

# Fire Performance in Roof Systems

## About Polyiso Insulation

Polyiso is a rigid foam insulation used in over 70% of commercial roof construction, in commercial sidewall construction and in residential construction.

The Benefits of using Polyiso include:

- Low environmental impact
- Virtually no global warming potential
- Zero ozone depletion potential
- Cost effective, optimized energy performance
- Long service life
- Recyclable through reuse
- Recycled content (amount varies by product)
- Regional materials (nationwide production network)
- Meets new continuous insulation (ci) standards
- Quality Mark™ certified LTRR-values
- High R-value per inch of thickness
- Thinner walls and roofs with shorter fasteners
- Excellent fire test performance
- Extensive building code approvals
- Preferred insurance ratings
- Compatible with most roof and wall systems
- Moisture resistance
- Dimensional stability
- Compressive strength

PIMA and polyiso products have received many environmental awards. These include an honorable mention in the Sustainable Buildings Industry Council's (SBIC) - "Best Practice" Sustainability Awards Program and the U.S. EPA's Climate Protection Award for the association's leadership in promoting energy efficiency and climate protection. The EPA also awarded PIMA and its members the Stratospheric Ozone Protection Award for "leadership in CFC phase-out in polyiso insulation and in recognition of exceptional contributions to global environmental protection."



Continuous improvement in the product and years of rigorous testing mean POLYISO INSULATION OFFERS THE MOST EXTENSIVE RANGE OF CODE APPROVALS FOR INSULATION USE IN ROOF SYSTEMS. It remains the **only** foam plastic insulation product for direct application to steel deck to earn FM Approval for Class 1 Roof Systems. Polyiso is also classified by UL for use in roof systems with direct-to-steel-deck applications of foam plastic insulation under both single-ply and asphalt-based roof coverings.

## Polyiso Insulation is the Best Choice for Roof Systems

*Polyiso is Used in All Types of Roof Systems*

For new construction or re-roof projects, polyiso is the only foam plastic insulation that can be used in all types of roof systems:

- **Built-up Roofs:** Polyiso has high-temperature stability and will not melt, like thermoplastic insulation, when hot mopped with asphalt.
- **Modified Bitumen Roofs:** Polyiso performs successfully in modified bitumen systems, which are attached with high temperature methods or with hot asphalt.
- **Singly-ply Roofs:** Polyiso can be used in all three types of single-ply systems: loose-laid ballasted, fully adhered, and mechanically attached. Polyiso is unaffected by properly applied construction adhesives and can be used without the need for a cover board.
- **Metal Roofs:** Polyiso performs successfully in architectural and structural metal roofing systems.

It is best to consult a specific polyiso manufacturer for its list of approvals for use in the desired system.

*Polyiso is Easy to Specify*

Polyiso insulation meets the requirements of ASTM C 1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Insulation Board. Specifying insulation products for the roofing system with ASTM C 1289, assures use of the best insulation product for the project.

## The Importance of Building Codes in Construction

Building codes are in place to provide a means to safeguard life and to protect the public welfare through regulating the design, construction practices, construction material quality (including fire performance), location, occupancy, and maintenance of buildings and structures. When regulating materials, many of the model building codes refer to quality standards developed by standard-setting organizations such as the American Society for

Testing and Materials (ASTM). Some building codes and insurance rating organizations also rely on test information from FM Global (FM) and Underwriters Laboratories Inc. (UL).

## Foam Plastic Insulation and Building Codes

ICC model codes include specific sections pertaining to the safe use of foam plastics in construction. Generally, the codes require that the foam core have a flame spread rating of 75 or less and a smoke development rating of 450 or less, when tested in accordance with ASTM E84. Further, all foam plastics must be separated from the interior of a building by an approved thermal barrier such as 1/2 inch gypsum board. For roofing applications, the smoke development rating does not apply. The elimination of the thermal barrier is allowed only under very specific conditions, as discussed below.

### *Direct Application of Foam Plastic Insulation to Steel Decks*

Polyiso is still the **only foam plastic insulation** product to have direct-to-steel-deck approvals from both FM **and** UL. FM approval for Class 1 roof systems was granted by passing FM 4450 and UL approval was earned by passing UL 1256. Both of these tests are specifically referenced in many building codes.

