SPRAY POLYURETHANE FOAM ALLIANCE

SPFA-126

Thermal and Ignition Barriers for Spray Polyurethane Foam Insulation

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ABOUT SPRAY POLYURETHANE FOAM ALLIANCE (SPFA)

Founded in 1987, the Spray Polyurethane Foam Alliance (SPFA) is the voice, and educational and technical resource, for the spray polyurethane foam industry. A 501(c)6 trade association, the alliance is composed of contractors, manufacturers, and distributors of polyurethane foam, related equipment, and protective coatings; and who provide inspections, surface preparations, and other services. The organization supports the best practices and the growth of the industry through a number of core initiatives, which include educational programs and events, the SPFA Professional Installer Certification Program, technical literature and guidelines, legislative advocacy, research, and networking opportunities. For more information, please use the contact information and links provided in this document.

DISCLAIMER

This document was developed to aid building construction and design professionals in choosing spray-applied polyurethane foam systems. The information provided herein, based on current customs and practices of the trade, is offered in good faith and believed to be true to the best of SPFA's knowledge and belief.

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DOCUMENT HISTORY

Date	Sections Modified	Description of Changes
Dec 2011		
August 2015	All	Administrative changes
August 2016	All	Technical and editorial updates to address new terminology for ignition and thermal barriers; update code references.
January 2021	Cover and Header	New SPFA Logo
October 2022	All	Technical review and update to include ICC-1100 and IAPMO ES1000

BUILDING ENVELOPE COMMITTEE

MISSION STATEMENT

The mission of the Building Envelope Committee is to:

1. To identify, explore, develop, and communicate an understanding of technical issues, including building codes and other standards, for the SPF industry.
2. Provide a wide range of technical information for members and building design professionals to properly specify and install spray foam insulation.
3. Maintain current and develop new SPFA TechDocs and TechTips applicable to application of spray foam insulation.

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POLICY STATEMENT

It is the policy and recommendation of the SPFA (Spray Polyurethane Foam Alliance) that spray polyurethane foams installed within the interior of buildings are covered with an approved thermal barrier, ignition barrier, or alternative barrier material as soon as possible after installation of the foam.

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WHY DO BUILDING CODES[1] REQUIRE THERMAL OR IGNITION BARRIERS?

SPF (spray polyurethane foam), like most other organic materials, is combustible. SPFs are formulated with flame retardants to meet the requirements of various construction codes and performance standards. Codes and standards use various fire performance tests to evaluate and describe performance characteristics of products (e.g., ASTM E84) and assemblies (e.g., NFPA 286) in response to heat and flame under controlled laboratory conditions. The results of fire performance tests are not intended to reflect hazards presented by SPFs or any other material under actual fire conditions, but to provide a means to evaluate and compare performance under standardized exposure conditions.

When exposed to fire sources, such as trash fires, welding arcs, cutting torches or red-hot metal, unprotected SPF can ignite and propagate flame under a flash-over scenario. Although, as a thermoset plastic, burning SPF will form a surface layer of less flammable char, the initial burning can produce combustible gases and black smoke. Full-scale fire testing methods include the determination of the likelihood to flash-over under controlled laboratory conditions.

For these reasons, and to allow sufficient time for occupants to escape a fire, model building codes require SPF to be covered by thermal barriers or ignition barriers, or to have the SPF assemblies meet large-scale fire tests as described in this document.

> **Note 1:** Exterior applications of SPF, such as roof systems or exterior wall assemblies, are subject to different requirements under the model building codes such as ASTM E108 / UL 790 (roof coverings) or NFPA 285 (exterior wall assemblies) testing and are not included in this document (SPFA 126).

Published by ICC-ES, (International Code Council – Evaluation Services) or IAPMO (International Association of Plumbing and Mechanical Officials) the following Acceptance Criteria are utilized to prepare evaluation reports for SPF systems and assemblies:

- AC377 Acceptance Criteria for Spray-Applied Foam Plastic Insulation.
- AC456 Acceptance Criteria for Fire-Protective Coatings Applied to Spray-Applied Foam Plastic Insulation without a Code-Prescribed Thermal Barrier.
- ICC-1100 Standard for Spray-applied Polyurethane Foam Plastic Insulation.
- ES-1000 Standard for Building Code Compliance of Spray-Applied Polyurethane Foam.

