

'Decoding' Thermal and Ignition Barrier Requirements for SPF

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Who is SPFA?

- Spray Polyurethane Foam Alliance
 - 1979: Urethane Foam Contractors Association (UFCA)
 - 1987: Polyurethane Foam Contractors Division of the Society of the Plastics Industry (SPI)
 - 1999: Affiliated with the American Chemistry Council (ACC)
 - 2003: independent trade association for contractors, manufacturers and distributors of polyurethane foam, equipment, protective coatings, inspections, surface preparations and other services.
 - Strong relationship with the ACC's Center for Polyurethanes Industry (CPI) and Spray Foam Coalition (SFC)

What does SPFA do?

- **Education and Research**
 - Accreditation and Education Programs
 - Technical Guidelines
 - Technical Helpline (1-800-523-6154)
 - Industry Research Programs
- **Promotion and Awareness**
 - Regulatory and Legislative Activities
 - Promotional and Marketing Tools
 - Website www.sprayfoam.org
 - Annual Spray Foam Conference and Exposition
 - Directory and Buyers' Guide

Objectives

- Why Do Codes Require Thermal or Ignition Barriers?
- Fire Testing Basics
- What is a Thermal Barrier?
- What is an Ignition Barrier?
- Inspection and Verification
- Application Examples per Model Building Code

Why Do Codes Require Ignition and Thermal Barriers?

- SPF, like most organic materials, is combustible
 - Unprotected SPF will ignite when exposed to fire
 - Smoke and combustible gases can accumulate in interior spaces during fire conditions and lead to flashover
 - Flame retardants added to slow flame spread
 - Flame spread measured under controlled conditions (ASTM E84), not representative of actual fire conditions

Why Do Codes Require Ignition and Thermal Barriers?

- Required by ICC Model Building Codes (I-codes)
 - Delays combustion and ignition of SPF
 - Provide extra time needed for worker and occupant egress
 - Requirements for Foam Plastics
 - IBC Chapter 26, Section 2603
 - IRC Chapter 3, Section R316



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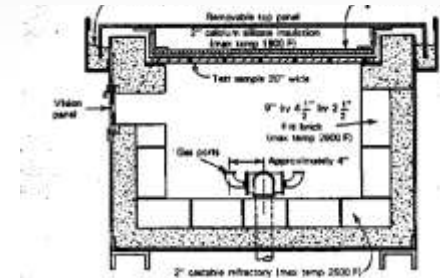
Fire Testing Basics

- **Three categories**
 - Surface Burning Characteristics (materials)
 - Room Tests (assemblies)
 - Structural Integrity Tests
- **Testing standards from...**
 - American Society for Testing of Materials (ASTM)
 - Underwriters Laboratories (UL)
 - National Fire Protection Association (NFPA)
 - Factory Mutual (FM)

Fire Testing Basics: Surface Burning

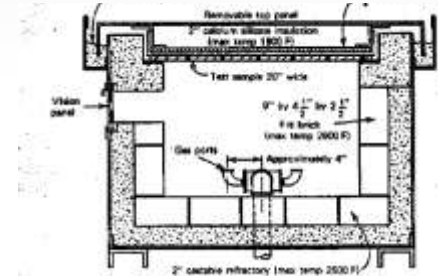
- **ASTM E84 (UL 723) Tunnel Test**

- 25' x 2' x 2' Steiner tunnel
- Req'd for most interior building products
- Material suspended on tunnel ceiling and ignited by gas burner at one end
 - Speed of flame front → Flame Spread Index (FSI)
 - Optical smoke density at outlet → Smoke Developed Index (SDI)
- FSI/SDI baseline:
 - 0/0 for fiber-cement
 - 100/100 for red oak
- 4" material thickness limitation



Fire Testing Basics: Surface Burning

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Surface Burning Test results are for comparative purposes only and not related to real-world fire conditions

Fire Testing Basics: Surface Burning

- **Requirements for Foam Plastics (<4")** [IBC 2603.3 / IRC R316.3]
 - Class B is a mandatory requirement
 - **FSI \leq 75 and SDI \leq 450**
 - Class A is an optional requirement (achieved by most SPF insulations) that may be mandatory in certain applications
 - **FSI \leq 25 and SDI \leq 450**
 - Different requirement on low-slope roofs
 - **FSI \leq 75 but no limit on SDI**
 - Roof assembly must pass FM4450 or UL1256

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NOTE: Surface Burning Test limited to 4" material thickness. Additional testing required for foam plastics to be installed >4"

