - Material was tested on suspended or furred-out noncombustible backing



Thin Interior Finish Materials

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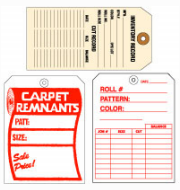
804 Interior Floor Finish

- Floor finishes typically less hazardous than wall and ceiling finishes
- Usually contributes to a fire after flashover occurs
- Related tests
  - ASTM E648 or NFPA 253
  - DOC FF-1 "Pill Test" (CPSC 16 CFR, Part 1630)
- Focuses on fiber-oriented floor coverings rather than wood, vinyl, etc.

86

804.3 Testing and Identification

- Requires a hang tag or other method to identify the manufacturer or supplier.
- Carpet required to be tested (ASTM E648/NFPA 253) as installed.
- Test reports are to be available on request of a building official.



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804.4 Interior Floor Finish Requirements

- In all occupancies, interior floor covering materials to comply with:
  - Requirements of DOC FF-1 "pill test" or ASTM D2859, and
  - Minimum critical radiant flux where specifically required
- Requirement that interior floor finish materials withstand a minimum critical radiant flux limited to:
  - Stairway and ramp enclosures
  - Exit passageways
  - Corridors
  - Rooms not separated from corridors by partitions extending from floor to underside of ceiling

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804.4.2 Minimum Critical Radiant Flux

Minimum classification of floor covering materials in exit enclosures, exit passageways, and corridors

		Class I	Class II	DOC FF-I "pill test"
Groups I-1, I-2, I-3	Sprinklered		X	
	Nonsprinklered	X		
Groups A, B, E, H, I-4, M, R-1, R-2, S	Sprinklered			X
	Nonsprinklered		X	
Other groups	Sprinklered			X
	Nonsprinklered			X

Classification of floor covering materials

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NFPA 253

Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Heat Source

- Test determines lowest heat flux that can sustain combustion.
- That distance is related back to the known flux at that point given by the panel to give minimum heat flux.
- Does not provide ranking of materials.

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NFPA 253

Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Heat Source

- The IBC provides rankings based on ranges of critical fluxes determined by the test.
- Two classifications:
  - Class I: greater than or equal to 0.45 watts/cm2
    - (Better performer)
  - Class II: between .22 and 0.45 watts/cm^2
    - (Poorer Performer)

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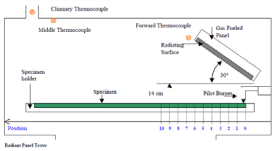
NFPA 253

Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Heat Source

- Applicable to floor surfaces
- Sample placed on horizontal surface and subjected to:
  - Piloted ignition
  - Radiative panel:
    - Simulates the radiation from upper layer in fire.
    - The intensity of the panel gets less further away.



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DOC FF-1, CPSC CFR 16: Pill Test

- Tests ability of carpet to address flame spread across the surface
- Minimum standard for all carpet sold in the United States over 24 square feet
- Less conservative than NFPA 253

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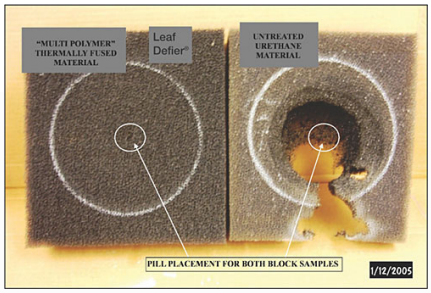
DOC FF-1, CPSC CFR 16: Pill Test



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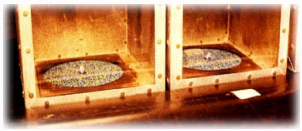
DOC FF-1, CPSC CFR 16: Pill Test

- Eight 9 x 9 inch samples are tested
- An ignition source is provided to see how far the flame spreads
- The test lasts as long as the flame continues



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DOC FF-1, CPSC CFR 16: Pill Test

- FAILURE = when charring extends more than 3 inches from the ignition source
- PASS = When seven out of eight samples pass
- Test is similar to cigarette ignition
- Provides a relative ranking, not necessarily indicator of actual performance

Tip

This is the minimum standard for all carpet sold in the United States over 24 square feet (2.2 m^2).

