2012 IFC and IBC Interior Finishes and Foam Plastics

2012 IBC® and IFC® Interior Finishes and Foam Plastics

Based on the 2012 International Building Code® (IBC®) and the 2012 International Fire Code® (IFC®)

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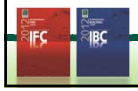
International Building Code

What is a Code?



Points To Remember About Codes

Do Not Memorize

Shall / Should

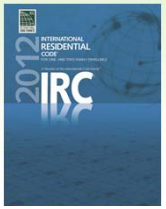
And / Or

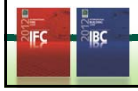
Exceptions

Footnotes

"That Depends"

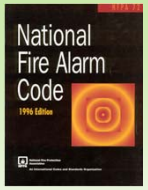
A **CODE** is an **adopted** set of regulations by the governing body of the City or County charged with the enforcement of Health and Safety Regulations.





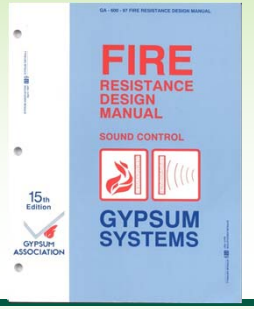
What is a STANDARD?

What are reference documents?



A STANDARD is a group of guidelines on how to perform an installation or task. They are enforceable when referenced by an adopting ordinance or CODE.

Reference documents are those documents listed in Chapter 35 of the International Building Code. Other reference documents can be found in the Codes or Standards themselves.



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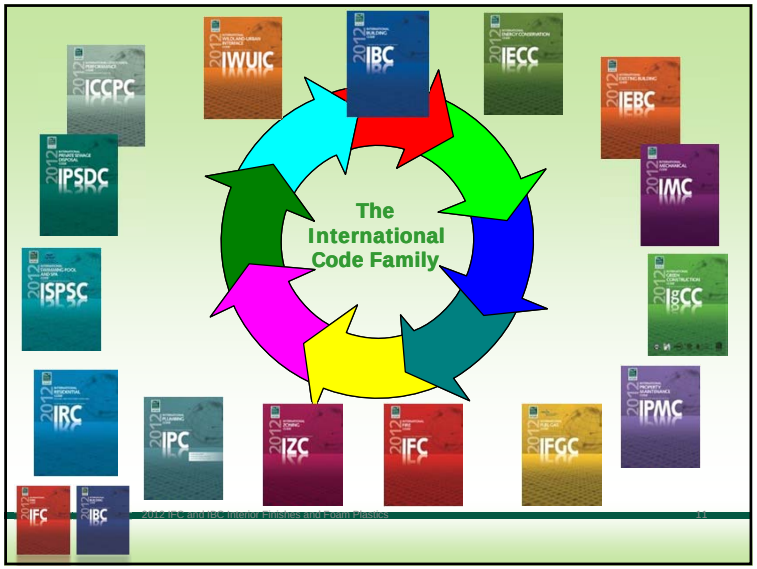
What are Appendices?

- Appendix A Employee Qualifications
- Appendix B Board of Appeals
- Appendix C Group U-Agricultural Buildings
- Appendix D Fire Districts
- Appendix E Supplementary Accessibility Requirements
- Appendix F Rodentproofing
- Appendix G Flood-resistant Construction
- Appendix H Signs
- Appendix I Patio Covers
- Appendix J Grading
- Appendix K Administrative Provisions
- Appendix L Earthquake Recording Instrumentation
- Appendix M Tsunami-Generated Flood Hazard

When can they be used?



101.2.1 APPENDICES.

- Provisions in the appendices shall not apply unless specifically adopted.

Structure of the IBC Fire Risks of Interior Finishes

- Module one - Introduction
- Module two - Fire Dynamic
- Module three - Flame-Resistance Tests
- Module four - Code Compliance
- Module five - Code Requirements
- Module six - Conclusions

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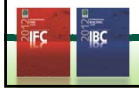
Module One

Introduction

Course Description

- Provides insight into hazards associated with interior finishes and decorative materials
- Review of applicable code sections including:
  - IBC (2012)
  - IFC (2012)



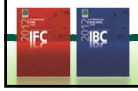
Course Description, Cont

- Focuses on the necessary tools used for work on interior finishes, materials, and trim
- Will address provisions from Chapter 8 and 26 in the IBC and Chapter 8 in the IFC
- This course will not address combustible furnishings and vegetation found in Sections 805 and 806 of the IFC.

Objectives

You 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



Objectives

You will be able to: (continued)

- List the proper steps for determining code compliance during:
  - Plan review
  - On-site inspections

Objectives

You will be able to: (continued)

- List the limitations of determining code compliance during:
  - Plan review
  - On-site inspections

Definitions

DECORATIVE MATERIALS

- All materials applied over the building interior finish for decorative, acoustical or other effect (such as curtains, draperies, fabrics, streamers and surface coverings), all other materials utilized for decorative effect (such as: batting, cloth, hay, stalks, straw, vines, leaves, trees, moss and similar items), including foam plastics and materials containing foam plastics. Decorative materials do not include floor coverings, ordinary window shades, interior finish and materials 0.025 inch (0.64 mm) or less in thickness applied directly to and adhering tightly to a substrate.

Definitions

EXPANDED VINYL WALL COVERING

- Wall covering consisting of a woven textile backing, an expanded vinyl base coat layer and a non expanded vinyl skin coat. The expanded base coat layer is a homogeneous vinyl layer that contains a blowing agent. During processing, the blowing agent decomposes, causing this layer to expand by forming closed cells. The total thickness of the wall covering is approximately 0.055 inch to 0.070 inch (1.4 mm to 1.78 mm)

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Definitions

FLAME SPREAD INDEX

- A comparative measure expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E 84.

FLASHOVER

- A transition phase in the development of a contained fire in which surfaces exposed to thermal radiation reach ignition temperature more or less simultaneously and fire spreads rapidly through the space.

Definitions, Continued

INTERIOR FINISH

- Interior finish includes interior wall and ceiling finish and interior floor finish.

INTERIOR FLOOR FINISH

- The exposed floor surfaces of buildings including coverings applied over a finished floor or stair, including risers.