Fire Testing Basics: Surface Burning

- **Requirements for Foam Plastics (>4")**
 - SPF greater than 4" thick to meet certain R-values
 - ASTM E84/UL 723 limited to 4" sample thickness
 - To qualify assemblies greater than 4" thick, special approval testing is permitted [[IBC 2603.9](#) / [IRC R316.6](#)]
- Special approval testing is performed on assembly
 - Using one of four large-scale corner fire tests
 - ½" gypsum board between foam and fire source
 - Determines maximum foam thickness intended for use

Fire Testing Basics: Surface Burning

- **ASTM E970 Critical Radiant Heat Flux Test Apparatus**
 - 1m long test panel
 - Used to qualify combustible insulations on attic floor
 - Flame should not progress more than 1 m under minimum heat flux of 0.12 W/m^2 from suspended gas burner
 - No material thickness limitation



Fire Testing Basics: Room-Corner

- **Room Corner Test Procedure**
 - Room constructed using typical wall and ceiling assemblies
 - Controlled fire source placed in corner
 - Wood crib or gas burner
 - Fire source ignited and observations recorded
 - Heat Release Rate
 - Temperatures at Ceiling
 - Heat Flux
 - Target Ignition
 - Flame-Over

Fire Testing Basics: Room-Corner

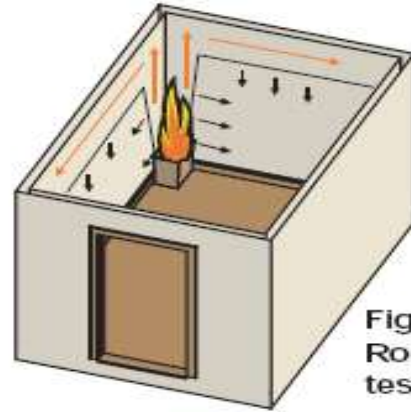
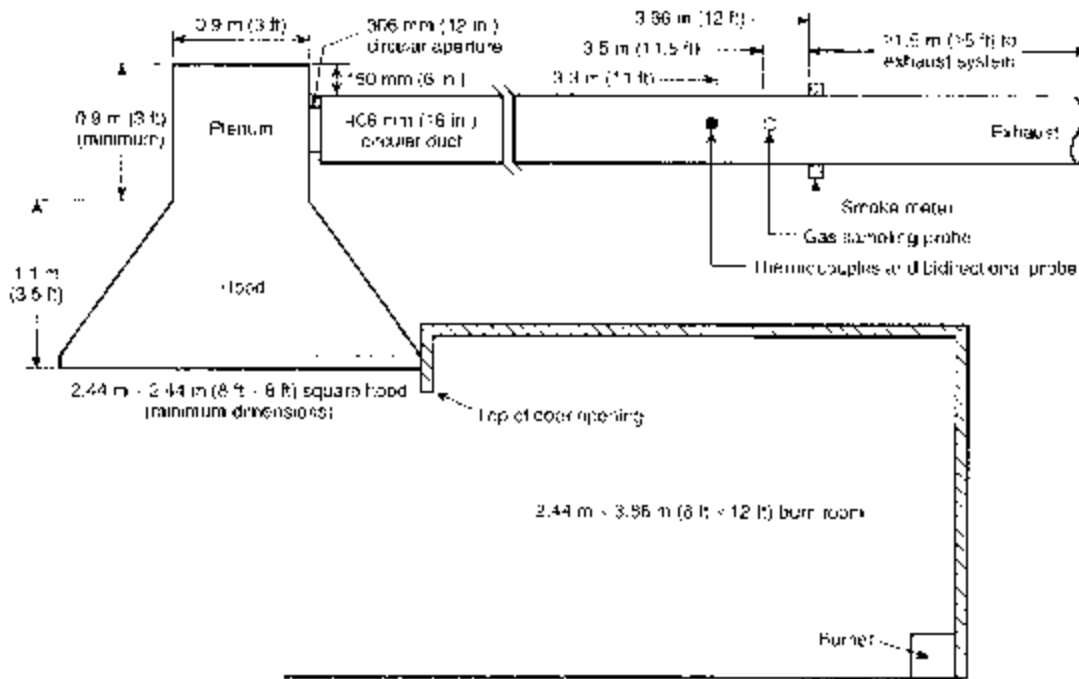