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805 Combustible Materials in Type I and II Construction

- Addresses combustible materials installed on, or embedded in, floors of Type I and II buildings
  - Not applicable to floors of stages and platforms
- Intent is to avoid fire spread under the flooring
- Fireblocking or solid fill is required if the flooring is not directly attached

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202 Decorative Materials

- Decorative materials are defined as all materials applied over the building interior finish for decorative, acoustical or other effect
- Not included as decorative materials are:
  - Wall and ceiling coverings
  - Ordinary window shades
  - Wallpaper and similar thin interior finish materials no more than 0.025 inches in thickness applied directly to a substrate

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806 Decorative Materials

- Provisions focus on items that are not physically part of the wall itself, including:
  - Curtains
  - Draperies
  - Hangings
  - General Décor (Holiday or otherwise)
- Primary test is NFPA 701 (flame propagation)
- Restrictions vary based on occupancy
- Foam plastics addressed by Section 2604.2

99

806.1 General Provisions

- Applicable to decorative materials in all occupancies:
  - Furnishings and materials of an explosive or highly flammable character are prohibited
  - Fire-retardant coatings to be maintained in existing buildings to retain effectiveness of treatment under service conditions encountered in actual use
  - Furnishings and other objects not to be placed to obstruct exitways and visibility of exits
  - Permissible amount of decorative vegetation and noncombustible decorative materials are prohibited

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806.3 Combustible Decorative Materials

- In Groups A, B, E, I M, R-2 and Group R-2 dormitories, combustible decorative materials suspended from walls and ceilings not to exceed 10% of specific wall or ceiling area to which materials are attached
- Focuses upon occupancies that:
  - Are unfamiliar to occupants
  - Contain large numbers
  - Have occupants who need assistance (nonambulatory)
  - Have societal expectation of protection.
  - Often use excessive décor.
- Movable partitions, paneling, wall pads and crash pads are regulated as interior finish, not decorative materials

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806.3, Exc. 1 Combustible Decorative Materials

- In **auditoriums of Group A**, curtains, draperies, fabric hangings and similar combustible decorative materials suspended from walls or ceilings to not exceed 75% of aggregate wall area where:
  - Building is sprinklered throughout, and
  - Material is installed in accordance with Section 803.15 regulating attachments and hangers at ceiling

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806.3, Exc. 2 Combustible Decorative Materials

- Within **sleeping units and dwelling units of Group R-2 dormitories**, curtains, draperies, fabric hangings and similar combustible decorative materials suspended from walls or ceilings to not exceed 50% of aggregate wall area where:
  - Building is protected throughout with an NFPA 13 sprinkler system

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806.4 NFPA 701

- Where required to exhibit improved performance of combustible decorative materials suspended from walls or ceilings, such materials to:
  - Meet the flame propagation performance criteria of Test 1 or 2, as appropriate, of NFPA 701, or
  - Exhibit a maximum heat release rate of 100kW when tested to NFPA 289, using the 20 kW ignition source
- Reports of test results to be furnished to the building official upon request

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NFPA 701 Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

- Test serves as a ranking of the ability of a material to propagate flame beyond the area of origin-level of combustibility.
- Decorative materials (draperies, etc.)
- Indication of level of combustibility
- Relative ranking of materials
- Not related to real fire exposure
- Two test methods established in NFPA 701:
  - Certain materials are more applicable to each
  - Test 1 (small scale) is typically preferred due to cost and easier to pass

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NFPA 701: Test Method 1

- Typically used to test fabrics used as curtains, draperies or other window treatments
- Smaller scale test
  - Densities ≤ 700 g/m²
  - Focus on mass loss as flammability indicator
  - Open front box 19.7" x 26.6" x 27.5"
  - Sample hanging on bar and exposed to ignition source for 45 seconds

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NFPA 701: Test Method 1: Performance Criteria (10 Specimens Per Test)

- Fragments should stay ignited
  - Of ≤ 40%
  - For ≤ 2 seconds
- Average weight loss
  - of ≤ 40%
- Individual specimen mass loss
  - Of ≥ 3 standard deviations
- Retest a second time
  - Must pass the above criteria

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NFPA 701: Test Method 2

- For materials such as:
  - Vinyl coated fabric used as blackout lining
  - Densities ≥ 700 g/m²
  - Plastic films
  - Awnings, tents, tarps, etc.