Evaluation reports (also known as Code Compliance Research Reports and Evaluation Service Reports / ESRs) assist local building officials to determine if, when and how building materials, products, components, and methods comply with the language and intent of building codes. Organizations publishing these reports have engineers on staff who are familiar with building codes and construction materials and components. Local building code officials ultimately determine code compliance and may accept or reject all or parts of these reports.

[1] References to section numbers of the International Building Code® (IBC) and International Residential Code® (IRC), promulgated by the International Code Council (ICC), are for the 2021 Edition of these codes. Code section numbers for earlier code editions may differ.

WHAT IS A THERMAL BARRIER?

A thermal barrier is a material installed between foam plastics (including SPF) and the interior of the building which is designed to delay the temperature rise of the foam during a fire situation and thereby delay its ignition and potential involvement in a fire. The IBC (*International Building Code®*) and the IRC *(International Residential Code®*) require (i.e., "prescribe") use of one of the following identified thermal barrier materials (also called "15-minute thermal barriers") to fire protect foam plastic insulation:

- 1/2 inch (12.7 mm) gypsum wallboard;
- 23/32-inch (18.2 mm) wood structural panel (2015, 2018, and 2021 IRC only);
- Heavy timber in accordance with IBC Section 602.4 (2018 and 2021 IBC only); or
- A material that is tested in accordance with and meets the acceptance criteria of both the temperature transmission fire test and the integrity fire test of NFPA 275 (2012 through 2021 both IBC and IRC only).

NFPA 275 requires two (2) tests:

1. Temperature Transmission Fire Test (Part I) wherein the allowable temperature rise measured on the unexposed surface of the thermal barrier material is limited during the 15-minute test; and

Integrity Fire Test (Part II) wherein the thermal barrier material is required to comply -with one the following test standards: NFPA 286, UL 1715, FM 4880 or UL 1040. To comply with the test standard, the thermal barrier material must remain in place during a 15-minute fire test.

WHAT IS AN ALTERNATIVE THERMAL BARRIER ASSEMBLY?

Assemblies containing foam plastic insulation, either exposed or with fire protective coverings that are not 15-minute thermal barriers, are recognized as being code compliant when successfully tested in accordance with any one of the following large-scale fire tests listed in the Special Approvals sections of the IBC and IRC:

- FM 4880
- NFPA 286
- UL 1040
- UL 1715

Assemblies passing such tests are defined as "Alternative Thermal Barrier Assemblies" in ICC-1100 *Standard for Spray-applied Polyurethane Foam Plastic Insulation* referenced in the 2021 IBC, as well as IAPMO ES-1000
Building Code Compliance of Spray-Applied Polyurethane Foam are code-compliant as alternates to 15-minute thermal barriers.

It is important to note that such testing does not qualify either the SPF or a protective covering installed over the SPF (e.g., a panel, sheet, coating, etc.) in the tested assembly as a 15-minute thermal barrier. Only materials meeting both the Temperature Transmission Fire Test and

Integrity Fire Test of NFPA 275 qualify as a 15-minute thermal barrier.

WHAT IS AN IGNITION BARRIER?

Both the IBC and IRC contain provisions that permit the use of foam plastic insulation without the prescribed thermal barrier for several prescribed uses (IBC Section 2603.4.1 and IRC Section R316.5). One such use is when the foam plastic is installed in certain attics and crawlspaces where entry is made only for repairs or maintenance (IRC) or for the service of utilities (IBC). In these locations, the IBC and IRC prescribe use of an ignition barrier to separate the foam plastic insulation from the attic or crawl space. Ignition barriers do not provide as much fire protection as thermal barriers but are considered acceptable for attic and crawlspaces where entry is limited.