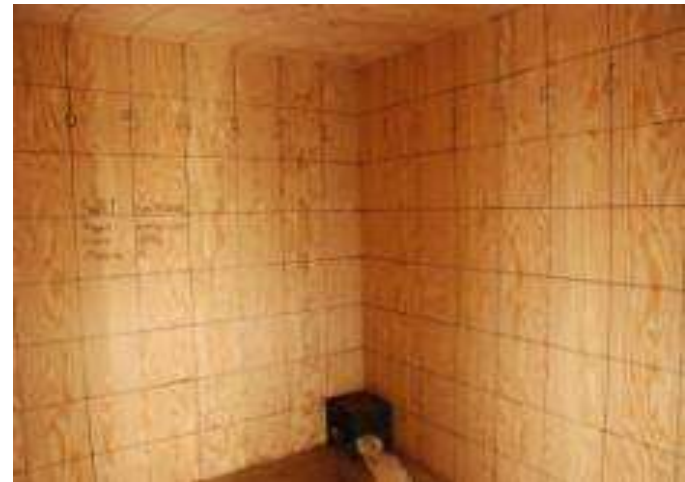
Figure 2.
Room-corner fire
test geometry.



Fire Testing Basics: Room-Corner



Fire Testing Basics: Room-Corner



Fire Testing Basics: Room-Corner



What is a Thermal Barrier?

- **Thermal Barrier Requirement** [IBC 2603.4 / IRC R316.4]
 - Separate foam plastics from all interior spaces with approved 15-minute thermal barrier

What is a Thermal Barrier?

- Two recognized thermal barrier coverings
 - ½” gypsum board [IBC 2603.4 / IRC R316.4]
 - Prescriptive for walls and ceilings
 - >95% of thermal barrier applications
 - nominal ¾ ” (19/32”) plywood [IBC Table 721.6.2(1)]
 - Not prescriptive but generally accepted for floors
- Non-prescriptive (equivalent) Thermal Barriers must be approved by large-scale fire testing

What is a Thermal Barrier?

- **Approved Thermal Barriers** [IBC 2603.4 / IRC R316.4]
 1. Prescriptive Thermal Barrier is ½” gypsum wallboard
 2. Equivalent Thermal Barrier is a coating or covering that must pass two large-scale fire tests:
 - Average temperature rise of the unexposed surface less than 250°F (120C) after 15 minutes of fire exposure per ASTM E 119 or UL 263
 - Remain in place 15 minutes during specified large-scale fire tests such as NFPA 286, UL 1715, UL 1040 or FM 4880

-- OR --

 - Comply with NFPA 275 (both test above)

What is a Thermal Barrier?

- **Special Approval / Alternate Assemblies** [IBC 2603.9 / IRC R316.6]

3. Alternate Assemblies (e.g. Exposed SPF or SPF with a protective covering) must:

- Remain in place 15 minutes during specified large-scale fire tests such as NFPA 286, UL 1715, UL 1040 or FM 4880
- Does not need to comply with requirements of IBC 2603.4.
- Product-Specific Assemblies must be tested:
 - Thermal Barrier Brand A on Foam Brand B
 - Protective coverings may include cementitious, fibrous and other proprietary products

What is a Thermal Barrier?

- No thermal barrier required:
 - Inside masonry or concrete walls [IBC 2603.4.1.1 / IRC R316.5.2]
 - Cooler and freezer walls (< 400 SF floor space)* [IBC 2603.4.1.2-3]
 - Laminated metal wall panels-one story [IBC 2603.4.1.4]
 - Roofing assembly* passing UL 1256 [IBC 2603.4.1.5 / IRC R316.5.2]
 - Entry doors [IBC 2603.4.1.7-8 / IRC R316.5.5]
 - Garage doors [IBC 2603.4.1.9 / IRC R316.5.6]
 - Siding backer board [IBC 2603.4.1.10 / IRC R316.5.7]

* SPF applications

What is a Thermal Barrier?

- No thermal barrier required:
 - Sill Plates and Headers [IBC 2603.4.1.13 / IRC R316.5.11]
 - Limited to Type V construction
 - Max thickness 3.25"
 - Class A Foam (LD and MD)



What is a Thermal Barrier?

- No thermal barrier required:
 - Certain Attics and Crawl Spaces
 - Entry is made only for service of utilities [IBC 2603.4.1.6]
 - Entry is made for repairs and maintenance [IRC R316.5.3]
 - No storage
 - Thermal barrier required between attic/crawlspace and occupied space
 - Ignition barrier is required separating foam from certain attic/crawlspace



What is an Ignition Barrier?