Definitions, Continued

INTERIOR WALL AND CEILING FINISH

- The exposed interior surfaces of buildings including, but not limited to: fixed or movable walls and partitions; columns; ceilings; and interior wainscotting, paneling or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including trim.



Definitions, Continued

SMOKE DEVELOPED INDEX

- A comparative measure expressed as a dimensionless number, derived from visual measurements of smoke obscuration versus time for a material tested in accordance with ASTM E 84.

TRIM

- Picture molds, chair rails, baseboards, handrails, door and window frames and similar decorative or protective materials used in fixed applications.

Case Studies

Name of Facility	Location	Date	Fatalities
Coconut Grove	Boston, MA	11/28/42	492
Beverly Hills Super Club	Southgate, KY	05/28/77	164
Happy Land Social Club	Bronx, NY	03/25/90	87
Station Night Club	West Warwick, RI	03/20/03	*100*

Data

The pyrotechnics were gerbs, cylindrical devices intended to produce a controlled spray of sparks. Gerbs are labeled using two numbers: one for how far the sparks fly, and one for how long the effect lasts. Biechele was fond of using 15 by 15's, which means they spray sparks 15 feet for 15 seconds. Three of that same caliber, at 45-degree angles, with the middle one pointing straight up, were the kind used that night. Gerbs are considered appropriate for indoor use before a nearby audience when proper precautions are observed.

Case Studies

These four (4) tragedies involved fire associated with the use of hazardous interior finishes, decoration and trim. In all four (4) cases, there were other complicating factors, including but not limited to:

Arson
Use of Pyrotechnics
Lack of Sprinklers
Non-compliant exit layout
Blocked Exits
Exits Opening Inward
Open Stairways

Case Study – The Station Nightclub Fire

Floor Plan **Insulation Test** Occupant Load

Module 2

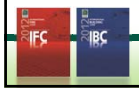
Fire Dynamics

ACTIVITY

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 Flame



ACTIVITY

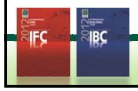
General Information Check Your Knowledge

- What is more rapid, apt to occur, or hazardous?
  - Larger room or smaller room?
  - Smaller Room

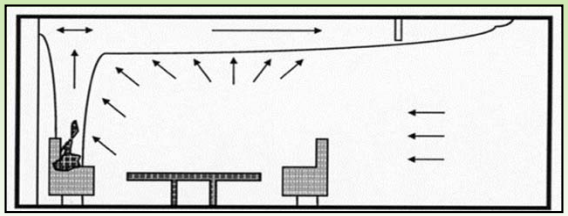
  - Material on wall or same material on ceiling?
  - Material on Wall

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

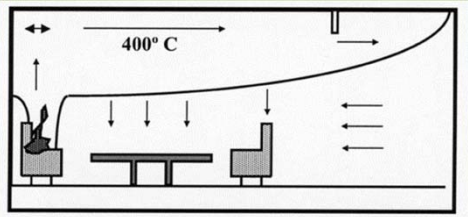


Progression of a Compartment Fire to Flashover



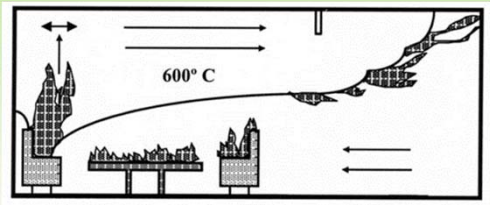
- Two-zone concept, with hot gases in the zone on top that thickens and cooler air in the bottom
- A hot layer will spill out to the next compartment

Progression of a Compartment Fire to Flashover



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

Progression of a Compartment Fire to 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.

- 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

Fuel Load Comparisons

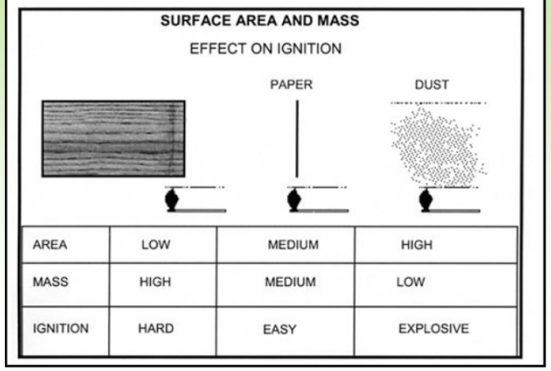
- Fuel load =
  - Potential fire energy per unit weight (Btu/lb or kj/kg) also known as Heat of Combustion
  - Plastics tend to have a much higher heat of combustion than celluloses (fabric, paper, etc.)
    - Plastics – 16,000 to 24,000 Btu/lb.
    - Cellulosic – 8,000 Btu/lb.

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

Surface Area to Mass Ratio

Figure 4: Surface Area and Mass



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

Fuel Load Comparisons

NIST

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

Surface Area to Mass Ratio

- Very important for ignition potential
  - Dust can be explosive
  - Paper is easier to ignite than a 2-inch by 4-inch (51 mm by 10 mm) block of wood

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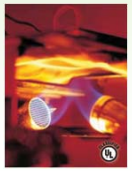
Fire Resistance vs. Flame Resistance

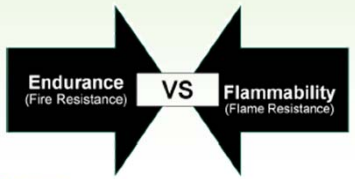
NOT THE SAME THING

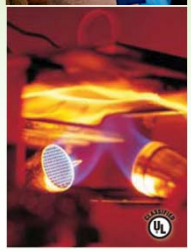
- **Fire resistance –** it is addressed in Chapter 7 (IBC) and typically focuses on the spread of fire after flashover. (ASTM E 119)
- **Flame resistance –** it is addressed in Chapter 8 and 26 (IBC) and Chapter 8 (IFC). These chapters focus on the initial developing fire within a compartment or area of a building. The strategy is to reduce the potential of flashover.



Fire Resistance vs. Flame Resistance

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





Flame Retardant and Flame Resistance

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

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.

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Flame Retardant and Flame Resistance

- Does NOT make materials flame or fire proof
- 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 E 84, NFPA 286 or NFPA 265).