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NFPA 701: Test Method 2

- Larger scale test focused on char length as flammability indicator
  - Test enclosure = 4 sided metal stack 12 inches by 12 inches by 84 inches
  - Test specimens 47 inches long
    - Folded – 4 specimens per test
    - Flat – 10 specimens per test
  - Exposed to ignition source for 2 minutes

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NFPA 701: Test Method 2

- Performance criteria
  - Any specimen flaming for more than 2 minutes after ignition source is removed = FAIL
  - Char-length failure criteria:
    - Folded – greater than 41.3 inches (1041 mm)
    - Flat – greater than 12 inches (305 mm)
  - Any portion that falls and burns for more than 2 seconds indicates failure of the test

Tip

Note: The char length being less restrictive for folded specimens is likely related to the more conservative indication of hazard (folded burns more easily than flat due to radiative feedback from the material).

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806.5 Foam Plastic

- Covered specifically in Section 2604
- Generally not allowed as an interior finish trim unless certain requirements can be met
  - Tested in realistic conditions to demonstrate acceptable performance or
  - Used as trim with a limit on the amount, dimensions density and flame spread

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806.6 Pyroxylin Plastic

- Specifically prohibited in Group A occupancies
- Highly flammable when exposed to heat
- Products of combustion are highly toxic
- Addressed in more detail in IFC Chapter 42
- Used as imitation leather and similar materials
- Uncommon in current times

112

806.7 Interior Trim

- Trim defined as picture molds, chair rails, baseboards, handrails, door and window frames, and similar decorative or protective materials used in fixed applications
- Combustible trim limited to 10 percent of the aggregate walls or ceilings
  - Not applicable to handrails and guardrails
- Minimum Class C flame spread index and smoke-developed index when tested to ASTM E84/UL 723
  - Does not apply to foam plastic used as interior trim

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806.8 Interior Floor-Wall Base

- Where interior floor-wall base is 6 inches or less in height, it shall be classified as Class I or II based on the interior floor finish test (ASTM E648 or NFPA 253
  - Class I floor-wall base required where floor finish required to be Class I
  - Exception for those floor-wall bases that have minimum Class C flame spread and smoke-developed index

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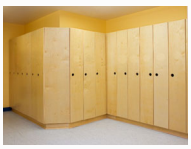
806.9 Combustible Lockers

- Lockers constructed of combustible materials to be regulated as interior finishes, except for those lockers that are:
  - Constructed entirely of wood and noncombustible materials, and
  - Located where interior finish materials required to meet Class C classification



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Chapter 4: Special Detailed Requirements

- **402 Covered Mall Buildings**
  - 402.6.4 Plastic signs
    - Area limited to 20 percent of wall area
    - Height ≤ 36 in for horizontal signs, ≥ 96 for vertical signs
    - ≥ 18 in from adjacent tenants
    - Nonfoam plastics
    - Must be Class B or pass NFPA 286
    - Comply as light transmitting plastics unless ignition greater than 650°F
    - Edges encased in metal
    - Foam plastics
    - ≤ 150 kW when tested to UL 1975
    - Not required to meet ASTM E84
    - Density ≥ 20 pound per cubic foot
    - Thickness ≤ ½ in

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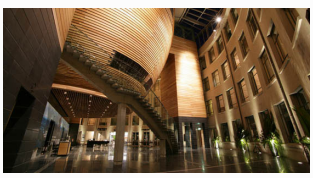
Chapter 4: Special Detailed Requirements

- **404 Atriums**
  - 404.8 Interior Finish
    - Class B minimum regardless of presence of sprinklers



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Chapter 4: Special Detailed Requirements

- **406 Motor Vehicle Related Occupancies**
  - 406.7.2 Canopies (Service Stations)
    - Plastic:
      - Class A flame spread rating
      - Smoke-Developed Index ≤ 450
      - Ignition temperature ≥ 650°F
- **411 Special Amusement Buildings**
  - 411.7 Interior Finish
    - Class A interior finish required in special amusement buildings in accordance with Section 803.1.

