

Fire Safety Guidelines for Use of Rigid Polyurethane and Polyisocyanurate Foam Insulation in Building Construction

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Introduction

Rigid polyurethane and polyisocyanurate foams are effective insulation materials that can be used by architects, builders, and contractors to meet today's stringent energy code requirements.¹ Depending on product-specific composition factors, the fire performance characteristics of polyurethane and polyisocyanurate foams may vary, as is the case with many other organic materials.

To promote jobsite safety, all organic foam insulation, regardless of whether they contain flame retardants, should be considered combustible and handled accordingly. The precautions detailed in this guidance document can help minimize potential ignition and fire during handling, storage, and use. Ultimately, the building code fire safety requirements that apply to the use of polyurethane and polyisocyanurate foams in a building will be determined by the specific application (e.g., roofing insulation, interior wall cavity insulation).

Current model building codes² require foam plastic insulations to be separated from the interior of a building by a thermal barrier such as ½ inch gypsum wallboard or other approved material meeting the requirements of National Fire Protection Association (NFPA) 275.³ However, the model building codes provide exceptions to this requirement under specific conditions.⁴ For example, Section 2603.9 of the 2015 International Building Code (IBC) exempts foam plastic insulations from the thermal barrier requirements where the products have been “specifically approved based on large scale

¹ For information about the performance features and applications of commercially available polyurethane and polyisocyanurate insulation products, consult the following publication by the Center for the Polyurethanes Industry: [Polyurethane and Polyisocyanurate Foams: Insulation That Works](#).

² The term “model building codes” used in this guidance document refers to the series of model codes developed and managed by the International Code Council (ICC). For more information on ICC’s model codes, visit: <http://www.iccsafe.org/>.

³ See the *International Building Code (IBC)* and *International Residential Code (IRC)* for information on thermal barrier requirements.

⁴ For example, Sections 2603.4.1 and 2603.9 of the 2015 IBC provide a list of exceptions for foam plastic insulation to the thermal barrier requirements.

test such as, but not limited to, NFPA 286 (with the acceptance criteria of Section 803.1.2.1) FM 4880, UL 1040 or UL 1715.”

Some polyurethane and polyisocyanurate foam insulations and systems have earned various building code acceptances for use without a thermal barrier as a result of this large scale fire testing. Examples include (1) polyisocyanurate roof insulation and spray polyurethane foam roofing systems directly applied to steel roof decks, (2) some metal-faced polyurethane and polyisocyanurate laminated panel products, and (3) some polyurethane foam sealant applications.

Always check applicable building codes for local requirements and consult the product manufacturer for further information regarding specific code acceptances.

Fire Safety During Construction

Fires involving building construction materials, including polyurethane and polyisocyanurate foams, can occur during the construction of a building. During the construction sequence there may be storage of exposed foam board, incomplete installation of thermal barriers, improper disposal practices, poor housekeeping and the potential presence of and exposure to open flame or other “hot work”⁵ from allied trades. Best construction practice suggests the following safety precautions at the construction site.⁶

Storage

- Consult federal, state, and local regulations for specific storage and handling requirements of polyurethane component chemical drums.
- Store drums within temperature and environmental conditions recommended by the material manufacturer.
- Store foam boardstock in limited quantities, in an accessible location, and free from ignition hazards.

Application

- Have trained professional contractors handle and apply spray polyurethane foam component chemicals. Handle liquid and applied materials in accordance to the system manufacturer/supplier recommendations.⁷
- Fires, spills, and other emergencies involving polyurethane component chemicals may require an immediate response by trained and knowledgeable personnel.⁸

5 The U.S. Occupational Safety and Health Administration (OSHA) defines hot work as “any work that involves burning, welding, using fire- or spark-producing tools, or that produces a source of ignition.” For more information, visit the OSHA website: https://www.osha.gov/SLTC/etools/oilandgas/general_safety/hot_work_welding.html.

6 For additional fire safety guidance from the Center for Polyurethanes Industry, see [Working with Polyurethane Foam Products During New Construction, Retrofit and Repair](#).

7 For additional information on safe handling practices for the chemical components of spray polyurethane foam visit www.spraypolyurethane.org.