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.

Methods of Flame Resistance

- Chemical
- Impregnation
- Coatings
- Pressure Impregnation

Pressure treatment plant.

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.

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).

Module Three

Flame-Resistance Tests

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.

Primary Tests

This table includes those tests that are most commonly used for walls and ceilings, floors, foam plastics and decorative materials such as draperies. More information on each of these tests can be found in your workbook.

Topic	Test	Common Name
Walls and ceilings	ASTM E 84 NFPA 286 (nontextiles) NFPA 265 (textiles)	Tunnel Test Room Corner Test Room Corner Test
Floors	NFPA 253* DOC FF-1 / CPSC 16 CFR 1630	Radiant Panel Test Pill Test
Foam plastics (walls and ceilings)	NFPA 286	Room Corner Test
Decorative materials	NFPA 701	Flame Propagation Test
Trim	ASTM E 84	Tunnel Test

* NFPA 253 is a more restrictive test aimed at exit ways and similar locations within buildings.

Match the Test

ACTIVITY

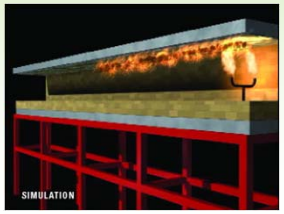
Each of the following tests on the left should be used for one of the choices on the right. See if you know the correct answers.

- NFPA 253 b
- Tunnel Test a
- NFPA 701 d
- UL 1975 c
- Pill Test b

a) Walls and ceilings
b) Floors
c) Foam plastics
d) Textiles and Films

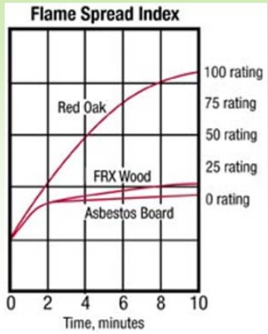
ASTM E84: Tunnel Test

- For wall and ceiling finishes
- Tested in a horizontal configuration
  - 25-foot long sample
- 10 minutes exposure to heat source



ASTM E84: Tunnel Test

- Three hazard classifications:
  - Class A: Flame spread 0-25 (lowest hazard)
  - Class B: Flame spread 26-75 (medium hazard)
  - Class C: Flame spread 76-200 (highest hazard)
- Smoke Developed Index 0-450



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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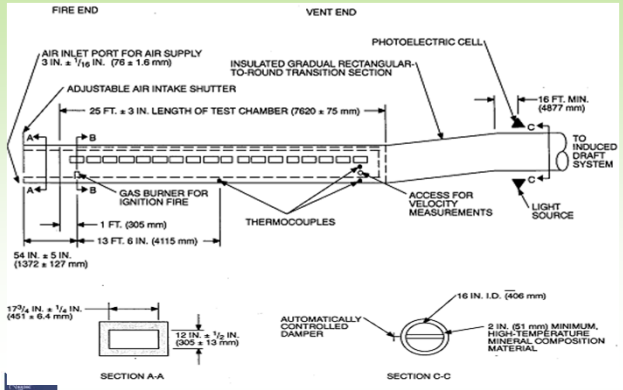
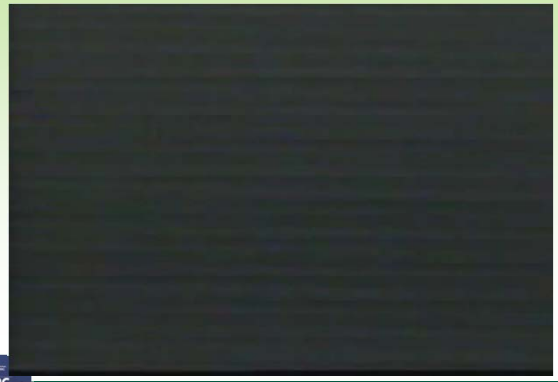
Figure 8.1.1Tunnel Test

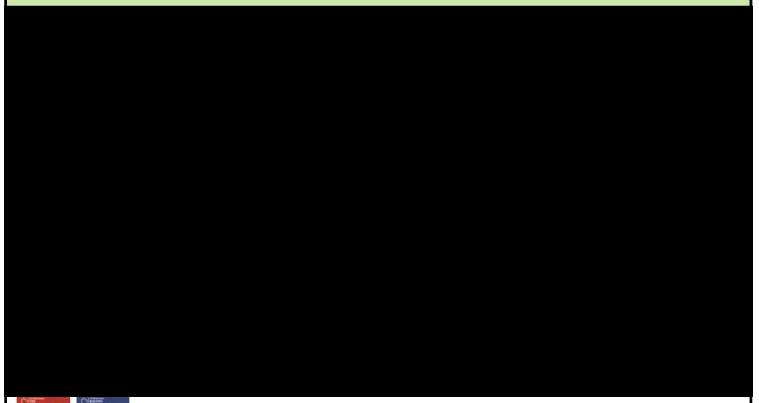


ASTM E 84



Flame in Tunnel Test

ASTM E 84



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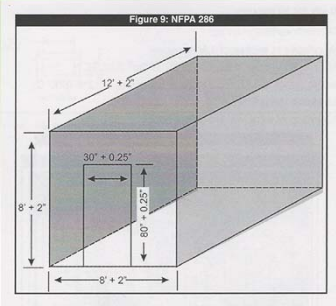
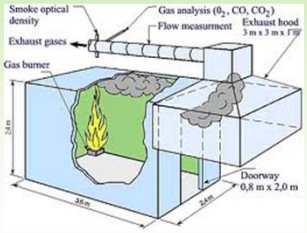
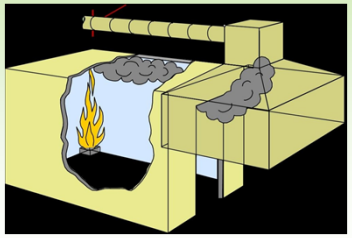
NFPA 286: Room Corner Test

