Foam Plastic Insulation and the Codes

Status of the foam industry

The positives!

- Polyurethane foam is becoming much more commonplace in the Home Performance industry and in commercial buildings.
- The number of polyurethane foam contractors has increased dramatically.

The negatives!

- There are no ANSI or other uniform industry installation standards to define what is required.
- There is no uniform installer certification process.
- Training is not typically required or comprehensive.
- Anyone can buy foam.

Status of the foam industry

The most common code violations encountered in foam projects:

- Missing thermal barriers
- Missing PFI barriers
- Lack of required fire protection inspections in commercial projects
- Failure to meet ventilation requirements in attics and crawl spaces

OSHA safety, site protection, and CAZ safety are separate issues.

Verification of compliance

1. Manufacturer's data
2. Labeling
3. Third-party evaluations

Verification of compliance

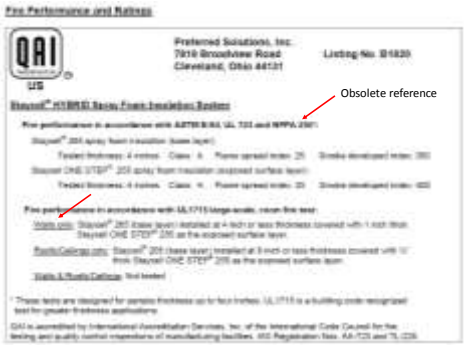
Manufacturer's data


TECHNICAL DATA SHEET

Verification of compliance

- Labeling
  1. All Foam Plastic must meet general, labeling, and surface burning characteristics to qualify for use in occupied buildings (Sections 3.16.1 through 3.16.3 per E84 tunnel test or UL 723)
  2. All foam plastic requires labeling and identification
  3. Approved agencies provide compliance certification

Labeling requirements



Verification of compliance

- Third-party evaluations
  - ICC
  - Other approved agency

Why third-party evaluations?
It's complicated, who knew, why, and, …….
you've got to be kidding!

ICC-ES Reports

1. An Evaluation Service Report (ESR) is a third-party report verifying that a product meets the code requirements for a given use.
2. The ICC Acceptance Criteria are a standardized set of compliance "guidelines" for evaluating product compliance.
3. The ICC Acceptance Criteria are not part of the codes.
4. Manufacturers are not required by the codes to have a third-party evaluation for their products.
5. AHJs, architects, owners, etc. may require them as submittals.
6. AHJs may still disapprove a product that has an ESR, or approve a product based on Acceptance Criteria that are not in the codes.

ICC Acceptance Criteria – SPF

ICC developed the Acceptance Criteria for any evaluation service. Includes guidelines for:
- products
- Installations
- applications

ICC-ES Reports

See Appendix X in AC-377

Why are barriers required?

Why are ignition & thermal barriers required?

Foamed plastics, like most organic materials, are combustible (spray, rigid foam board, sealants)

- Unprotected foam can ignite when exposed to fire sources
- Flashover and smoke can develop in interior spaces in certain conditions
- Flame retardants are added to slow flame spread
- Flame spread measured under controlled conditions, (ASTM E84), may not be representative of actual fire conditions

Why do Codes Require Ignition & Thermal Barriers?

Barriers are required in the ICC Model Building Codes (I-codes)

- Delays combustion and ignition of SPF
- Provides extra time needed for worker and occupant egress
- Requirements for Foam Plastics
  - IBC Chapter 26, Section 2603
  - IRC Chapter 3, Section R316

Foam and the codes FAQs

- Do the protection requirements for bulk foam apply to foam sealants?
- Question posed to the ICC: Foam sealants are typically used to fill cracks and seal penetrations; but, when they are used to seal top plates or rim joists, the application may be wider and thicker than the term "sealant" would seem to imply. Where is the line between foam sealants and foam plastic insulation?
- ICC - No response to where they would draw the line in real-world situations, but generally said if it is foam plastic, it must be protected as such (Dow Froth-Paks NFPA 286 tested).

The code definition for "foam plastic"

Definition: Foam Plastic Insulation - IRC (2012) SECTION R202 Definitions

"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 acoustic purposes and that has a density less than 20 pounds per cubic foot (320 kg/m3) unless it is used as interior trim."

Ref: Section R316 Foam Plastic

15-minute thermal barriers

Where <u>aren't</u> 15-minute thermal barriers required?