Table 1 lists the prescriptive ignition barriers identified in the model building codes:

Table 1: Prescriptive Ignition Barriers Under the 2021 IBC and 2021 IRC

Material	Thickness	2021 IBC	2021 IRC	
		Attics and Crawlspaces	Attics	Crawlspaces
Mineral fiber insulation	1½ inch (38 mm)	YES	YES	YES
Wood structural panels	¼ inch (6.4 mm)	YES	YES	YES
Particleboard	thickness varies with code	¼ inch (6.4 mm)	3/8 inch (9.5 mm)	3/8 inch (9.5 mm)
Hardboard	¼ inch (6.4 mm)	YES	YES	YES
Gypsum board	3/8 inch (9.5 mm)	YES	YES	YES
Corrosion-resistant steel	base metal thickness of 0.016 inch (0.406 mm)	YES	YES	YES
Cellulose insulation, spray-applied, self-supporting	1½ inch (38 mm)	YES	YES	NO
Fiber-cement panel, soffit or backer board	¼ inch (6.4 mm)	NO	YES	YES

Note: Table 1 is based on the 2021 IBC and 2021 IRC. Ignition barrier materials prescribed under other code editions may vary.

WHAT IS AN ALTERNATIVE IGNITION BARRIER ASSEMBLY?

Assemblies containing foam plastic insulation, either exposed or with fire protective coverings that are not code-prescribed ignition barriers, are recognized as being code compliant when successfully tested in accordance with the large-scale fire tests listed in Acceptance Criteria AC 377, ICC – 1100 and IAPMO ES-1000. Such assemblies are defined as ”Alternative Ignition Barrier Assemblies”.

> **Note 2:** A 15-minute thermal barrier or alternative thermal barrier assembly separating occupied spaces adjacent to attic or crawl spaces is still required. The ignition barrier allowance is only applicable to the SPF surfaces within the attic space or the crawl space.

WHERE IS A THERMAL BARRIER REQUIRED?

All model building codes, with limited exceptions, require SPF be separated from the interior of the building by an "approved thermal barrier." Therefore, unless an exception applies, all interior SPF applications are required to be covered with an approved thermal barrier or be part of an approved alternative thermal barrier assembly.

Exceptions to the thermal barrier requirement include:

- Exterior applications as part of certain tested and classified roof assemblies.
- Certain masonry or concrete constructions.
- Certain attics and crawl spaces (see discussion under "Where Is an Ignition Barrier Permitted?").
- Sill plates and joist headers or rim joists in Type V construction (subject to prescribed limitations).
- Alternative Thermal Barrier Assemblies
- Others as provided by the model building codes.

Careful review of the specific code requirements on a case-by-case basis is recommended.

WHERE IS AN IGNITION BARRIER PERMITTED?

The IBC and IRC permit the use of an ignition barrier instead of a 15-minute thermal barrier in certain attics and crawl spaces where entry is made only for repairs and maintenance (IRC) or for the service of utilities (IBC) [see Note 3 below].

> **Note 3:** Model building codes do not require the prescribed 15-minute thermal barrier requirement in certain attics and crawl spaces where entry is made only for repairs or maintenance (IRC) or for the service of utilities (IBC). This language is often misunderstood and misinterpreted by designers, builders, SPF applicators, and building officials .

While the ultimate decision is left to the discretion of the local authority having jurisdiction, ICC Staff and ICC-ES engineers offer the following conditions that would determine if the space is entered only for repairs, maintenance, or service of utilities:

- Limited access (hatch, small door, etc.)
- Utilities within the space including, but not limited to, HVAC equipment, ductwork, electrical lines, plumbing, wiring of any type (telephone, Internet, cable, security), radiant heating systems, sprinkler systems, etc.
- Possibility that any utility as described above may be installed in the future

Based on the interpretation of the building code, the following criteria are often applied to determine appropriate fire protection for SPF surfaces in attics and crawlspaces:

Unless otherwise approved by the local code official, the following limitations apply to thermal barriers and alternative thermal barrier assemblies:

1. SPF must be installed at thicknesses and density equal to or less than tested.
2. Fire-protective materials must be installed at thicknesses equal to or greater than tested.
3. SPF formulations and fire-protective materials must conform to that which was tested.