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



Room Corner Test





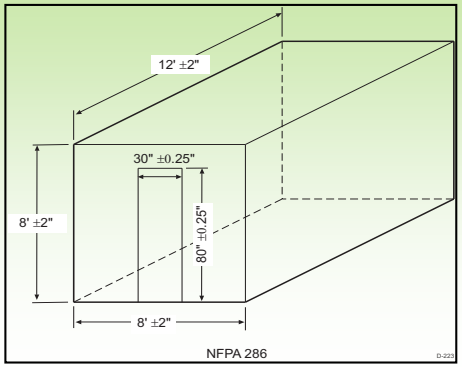
NFPA 286: Room Corner Test

- 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

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

NFPA 286: Room Corner Test



For SI: 1 inch = 25.4 mm
1 foot = 304.8 mm

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NFPA 265: Room Corner Test

- Differences
  - 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)

NFPA 265: Room Corner Test

- Similar approach to 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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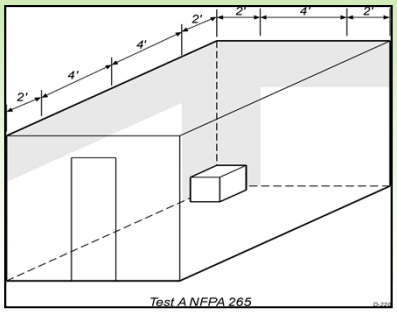
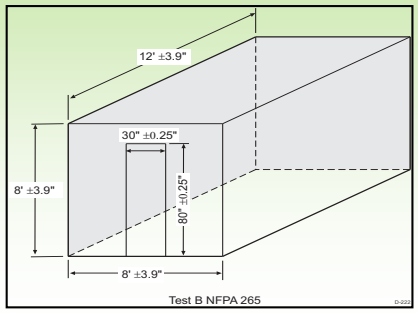
Test A

- Smaller scale
- Limited application of material
- More restrictive pass/fail criteria
- Preferred test (less expensive)
- Only allowed in the IFC



Test B

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



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

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

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 found in NFPA 701:
  - Certain materials are more applicable to each
  - Test 1 (small scale) is typically preferred due to cost and easier to pass

Test Method 1

- 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

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

Test Method 2

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

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

Test Method 2

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).

- 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

NFPA 253 – Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Heat Source

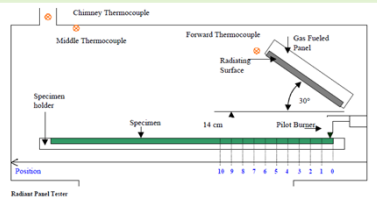
- Test determines lowest heat flux that can sustain combustion.
- That distance is related back to the known flux at that point given by the panel to give minimum heat flux.
- Does not provide ranking of materials.

NFPA 253 – Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Heat Source

- The code provides rankings based on ranges of critical fluxes determined by the test.
- Two classifications:
  - Class I: greater than or equal to .45 watts/cm^2 (Better performer)
  - Class II: between .22 and watts/cm^2 (Poorer Performer)

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.



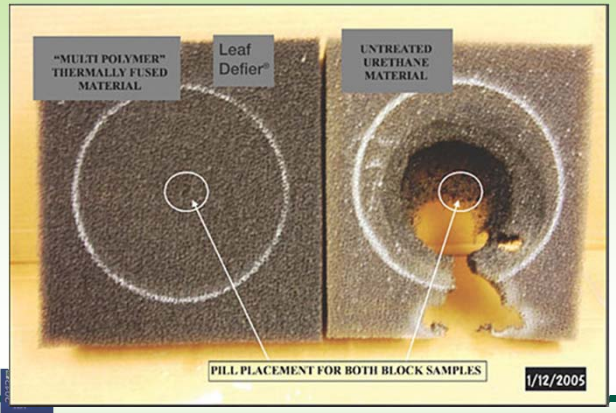
DOC FF-1, CPSC CFR 16: Pill Test

- 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

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

DOC FF-1, CPSC CFR 16: Pill Test



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).

Flame-resistance Tests

- Can a material that is considered a non-textile material be tested to NFPA 265?

No, it must be tested to NFPA 286 or ASTM E 84.

Flame-resistance Tests

- List three reasons why NFPA 286 is more conservative than NFPA 265.

1. Heat release rate is in excess of 160 kw for 10 minutes (265 is 150 kw for 10 minutes).
2. Samples are on walls and ceilings (265 is just walls).
3. Gas burners are flush against wall (265 burners are 2 inches from wall).

Flame-resistance Tests

- List three characteristics that define flashover according to NFPA 286.

1. One characteristic is that flames exit the doorway.
2. Another characteristic is that there is a heat release in excess of 1 MW.
3. A last characteristic is an average upper layer temperature in excess of 112°F.

Module Four

Code Compliance

Three Stages

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

Plan Review

- Both IBC and IFC compliance is required
- Non structural plan review guides, such as checklists created for use by project managers in their specific jurisdictions, are helpful.
- Non combustible materials should always be encouraged where realistic.

Plan Review

- Manufacturer's documentation on information such as the following is critical:
  - How was the material tested?
  - Was it tested only on the ceiling?
  - Was the entire assembly tested or just the single 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.

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.

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)

Ensuring Compliance

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

ACTIVITY

Code Compliance

- Directions:
- On the next 2 slides, match each of the stages with the correct characteristic. There is only one correct answer for each characteristic.

ACTIVITY

Code Compliance

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 should always be encouraged where realistic.

Code Compliance

ACTIVITY

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.

Philosophy

- 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

Module Five

Code Requirements

Code Requirements

- IBC
  - Chapter 8: Interior Finishes
  - Chapter 4: Special Detailed Requirements Based on Use and Occupancy
  - Chapter 26: Plastic
- IFC
  - Chapter 8: Interior Finishes, Decorative Materials and Furnishings

2012 IFC and IBC Interior Finishes and Foam Plastics

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

801 General

- Defines scope and applicability of this 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).

Interior Finish Requirements

- Purpose is to limit flame spread and smoke development.
- Exceptions
  - <.036 inches thick applied directly to walls or ceilings
  - Exposed heavy timber of Type IV construction
  - Combustible materials are acceptable – "that depends".
  - Decorative Materials
  - The focus is on combustibility and flame resistance in terms of ability to propagate flame

Interior Finish Requirements

- Trim Requirements
  - Minimum flame spread ratings
  - Limitation on percent of wall and ceilings covered
  - Flood Resistant Construction
  - Requires buildings in hazard areas to use flood damage resistant finishes, trim, and materials
  - References several FEMA standards
- Foam Plastic Requirements
  - Fairly Restrictive
  - Interior Finish and Trim allowed Sections 2603.7 & 2604.