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Code Compliance

Module 4

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Three Stages of Compliance

1. Plan review
   - Best time to deal with compliance issues
   - Consult with owners/designers (acoustical requirements and maintenance concerns)
2. Construction review
   - Proper installation
   - Careful review of changes since plan review
3. Maintenance
   - Most difficult stage of compliance

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Plan Review

- Both IBC and IFC compliance is required
  - IFC provisions deal primarily with furniture, fixtures and other elements not a part of the building's construction
  - Often overlaps with IBC requirements
- Nonstructural plan review guides, such as checklists created for use by project managers in their specific jurisdictions, are helpful.
- Noncombustible materials typically provide for compliant conditions with limited or no requirements.

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Plan Review

- Manufacturer's documentation on following information is critical:
  - How was the material tested?
  - Was it tested only on the wall? The ceiling?
  - Was the entire assembly tested or just the single exposed material?
  - In what direction (horizontal or vertical) was it tested?
- If the material was not tested as proposed for use, it may not be used unless retested.

122

Construction Review

- Materials need to be installed per the manufacturer's documentation.
- Installation problems occur when the instructions are complex or difficult to follow.
- Any changes that have occurred since plan review need careful review of the manufacturer's limitations and how they have been tested.

123

Maintenance

- No reliable field test are available.
- Materials can appear very similar.
- A minor chemical change to a plastic can significantly increase flammability.
- Checking documentation is the only verification method for the field.
- Other issues associated with the maintenance phase include:
  - Possibility of layers of wall coverings
  - Determining the application method
  - Need for reapplication of flame retardant (frequency and method)

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Ensuring Compliance

- Manufacturers instructions
- Testing documentation
- Evaluation reports
- Records of maintenance – dates needed for retreatment

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Code Compliance Review

a. Plan review
b. Construction review
c. Ongoing maintenance

__c__ 1. Checking documentation is the only verification method for the field.

__a__ 2. Both IBC and IFC compliance is required.

__c__ 3. An issue is the need for reapplication of flame retardant (frequency and method).

__b__ 4. Materials need to be installed per the manufacturer's documentation.

__a__ 5. Noncombustible materials typically provide for compliance.

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Code Compliance

a. Plan review
b. Construction review
c. Ongoing maintenance

__a__ 6. Checklists created for use by project managers in their specific jurisdictions are helpful.

__c__ 7. Materials can appear very similar but possess very different burning characteristics because a minor chemical change to a plastic can significantly increase flammability.

__b__ 8. Installation problems can occur when the instructions are complex or generally difficult to follow; therefore, it is critical for those instructions to be reviewed carefully.

__c__ 9. No reliance field tests are available.

__a__ 10. If the material was not tested as proposed for use, it may not be used unless retested.

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Foam Plastic Insulation

Module 5

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2603.1 Foam Plastic Insulation in Buildings

- Provisions set forth in Section 2603
- In addition, spray-applied foam plastic insulation to comply with ICC 110-2018 – *Standard for Spray-Applied Foam Plastic Insulation*

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202 Definition of Foam Plastic Insulation

- Foam plastic insulation is a plastic that:
  - is intentionally expanded by the use of a foaming agent
  - to produce a reduced-density plastic
  - containing voids consisting of open or closed cells
  - distributed throughout the plastic
  - for thermal insulating or acoustical purposes and
  - has a density less than 20 pounds per cubic foot.

