

Guidance on Flammability Code Requirements for Polyurethane Foam Used as Interior Finish or Trim

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Purpose

Polyurethane foam can be used in buildings as an interior wall or ceiling finish or trim but only after the product has been shown to meet relevant building code requirements and has been approved by the Authority Having Jurisdiction (AHJ) - typically the local building code inspector.

Generally, a code-prescribed thermal barrier (1/2-inch thickness gypsum wall board or equivalent) is required (2012 IBC, Sec. 2603.4) over installed polyurethane foam, but, at times, it may be more practical to install another type of barrier, or in certain circumstances, no barrier. In such a situation, the model building codes have provisions that allow, via large scale fire tests, the demonstration of acceptable performance of assemblies without the prescriptive thermal barrier, as described in 2012 IBC, Sec. 2603.10. This guidance document addresses some of the model building code flammability requirements when using polyurethane foam as an interior finish or trim. It does not address all of the model building code requirements.

Model and local building codes are used in the United States to provide guidance and requirements for the use of materials and systems used in buildings. Model building codes are “living documents” that are updated and changed on a periodic basis. The information presented here is based on the 2012 edition of the IBC and IRC and is believed to be current as of the date of publication.

NOTE: The reader should always check with the local Authority Having Jurisdiction with regard to the code edition in effect and requirements for the use of foam plastics in a particular project. This document is not meant to be comprehensive and the reader is encouraged to contact raw material suppliers, product manufacturers, registered design professionals and code enforcement officials for information on specific materials and projects.

What is an Interior Finish or Trim?

The International Building Code (2012 IBC, Chapter 2, Definitions)(1) defines Interior Wall and Ceiling Finish as, “[t]he exposed interior surfaces of buildings, including but not limited to fixed or movable walls and partitions [this would include fabric or vinyl covered panels]; toilet room privacy partitions; columns; ceilings; and interior wainscoting, paneling or other finish applied structurally or

for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including trim.”

The IBC defines trim (2012 IBC, Chapter 2, Definitions) as, “Picture molds, chair rails, baseboards, handrails, door and window frames and similar decorative or protective materials used in fixed applications.” Specific requirements for trim are outlined in 2012 IBC, Section 2604.2

The International Residential Code (IRC)(2) defines “trim” similarly: “Foam Plastic Interior Trim. Exposed foam plastic used as picture molds, chair rails, crown moldings, baseboards, handrails, ceiling beams, door trim and window trim used in fixed applications.” Specific requirements for trim are also outlined in 2012 IBC, Sec. 2604.2

The IBC and IRC definitions treat polyurethane foam used as interior finish or trim differently than other polyurethane foam typically used as insulation, and the foam trim or finish is generally not subject to the requirement to be covered by a thermal or ignition barrier. While these barriers are outlined later in this document for reference, the purpose of this document is to address only polyurethane foams used as interior finishes or trim.

Considerations for Flexible and Rigid Polyurethane Foam as an Interior Finish

Both flexible and rigid polyurethane foams may be used as interior finishes when they meet the pertinent performance and the building code requirements of the Authority Having Jurisdiction.

Flexible polyurethane foam used as an interior finish is typically either for the purpose of sound treatment, sound insulation, sound absorption, or otherwise altering the acoustic properties of a room, or used as decorative trim. Generally, in these applications, the polyurethane foam remains exposed. Take care to ensure that exposed flexible foam meets applicable building code requirements without the use of the prescriptive thermal barrier and passes a **Special Approval** test as outlined in 2012 IBC, Sec. 2603.10. *Note:* At the time of this publication, specific flexible polyurethane foam products that have achieved the special approval needed to be used as an interior finish without the addition of a thermal barrier are not available. However, foam technologies are continuously evolving, and it is possible that future products may be developed that meet the requirements of the 2012 IBC, Sec. 2603.10 **Special Approval** test to allow flexible polyurethane foam

to be used as an interior finish without the inclusion of a prescriptive thermal barrier. For more information about flexible polyurethane foam specifically, consult the Polyurethane Foam Association (PFA)⁽³⁾.