For example, in the International Building Code (IBC), the requirements for a thermal barrier are not applicable to foam plastic roof insulation used in roof deck construction that complies as an assembly with FM 4450 or UL 1256. For all roof applications, the smoke developed rating shall not be applicable.

Both the IBC and International Residential Code (IRC) have similar requirements. Polyiso insulation first successfully passed UL 1256 over 20 years ago and today satisfies the major share of the market's demand for "direct-to-steel-deck" applications.

### *Importance of FM 4450 Calorimeter Test and UL 1256 Resistance to Interior Fire Spread Test*

The spread of fire on the underside of a roof deck is a concern when buildings have large, open interior space, such as a warehouse or manufacturing facility. The two fire tests used by code bodies to evaluate the spread of fire in this manner are FM 4450 (also called the FM Calorimeter Test) and UL 1256 (also known as the Resistance to Interior Fire Spread Test). While both tests evaluate the entire roof assembly from deck to roof covering, the test conditions and test pass criteria are very different:

|  | FM 4450   | UL 1256   |
|--|---|---|
| Exposed Sample Size  | 4 feet x 4 feet   | 1.48 feet x 24 feet   |
| Test Duration  | 30 min.   | 30 min.   |
| Fuel Source/Rate (Btu/min.)  | Heptane/Propane / 26,400  | Natural Gas / 5,000   |
| Temperature @ 10 min.  | 1500 degrees F  | 580°F (Vent and with non-combustible calibration sample)  |
| Temperature @ 30 min.  | 1600 degrees F  | NA  |
| Pass Criteria  | No external flaming;<br>no dropping of flaming particles into the furnace | Flame spread @ 10min. less than 10 feet; 30 mins. flame spread less than 14 feet; subjective on thermal degradation and "combustive" damage |
| Pass Criteria, Maximum Fuel Contribution (Btu/ft <sup>2</sup> /min.) | 3 min. 410<br>5 min. 390<br>10 min. 360<br>30 min. 285 (avg.)             | NA  |

Not all foam plastic insulations perform equally in these tests. Polyiso is a thermoset material and withstands high temperatures which accounts for its successful performance in both FM 4450 Calorimeter and ANSI/UL 1256 testing. Other foam plastic insulations, like polystyrene, are thermoplastic materials which soften at 165° F and melt at approximately 200° F, long before the standard 30 minute fire exposure is ended. Because of the high temperatures reached in the FM 4450 Calorimeter test, the polystyrene melts through the seams of the steel deck, spreads fire on the underside of the deck during the test and liberates flaming particles into the furnace. Accordingly, RoofNav, FM Approvals web-based tool, does not list any Class 1 Roof Systems approvals for the use of polystyrene insulation in a direct to steel deck application (i.e., without the use of a thermal barrier).

Only roof assemblies that pass FM 4450 may be used in FM insured buildings.

## PIMA

*For over 20 years, PIMA (Polyisocyanurate Insulation Manufacturers Association) has served as the unified voice of the rigid polyiso industry proactively advocating for safe, cost-effective, sustainable and energy efficient construction.*

*PIMA produces technical bulletins in an effort to address frequently asked questions about polyiso insulation. PIMA's technical bulletins are published to help expand the knowledge of specifiers and contractors and to build consensus on the performance characteristics of polyiso. Individual companies should be consulted for specifics about their respective products.*

*PIMA's membership consists of manufacturers and marketers of polyiso insulation and suppliers to the industry. Our members account for a majority of all of the polyiso produced in North America.*

## SAFETY

*Polyiso insulation, like wood and other organic building materials, is combustible. Therefore, it should not be exposed to an ignition source of sufficient heat and intensity (e.g., flames, fire, sparks, etc.) during transit, storage or product application. Consult the product label and/or the PIMA members' Material Safety Data Sheets (MSDS) for specific safety instructions. In the United States, follow all regulations from OSHA, NFPA and local fire authorities; in Canada, follow all regulations from Health Canada Occupational Health and Safety Act (WHMIS) and local fire authorities.*

**For more information on polyisocyanurate insulation, visit [www.polyiso.org](http://www.polyiso.org)**



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