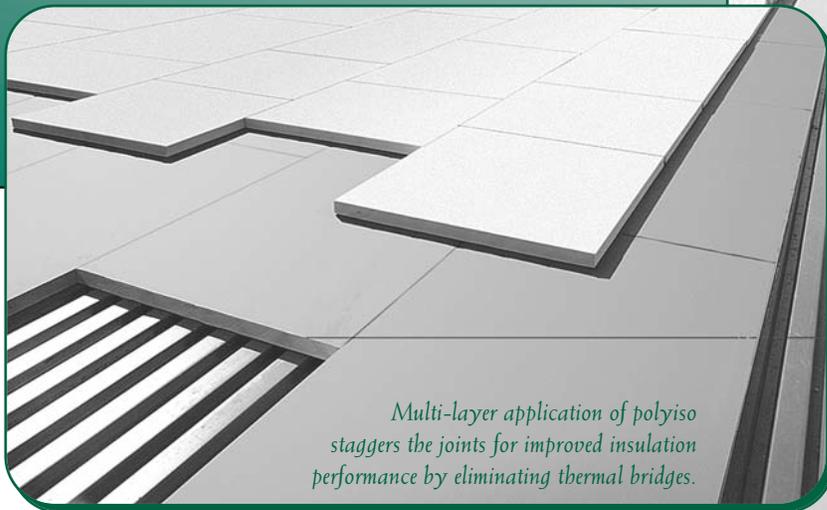


# "GREEN" POLYISO RIGID FOAM INSULATION

BY PAUL R. BERTRAM JR., CDT



*Multi-layer application of polyiso staggers the joints for improved insulation performance by eliminating thermal bridges.*



*Polyiso insulation being attached to surface of roof decking.*

**P**olyiso foam insulation has long been a popular choice of the roofing industry. The National Roofing Contractors Association (NRCA) recently reported that over 55% of all insulation utilized by its members is polyiso foam. The Polyisocyanurate Insulation Manufacturers Association (PIMA, [www.pima.org](http://www.pima.org)) reported that in 1999, 4.5 billion board feet of polyiso were used as both wall and roof insulation, clearly indicating the confidence of the construction industry in its energy efficiency. To make polyiso even more appealing, many manufacturers have qualified for participation in various Energy Star® programs.

This preferred product status hasn't been without its challenges, the most notable being the Montreal Protocol (<http://nwi.org/treaties/montreal.html>) which required polyiso foam insulation manufacturers to eliminate harmful ozone-depleting chemistry which first affected the use of chlorofluorocarbons (CFCs). Non-essential use was banned in 1993. By January 2003, all HCFC141b must be eliminated, which up until recently has been the main chemical blowing agent of most polyiso foam insulation. Both the CFC and hydrochlorofluorocarbon (HCFC) chemistries of polyiso foam products have traditionally not been classified as "green" building products and therefore have not been part of "green" specification.

One of the concerns stated by the NRCA at its 2000 convention was that there doesn't seem to be a clearly defined chemistry transition for elimination of HCFCs as there was for the elimination of CFCs to HCFC141b. Very few polyiso manufac-

turers are on the fast track for compliance, and only three to date have fully met the rigid new standards. Atlas Roofing led the industry and was the first polyiso manufacturer to introduce a plant conversion dedicated to HCFC-free technology, shifting its blowing agent from HCFC141b to a hydrocarbon-type chemistry. This was formally introduced at the 1998 NRCA show in Phoenix as AC Ultra. Atlas has converted two additional plants, constructed another, and is finishing conversion on five additional facilities. Two other manufacturers, Firestone and R-Max, followed suit with conversion announcements made earlier this year. John Geary of Firestone reported that their Jacksonville plant is converted and the balance of their plants will follow.

The NRCA reported this year that it has received a number of polyiso performance-related complaints. The problems were identified in several areas such as: facer delamination, edge cavitation, cupping or bowing, shrinkage, and crushing or powdering. The NRCA recommends use of cover boards over polyisocyanurate insulation, as stated in the NRCA Technical Bulletin 9, dated 1988, where hot-applied bituminous membranes are installed. However, it now further recommends the use of cover boards to include all other low-slope membrane roof assemblies, including thermoset and thermoplastic single-

## Physical Properties of HCFC-free Polyiso Insulation

Property	Test Method	Typical Results	
		Product A	Product B
Dimensional Stability (length & width)	ASTM D-2126	<2% linear change	<2% linear change
Compressive Strength (length & width)	ASTM D-1621	20 psi (138kPa)	25 psi (172kPa)
Water Absorption	ASTM C-209	<1% by volume	<1% by volume
Moisture Vapor Transmission	ASTM E-96	<One (1) Perm [57.5ng/(Pa*s*m2)]	<One (1) Perm [57.5ng/(Pa*s*m2)]
Product Density	ASTM D-1622	Nominal 2.0 pcf	Nominal 2.1 pcf
Flame Spread	ASTM E-84	25 - 50 *	25 - 50 *
Service Temperature		100° F to +250° F Max. (-73° to 122° C)	100° F to +250° F Max. (-73° to 122° C)

\*The numerical ratings as determined by ASTM Test Method E-84 are not intended to reflect hazards presented by this or any other material under actual fire conditions. A flame spread index of 75 or less meets code requirements regarding flame spread for foam plastic roof insulation. However, flame spread values are not required for foam plastic insulation used in roof deck constructions that comply as an assembly with FM 4450 or UL 1256. The physical properties listed above are presented as typical average values as determined by accepted ASTM test methods and are subject to normal manufacturing variation.

ply roof assemblies in ballasted, mechanically-attached, and fully-adhered configurations. (Editor's note: See "Use of Cover Boards Over Polyisocyanurate Roof Insulation," and "PIMA Cautions That NRCA Recommendations for Cover Boards in All Roof Applications May Void Warranties and May Compromise Roof System Performance," in the July 2000 issue of RCIItems, pages 4 and 5.)

