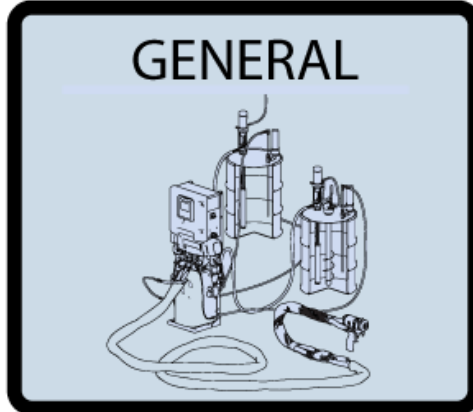
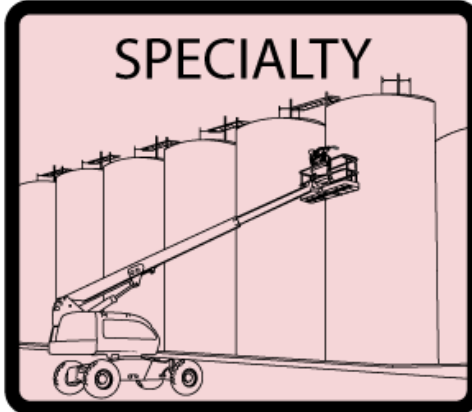
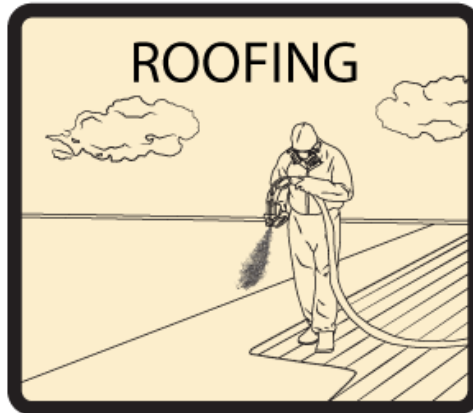
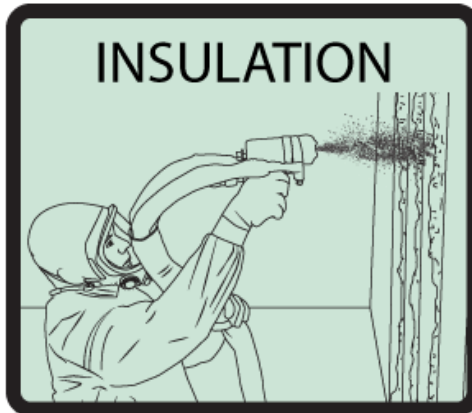




Thermal Barriers and Ignition Barriers for the Spray Polyurethane Foam Industry

SPFA-126

FIRE PROTECTION



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ABOUT THE 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 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

NOTE: This document was developed to aid building 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, but is made WITHOUT WARRANTY, EITHER EXPRESS OR IMPLIED, AS TO FITNESS, MERCHANTABILITY, OR ANY OTHER MATTER. SPFA DISCLAIMS ALL LIABILITY FOR ANY LOSS OR DAMAGE ARISING OUT OF ITS USE. Individual manufacturers and contractors should be consulted for specific information. Nominal values which may be provided herein are believed to be representative, but are not to be used as specifications nor assumed to be identical to finished products. SPFA does not endorse the proprietary products or processes of any individual manufacturer, or the services of any individual contractor.

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.

TECHNICAL OVERSIGHT COMMITTEE

MISSION STATEMENT

The mission of the Technical Committee is to provide a wide range of technical service to the Spray Polyurethane Foam (SPF) industry such as, but not limited to:

- (1) Review existing documents and serve as a clearing house to ensure the “Continuity of Value” of technical information published by SPFA and others concerning the products and services to the SPF industry;
- (2) Review, research, develop, and issue documents concerning new products, systems and services; and
- (3) To identify, explore, develop, and communicate an understanding of technical issues facing the SPF industry.

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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 be covered with a thermal or ignition barrier as soon as possible after the initial application, except as an assembly specifically approved by a building code authority based on fire tests specific to the application.

WHY DO CODES 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. Some common fire tests are [ASTM E84](#), [UL 723](#) and others; however, the flame spread and smoke developed indexes from these tests are used solely to measure and describe properties of products in response to heat and flame under controlled laboratory conditions. The numerical flame spread and smoke developed indexes are not intended to reflect hazards presented by SPFs or any other material under actual fire conditions.