- Thermal Barrier: Thermal barriers are required whenever the attic or crawlspace is used or could reasonably be used as an auxiliary living space or for storage. Criteria for such space may include: ease of entry (such as fixed stairs), and presence of usable flooring (other than minimal pathways for equipment access). The presence of any of the previous criteria does not automatically require thermal barrier protection, but rather offers guidance on what a code official might consider when determining the use of the space.
- Ignition Barrier: Ignition barriers are required whenever the attic or crawlspace is not or could not reasonably be used as an auxiliary living space or for storage. Criteria may include difficulty of entry (for example, a hatch or opening not easily accessible) and lack of flooring.
- No Barrier: Barriers are not required whenever no access exists to the space and the space is not connected and does not communicate with other spaces. (See Note 2 regarding thermal barriers for ceiling and floor treatments.

Refer to Appendix C Examples of Constructions for illustrations.

SELECTION OF THERMAL BARRIERS

Generally, there are two options:

1. Thermal Barriers: The IBC and IRC specifically identify several materials as prescribed thermal barriers. Additionally, these codes qualify materials which have been tested in

accordance with NFPA 275 (parts I and II) as thermal barriers. Examples of thermal barrier materials that may be qualified via NFPA 275 include:

- Spray-applied cementitious materials
- Spray-applied cellulosic materials
- Portland cement plaster
- Other various proprietary materials

2. Alternative Thermal Barrier Assemblies: SPF may be covered with various fire-protective products or left exposed provided the assembly complies with the code-prescribed large-scale fire testing representing the actual end-use configuration. Assemblies tested in both horizontal and vertical orientations qualify for use in all construction planes. These alternative thermal barrier assemblies may be recognized in a third-party listing or code evaluation report.

Code evaluation reports, listings, and fire test reports are useful in assisting local code officials in determining the code compliance of tested thermal barriers and alternate thermal barrier assemblies.

Alternative ignition barrier assemblies are NOT alternative thermal barrier assemblies.

SELECTION OF IGNITION BARRIERS

Generally, there are two options:

1. Prescriptive ignition barriers: These are specifically named in the IBC and IRC by type and thickness (for a list, see Table 1 in the "What is an Ignition Barrier" section above).

2. Alternative Ignition Barrier Assemblies: SPF may be covered with various fire-protective products or left exposed provided the assembly has been specifically approved by the local code official on the basis of testing and evaluation in accordance with the applicable requirements of ICC-ES AC377, ICC-1100, and IAPMO ES-1000. Proof of appropriate testing is required for recognition of these assemblies in a third-party code evaluation report. Additional limitations (to those under the codes for prescriptive ignition barriers) may apply to alternative ignition barrier assemblies (see Note 4).

Unless otherwise approved by the local code official, the following limitations apply to alternative ignition barrier assemblies:

1. SPF must be installed at thicknesses and density equal to or less than tested.
2. Fire-protective materials must be installed at thicknesses equal to or greater than tested.
3. SPF formulations and fire-protective materials must conform to that which was tested.

Note 4: ICC-ES AC377, ICC-1100 and IAPMO ES-1000 limit the use of alternative ignition barrier assemblies in attic and crawl spaces as follows [cited from AC-377 version approved April 2020]:

a. Entry to the attic or crawl space is only to service utilities, and no

storage is permitted.

b. There are no interconnected attic or crawl space areas.
c. Air in the attic or crawl space is not circulated to other parts of the building.
d. Attic ventilation is provided when required by 2021 and 2018 IBC Section 1202.2, 2006, 2009, 2012 and 2015 IBC Section 1203.2 or IRC Section R806, except when air-impermeable insulation is permitted in unvented attics in accordance with the 2018 IBC Section 1202.3, 2015 IBC Section 1203.3, 2012 IRC Section R806.5, 2009 IRC Section R806.4. Under-floor (crawl space) ventilation is provided when required by 2018 IBC Section 1202.4, 2015 IBC Section 1203.4 (2012, 2009 and 2006 IBC Section 1203.3) or IRC Section R408.1, as applicable.
e. The foam plastic insulation is limited to the maximum thickness and density tested.
f. Combustion air is provided to combustion appliances in accordance with 2009, 2012, 2015, 2018 and 2021 IMC Section 701 or 2006 IMC Sections 701 and 703.
g. The installed coverage rate or thickness of coatings, if part of the insulation system, shall be equal to or greater than that which was tested.