Other concerns had to do with ASTM C-1289, "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board." In the standard it is noted that curing time is not specified. The NRCA believes that improperly-cured polyiso is more prone to problems.

PIMA's response to the concerns stated by the NRCA is that before adding a cover board or any material to a roof assembly, a roofing contractor should consult the roof system manufacturer, specifier, and/or designer to ensure the approvals, system performance, warranties, building codes, insurance ratings, and all other requirements comply with specifications.

These issues are mentioned as they are current topics of discussion and with new polyiso blowing agents being introduced, the discussions will continue. New technologies are not immediately embraced by an industry that relies on testing approvals and proven track records. The good news is that there are currently two years of field-tested applications from the earliest manufacturer, Atlas Roofing, as well as additional field performance data from their first prototype roof applied in 1995 and subsequent installations.

Material characteristics and performance ratings of HCFC-free polyiso products are equal to or better than polyiso with HCFCs. Adhesion, compression strength, fire ratings, moisture vapor transition, water absorption, and R-values have proven test results. In April of 1999, Atlas Roofing conducted a roofing symposium and invited many of the leading roofing industry experts to learn more about performance and physical characteristics of

this "green" technology. Many questions about the performance of the new blowing agent in this new generation of polyiso were discussed.

The data above represents typical physical properties of this new HCFC-free polyiso insulation, as reported with ACUltra from Atlas Roofing and ISO 95+ GL from Firestone.

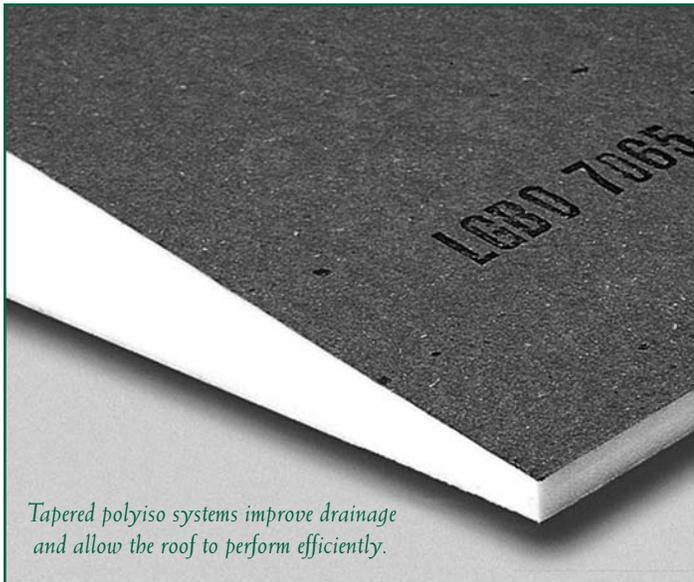
While conversion of polyiso from HCFC141b to new blowing agent technology has been going on, the US Green Building Council developed the "Green Spec," and polyiso is now listed as a "Green" building product. Defining a Green building product requires some discussion in that there are several ways in which polyiso could be considered "Green."

First, polyiso manufacturers that have eliminated HCFC141b offer a Green product because they have removed the harmful ozone-depleting chemicals from their products.

Second, Polyiso that is HCFC-free also classifies as a building component that reduces the heating and cooling loads.



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*Tapered polyiso systems improve drainage and allow the roof to perform efficiently.*

The US Green Building Council ([www.usgbc.org](http://www.usgbc.org)), announced the first standard for Green buildings. LEED's (Leadership in Energy and Environmental Design) Green Building Rating System represents the construction industry's definition for what constitutes a green building. Points are earned for successful accomplishment of the measures. A minimum of 50% of the available points is required to rate as a green building. There are various levels of rating that can be achieved. The LEED program identified five environmental goals:

- Planning sustainable sites
- Improving energy efficiency
- Conserving materials and resources
- Enhancing Indoor Air Quality

- Safeguarding water.

In conclusion, the new generations of HCFC-free polyiso rigid board insulation meet the requirements for the LEED program and for the first time are considered a Green product. The Montreal Protocol was the motivation to the industry for making polyiso more environmentally friendly. However, programs like LEED also have incentives for working with Green products. Companies like Atlas Roofing, Firestone, and R-Max continue to lead the industry in research and development of new technologies such as Atlas' AC Ultra and Firestone's ISO 95+ GL.

PIMA has a proposal for new polyiso testing standards. The test is called the RLE (Rolling Load Emulator) and will help establish better performance information for the industry. With the 2003 Montreal Protocol polyiso conversion deadline a short time away, consultants are advised to keep aware of trends. Stay informed by visiting PIMA at [www.pima.org](http://www.pima.org). ■

## ABOUT THE AUTHOR

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