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Concepts of Foam Plastic Insulation Regulation

- Foam plastic insulation poses various hazards, requiring regulation by the IBC:
  - Sustain rapid combustion
  - Gases can be toxic
  - Can create a smoky fire difficult to extinguish

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2603.2 Labeling and Identification

- Packages and containers of foam plastic delivered to job site to bear label of approved agency, indicating:
  - Manufacturer's name
  - Product listing
  - Product identification
  - Information needed to determine that end use complies with code requirements

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2603.3 Surface-Burning Characteristics

- Unless otherwise indicated, foam plastic insulation and foam plastic cores of manufactured assemblies to have:
  - Maximum flame spread index of 75, and
  - Maximum smoke-developed index of 450

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2603.4 Thermal Barrier Required

- Other than where specifically exempted, foam plastic to be separated from interior of building by an approved thermal barrier
- Thermal barrier to consist of:
  - Minimum ½" gypsum wallboard, or
  - Heavy timber, or
  - Material tested per NFPA 275
    - Temperature Transition Fire Test
    - Integrity Fire Test

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2603.4.1 Thermal Barrier Not Required

- Specified thermal barrier not required for a variety of conditions if specified conditions or methods of protection are provided, including:
  - Masonry or concrete construction
  - Cooler and freezer walls
  - Walk-in coolers
  - Exterior walls of one-story buildings
  - Roofing
  - Attics and crawl spaces

(continued)

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2603.4.1 Thermal Barrier Not Required (continued)

- Specified thermal barrier not required for a variety of conditions if specified conditions or methods of protection are provided, including:
  - Doors
    - Not required to have a fire-resistance rating
    - Exterior doors in Group R-2 and R-3 buildings
    - Garage doors
  - Siding backer board
  - Interior trim
  - Interior signs
  - Type V construction sill plates, joist headers and rim joists
  - Floors

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2603.4.1.1 Masonry or Concrete Construction

- Thermal barrier not required for foam plastic insulation installed in a masonry or concrete wall, floor or roof system where covered on each face by a minimum 1-inch thickness of masonry or concrete

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2603.4.1.2 Cooler and Freezer Walls

- Thermal barrier not required for cooler and freezer walls where foam plastic insulation:
  - Has a maximum thickness of 10 inches
  - Has a maximum flame spread index of 25
  - Has a maximum smoke-developed index of 450
  - Has a minimum flash ignition of 600° F
  - Has a minimum self-ignition temperature of 800° F
  - Has a covering of minimum 0.032” aluminum or corrosion-resistant steel having a base metal thickness of 0.0160-inch at any point
  - Is protected by an NFPA 13 sprinkler system, both in the cooler or freezer and in the area of the building where the sprinkler is located

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2603.4.1.3 Walk-In Coolers

- Where the building is not sprinklered, thermal barrier not required in walk-in coolers and freezers where foam plastic insulation:
  - Is no thicker than 4 inches
  - Has a maximum flame spread index of 75
  - Is covered with a metal facing of minimum 0.032-inch-thick aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.016 inches
- Aggregate floor area of coolers and freezers without thermal barrier limited to 400 square feet

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2603.4.1.4 Exterior Walls of One-Story Buildings

- Limited to one-story buildings, thermal barrier not required where foam plastic is installed in or on exterior walls provided foam plastic:
  - Has maximum flame spread index of 25
  - Has smoke-developed index of 450
  - Is no thicker than 4 inches
  - Is covered with a metal facing of minimum 0.032-inch-thick aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.0160 inches
  - Is installed on building that is fully sprinklered per NFPA 13

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2603.4.1.5 Roofing

- Thermal barrier not required for foam plastic insulation where:
  - Part of a Class A, B or C roof covering assembly, and
  - Installed in accordance with IBC and manufacturer's instructions, and
  - Assembly is separated form interior of building with minimum 0.47-inch wood structural panels, or
  - Assembly tested per NFPA 276 or UL 1256

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2603.4.1.6 Attics and Crawl Spaces

- Thermal barrier not required under specified conditions for attics and crawl spaces unless such spaces are used for storage or general occupancy
- Use of an ignition barrier, rather than a thermal barrier, is acceptable where extent of entry into the attic or crawl space is limited to service of utilities, such as spaces containing:
  - Mechanical equipment
  - Fans
  - Water heaters furnaces
  - Etc.