- **Ignition Barrier** [IBC 2603.4.1.6 / IRC R316.5.3]
 - Fire protection requirements can be reduced from 15-minute thermal barrier to ignition barrier in limited-access spaces (certain attics and crawlspaces)
 - Six prescriptive ignition barriers include:
 - 1 ½" mineral fiber insulation
 - ¼ " wood structural panels
 - ⅜" particleboard
 - ¼ " hardboard
 - ⅜" gypsum board
 - corrosion-resistant steel having a base metal thickness of 0.016"
 - **Alternative Ignition Barrier Assemblies by Special Approval Testing**

What is an Ignition Barrier?

- Special Approval Tests for Alternative Ignition Barrier Assemblies [IBC 2603.9 / IRC R316.6]
 - Same four large-scale corner burn tests as thermal barrier
 - NPFA 286, UL1715, FM4880 or UL1040
 - Special end-use fire tests per AC-377
 - Equivalent performance to ¼” plywood
 - AC-377 Appendix X Test for SPF in crawlspaces and under roof decks in unvented attics since June 2009
 - ASTM E970 Radiant Heat Flux Test for SPF on attic floors since June 2011

Ignition Barrier Performance

PASS [IB_pass.wmv](#)
with intumescent coating

AC-377 Appendix X (modified
NFPA286 Room Corner) Test for
Ignition Barriers

FAIL [IB_fail.wmv](#)
without intumescent coating

Ignition Barrier Performance

PASS [IB_pass.wmv](#)
with intumescent coating

AC-377 Appendix X (modified NFPA286 Room Corner) Test for Ignition Barriers

FAIL [IB_fail.wmv](#)
without intumescent coating



Even if building codes are not applicable in your jurisdiction or for a specific project, (e.g, retrofit insulation), always use the ignition barrier system recommended by the foam manufacturer.

Fire Testing: Commercial Buildings

- Additional requirements for SPF in Type I-IV Construction [IBC 2603.5]
 - Labelling of product
 - Thermal barrier required
 - Class A per ASTM E84 (<25 FS, <450 SD)
 - NFPA 259 test data corresponding to SPF tested per NFPA 285
 - NFPA 286 test data showing no sustained flaming
 - NFPA 285 test data for each wall assembly
 - ASTM E119 or UL 263 required for fire-resistance rated wall assemblies

Inspection and Verification

- **Alternative Fire Assembly Test Results**
 - Test performed by accredited 3rd -party lab
 - Sometimes difficult to interpret
- **Evaluation Report**
 - Test performed by accredited 3rd-party lab
 - Test results independently evaluated
 - Report defines installation
 - Product identification
 - Maximum thickness for foam
 - Alternative ignition barrier assemblies (if any)