Caution: Just because a material is advertised as a “thermal barrier”, “ignition barrier” or an assembly not requiring a thermal or ignition barrier, it does not mean that it has been approved by a local code official. Ask for an evaluation report, test data, local code approvals, listings or other written indications of acceptability under the code to be sure that the product or assembly selected offers the fire protection that the code requires.

APPENDIX A

Referenced Standards

AC 377: *Acceptance Criteria for Spray-Applied Foam Plastic Insulation.* International Code Council Evaluation Service

AC 456: *Acceptance Criteria for Fire-Protective Coatings Applied to Spray-Applied Foam Plastic Insulation without a Code-Prescribed Thermal Barrier*: International Code Council Evaluation Service.

ASTM E84: *Standard Test Method for Surface Burning Characteristics of Building Materials*. West Conshohocken, PA: ASTM International.

ASTM E970: *Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.* . West Conshohocken, PA: ASTM International.

FM 4880: *Approved Standard for Class I Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems.* Norwood, MA: FM Approvals.

IAPMO ES-1000: *Building Code Compliance of Spray-Applied Polyurethane Foam.* Ontario, CA: International Association of Plumbing and Mechanical Officials.

ICC-1100: *Standard for Spray-applied Polyurethane Foam Plastic Insulation*. Washington, D.C.: International Code Council, Inc.

IBC: *International Building Code*. Country Club Hills, IL: International Code Council.

IRC: *International Residential Code*. Country Club Hills, IL: International Code Council.

NFPA 275: National Fire Protection Association (NFPA). *NFPA 275 Method of Fire Tests for The Evaluation of Thermal Barriers*. Battery Park, MA: National Fire Protection Association.

NFPA 285: *Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.* Battery Park, MA: National Fire Protection Association.

NFPA 286: *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth* (Note: NFPA 286 does not include pass/fail criteria within it; the criteria are specifically defined within the IBC and IRC). Battery Park, MA: National Fire Protection Association.

UL 723: *Standard for Test for Surface Burning Characteristics of Building Materials*. Northbrook, IL: Underwriters Laboratories, Inc.

UL 1715: *Standard for Fire Test of Interior Finish Material*. Northbrook, IL: Underwriters Laboratories, Inc.

UL 1040: *Standard for Fire Test of Insulated Wall Construction.* Northbrook, IL:

Underwriters Laboratories, Inc.

APPENDIX B

Definitions and Acronyms

15-Minute Thermal Barrier: (see Thermal Barrier)

AC: Acceptance Criteria are developed by the ICC-ES technical staff in consultation with the report applicant and with input from interested parties. Acceptance Criteria are used as a guide to develop evaluation reports.

Alternative Ignition Barrier Assembly: An assembly consisting of either the exposed SPF or the SPF with a fire-protective product that complies with the conditions of acceptance of Appendix X or for attic floors, complies with ASTM E970.

Alternative Thermal Barrier Assembly: An assembly consisting of either the exposed SPF or the SPF with a fire-protective product that complies with the Special Approval sections of the IBC and IRC or ICC-1100 that references test procedures NFPA 286, UL 1715, FM 4880 or UL 1040.

Appendix X: A fire test protocol based on, but less severe than, NFPA 286 to qualify alternative ignition barrier assemblies. Details of this test protocol may be found in AC377.

Approved: Acceptable to the building official.

Building Official: The officer or other designated authority charged with the administration and enforcement of the building code.

Evaluation Report: Report provided by an accredited or qualified third-party reporting results of technical evaluations of data for compliance with a standard or set of criteria. In the context of buildings and construction, these reports commonly evaluate compliance of a product or assembly with the relevant requirements of the construction codes, consensus standards or acceptance criteria. Evaluation reports are used to help confirm code-compliance of products and assemblies.

ICC: International Code Council (www.iccsafe.org) The ICC formed in 1994 by the merger of BOCA, ICBO and SBCCI to promulgate a common set of model building codes. Codes developed by the ICC are commonly referred to at the I-CODES.