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2603.4.1.6 Attics and Crawl Spaces

- Acceptable methods of ignition protection include:
  - 1½-inch-thick mineral fiber insulation
  - ¼-inch-thick wood structural panels
  - ¼-inch-thick particleboard
  - ¼-inch-thick hardboard
  - 3/8-inch-thick gypsum board
  - Corrosion-resistant steel w/base metal thickness of 0.016 inch
  - 1½-inch-thick self-supported spray-applied cellulose insulation (attic spaces only)

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2603.4.1.7-2603.4.1.9 Doors

- Various types of doors containing foam plastic insulation are exempt from the requirement of a thermal barrier where specified conditions are met:
  - Doors not required to have a fire protection rating
  - Exterior doors in buildings of Group R-2 and R-3
  - Garage doors

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2603.4.1.7 Doors Not Required to Have a Fire Protection Rating

- Thermal barrier not required for those side-hinged or pivoted doors containing a foam plastic core that has a:
  - Maximum flame spread index of 75, and
  - Maximum smoke-developed index of 450, and
  - Facing of aluminum at least 0.032 inch thick, or
  - Facing of steel having a base metal thickness no less than 0.016 inch in thickness

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2603.4.1.8 Exterior Doors in Buildings of Group R-2 or R-3

- Thermal barrier not required for foam-filled exterior entrance doors to individual dwelling units of Group R-2 and R-3 occupancies provided such doors:
  - Do not require a fire-resistance rating, and
  - Are faced with aluminum, steel, fiberglass, wood or other approved materials

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2603.4.1.9 Garage Doors

- Thermal barrier not required in garage doors with foam plastic used as a core material where:
  - Doors do not require a fire-resistance rating, and
  - Facing of doors is metal
    - 0.032-inch thick minimum for aluminum
    - 0.010-inch thick minimum for steel
    - 0.125-inch thick minimum for wood
- Thermal barrier also not required for garage doors in detached and attached garages associated with one- and two-family dwellings.

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2603.4.1.10 Siding Backer Board

- Foam plastic insulation permitted for use as siding backer board provided:
  - Insulation ≤ 2,000 BTUs as determined by NFPA 259, and
  - Maximum thickness of ½ inch, and
  - Separated from building interior by minimum 2 inches of mineral fiber insulation or equivalent, or
  - Where applied as insulation with re-siding over existing wall construction

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2603.4.1.11 Interior Trim

- Where foam plastic is used as interior trim and complies with Section 2604, a thermal barrier is not required
- Section 2604 requires:
  - Maximum density of 20 pcf
  - Maximum thickness of ½ inch
  - Maximum width of 8 inches
  - Maximum surface area limit of 10% of specific wall or ceiling area to which trim is attached
  - Maximum flame spread index of 75
    - Or tested to NFPA 286

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2603.4.1.13 Type V Construction

- No thermal barrier is required where foam plastic insulation is spray-applied to a combustible sill plate in Type V construction provided:
  - Maximum thickness of foam plastic to be 3¼ inch
  - Density of foam plastic to be in range of 1.5 to 2.0 pcf
  - Flame spread index of foam plastic to be 25 or less
  - Smoke-developed index of foam plastic to be 450 or less

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2603.4.1.14 Floors

- Thermal barrier not required on walking surface of structural floor system that contains foam plastic insulation where covered by minimum nominal ½-inch-thick wood structural panel or approved equivalent
  - Thermal barrier is required on underside of structural floor system if exposed to interior of building

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2603.5 Exterior Walls of Building of Any Height

- Exterior walls of buildings of Types I, II, III and IV construction to comply with following provisions:
  - Sec. 2603.5.1 Fire-resistance-rated walls
  - Sec. 2603.5.2 Thermal barrier
  - Sec. 2603.5.3 Potential heat
  - Sec. 2603.5.4 Flame spread and smoke-developed indices
  - Sec. 2603.5.5 Vertical and lateral fire propagation
  - Sec. 2603.5.6 Label required
  - Sec. 2603.5.7 Ignition

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2603.5.1 Fire-Resistance-Rated Walls

- Where wall required to have a fire-resistance rating, information to be provided to substantiate that required rating is maintained

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2603.5.2 Thermal Barrier

- Any foam plastic insulation to be separated from building by complying thermal barrier, except:
  - Where special approval obtained per Section 2603.9, or
  - For one-story buildings complying with Section 2603.4.1.4