8 If you need additional guidance, CHEMTREC®, the Chemical Transportation Emergency Center, is available to provide assistance by telephone 24-hours a day in the event of an emergency involving a fire, leak, spill or personnel exposure. CHEMTREC’s emergency number is 1-800-424-9300.

- Polyurethane and polyisocyanurate foam may be exposed to open flame from welding, cutting torches, and other ignition sources from allied trades during certain construction sequences. Trades performing hot work should comply with NFPA 51 B, as described in OSHA Standard 29 CFR 1910.252.⁹

Disposal

- All persons involved in waste disposal have an independent obligation to ascertain that their actions are in compliance with current federal, state, and local laws and regulations.¹⁰
- Do not torch, cut, or reuse empty drums of polyurethane component chemicals. Empty drums may be sent to a qualified drum reconditioner, drum recycling facility, or a landfill that is permitted to accept used drums. Information on drum reconditioning can be found through the Reusable Industrial Packaging Association at www.reusablepackaging.org. Consult the insulation product manufacturer for additional assistance on waste disposal.

Fire Safety in Design

Material manufacturers and suppliers of polyurethane and polyisocyanurate foam products provide a maximum service temperature for each product. Consult the material supplier for more information.

Local building codes, model building codes, fire code officials, insurance underwriters, and manufacturers' specifications and/or installation instructions should be consulted in each specific instance of product application, system design, and building occupancy.

The following are several fire safety design best practices for consideration by architects, builders, and contractors. State and local building codes should always be observed:

Interior Applications

- Thermal insulation provided by polyurethane and polyisocyanurate foams can result in rapid heat buildup if a fire should occur. The improper use of polyurethane and polyisocyanurate foam insulation, in conjunction with other combustible materials in and within the building structure, may contribute to the rapid spread of fire. Thermal insulation should only be used and installed in strict accordance with local building codes and manufacturer/supplier recommendations, as well as insurance carrier considerations.
- Polyurethane and polyisocyanurate foams used in interior applications should be covered with a thermal barrier, such as ½ inch gypsum wallboard or approved alternate material or assembly. Some polyurethane and polyisocyanurate foam insulations and systems have earned various building code acceptances as a result of fire testing for use without a thermal barrier.
- For panels comprising metal facings on foam cores, the model building codes specify minimum thickness for steel (0.016") or aluminum (0.032") facings and maximum flame spread and smoke ratings for the foam core.¹¹ Some metal-faced polyurethane and polyisocyanurate-laminated panels may be exempt from these requirements as a result of fire testing.

⁹ For additional information fire safety guidance when working with polyurethane foam products consult the following publication by the Center for the Polyurethanes Industry: [Fire Safety Guidance](#).

¹⁰ For additional information on the proper disposal of containers and wastes from polyurethane raw materials, consult the following publication by the Center for the Polyurethanes Industry: [Guidelines for the Responsible Disposal of Wastes and Containers from Polyurethane Processing](#).

¹¹ See the *International Building Code (IBC)* and *International Residential Code (IRC)* for information on thermal barrier requirements.

- Fire blocking may be required in the design of certain concealed spaces and at penetrations into pipe chases and ventilation shafts. Consult local building codes for specific requirements.
- Polyurethane and polyisocyanurate foams should not be used in direct contact with or in areas immediately adjacent to or immediately above combustion equipment (such as furnaces and chimneys), high temperature process equipment or piping (unless specifically designed for such application), or in other locations that could subject the foam insulation to temperatures exceeding manufacturer/supplier recommendations.
- Polyurethane and polyisocyanurate foams may be used to fill cavities within masonry walls or under grade-level concrete floors. Consult manufacturers and suppliers of foam insulation products for specific recommendations.

Exterior Applications

- As determined by the applicable building code requirements, polyurethane and polyisocyanurate foam insulations are acceptable components of roof assemblies over most roof decks if the foam insulation is part of a Class A, B, or C roof covering tested in accordance with ASTM E108, UL 790, ANSI/UL 1256 or FM 4450, as required.
- When used as an exterior insulating material on structures, such as tanks or chemical processing equipment, polyurethane or polyisocyanurate foam products also may require protection (1) from the weather and ultraviolet rays of the sun, (2) from severe physical impact, and (3) from accidental ignition.
- Consult your material manufacturer/supplier, insurance underwriter, local building code official, and/or local fire official for specific requirements.