Rigid polyurethane foam is often used for its thermal insulation, sound blocking and attenuation, decorative and other properties. The model building codes require that all foam plastics be separated from the interior of a building by an approved thermal barrier, such as ½-inch gypsum wallboard. However, there are specific applications and conditions where the model building codes reduce the protective requirement to an “ignition barrier” or further reduce the requirement to fully exposed or unprotected, as is the case with decorative interior trim (2012 IBC, Sec. 2604.2)

Considerations for Fire Performance

Model building code requirements are built around fire performance and life safety; therefore, model building code requirements for flammability are generally the same for all foam plastics. Depending upon the chemical formulation and other product composition factors, combustibility characteristics of foams may vary widely, as they do for most other organic materials. All organic foam insulation types, regardless of whether they contain fire retardants or not, should be considered combustible and handled accordingly.

With some exceptions (2012 IBC Sec. 2603.3) foam plastic must have a minimum Class B rating, flame spread index from 26 to 75, and smoke developed index ≤ 450 , when tested against ASTM E84⁽⁴⁾ or UL 723⁽⁵⁾ standards. Depending on the assembly and its location, end-use tests are available that allow for the omission of the prescriptive thermal or ignition barrier (2012 IBC, Sec. 2603.10). The model codes state, “Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use.” For the reader’s reference, some descriptions of thermal and ignition barriers follow below.

Considerations for Thermal Barriers

The IBC 2012 code now includes the NFPA 275⁽⁶⁾ test standard: a two-part test that defines a material as a thermal barrier for foam plastic insulation. Part I of NFPA 275 verifies that the temperature rise on an unexposed surface does not exceed 130°C (250°F) after 15 minutes of exposure. The ASTM E119 time temperature curve on the exposed surface is used here. This part of the test is performed on

the prospective “thermal barrier” candidate alone without (polyurethane or other) insulation, but over a thermally inert substrate, e.g., gypsum drywall or masonry construction. Part II of NFPA 275 can be a room or corner fire test using the NFPA 286⁽⁸⁾, FM 4880⁽⁹⁾, UL 1040⁽¹⁰⁾, or UL 1715⁽¹¹⁾ test. This part of the test is performed on an assembly that includes polyurethane (or other) insulation. The conditions of acceptance are described in the listed test standards above.

Omission of the prescriptive thermal barrier requires special approval based on end-use testing, as described in 2012 IBC, Sec. 2603.10. An example of a test that can be used is the NFPA 286 “Room-Corner” Test with the following acceptance criteria (2012 IBC, Sec. 803.1.2.1):

- “During the 40 kW flame exposure, flames shall not spread to the ceiling;
- During the 160 kW flame exposure, flames shall not spread to the outer extremity of the sample on any wall or ceiling and flashover shall not occur;
- During the entire test, the peak rate of heat release shall not exceed 800 kW and the total smoke released shall not exceed 1,000 m².”

The NFPA 286 Room-Corner Test is an important requirement to consider when planning to use a foam plastic product without a prescriptive thermal barrier.

Considerations for Ignition Barriers

There may be considerations for ignition barriers, like some building locations and applications where the building codes allow a reduced level of protection provided by an ignition barrier, as opposed to the level of protection provided by a thermal barrier. For example, ignition barriers are permitted in attics or crawl spaces where entry is made only for service of utilities, and no storage or living space is present (See 2012 IBC, Sec. 2603.4.1.6 or 2012 IRC, Sec. R316.5.3 or .4).

Prescriptive ignition barriers can include:

- 1 ½” (38 mm) thick mineral fiber insulation;
- ¼” thick (6.4 mm) wood structural panel, particleboard or hardboard;
- 3/8” (9.5 mm) gypsum wallboard;
- Corrosion-resistant steel having a base metal thickness of 0.016” (0.4 mm);
or
- Other approved material installed in such a manner that the foam plastic insulation is not exposed.

A thermal barrier is still required between the foam plastic in the attic or crawl space area and interior living space (2012 IBC, Sec. 2604).

Additional useful information on the use and approval of thermal or ignition barriers can be found in the International Code Council Evaluation Service (ICC-ES)⁽¹²⁾ Acceptance Criteria 377, Appendix X, for Spray-Applied Foam Plastic Insulation and in the Spray Polyurethane Foam Alliance document, AY-126, *Thermal and Ignition Barriers for the SPF Industry*.