Inspection and Verification

- **Evaluation Service Reports**

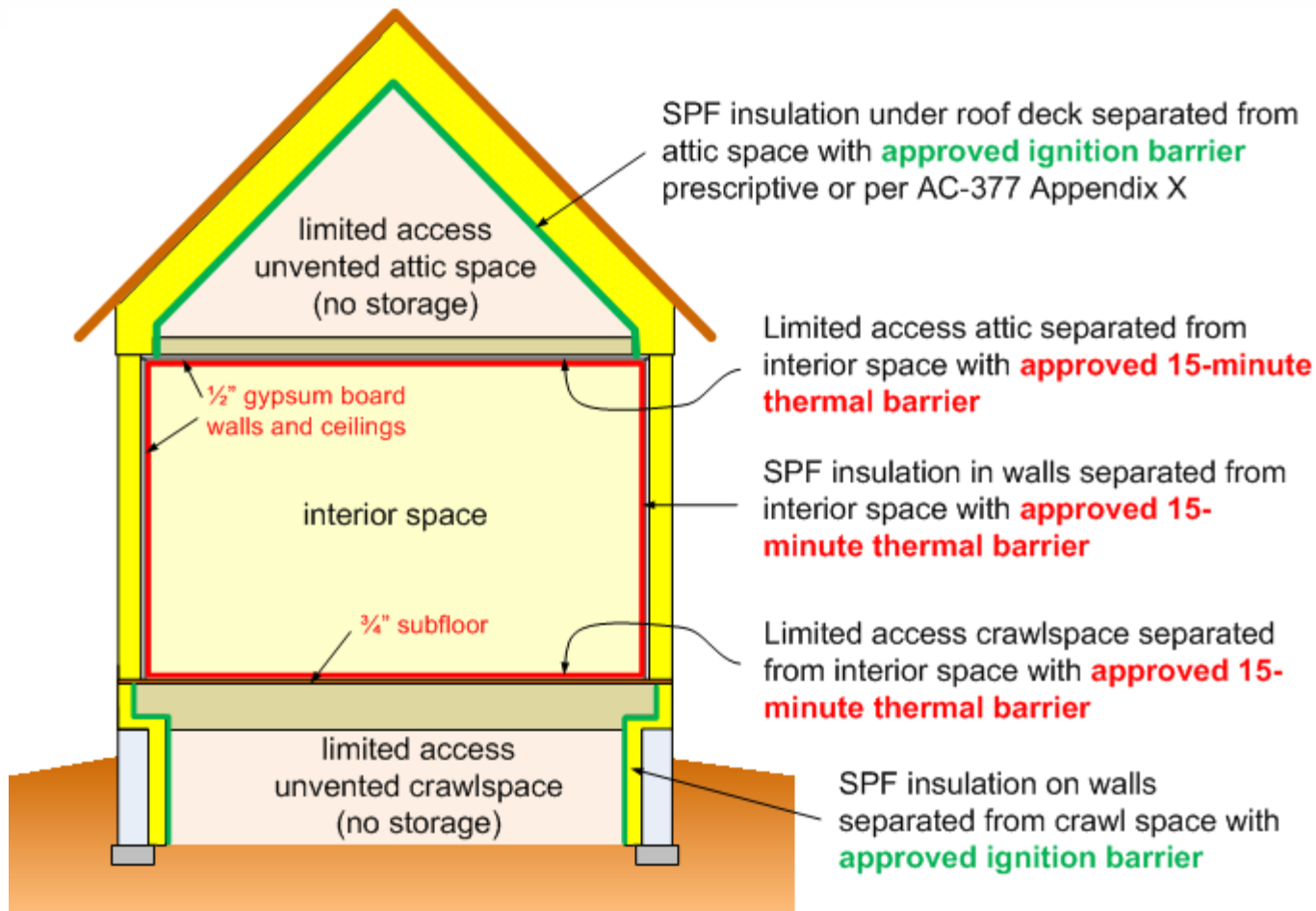
- Majority of SPF insulation products have current ESRs
- Available from manufacturer or ICC-ES websites
- Eliminates need for contractors and inspectors to interpret test data
- Defines product-specific requirements for thermal and ignition barriers based on fire testing
- A sample ESR:



ESR Example

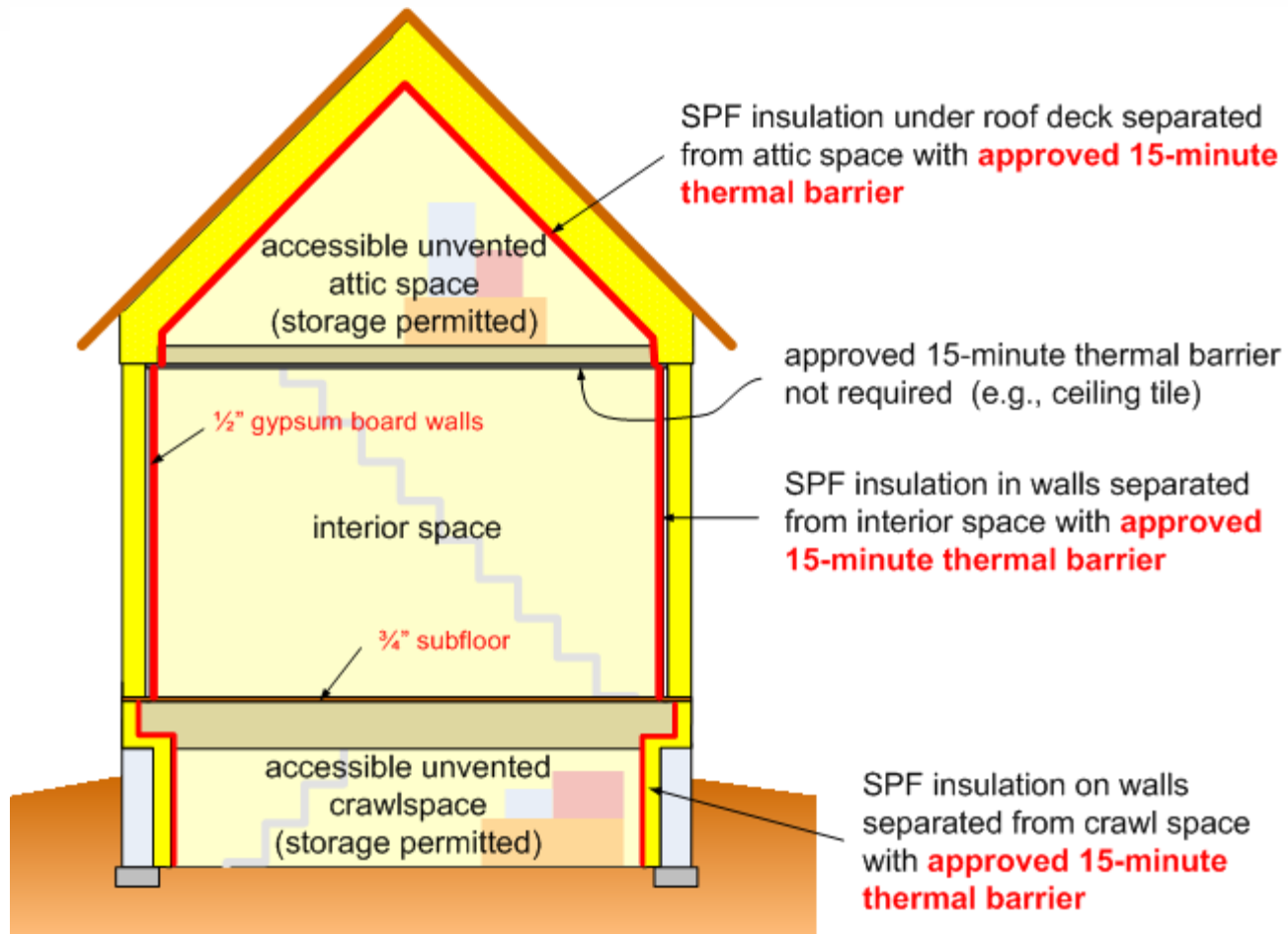
Application Examples

Unvented Attic and Crawl Space



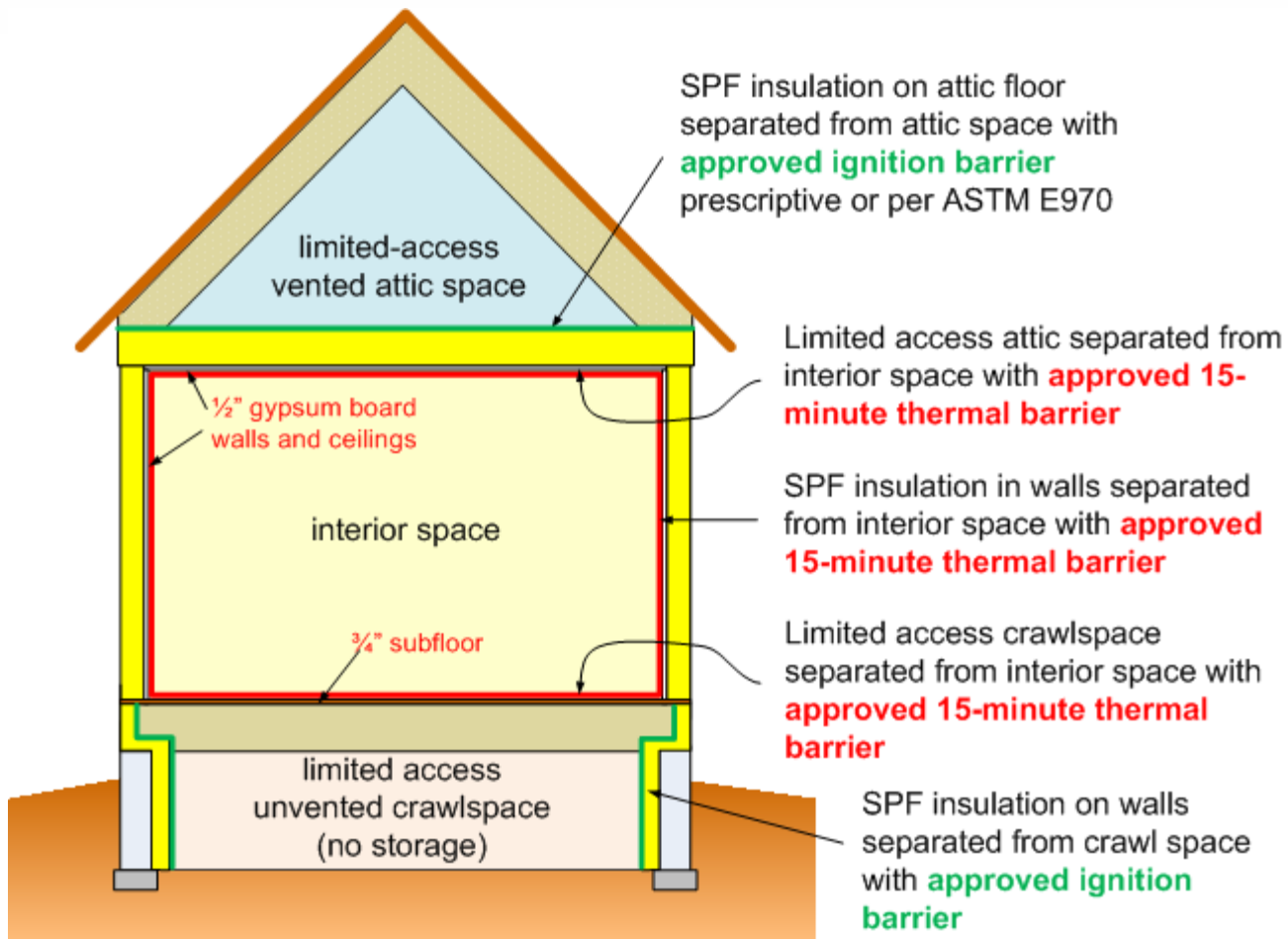
Application Examples

Unvented Attic and Crawl Space – w/ Storage



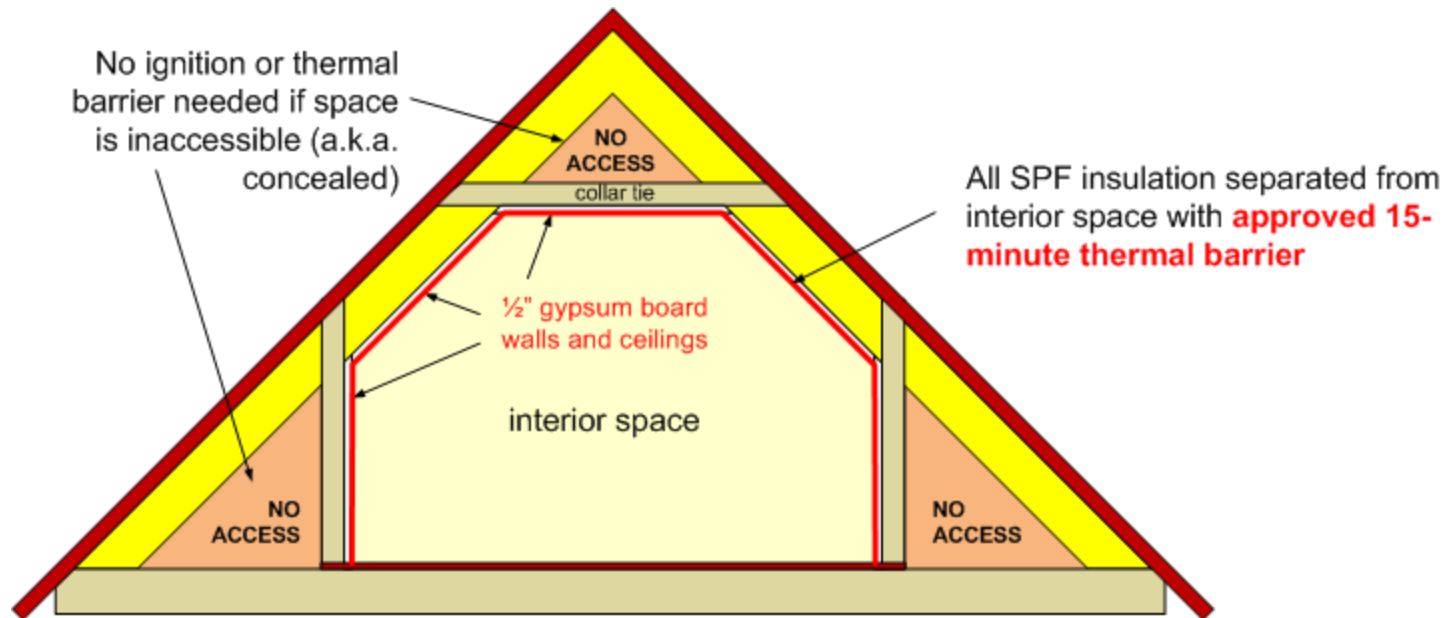
Application Examples

Vented Attic and Unvented Crawlspace



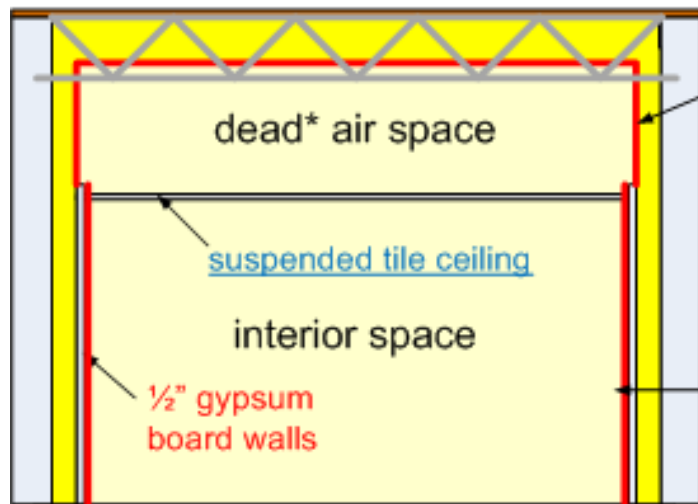
Application Examples

Finished Room Over Garage



Application Examples

Space Under Low-Slope Roof: Tile Ceiling



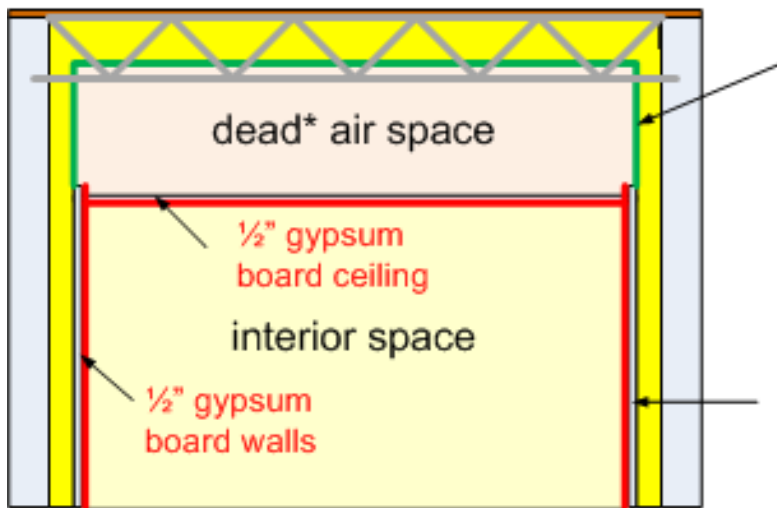
SPF insulation under roof deck separated from air space with **approved 15-minute thermal barrier**

* If air space is used as an air return plenum, SPF must be covered with a 25 FSI / 50 SDI layer in addition to thermal barrier

SPF insulation in walls and ceiling separated from interior space with **approved 15-minute thermal barrier**

Application Examples

Space Under Low-Slope Roof: Gyp Board Ceiling