Combustibility Tests and Ratings

Numerous federal regulations and state and local building codes refer to various fire tests and standards such as ASTM E84, UL 790, FM 4880, UL 1040, and UL 1715. Laboratory tests and numerical ratings derived from these tests are available to compare certain combustibility characteristics of plastics, other construction materials, and assemblies. However, the tests and ratings are 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. Consult your local building code and/or fire official for specific requirements.

FIRE TESTING, BUILDING CODES, AND STANDARDS*

ANSI/UL 1256	Fire Test of Roof Deck Constructions
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E108	Standard Test Method for Fire Tests of Roof Coverings
FM 4450	Class 1 Insulated Steel Deck Roofs
FM 4880	Building Corner Fire Test Procedure
NFPA 275	Fire Tests of Thermal Barriers
NFPA 286	Wall and Ceiling Interior Finish Test Procedure
NFPA 51B	Fire Prevention During Welding, Cutting, and Other Hot Work
OSHA 29 CFR 1910	Occupational Safety and Health Standards
UL 790	Tests for Fire Resistance of Roof Covering Materials
UL 1040	Fire Test of Insulated Wall Construction
UL 1715	Fire Test of Interior Finish

**This table only contains the tests, building codes, and standards referenced in this document. Other tests, codes, and standards may apply. Always consult with authorities having jurisdiction.*

Rigid polyurethane and polyisocyanurate foams will, if ignited, release various products of combustion such as smoke and gasses. As with other organic materials, such as wood, the most significant combustion gases are carbon monoxide and carbon dioxide.

The guidelines contained in this document reflect practices generally recognized by federal agencies, the model building codes, insurers, and other regulatory bodies as providing requisite levels of safety to life and property.

Additional Information

Information on the fire tests, building codes, and standards may be obtained from:

American National Standards Institute (ANSI)

www.ansi.org

American Society of Testing and Materials (ASTM)

www.astm.org

Factory Mutual (FM)

www.fmglobal.com

International Code Council (ICC)

www.iccsafe.org

National Fire Protection Association (NFPA)

www.nfpa.org

Occupational Safety & Health Administration (OSHA)

www.osha.gov

Underwriters Laboratories Inc. (UL)

www.ul.com

Further information on the proper application of rigid polyurethane or polyisocyanurate foams may be obtained from the manufacturer or supplier of the materials, as well as the following trade organizations:

ACC Center for the Polyurethanes Industry (CPI)

www.polyurethane.americanchemistry.com

Polyisocyanurate Insulation Manufacturers Association (PIMA)

www.pima.org

Spray Polyurethane Foam Alliance (SPFA)

www.sprayfoam.org

Disclaimer

This guidance document was prepared by the American Chemistry Council's Center for the Polyurethanes Industry. It is intended to provide general information on fire safety guidelines for the use of rigid polyurethane and polyisocyanurate foam insulation. It is not intended to serve as a substitute for in-depth training or supplier/manufacturer recommendations, nor is it designed or intended to define or create legal rights or obligations. It is not intended to be a "how-to" manual, nor is it a prescriptive guide. All persons involved in safe handling, storage, and use of rigid polyurethane and polyisocyanurate foam insulation have an independent obligation to ascertain that their actions are in compliance with current federal, state and local laws and regulations and should consult with legal counsel concerning such matters. The guidance is necessarily general in nature and individual companies may vary their approach with respect to particular practices based on specific factual circumstance, the practicality and effectiveness of particular actions and economic and technological feasibility. Neither the American Chemistry Council, nor the individual member companies of the Center for the Polyurethanes Industry of the American Chemistry Council, nor any of their respective directors, officers, employees, subcontractors, consultants, or other assigns, makes any warranty or representation, either express or implied, with respect to the accuracy or completeness of the information contained in this guidance document; nor do the American Chemistry Council or any member companies assume any liability or responsibility for any use or misuse, or the results of such use or misuse, of any information, procedure, conclusion, opinion, product, or process disclosed in this guidance document. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

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