ICC-ES: International Code Council Evaluation Services (www.icc-es.org) , is a nonprofit, limited liability company (ICC subsidiary) that performs technical evaluations of building products, components, methods, and materials.

Ignition Barrier: A building code permitted protective covering applied over foam plastic insulations, including SPF, in attics and crawlspaces to increase the time it takes for the foam

plastic to become involved in a fire. Ignition barriers do not provide as much fire protection as thermal barriers. The building code restricts the use of ignition barriers to attics and crawlspaces of limited access (check the local building code for specific requirements).

NFPA: National Fire Protection Association (www.nfpa.org), is a global nonprofit organization, established in 1896, devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards.

Thermal Barrier: A material installed over spray polyurethane foam (and other foam plastics) designed to slow the temperature rise of the foam during a fire situation and delay its involvement in the fire. With certain exceptions, building codes require that SPF be separated from interior spaces with a thermal barrier. Building codes define thermal barriers as those specifically listed in the code (such as ½-inch gypsum wallboard) or those tested in accordance with NFPA 275 (meeting both the Temperature Transmission Fire Test and the Integrity Fire Test). Such materials are commonly termed "15-minute thermal barriers", since 15 minutes of fire resistance is required.

APPENDIX C

Examples of Constructions

In Figures C1-C7, the following terms are interchangeable:

1. Alternative ignition barrier assemblies with ignition barriers;
2. Alternative thermal barrier assemblies with thermal barriers.

Ignition barriers and alternative ignition barrier assemblies are NOT interchangeable with thermal barriers and alternative thermal barrier assemblies.

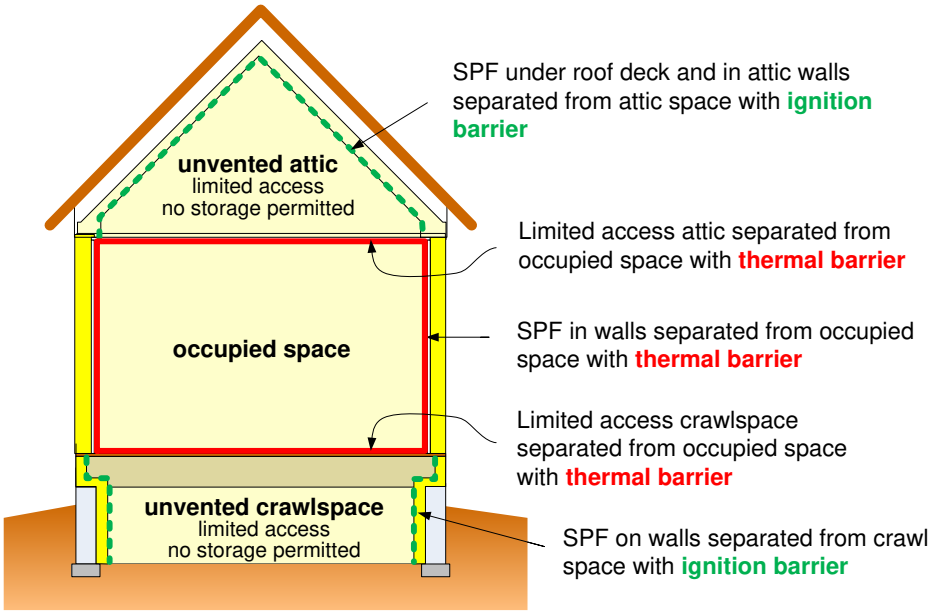

FIGURE C1 – Thermal and ignition barrier requirements for unvented attics and crawlspaces having limited access and no storage