SPF insulation under roof deck separated from dead air space with **approved ignition barrier**

* If air space is used as an air return plenum, SPF must be covered with a 25 FSI / 50 SDI layer in place of ignition barrier

SPF insulation in walls and ceiling separated from interior space with **approved 15-minute thermal barrier**

Final Comments

- **Thermal Barriers and SPF**
 - All SPF requires thermal barrier between foam and all interior spaces
 - If uncovered foam passes 15-minute thermal barrier test, or meets acceptance criteria of corner tests, no thermal barrier covering or coating is needed

Final Comments

- Ignition Barriers and SPF

- Most closed-cell foams do not require additional ignition barrier coverings or coatings in limited access attics and crawlspaces
- Most open-cell foams require additional ignition barrier coverings or coatings in limited access attics and crawlspaces
- Always consult evaluation report or third-party fire test reports to confirm ignition barrier requirements for each SPF product.
- Always confirm requirements with local code official

Summary

- Why Do Codes Require Thermal or Ignition Barriers?
- Fire Testing Methods
- What is a Thermal Barrier?
- What is an Ignition Barrier?
- Inspection and Verification
- Application Examples per Model Building Code

Key References

1. SPFA AY-126 - *“Ignition and Thermal Barriers for the Spray Polyurethane Foam Industry”* ©2011 SPFA
2. *“Know the Code: Using Spray Foam Insulation in Attics and Crawlspace”*, Center for the Polyurethanes Industry Guidance Document, October 2009
3. Duncan, R.S., Beitel, J. and Sheldon, M. *“New Fire Test Method for Ignition Barrier Alternatives in Attics and Crawlspace”* 2009 CPI Technical Conference Paper



Thank You!

Questions?

SPFA Website:

www.sprayfoam.org