2012 IFC and IBC Interior Finishes and Foam Plastics

803 Wall and Ceiling Finishes

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

803 Wall and Ceiling Finishes

- Three tests
  - ASTM E 84, Tunnel Test ~ Non Textiles and Textiles with Sprinklers
  - NFPA 286, Room Corner Test ~ Non Textiles and Textiles
    - Considered equivalent to Class A under ASTM E 84
    - 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

803.1.1 General

- Requires compliance with ASTM E 84 for textiles and nontextiles
- 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)

803.1 General

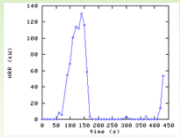
(B)Table 803.1(3)
Typical Flame Spread of Common Materials

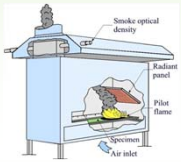
Material	Flame spread
Glass-fiber sound-absorbing blanks Mineral-fiber sound-absorbing panels Shredded wood fiberboard (treated) Sprayed cellulose fibers (treated)	15 to 30 10 to 25 20 to 25 20
Aluminum (with enamel finish on one side) Asbestos-cement board	5 to 10 0
Brick or concrete block Cork Gypsum 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

2012 IFC and IBC Interior Finishes and Foam Plastics

803.1.2.1 Interior wall or ceiling finishes other than textiles

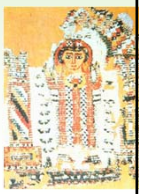
- Allows use of NFPA 286 for nontextiles
- Sets acceptance criteria as:
  - During 40 kW exposure,
    - flames cannot spread to ceiling
    - Flames cannot spread to the outer extremity of the sample
    - Flashover, as defined by NFPA 286, cannot occur
    - Peak Rate of heat release is 800 kW.
    - Smoke production is limited to 1,000 m^2





803.5 - Textile Wall Coverings 803.6 – Textiles Ceiling Coverings

- Textiles are required to comply with this section:
  - Woven or nonwoven
  - Napped
  - Tufted
  - Looped



803.6 Textiles

- Several options for compliance
  - ASTM E 84 Class A rating with sprinklers
  - NFPA 265 requires testing with product mounting system
  - IBC only allows Method B test protocol
    - Only tests walls
    - Materials are applied to Three walls (excluding wall with opening)
    - Pass/Fail Criteria (found in IBC Section 803.1.2.1)
  - Method B pass/fail criteria (more conservative test, criteria less restrictive)
    - Test involves three sides
    - 40 kW exposure-cannot spread to ceiling.
    - 150 kW exposure.
    - - Cannot spread to outer extremities of 8 ft X 12 ft wall
    - - Flashover cannot occur.

803.6 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 1000m2

2012 IFC and IBC Interior Finishes and Foam Plastics

803.7 Expanded Vinyl Wall Coverings

- ASTM E 84 does not reliably predict fire hazards
- Allows use of
  - ASTM E 84 with sprinklers
  - NFPA 265 or
  - NFPA 286




803.8 Expanded Vinyl Ceiling Coverings

- Tested in the manner intended for use
- Using product mounting system, including adhesive
- Concealed and exposed
- ASTM E 84, NFPA 286, NFPA 723


803.8 Expanded vinyl ceiling coverings

- Focuses on proper construction of ceiling systems
- References Chapter 7, if part of a fire-resistance assembly


803.9 Interior finish requirements based on group

- Requirements for interior finishes, walls and ceiling
- Based on ASTM E 84 classifications (A, B, C)
- Refers to Table 803.9

2012 IFC and IBC Interior Finishes and Foam Plastics

803.9 Wall and Ceiling Finishes

- Interior finish based on group
- Table 803.9 provides classifications based upon
  - Occupancy
  - Location within the building
  - Sprinklered / unsprinklered

TABLE 803.9
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY[k]

GROUP	SPRINKLERED[j]			NONSPRINKLERED		
	Interior exit stairways, interior exit ramps and exit passageways[a, b]	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces[c]	Interior exit stairways, interior exit ramps and exit passageways[a, b]	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces[c]
A-1 & A-2	B	B	C	A	A[d]	B[e]
A-3[f], A-4, A-5	B	B	C	A	A[d]	C
B, E, M, R-1	B	C	C	A	B	C
R-4	B	C	C	A	B	B
F	C	C	C	B	C	C
H	B	B	C[g]	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B[h, i]	A	A	B
I-3	A	A[j]	C	A	A	B
I-4	B	B	B[h, i]	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 = 0.0929m².

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 803.11.1.
b. In other than Group I-2 occupancies in buildings less than three stories above grade plane of other than Group I-3, 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 upon 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 enclosing spaces and the rooms or spaces on both sides shall be considered one. 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 not be 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.

803 Wall and Ceiling Finishes

- Locations within building
  - Exit enclosure and exit passageways (most restrictive)
  - Corridors (common area of exit access)
  - Rooms and enclosed spaces (least restrictive)
- Same Table within IFC for existing buildlings.