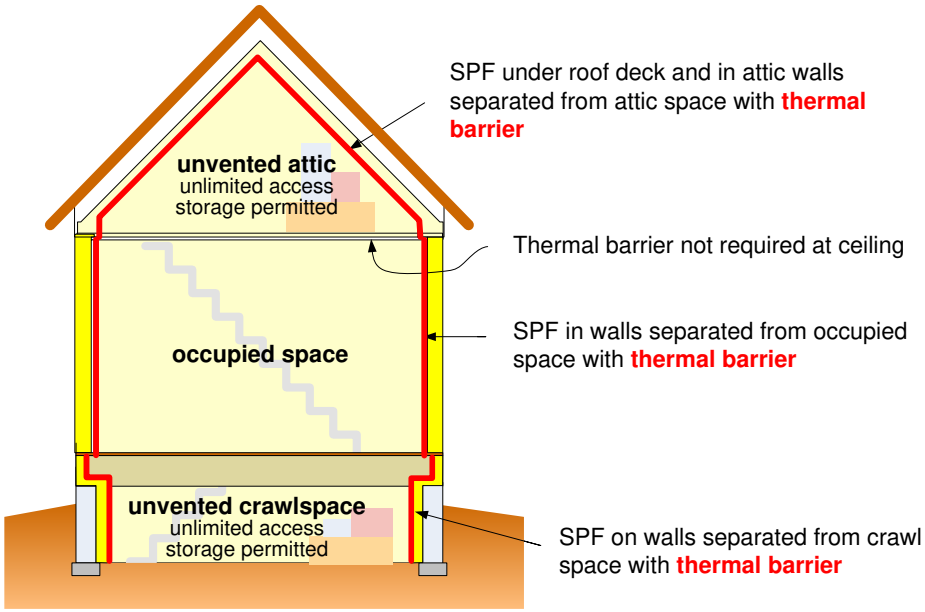

FIGURE C2 – Thermal barrier requirements for unvented attics and crawlspaces with unlimited access or used for storage

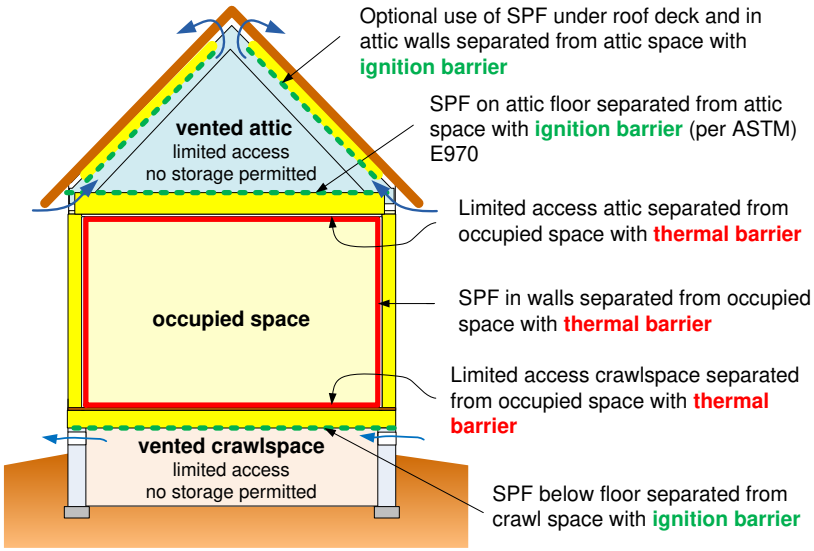

FIGURE C3 – Thermal and ignition barrier requirements for vented attics and crawlspaces with limited access

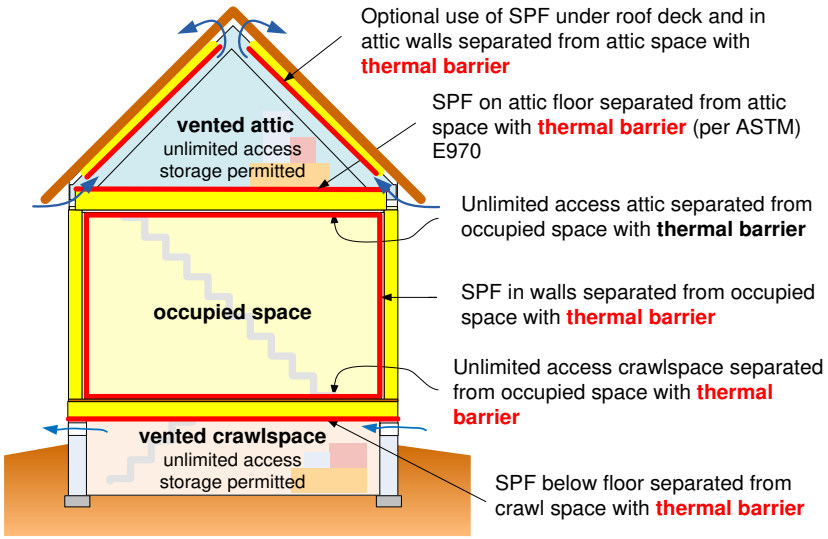

FIGURE C4 – Thermal barrier requirements for vented attics and crawlspaces with unlimited access