When exposed to fire sources, such as trash fires, welding arcs, cutting torches or red-hot metal, unprotected SPF can ignite and may result in a flash fire. Although burning SPF will form a surface layer of less flammable char, the initial burning can produce combustible gases and black smoke. In confined interiors, these combustible gases can accumulate and ignite, resulting in flashover, a dangerous fire situation. Under these conditions, additional foam and other combustibles can become involved in the fire, creating additional combustible gases and feeding the fire.

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 [NFPA 285](#), testing and are not included in this document (SPFA 126).

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 to delay or prevent the foam's involvement in a fire. The [IBC](#) (*International Building Code*®) and the [IRC](#) (*International Residential Code*®) define approved thermal barriers (“15-minute thermal barriers”) as:

Published by ICC-ES, (*International Code Council – Evaluation Services*) 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.*

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.

- ½ inch (12.7 mm) gypsum wallboard;
- 23/32-inch (18.2 mm) wood structural panel (IRC 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](#)

[NFPA 275](#) requires two (2) tests:

1. Temperature Transmission Fire Test (Part I) wherein the temperature rise of the unexposed surface of the barrier material is limited within the test standard; and
2. Integrity Fire Test (Part II) to establish that the barrier material will sufficiently remain in place during a fire scenario by complying with one of the following 15-minute fire test standards: [NFPA 286](#), [UL 1715](#), [FM 4880](#) or [UL 1040](#).

Many assemblies without thermal barriers have earned various building code acceptances as an alternate to the use of thermal barriers over SPF based on large-scale fire testing. The assembly, consisting of either the exposed foam plastic or the foam plastic with a fire-protective product, is tested using one of the following procedures and termed an “alternative thermal barrier assembly”:

- [NFPA 286](#)
- [UL 1715](#)
- [FM 4880](#)
- [UL 1040](#)

WHAT IS AN IGNITION BARRIER?

Model building codes include a specific exception to the thermal barrier requirement in attics and crawlspaces where entry is made only for repairs or maintenance (IRC) or for the service of utilities (IBC). In these locations, the foam plastic insulation must be separated from the attic or crawlspace using an ignition barrier. 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 2015 IBC and 2015 IRC

Material	Thickness	2015 IBC	2015 IRC	
		Attics and Crawlspace	Attics	Crawlspace
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	NO

Note: Table 1 is based on the 2015 IBC and 2015 IRC. Permissions under other code editions may vary.

Building code authorities may accept alternative ignition barrier assemblies based on large-scale tests and acceptance criteria such as that described in [AC377](#), Appendix X. (On attic floors only, [ASTM E970](#), as outlined in [AC377](#), may be used to qualify alternative ignition barrier assemblies.)

Note 2: A thermal barrier or alternative thermal barrier assembly is still required between occupied interior spaces and the attic and the crawlspace. The ignition barrier exception is only applicable to the SPF surfaces facing the attic and crawl space.

WHERE IS A THERMAL BARRIER REQUIRED?

All model building codes require that SPF, with some exceptions, must 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 crawlspaces (see discussion under “Where Is an Ignition Barrier Permitted?”).
- Sill plates and joist headers or rim joists limited to certain SPFs, at certain thicknesses, in Type V construction.

- Specifically-approved assemblies based on large scale tests.
- 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 as an alternative to installing a thermal barrier in attics and crawlspaces where entry is made only for repairs and maintenance (IRC) or for the service of utilities (IBC) [see Note 3 below]. Therefore, in such attics or crawlspaces, SPF surfaces need not be covered with a thermal barrier provided it is (1) covered with a prescriptive ignition barrier; or (2) part of an approved alternative ignition barrier assembly, such as those tested in accordance with [AC377](#), Appendix X (or [ASTM E970](#) for attic floors only).

Note 3: Model building codes allow an exception to the thermal barrier requirement in attics and crawlspaces 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 alike.