- Some assemblies that <u>meet specific requirements</u> do not require 15-minute thermal barriers
  - 1"Masonry or concrete construction (R316.5.1)
  - Roof decks (R316.5.2 per R803)
    - 15/32" T&G wood planks
  - Exterior re-siding (R316.5.8 per NFPA 259, , 2603.4.1.10)
  - Interior trim (R316.5.9 , 2603.4.1.11)
  - Sheathing (R316.5.12 per R316.5.3 – attics only)
  - Floors with ½" wood structural panel deck (316.5.13)

Where aren't 15-minute thermal barriers required?

- Unoccupied spaces - Ignition barriers or products with specific approvals are required in:
  - Attic walls, floors, slopes (R3.16.5.3 per R807.1, R3.16.6, 2603.4.1.6)
  - Crawl spaces (R3.16.5.4 per R408.4, R3.16.6 , 2603.4.1.6)
- Sill plates and headers (R316.5.11 per ASTM E84 or UL 723 , 2603.4.1.13)

What is a 15-minute thermal barrier?

- Thermal barrier – an insulating material that prevents foam from reaching 250F *above the ambient* (E119 or UL263).
- 15-minutes
  - How long it has to keep the foam cooler than the ignition temperature (E119 or UL263).
  - How long it has to stay in place during specified large-scale fire tests (NFPA 286, etc.).

Where are 15-minute thermal barriers required?

- In all occupied spaces - All building types
- In unoccupied spaces "with reasonable access"
- IBC - 2603.4.1.6
- IRC – R316.4

Types of 15-minute thermal barriers

- Prescriptive
- Non-prescriptive, but listed as acceptable
- Equivalent/alternate non-prescriptive
  - Not assembly specific
  - Assembly specific
- Typically approved, but not listed or equivalent
- Foam products that do not need a barrier

SPFA/ACC

- Thermal Barriers and Ignition Barriers for the Spray Polyurethane Foam Industry – SPFA/ACC AY-126 Search AY-126 at http://www.sprayfoam.org
- AY-126 is approved by the ICC and on the ICC web site - http://www.icc-es.org/News/Articles/AY126Thermal BarriersSPF2011-51811.pdf

What is a 15-minute thermal barrier?

Prescriptive - 1/2" gypsum board (C-C IPF)

What is a 15-minute thermal barrier?

Non-prescriptive or equivalent/alternative coatings or coverings (not assembly specific)

- Must be tested in accordance with, and meet the acceptance criteria of both the following:
  - Temperature Transmission Fire Test (ASTM E119)
  - Integrity Fire Test (NFPA 286, UL 1715, UL 1040 or FM 4880)
- Or: NFPA 275 (combines both tests above)
- Examples:
  - Cement-based coatings of an adequate thickness
  - Fire retarded cellulose of an adequate thickness
  - Some liquid-applied coatings of an adequate thickness

Fire Testing: Room-Corner

Fire Testing: Room-Corner

The large-scale testing process

What is a 15-minute thermal barrier?

Examples of trade-name, spray-applied thermal barrier products

1. CAFCO 560 (3/4)
2. CAFCO Ceramospray IV (1")
3. Contego TB (30 mil)
4. Fire Free 88 (.02")
5. Fire shell
6. Fire Stop
7. Flame Seal (400 sf/gal)
8. Foam Safe (50 sf/ 40 lb. bag)
9. IFT, DC315 (22 mil)
10. MCT 15
11. Monokote Z-3306 (7/8")
12. NTEC Supertherm (40 mil)
13. Pyrocrete 239 (1")
14. Pyroshield (40 mil)
15. SAFECOAT (5 mil dry)
16. ThermoCon (1")
17. Ure-K (3/4")
18. Zonolite (3/4")

Do-it-yourself barriers

Follow the manufacturer's Instructions

(excerpt from 7-page product application procedures for "qualified" installers using "specified" airless spray equipment)

Coatings – Spray-applied

Cast-in-place concrete

NTEC Supertherm
Use colorant to QA thickness

What is a 15-minute thermal barrier?

Non-prescriptive or equivalent/alternative coatings or coverings

Product-Specific Assemblies must be tested:

- Coating/Covering Brand A onto Foam Brand B

What is a 15-minute thermal barrier?

IFT DC 315

What is a 15-minute thermal barrier?

Non-prescriptive or equivalent/alternative coatings or coverings

Product-Specific Assemblies must be tested:

- Tested cladding materials

Tested products

Rigid foam board

What is a 15-minute thermal barrier?