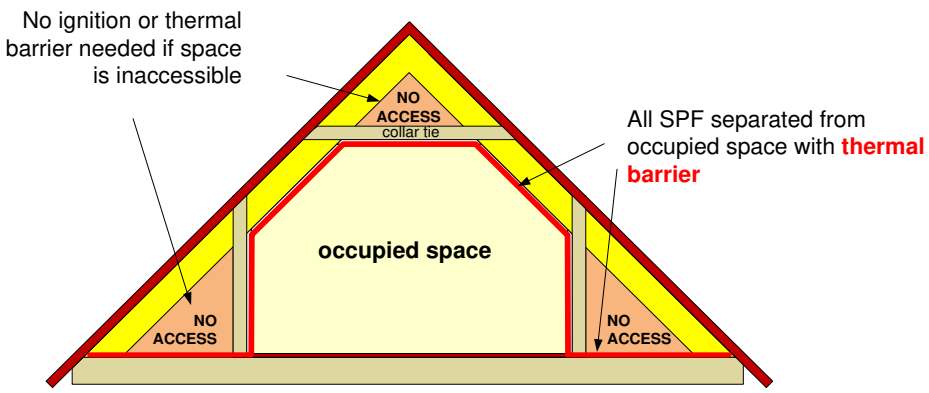

FIGURE C5 – Thermal barrier requirements for areas having no access adjacent to occupied spaces

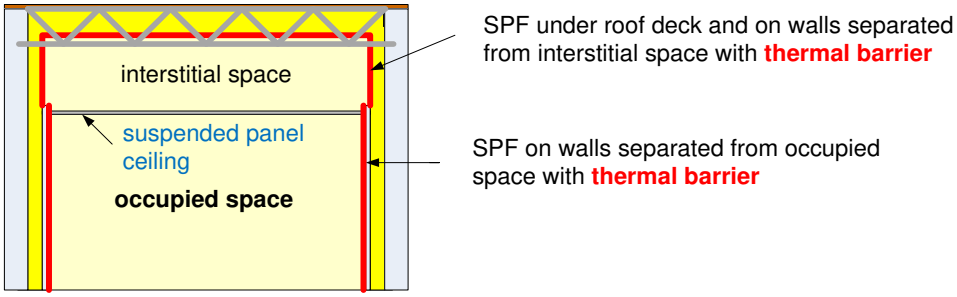

FIGURE C6 – Thermal barrier requirements for interstitial space with suspended panel ceilings which are not thermal barriers

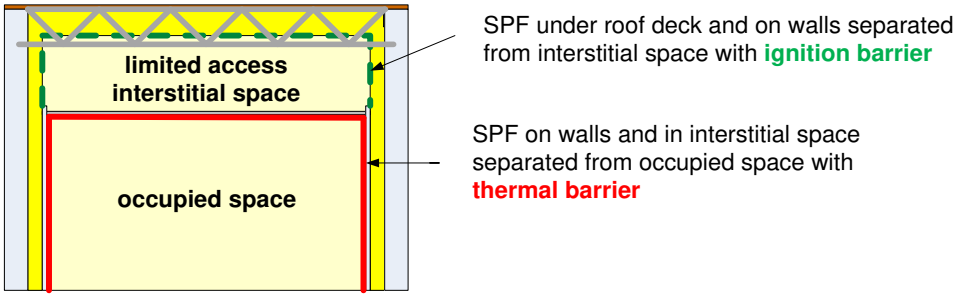

FIGURE C7 – Thermal and ignition barrier requirements for interstitial space with ½" gypsum board ceiling or other thermal barrier