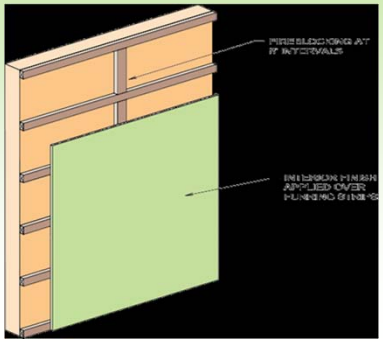
803.10 Stability

- Ensures level of durability when exposed to heat
- Loose materials contribute to fire load and case of fire spread
- Criteria > 200°F for at least 30 minutes
- No standard methodology available to determine whether materials can withstand temperature exposure

2012 IFC and IBC Interior Finishes and Foam Plastics

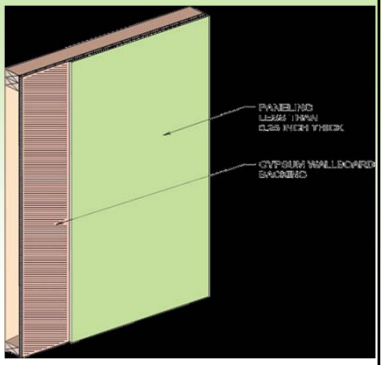
803.11 Application

- Fire-resistance-rated and noncombustible construction require specific installation
  - Material must be applied directly to the surface or on furring strips < 1.75 inches (44mm)
- Furred area must:
  - Contain inorganic or Class A material or
  - Be fireblocked – maximum 8 foot any direction according to Section 718



803.11 Application

- Wall or ceiling finish > .25 inches must be applied to noncombustible backing except:
  - If it is Class A material
  - On materials that were tested on suspended or furred-out noncombustible backing



803.11.2 Set Out Construction

- Set out greater than 1.75 inches
  - Class A material must be used; or
  - Sprinklers must be on both sides (dropped ceiling).
  - Heavy timber (Type IV)
  - All classes of material allowed
  - Fire blocking is required for materials applied to heavy timber (Type IV)

804 Interior Floor Finish

- Generally less hazardous
- Usually contribute to a fire after flashover
- Related tests
  - NFPA 253
  - DOC FF-1 “Pill Test” (CPSC 16 CFR, Part 1630)
- Focuses on fiber oriented floors rather than wood, vinyl, etc.

804.3 Testing and Identification

- Requires a hang tag or other method to identify the manufacturer or supplier.
- Carpet required to be tested as installed.
- Test reports are to be available on request of a building or fire official.

804.4.1 Minimum Critical Radiant Flux

- Requirements apply to:
  - Vertical exits
  - Exit passageways
  - Exit access corridors
- Requirements are based on and the Pill Test
  - Class I: Group I-2 & I-3 occupancies
  - Class II: Group A, B, E, H, I-4, M, R-1, R-2 and S
  - Pill Test: Remaining portion of buildings and occupancies.
- Classifications can shift downward if sprinklers are provided

805 Combustible Materials in Type I and II Construction

- Covers allowable flooring in Type I and II construction
- Intent is to avoid fire spread under the flooring
- Combustible flooring is allowed
- Fire blocking or solid fill is required if the flooring is not directly attached

806 Decorative Materials

- Same as IFC Section 806 except for schools
  - But IFC also addresses issues such as materials on walls in schools and daycares
- Focus on items that are not physically part of the wall itself:
  - Curtains
  - Draperies
  - Hangings
  - General Décor (Holiday or other wise)

806 Decorative Materials

- Primary test is NFPA 701 (flame propagation)
- Restrictions vary based on occupancy
  - More detail provided about Section 806.1 below regarding why restrictions are not universal to all occupancies
- Foam plastics addressed by section 2604.2

806.1 General

- Gives specific occupancies and elements that are regulated:
  - Groups A, E, I, R-1 and dormitories in R-2
  - Groups I-1 and I-2
  - Group I-3
  - Fabric partitions in Group B and M occupancies suspended from ceiling (not supported by floor).
    - Required to meet flame propagation criteria in NFPA 701 or
    - Be noncombustible

806 Decorative Materials and Trim

- Movable walls, partitions, paneling, wall pads and crash pads les then 10% of the wall or ceiling area are considered decorative materials.
- Focuses upon occupancies that
  - Are unfamiliar to occupants
  - Contain large numbers
  - Have occupants who need assistance (non ambulatory)
  - Have societal expectation of protection.
  - Often use excessive décor.
- Noncombustible décor not limited

806.1.1 Noncombustible Materials

- Not limited in any occupancy
- Never a good idea to substitute a noncombustible material with a flame-retardant materials
  - If substitution made, other safety features (sprinklers) should be provided

2012 IFC and IBC Interior Finishes and Foam Plastics

806.1.2 Combustible Decorative Materials

- Cannot exceed 10 percent of the walls and ceilings (total area)
- Exception for group A:
  - 50 percent of walls and ceilings when fully sprinklered and
  - Stability of materials is to be in accordance with Section 803.4

806.1.2 Combustible Decorative Materials

- Exception for fabric partitions
  - Not supported by floor
  - Group B and M occupancies
  - Meeting flame propagation criteria of NFPA 701
  - Correlates with requirements in Section 806.1

806.3 Foam Plastic

- Covered specifically in Chapter 26 and Section 803.7 of the IFC
- 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

806.4 Pyroxylin Plastic

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

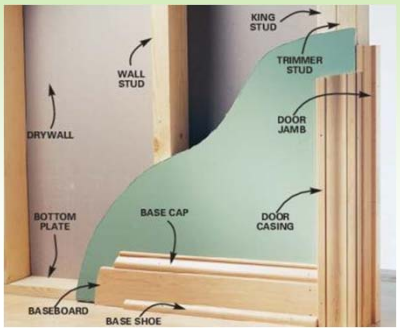
2012 IFC and IBC Interior Finishes and Foam Plastics

806.5 Interior Trim

- Limited to 10 percent of the aggregate walls or ceilings
- Not foam plastic
- Minimum Class C rating
- Does not include guardrails and handrails

806.5 Interior Trim

- Does include things such as:
  - Baseboards
  - Chair rails
  - Window trim
  - Crown molding



Chapter 4: Special Detailed Requirements

- 402 Covered Mall Buildings
  - 402.15 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
    - Ignition greater than 650 oF or light transmitting plastics
    - Edges encased in metal
    - Foam plastics
    - < 150 kW when tested to UL 1975
    - Not required to meeet ASTM E 84
    - Density > 20 pound per cubic foot
    - Thickness < ½ in

Chapter 4: Special Detailed Requirements

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

2012 IFC and IBC Interior Finishes and Foam Plastics

Chapter 4: Special Detailed Requirements

- 406 Motor Vehicle Related Occupancies
  - 406.5.2 Canopies (Service Stations)
    - Plastic:
      - Class A flame spread rating
      - Smoke-Developed Index < 450°F
      - Ignition temperature > 650°F
- 410 Stages and Platforms
- 410.3.5.3 Smoke Test
  - Curtain Fabric:
    - Smoke-Developed rating < 25
    - Intent was likely a Class A Rating

Chapter 4: Special Detailed Requirements

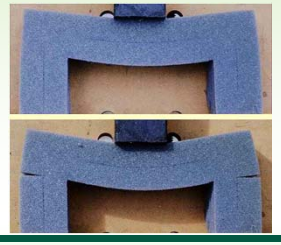
- 410.3.6 Scenery
  - Combustible materials must comply with the flame propagation criteria of NFPA
  - 701Foam Plastics must comply with IBC Section 2602.
- 411 Special Amusement Buildings
  - 411.8 Interior Finish
    - Class A interior finish required in special amusement buildings with > 50 occupants.