Considerations for Other Materials

Other protective systems may be available for polyurethane foam. It is possible that assemblies protecting polyurethane foam with other materials, such as intumescent or other coating systems applied to the foam, may qualify as an interior finish. The system must either pass the required NFPA 286 or other Special Approval tests (IBC 2603.10 and point 2a below), or behave as a thermal or ignition barrier (see discussion in this document).

Some Model Building Code Requirements

The model building code requirements for foam plastic insulation used as interior finish or trim include the following:

1. Labeling and Identification (2012 IBC, Sec. 2603.2):

“Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an *approved agency* showing the manufacturer’s name, product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.”

2. Surface Burning Characteristics (2012 IBC, Sec. 2603.3):

“...foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index [FSI] of not more than 75 and a smoke-developed index [SDI] of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723.” These values usually correspond to a Class B rated foam and are minimum requirements, but refer point b below. Interior trim is usually treated differently; see Item 6 below. Remember that ASTM E84 testing alone is not sufficient to qualify foam plastic use as interior finish under the code.

- a. Flame spread Index requirements in accordance with IBC Chapter 8 (Sec. 803.1 and 803.4)

Sec. 803.1.2.1 states the NFPA acceptance criteria for wall or ceiling finish materials:

“Acceptance criteria for NFPA 286:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m².”

- b. Flame spread index requirements in accordance with 2012 IRC, Sec. R316.5.10, Interior Finish:

“Foam plastics shall be permitted as interior finish where *approved* in accordance with Sec. R316.6 [*Specific Approval*].” Special Approval tests include NFPA 286, FM4880, UL 1040 or UL 1715 or fire tests based on the actual end-use configurations. “Foam plastics that are used as interior finish shall also meet the flame spread index and smoke developed index requirements of Sections R302.9.1 and R302.9.2.” FSI \leq 200 (Class C) and SDI of 450 or less.

3. Special Approval (IBC, Sec. 2603.10 and Sec. 803.4) in lieu of Prescriptive Thermal Barrier (2603.4):

To leave foam exposed and omit the prescriptive thermal barrier, end-use testing according to NFPA 286 with acceptance criteria of Section 803.1.2.1 (see point 2a above) must be performed. This applies both to exposed foam plastics and to foam plastics used in conjunction with a textile or vinyl facing or coverings such as a site-fabricated stretch system (Sec. 803.5 - 803.8, 801.8).

4. Stability (IBC Sec. 803.10):

The interior finish product shall not readily become detached when subjected to room temperatures of 200°F (93°C) for not less than 30 minutes.

5. Application of interior finish materials to fire-resistance-rated structural elements (2012 IBC, Sec. 803.11):

There are a number of additional requirements for interior finish materials that are applied to walls, ceilings or structural elements required to have a fire-resistance rating or to be of noncombustible construction.

6. Interior Trim (2012 IBC, Sec. 2604.2, 2012 IRC, Sec. R316.5.9):

Interior trim is defined somewhat differently than interior finish materials but is treated the same in both the IBC and IRC.

- “The minimum density of the interior *trim* shall be 20 pcf (320 kg/m²).
- The maximum thickness of the interior *trim* shall be ½” (12.7 mm) and the maximum width shall be 8” (204 mm).
- The interior *trim* shall not constitute more than 10% of the specific wall or ceiling areas to which it is attached.
- The flame spread index shall not exceed 75 where tested in accordance with ASTM E84 or UL 723 FSI shall not exceed 75. The smoke developed index shall not be limited.

Exception: When the interior *trim* material has been tested as an interior finish in accordance with NFPA 286 and complies with the acceptance criteria in Section 803.1.2.1, it shall not be required to be tested for flame spread index in accordance with ASTM E 84 or UL 723.”

Possible Misconceptions and Pitfalls

The 2012 International Building Code (2012 IBC) Section 807 (Insulation) states that thermal and acoustical insulation shall comply with Section 720 (Thermal-and Sound-Insulating Materials). Section 720 also states that “foam plastic insulation shall comply with Chapter 26.”