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2603.5.3 Potential Heat

- Potential heat of foam plastic in any portion of wall or panel not to exceed potential heat of foam plastic insulation contained in wall assembly as tested to NFPA 285
  - Not required for one-story buildings complying with Section 2603.4.1.4
- Potential heat to be determined by NFPA 259 test

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2603.5.4 Flame Spread and Smoke-Developed Indices

- Foam plastic insulation, exterior coatings and facings to be tested separately at the intended thickness for use, but no more than 4 inches
  - Testing as only an assembly is permitted in limited applications
- Each of these components to have:
  - Flame spread index of 25 or less
  - Smoke-developed index of 450 or less

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2603.5.5 Vertical and Lateral Fire Propagation

- Exterior wall assembly to be tested to, and comply with acceptance criteria of, NFPA 285
- NFPA 285 evaluates the fire propagation characteristics of exterior wall assemblies containing combustible components
- Applicable to both bearing and nonbearing exterior walls

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2603.5.5 Vertical and Lateral Fire Propagation

- Testing to NFPA 285 not required for:
  - One story buildings complying with Section 2603.4.1.4
    - Limits foam plastic to 25 flame spread index and 450 smoke-developed index
    - Maximum foam plastic thickness of 4 inches
    - Covered with complying metal facing
    - Building is fully sprinklered with NFPA 13 system
  - Wall assemblies with foam plastic insulation covered on each face by minimum 1-inch-thick masonry or concrete
    - No airspace between insulation and concrete or masonry, or
    - Insulation has flame spread of no more than 25 and maximum 1-inch airspace between insulation and concrete/masonry

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2603.5.6 Label Required

- Each piece, package or container of foam plastic insulation to bear the label of an approved agency
- To be located on the edge or face of each piece or package, the label shall contain:
  - Manufacturer's or distributor's identification, and
  - Model number, and
  - Serial number, or
  - Other definitive information describing performance characteristics and approved agency's identification

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2603.5.7 Ignition

- Exterior walls shall not exhibit any sustained flaming when tested to NFPA 286 (Corner Burner Test)
  - Where material intended to be used in multiple thicknesses, tests to be performed on both the minimum and the maximum thicknesses intended for use
- Not required where assembly protected on the outside, including the use of a complying:
  - Thermal barrier
  - Concrete or masonry
  - Metal-faced panels
  - Stucco
  - Fiber-cement siding

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2603.6 Roofing

- Foam plastic insulation permitted as part of a roof covering assembly where:
  - Insulation meets requirements for labeling and identification, surface-burning characteristics and thermal barrier, and
  - Assembly is a Class A, B or C roofing assembly as tested per ASTM E108 or UL 790

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2603.9 Special Approval

- Foam plastic not required to comply with thermal barrier or roofing requirements where specifically approved based on large-scale tests, such as:
  - NFPA 286 (w/Sec. 803.1.1.1 acceptance criteria)
  - FM 4880—Evaluating Fire Performance of Insulated Building Panel Assemblies and Interior Finish Material
  - UL 1040—Insulated Wall Construction
  - UL 1715—Interior Finish Material
  - Other tests as applicable
- Testing to be related to actual-end use configuration
  - To be performed on the finished foam plastic assembly in the maximum thickness intended for use

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Main Ideas

- Interior finishes play a large role in the beginning stages of a fire
- Flame resistance is much different than fire resistance – flammability vs. endurance

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Main Ideas

- Many methods of providing flame resistance are available:
  - Chemical
  - Impregnation
  - Pressurized Impregnation
  - Coatings

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Main Ideas

- Flammability/Combustibility/Flame Propagation Tests:
  - Various tests are available
  - Some also address more realistic fire conditions
  - Need to ensure correct tests have been used for the intended application

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Main Ideas

- Code compliance has three major phases:
  - Plan Review
  - Construction Review
  - Maintenance
- Code requirements
  - Chapter 8 of IBC and IFC
  - Chapters 4 and 26 of the IBC

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Final Reflection

- This slide will help the learner to reflect on the day and what they will take back to the job and apply.
- What? What happened and what was observed in the training?
- So what? What did you learn? What difference did this training make?
- Now what? How will you do things differently back on the job as a result of this training?

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