A Review of Thermal and Ignition Barrier Requirements for Spray Foam Insulation
Agenda

• Why Do Codes Require Thermal or Ignition Barriers?
• What is a Thermal Barrier? Where is it required?
• What is an Ignition Barrier? Where is it required?
• Inspection & Verification; Importance of Spray Foam Evaluation Service Reports (ESRs)
• Application Examples
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
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?

• Recognized thermal barrier coverings
  • ½” gypsum board [IBC 2603.4 / IRC R316.4]
    • Prescriptive for walls and ceilings
    • >95% of thermal barrier applications
  • 23/32” wood structural panel [2015 IRC R316.4]
  • nominal ½” plywood for floors [IBC 2603.4.1.14]

• 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. **Typical 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 (120°C) 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)
NFPA 286 Room Corner Test
What is a Thermal Barrier?

• **Special Approval / Alternate Assemblies** [IBC 2603.10 / 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 cementious, fibrous, intumescent coatings 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  [IBC 2603.4.1.2]
  - Exterior walls-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]
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 & residential 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/crawl space and occupied space
    - **Ignition barrier** is required separating foam from certain attic/crawl space
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”
What is an Ignition Barrier?

• Special Approval Tests for Alternative Ignition Barrier Assemblies  [IBC 2603.10 / IRC R316.6]

• Applications without a Prescriptive Ignition Barrier allowed
• 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; Modified NFPA 286 Test
  • ASTM E970 Radiant Heat Flux Test for SPF on attic floors since June 2011
What is an Ignition Barrier?

• **Special Approval Tests for Alternative Ignition Barrier Assemblies**  [IBC 2603.10 / IRC R316.6]

• Fire tests related to actual end-use configurations. The specific approval shall be based on the actual end use configuration and shall be performed on the finished foam plastic assembly in the maximum thickness intended for use.
Acceptance Criteria 377
What is an Ignition Barrier?

PASS
with intumescent coating

FAIL
without intumescent coating

AC-377 Appendix X (modified NFPA 286 Room Corner) Test for Ignition Barriers
What is an Ignition Barrier?

PASS
Foam As Is

PASS
Foam Successfully Tested in End Use Configuration

AC-377 Appendix X (modified NFPA 286 Room Corner) Test for Ignition Barriers

Alternative, test protocol based on end use conditions attic testing and modelling. Approved by ICC-ES.
Inspection and Verification

• **Alternative Fire Assembly Test Results**
  • Test performed by accredited 3rd-party lab
  • Sometimes difficult to interpret

• **Evaluation Service or Technical 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
  • Technical Evaluation Reports (TER) also used
  • A sample ESR:
Importance of Evaluation Service Reports
Importance of Evaluation Service Reports

The foam plastic insulation must not be used in electrical outlet or junction boxes or in direct contact with rain or water, and must be protected from the weather during and after application. Where the insulation is used as an impermeable insulation, such as in unvented attic spaces regulated by IRC Section R806, the insulation must be installed at a minimum thickness noted in Section 5.4. The insulation can be installed in one pass to the maximum thickness. Where multiple passes are required, the time between passes is negligible.

3.2.4 Classic Epoxy Plus: The insulation must be used in areas where the maximum service temperature is no greater than 180°F (82°C). The insulation must be applied when the temperature is at or above 14°F (−10°C) and be protected from the weather during and after application.

4.3 Thermal Barrier:

4.3.4 Classic Plus: The insulation must be used in areas where the maximum service temperature is no greater than 180°F (82°C). The insulation must be applied when the temperature is at or above 14°F (−10°C) and be protected from the weather during and after application.

5.2 Intumescent Coatings:

5.2.1 No Burn Plus X2, No Burn Plus X2 Intumescent coating is a latex-based coating supplied in 1-gallon (4 L) and 5-gallon (18.9 L) cans. The coating material has a shelf life of 12 months when stored in factory-sealed containers at temperatures between 40°F (4°C) and 90°F (32°C).

6.0 INSTALLATION

6.1 General: The manufacturer's published installation instructions and the report must be strictly adhered to and a copy of these instructions and this evaluation report must be available on the job site at all times during installation.

6.2 Application: General: Icynene Classic Plus foam plastic insulation must be applied on the job site. The insulation must be protected from the weather during and after application. Surfaces to be coated must be dry, clean, and free of oil, lint, dust, dirt, and other substances that could interfere with adhesion or the bonding trick.
Importance of Evaluation Service Reports
Application Examples

Unvented Attic and Crawlspace

- SPF insulation under roof deck separated from attic space with **approved ignition barrier**
- prescriptive or per AC-377 Appendix X
- Or Foam Successfully Tested in End Use Configuration

- Limited access attic separated from interior space with **approved 15-minute thermal barrier**
- SPF insulation in walls separated from interior space with **approved 15-minute thermal barrier**

- Limited access crawlspace separated from interior space with **approved 15-minute thermal barrier**

- SPF insulation on walls separated from crawl space with **approved ignition barrier**

©2011 Spray Polyurethane Foam Alliance
Application Examples

Unvented Attic and Crawlspace – with Storage

- SPF insulation under roof deck separated from attic space with **approved 15-minute thermal barrier**
- **Approved 15-minute thermal barrier** not required (e.g., ceiling tile)
- SPF insulation in walls separated from interior space with **approved 15-minute thermal barrier**
- SPF insulation on walls separated from crawl space with **approved 15-minute thermal barrier**

©2011 Spray Polyurethane Foam Alliance
Application Examples

Vented Attic and Unvented Crawlspace

- SPF insulation on attic floor separated from attic space with approved ignition barrier prescriptive or per ASTM E970
- Limited access attic separated from interior space with approved 15-minute thermal barrier
- SPF insulation in walls separated from interior space with approved 15-minute thermal barrier
- Limited access crawlspace separated from interior space with approved 15-minute thermal barrier
- SPF insulation on walls separated from crawl space with approved ignition barrier

©2011 Spray Polyurethane Foam Alliance
Application Examples

Finished Room Over Garage

- No ignition or thermal barrier needed if space is inaccessible (a.k.a. concealed)
- All SPF insulation separated from interior space with approved 15-minute thermal barrier
- ½” gypsum board walls and ceilings
- Interior space
Application Examples

Space Under Low-Slope Roof: Tile Ceiling

dead* air space
suspended tile ceiling
interior space

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

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 thermal barrier

ICYNENE®

©2011 Spray Polyurethane Foam Alliance
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 thermal barrier

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

• All SPF requires thermal barrier between foam and all interior spaces
• Cannot substitute an Ignition Barrier for a Thermal Barrier—an Ignition Barrier does not provide adequate protection
• Ignition Barriers can be used to protect foam plastics in limited access attics & crawlspaces
• Some foams tested to not need an IB coating
• Follow the ESR of the spray foam insulation for coating, covering & application specifics
Questions?