Examples of materials that are not prescriptive, exempt, or tested; but, are generally accepted as a thermal barrier by AHJs:

- ¾ ” SE wood boards - Not prescriptive but generally accepted for floors or roof sheathing
- Metal or wood lath and plaster
- Sheet metal siding or decking
- Attics or basements with sprinklers (varies with AHJs – only mentioned in coolers)

Lath & Plaster Thermal Barrier

Plaster Thermal Barrier

Injection, Poured, FIP

When aren't thermal barriers required?

Specific approved products or systems that don't require a thermal barrier:

- Great Stuff Fireblock
- Dow Froth Pak
- PSI One Step
- EcoGuard 500 (pending)

Exceptions – Specialty Approved Foams

Attic application

Protect from ignition barriers?

Frequently Asked Questions

1. What is the difference between a thermal barrier and an ignition barrier?
   - TBs provide time to escape a fire, IBs prevent a fire from igniting. The test methods for products are also different.
2. Can I spray on intumescent coatings myself?
   - Yes, but the manufacturer may have requirements.
3. What constitutes an acceptable ignition barrier? Coatings? Hard Barriers? Answer to follow.
4. There's also been mention of the use of fiberglass batts as an ignition barrier…… True?
   - True, 1 ½" mineral fiber is a prescriptive ignition barrier. 2" cellulose is also an IB in JHAs that have adopted the 2012 IRC. Mass. is using the ___?____ version.

What is an ignition barrier?

Ignition barriers are intended to prevent foam from reaching flash-over for the minimum time provided by prescriptive ignition barriers. When designing the test, the time chosen was 4:18, which is equivalent to when wood paneling (the worst prescriptive ignition barrier) reached flash over.

- Ignition barriers protect against auto-ignition (650-800°F).
- Ignition barriers (Pass/Fail criteria = 4 minutes 18 seconds) - Modified NFPA 286.

What are protect from ignition barriers?

Prescriptive ignition barriers for attics and crawl spaces (R316.5.3, R316.5.4)

- All 15-minute thermal barriers
- 1-1/2" Mineral fiber insulation
- 1/4" Plywood
- 3/8" particleboard
- 1/4" hardboard
- 3/8" gypsum board
- .016" corrosion-resistant steel
- 1-1/2" Cellulose - attic floors (Attics only – new in 2012)

Others by special approval:

Ignition barrier matrix

Ignition barriers

Why are there so few IB tests?

- Most foam manufacturers make foam that is approved to be left exposed in attics, so why use ignition barriers?
- Some manufacturers are uncomfortable with what may happen with intumescent barriers that have only been tested for 4:18.
- Why 4:18?

Building locations

- Typical locations
  - Occupied spaces
  - Attics
  - Crawl spaces
  - Rim joists
- Exceptions

Locations – typical unoccupied spaces

Unfinished and/or unoccupied spaces where entry is made only for the service of utilities.

- Attics
- Crawl spaces

The means and purpose of access to an attic primarily determines if it is unoccupied space. *Some AHJs consider all attics with walk-up or pull-down stairs as occupied space*.

Locations - Attics

R316.5.3 Attics. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. Attic access is required by Section R807.1.
2. The space is entered only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the prescriptive ignition barrier materials.

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

From IRC (2012)

Locations – Attics

AC-377
As an alternative, the prescriptive ignition barrier shall not be required when satisfactory testing is conducted with exposed foam plastic insulation or with a foam plastic insulation system, such as foam plastic insulation covered by a coating, in accordance with either Appendix A1.0 or Appendix X of this criteria.

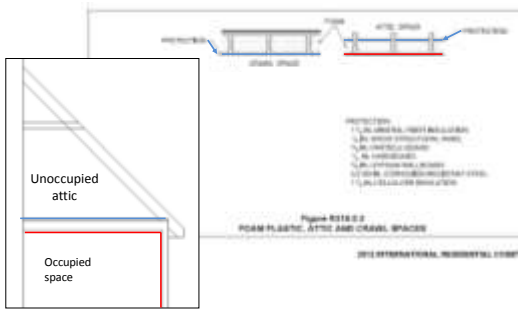
Locations – Attics

An attic qualifies for the ignition barrier exception if:

- IRC R316.5.3 Attics: If the attic area exceeds 30 square feet and has a vertical height of 30 inches or more.
- The "purposes of repairs and maintenance" are for attics that contain only mechanical equipment, electrical wiring, fans, plumbing, gas or electric hot water heaters, gas or electric furnaces, etc.
- The attic space cannot be used for storage.
- AC-377 definition: Same as R316.53

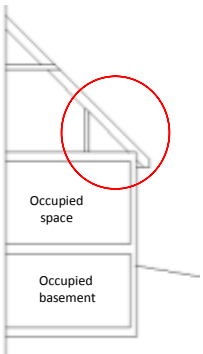
Is this code language?