While the ultimate decision is left to the discretion of the local code authority, 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 this interpretation of the building code, the following criteria are often applied to determine appropriate fire protection for SPF surfaces in attics and crawlspaces:

- **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 ½-inch gypsum wall board and 23/32-inch wood structural panel (IRC only) as thermal barriers. Additionally, these codes define materials which have been tested in accordance with [NFPA 275](#) (parts I and II) as thermal barriers. Typical tested thermal barrier materials 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 has been specifically approved on the basis of large-scale fire testing representing the actual end-use configuration. Alternative thermal barrier assemblies may have a currently valid evaluation report. Local code officials are permitted to allow the use of an alternative thermal barrier assembly which has not been issued an evaluation report provided that data satisfactory to the code official is submitted for approval. IRC and IBC identify the following tests for alternative thermal barrier assemblies:

- [NFPA 286](#)
- [UL 1715](#)
- [UL 1040](#)
- [FM 4880](#)

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.

Evaluation reports can assist local code officials in determining the code compliance of tested thermal barriers and alternative thermal barrier assemblies. Local code officials are permitted to approve the use of a tested thermal barrier or alternate thermal barrier assembly that has not been issued an evaluation report provided that data satisfactory to the code official is submitted for approval.

Alternative ignition barrier assemblies tested under Appendix X or ASTM E970 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 Appendix X or [ASTM E970](#) (attic floors only) testing. Proof of appropriate testing supported by an evaluation report may be required. 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: Appendix X limits the use of alternative ignition barrier assemblies in attic and crawl spaces as follows [cited from AC-377 version approved April 2016]:

- 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 IBC Section 1203.2 or IRC Section R806, except when air-impermeable insulation is permitted in unvented attics in accordance with the 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 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 in accordance with IMC Section 701 (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. Approved April 2016, <http://shop.iccsafe.org/es-acceptance-criteria.html>.

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. Approved October 2015, <http://shop.iccsafe.org/es-acceptance-criteria.html>

ASTM E84: *Standard Test Method for Surface Burning Characteristics of Building Materials*

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

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.*

IBC: International Code Council (2015). *International Building Code.* Country Club Hills, IL: International Code Council.

IRC: International Code Council (2015). *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*

UL 1715: *Standard for Fire Test of Interior Finish Material.*

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

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 section of the IBC or the Specific Approval section of the IRC. Referenced test procedures include 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 as 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).

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.

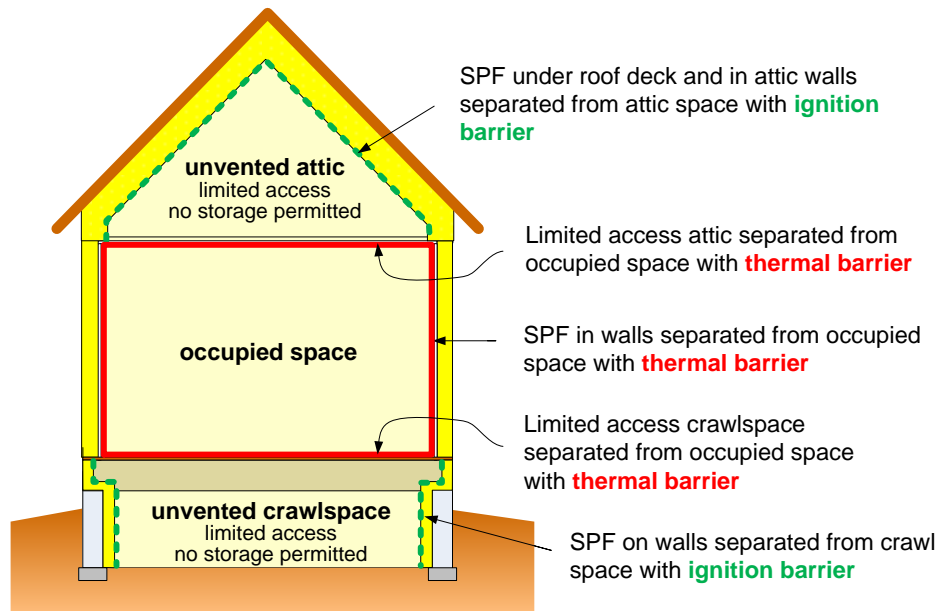


FIGURE C1 – Thermal and ignition barrier requirements for unvented attics and crawlspaces having limited access and no storage