IBC Chapter 26: Plastic

- 2604 Interior Finish and Trim
  - Non-foam plastic in accordance with Ch 8
  - Foam
    - Interior finish
      - Section 2603.8
      - FM 4880
      - UL 1040
      - NFPA 286
      - UL 1715
      - ASTME 84
    - Trim: 2604.2

IBC Chapter 26: Plastic

- Interior Finish – Foam Plastic
- Section 2603.8 allows large scale testing
  - Large scale testing demonstrates performance
    - FM 4880
    - UL 1040
    - NFPA 286



IBC Chapter 26: Plastic

- Interior Trim – Foam Plastic
- Section 2604.2 allows trim with following criteria
  - > 20 pcf density
  - Thickness < ½ inch
  - Width < 8 inches
  - < 10 percent of wall or ceiling area
  - Class B minimum flame spread

IFC Chapter 8

- 801 General
- 802 Definitions
- 803 Furnishings
- 804 Decorative Vegetation
- 805 Decorations and Trim

Tip

Note: This workbook is focusing primarily on the interior finishes, trim and decorative materials as it pertains to those things applied to walls and ceilings versus vegetation and furnishings; therefore, Sections 805, 806 and 808 will not be addressed.

IFC Chapter 8

- 806 Interior Finish and Decorative Materials
- 807 Decorative Materials other than decorative vegetation in new and existing buildings
- 808 Furnishings other than upholstered furniture and mattresses or decorative materials in new and existing buildings

801 General

- Defines the scope of the chapter which covers:
  - Interior Finish
  - Interior Trim
  - Furniture
  - Furnishings
  - Decorative materials
  - Decorative vegetation

2012 IFC and IBC Interior Finishes and Foam Plastics

803 Interior wall and ceiling finishes and trim in existing buildings

- Similar contents to Section 803 of the IBC
- Materials separated into
  - Non-textile
  - Textile
- Focus in on existing buildings

803.1 General

- Allows materials to be tested to one of the following:
  - ASTM E 84 Tunnel Test
  - NFPA 286 Room Corner Test
- Exceptions for:
  - Materials < .036 inches thickness that are applied directly to the surface of walls or ceilings
  - Exposed Heavy timber of Type IV construction

Tip

Note: NFPA 265 room corner test can be used for textiles -addressed in Section 803.5.

803.1.1 Classification in Accordance with ASTM E84

- Provides the classifications when a product is tested to ASTM E84
  - Class A: Flame spread 0-25
  - Class B: Flame spread 26-75
  - Class C: Flame spread 76-200

Tip

Note: Maximum smoke-developed index for all three is 450. 803.1.2 Classification in accordance with NFPA 286

803.1.2 Classification in accordance with NFPA 286

- Allows use of NFPA 286 to test materials for compliance
- Acceptance criteria
- Acceptance criteria different than IBC

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803.2 Stability

- Same requirement as the IBC
- Ensures level of durability when exposed to heat
- Loose materials contribute to fire load and ease of fire spread
- Criteria > 200 F for at least 30 minutes
- Currently no standard methodology available to determine whether materials can withstand temperature exposure

803.3 Interior finish requirements based upon occupancy

- Refers to table 803.3 for the flame spread rating requirements based upon:
  - Occupancy/Use type
  - Location within buildings
  - Whether sprinklers are used

803.4 Fire Retardant Coatings

- Specific to the IFC
- Allows ability to apply fire retardants treatments in existing buildings to achieve compliance
- Requires compliance with NFPA 703 to provide level of quality assurance
- Maintenance in accordance with manufacturers instructions

803.5 Textile Wall Coverings

- Textiles are required to comply with this section:
  - Woven or nonwoven
  - Napped
  - Tufted
  - Looped

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803.5 Textile Wall Coverings

- Several options for compliance
  - ASTM E 84 Class A rating with sprinklers
  - NFPA 265 (Room corner test for textiles)
    - Method A or B test protocol acceptable
    - Method A test protocol pass/fail criteria

803.6 Expanded vinyl wall or ceiling finishes

- Requires compliance with test method NFPA 286 which tests the walls and ceilings
- Also allows compliance with NFPA 265 for textiles
- Compliance with ASTM E 84 is not allowed to demonstrate compliance

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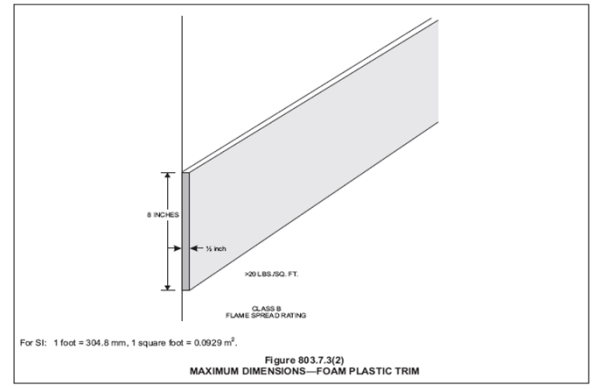
803.7 Foam Plastic Materials

- Addresses the use of foam plastic liner as interior wall or ceiling finish and trim
- Trim addressed again in Section 804
- Interior wall and ceiling finish allowed
- Trim requirements same as IBC Section 2604.2

803.7 Foam Plastic Materials



For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

Figure 803.7.3(2)
MAXIMUM DIMENSIONS—FOAM PLASTIC TRIM

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804 Interior Wall and Ceiling Trim in New and Existing Buildings