Locations - Attics

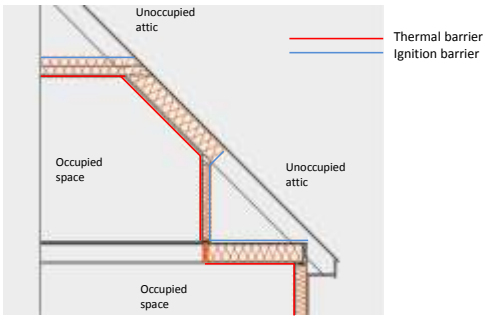


Locations - Attics

Locations - attics



Locations - attics



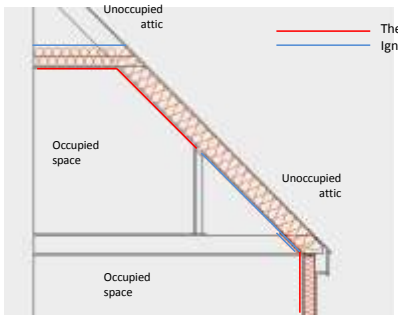
No PFI barrier

No code approval for AC-377 exception

Locations - Attics

Locations - attics

Locations - attics



Ignition barrier matrix

Matrix of ignition barrier types and locations for foam plastic - 5-2013 Draft

R = Thermal barrier req. I = Ignition barrier req. A = Acceptable, NOT R S = By special approval N = No barrier required I = AAA approved		Unoccupied attics			Crawl spaces			Sill plates & headers			
	IRC R8 AC 377	Walls	Floors	Roof slopes	Walls	Floors	Ceilings	Crawl spaces	Basements	Vapor Retarder	Attics
Specific approvals											
Full-scale foam & barrier tests	316.6	I	I	I	I	I	I	N	N	I	I
Specialty foam systems	316.6	I	I	I	I	I	I	N	N	I	I
Kits and cans											
Great Stuff Pinkfoam	N/A	I	I	I	I	I	I	N	N	I	I
Dow Froth-Pak	316.6	Max. 6" x 2"			Max. 6" x 2"			N	N	I	I
One Step Foam Pak	316.6	Pending			Pending			N	N	N	N
Bulk foam											
One Step - C-C	316.6	Walls or roof			Walls or roof			N	N	N	N
EcoSeal XSB - SI-C	316.6	Pending			Pending			I	I	I	I

Locations – Crawl spaces

- R316.5.4 Crawl spaces. The thermal barrier specified in Section R316.4 is not required where all of the following apply:
  - Crawlspace access is required by Section R408.4.
  - Entry is made only for purposes of repairs or maintenance.
  - The foam plastic insulation is protected against ignition using one of the prescriptive ignition barrier materials.
- An ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

Locations – Crawl spaces

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A2.0 Use in Crawl Spaces:

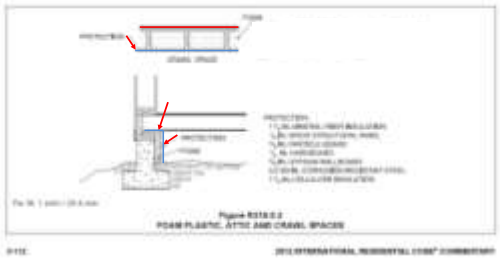
- A2.1 Spray-applied polyurethane foam plastic insulation installed in a crawl space where entry is made only for service of utilities shall be protected by an ignition barrier as set forth in IBC Section 2603.4.1.6, IRC Section R314.5.4 or Exception 4 of UBC Section 2602.4, except as noted in Section A2.2.
- A2.2 As an alternative, the ignition barrier shall not be required when satisfactory tests are conducted with exposed foam plastic.

X2.1 Test Method: The test procedure to be used is NFPA 286, "Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth."

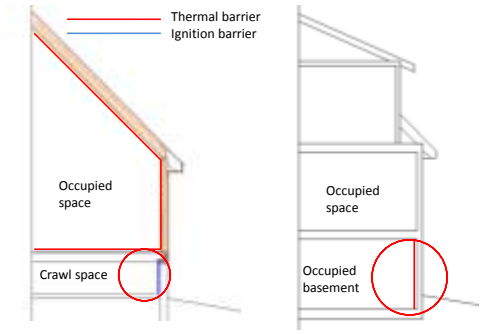
X2.2.1 No interconnected spaces, not circulated to another space.