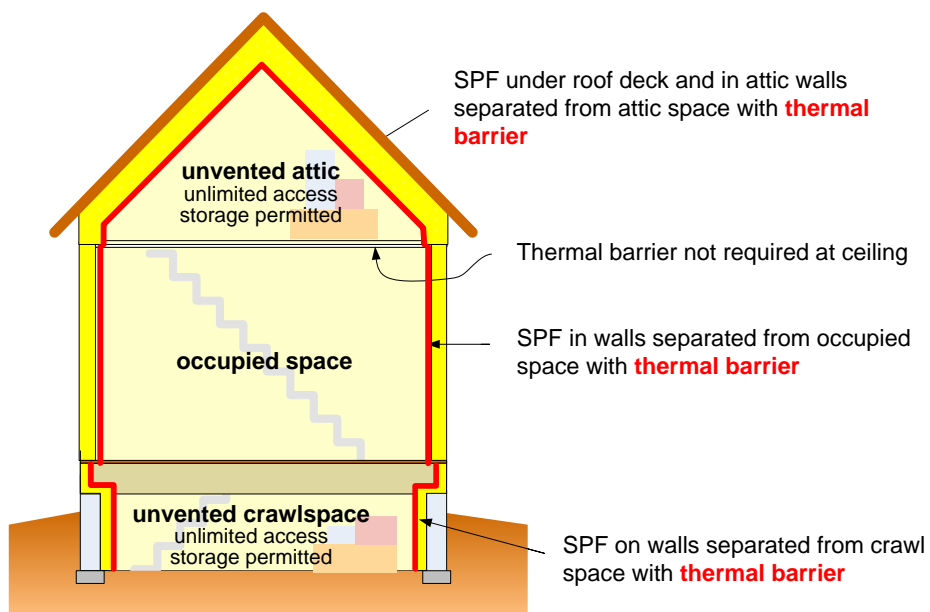


FIGURE C2 – Thermal barrier requirements for unvented attics and crawlspaces with unlimited access or used for storage

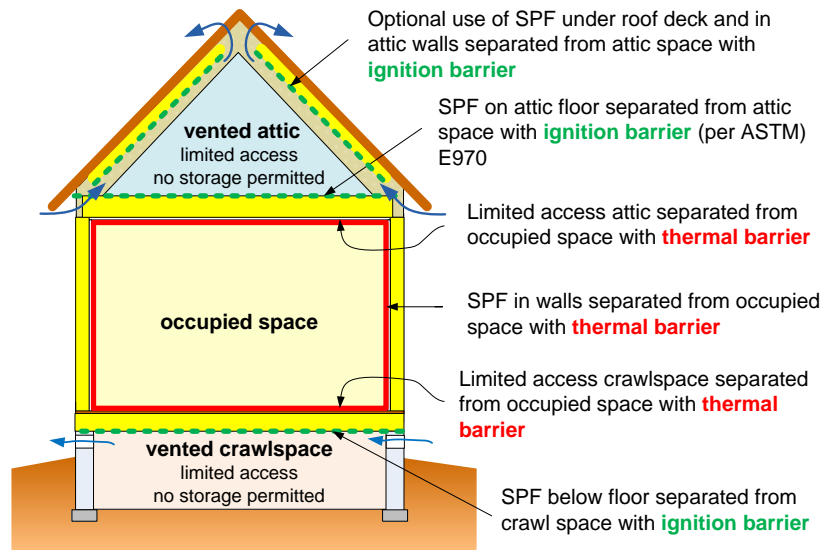


FIGURE C3 – Thermal and ignition barrier requirements for vented attics and crawlspaces with limited access