- For new and existing buildings wall and ceiling trim
- Same requirements as IBC
- Trim other than Foam Plastic
- Foam Plastic

807 Decorative Materials other than Decorative Vegetation in New and Existing Buildings

- New and existing buildings
- IBC is focused only on new
- Requirements the same as the IBC except for some additional requirements related to building contents
  - Group A
  - Group E and I-4

807 Decorative Materials other than Decorative Vegetation in New and Existing Buildings

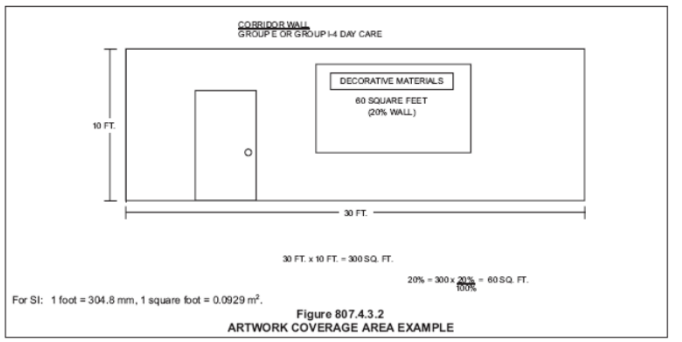


Figure 807.4.3.2
ARTWORK COVERAGE AREA EXAMPLE

Code Requirements

- Name at least two things that interior finish requirements are based on.

Interior finish requirements are based on:

- ASTM E 84 classifications, occupancy, location within the building

and

- sprinklered or unsprinklered.

Code Requirements

- What are three examples of textiles that are required to comply with Section 803.6?

Textiles that are required to comply with Section 803.6 include:

- woven, or nonwoven
  - napped tufted
    - looped

Module Six

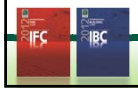
Conclusions

Code Requirements

- List the flame spreads of Class A, B and C when a product is tested to ASTM E 84.
  - The flame spread for Class A is 0-25.
  - The flame spread for Class B is 26-75.
  - The flame spread for Class C is 76-200.

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



Main Ideas

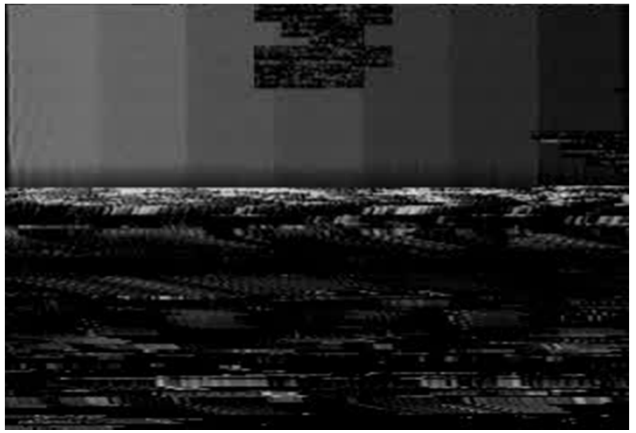
- Many methods of providing flame resistance are available
  - Chemical
  - Impregnation
  - Pressurized Impregnation
  - Coatings

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

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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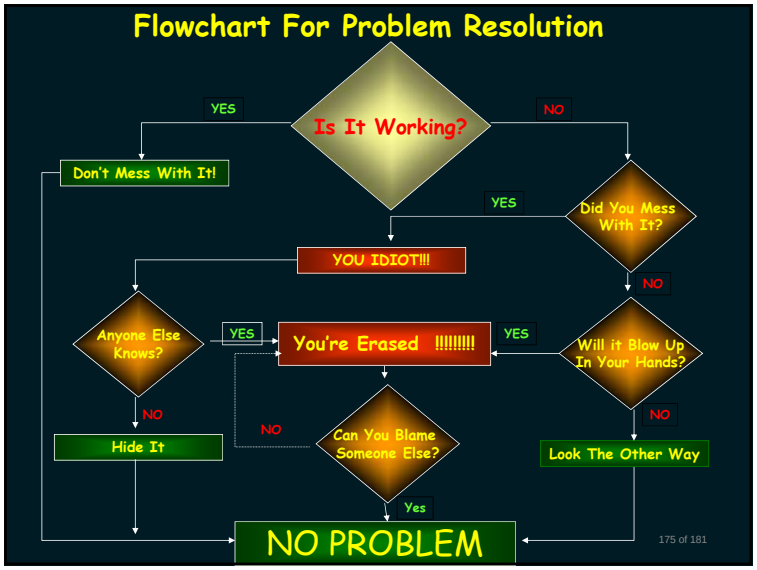

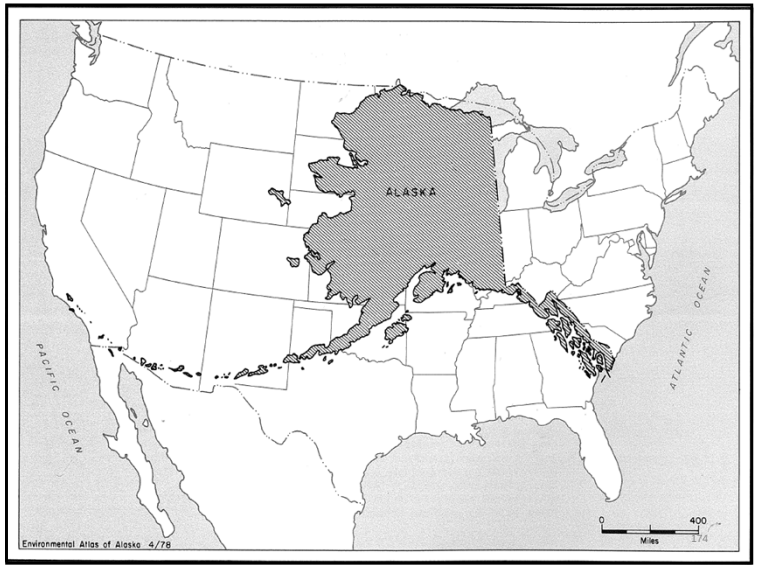

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