2012 IBC, Table 803.9 lists interior wall and ceiling finish flame spread requirements by occupancy for buildings with sprinklers and buildings without sprinklers. Some Class C flame spread requirements are listed in the table. It also states that foam plastics must meet, at a minimum, Class B and other requirements previously outlined.

Additional testing is required beyond the flame spread and smoke developed rating of ASTM E84 in order for the foam to be used as an interior finish. (2012 IBC Sec. 2603.10 and 2604).

Summary

For end-users of foam plastics as interior finish or trim, it is important to remember that the foam requires a thermal or ignition barrier, unless otherwise permitted by the model building codes or AHJ as previously discussed in this document. Some assemblies and applications, based on permissible testing, may not require thermal or ignition barriers. Refer to the label to see if the product is compliant with interior finish or trim code requirements. For the application intended, check applicable building codes for local area requirements. Consult the manufacturer for further information regarding specific testing, performance and code acceptance details of any given product or combination of products.

Review local building codes, model building codes (e.g., the IBC or IRC), fire code officials, insurers, and manufacturers' specifications and installation instructions in each specific instance of product application, system design, and building occupancy; for example, see 2012 IBC, Sec. 803.9. Additionally, certain applications and occupancies may require sprinkler protection and/or smoke detectors (2012 IBC, Sec. 803.9).

The improper use of polyurethane foam, in conjunction with other combustible materials in and within the building structure, could contribute to the rapid spread of fire. Use and install foam plastic according to the manufacturer and/or supplier recommendations and refer to the model and local building codes, as well as insurance carrier considerations.

Additional requirements (2012 IBC, Sec. 803.11) may apply when foam plastic is used within fire-resistance rated and/or noncombustible construction. For example, codes may require the inclusion of fire blocks in the design of large warehouse ceiling areas, between floors in certain multi-story buildings, in certain concealed spaces, and at penetrations into pipe chases and ventilation shafts. Consult the model and local building codes for specific requirements.

For More Information

- International Code Council - www.iccsafe.org
- ASTM International - www.astm.org
- FM Global - www.fmglobal.com
- Underwriters Laboratories, Inc. - www.ul.com
- National Fire Protection Association - www.nfpa.org
- Spray Polyurethane Foam Alliance - www.sprayfoam.org
- Polyurethane Foam Association - www.pfa.org
- Center for the Polyurethanes Industry www.polyurethane.org

References:

- ¹ International Code Council. 2012 International Building Code (IBC).
- ² International Code Council. 2012 International Residential Code (IRC).
- ³ Polyurethane Foam Association (PFA) www.pfa.org.
- ⁴ ASTM International. ASTM E84, "Standard Test Method Standard Test Method for Surface Burning Characteristics of Building Materials"
- ⁵ Underwriter Laboratories. UL 723, " Test for Surface Burning Characteristics of Building Materials"
- ⁶ NFPA 275, "[Standard Method of Fire Tests for the Evaluation of Thermal Barriers Used Over Foam Plastic Insulation](#)"
- ⁷ ASTM International. ASTM E119, "Standard Test Methods for Fire Tests of Building Construction and Materials"
- ⁸ NFPA 286: "Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth"
- ⁹ FM Global. ANSI-FM 4880: "American National Standard for Evaluating (A) Insulated Wall or Wall and Roof/Ceiling Assemblies; (B) Plastic Interior Finish Materials; (C) Plastic Exterior Building Panels; (D) Wall/Ceiling Coating Systems; and (E) Interior or Exterior Finish Systems"
- ¹⁰ Underwriter Laboratories. UL 1040 - Safety Fire Test of Insulated Wall Construction
- ¹¹ Underwriter Laboratories. UL 1715 - Fire Test of Interior Finish Material
- ¹² International Code Council Evaluation Service (ICC-ES), www.icc-es.org

NOTE ON TESTING: Laboratory tests and numerical ratings derived from these tests are the most common means available today to compare certain significant combustibility characteristics of plastics, other materials of construction, and assemblies. These tests and ratings also are used to communicate this information to knowledgeable consumers. However, the tests and ratings are valid only as measurements of the performance of these materials and/or assemblies under specific, controlled test conditions and are not intended to reflect hazards under actual fire conditions. More than one test may be necessary to adequately qualify a material for an intended or proposed use. Authorities having jurisdiction should be consulted.

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