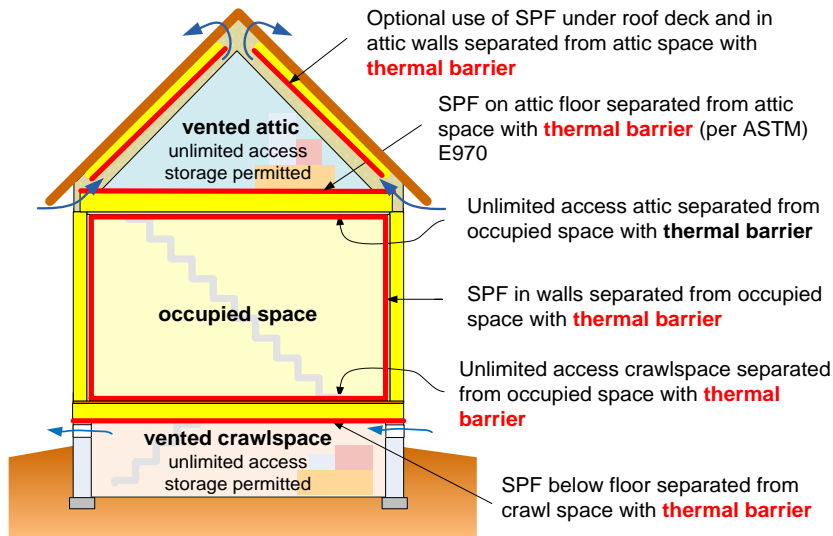


FIGURE C4 – Thermal barrier requirements for vented attics and crawlspaces with unlimited access

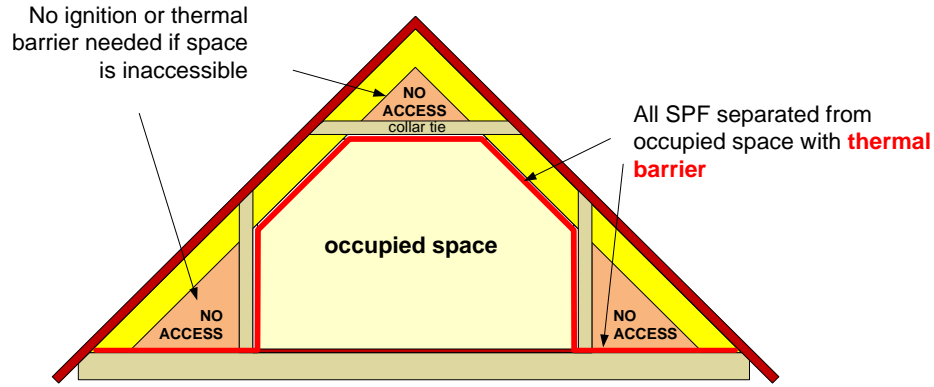


FIGURE C5 – Thermal barrier requirements for areas having no access adjacent to occupied spaces

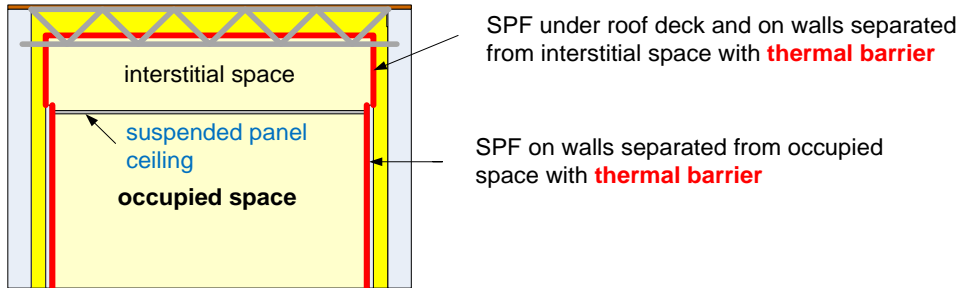


FIGURE C6 – Thermal barrier requirements for interstitial space with suspended panel ceilings which are not thermal barriers

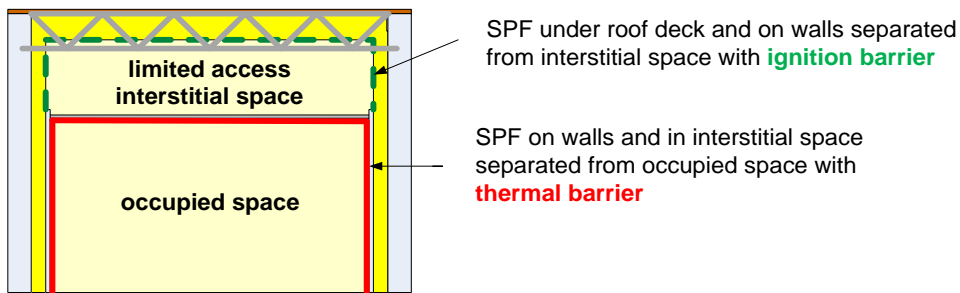


FIGURE C7 – Thermal and ignition barrier requirements for interstitial space with 1/2" gypsum board ceiling or other thermal barrier