Locations – Crawl spaces

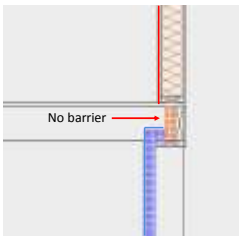
Thermal barrier
Ignition barrier



Locations – Crawl spaces



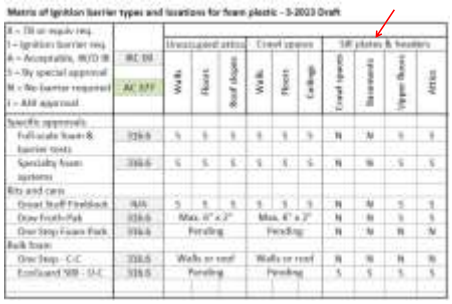
Locations – Crawl spaces



Thermal barrier
Ignition barrier

Locations – Crawl spaces

Ignition barrier matrix

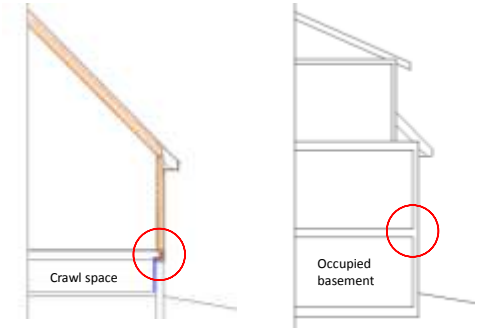


Locations - Sill plates and headers

R316.5.11 Sill plates and headers. Foam plastic shall be permitted to be spray applied to a sill plate and header without the thermal barrier specified in Section R316.4 subject to all of the following:

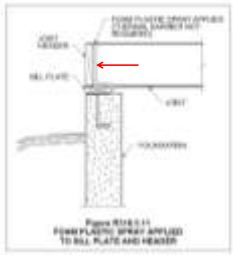
1. The maximum thickness of the foam plastic shall be 3-1/4 inches (83 mm).
2. The density of the foam plastic shall be in the range of 0.5 to 2.0 pounds per cubic foot (8 to 32 kg/m3).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E 84 or UL 723.

Locations - Sill plates and headers



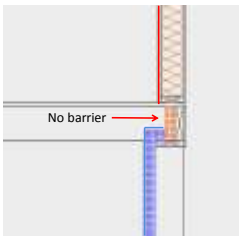
Locations - Sill plates and headers

Commentary Figure R316.5.11

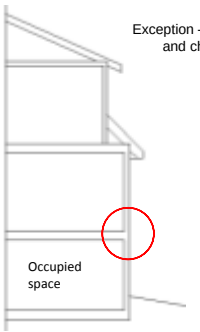


Typical rim joist configuration

Locations - Sill plates and headers

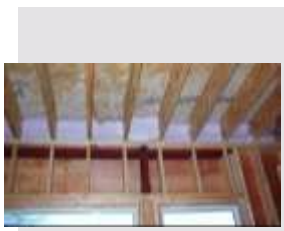


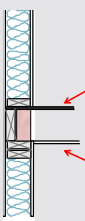
Locations - Sill plates and headers?



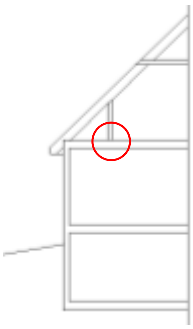
Exception – Plenums and chases

Locations - Sill plates and headers?





Locations - Sill plates and headers?



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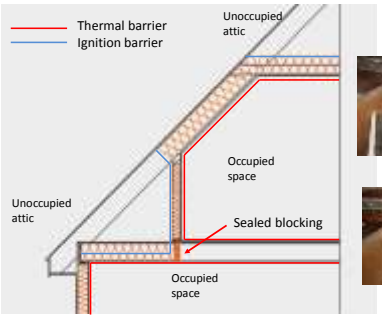
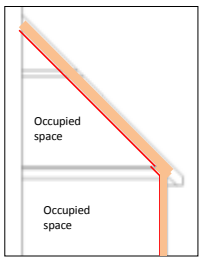
Locations - Sill plates and headers?



Locations - Sill plates and headers?

Thermal barrier
Ignition barrier



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Cover insulation with IB or attic insulation

Locations - Sill plates and headers?