

Continuous Insulation Using Polyiso Wall Sheathing

What it is, what it does, and why you need it

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:

- Moisture resistance
- 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
- 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 wall systems
- 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."



Introduction

National model energy codes are advancing the way we approach building commercial and residential exterior walls by emphasizing the use of continuous insulation systems, which provide a continuous insulation layer over an entire wall, not just in the wall cavities. Building science experts have known for some time that continuous insulation is a very effective way to insulate building envelopes for energy savings. Now, modern building codes are putting this knowledge into practice.

What is continuous insulation?

Continuous insulation is defined as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope."¹ Figure 1 shows several common applications of continuous insulation.

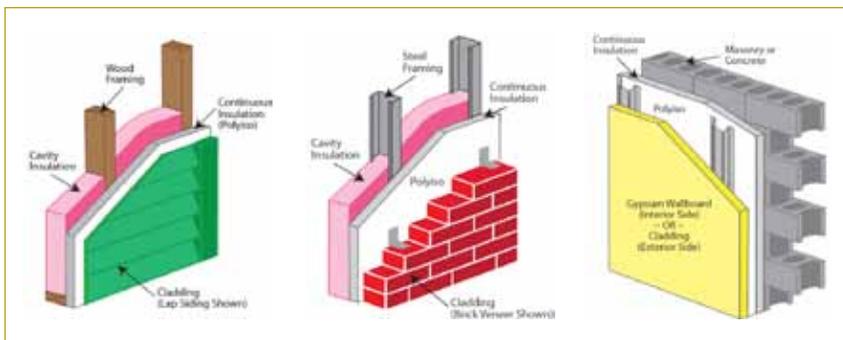


Figure 1. Light frame and mass wall systems with continuous insulation for code-compliant residential and commercial building construction.

As shown in Figure 1, continuous insulation can be used with variety of wall structural systems and cladding materials such as cement board, PC stucco, wood lap, brick veneer, stone, and vinyl siding. Furthermore, continuous insulation can be placed on the interior or exterior side of the wall with proper consideration of climate-dependent moisture vapor control code requirements. For example, it is common to place continuous insulation on the inside face of foundation walls and also above-grade masonry walls, which is considered a typical practice in Florida where the exterior masonry wall face is coated with stucco or parging. Finally, it is possible to use continuous insulation alone to meet energy code without any cavity insulation for the ultimate "warm wall" design.

¹ASHRAE 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., Atlanta, GA.

What does it do?

Continuous insulation can serve several important functions in a high-performing wall system including continuous thermal insulation, moisture vapor control, water resistive barrier and air barrier. These capabilities provide the following benefits:



Figure 2. Thermal bridging through wall framing causes a disproportionate amount of heat loss. With continuous insulation, heat loss from thermal bridging is minimized providing a favorable economic and environmental benefit over use of cavity insulation alone.

- **Increased thermal performance**
By blocking thermal bridging, a continuous insulation system increases the overall thermal performance of a wall assembly and a building.
- **Reduced operating costs**
Continuous insulation keeps energy and heat loss to a minimum, increasing the building's energy efficiency and leading to lower monthly operating costs.
- **Reduced air infiltration and exfiltration**
Continuous insulation with taped or sealed joints restricts air movement through the wall, helping to further reduce building heat loss.
- **Reduced risk of water condensation and moisture intrusion**
Continuous insulation is a very moisture-resistant system, guarding the thermal and structural performance of the building.
- **Efficient installation**
When used as a multi-function sheathing, continuous insulation can simplify the steps to construct a code-compliant wall assembly.
- **Dimensional Stability**
Polyiso insulation has excellent dimensional stability and meets ASTM C 1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

Get-R Done TIP#1:

Many methods of attaching cladding materials over continuous insulation to a variety of wall substrates are available. For information on a variety of practical solutions, refer to:

(http://www.foamsheathing.org/images/TM_Cladding_Attachments_Through_Thick_Foam_Sheathing.pdf).

Get-R Done TIP#2:

Specify continuous insulation to serve multiple wall assembly functions, including energy code R-value compliance and the building code's water resistive barrier (WRB) requirements. A continuous insulation WRB also provides an effective air barrier required by the energy code when taped sheathing joints are used. Be sure to install continuous insulation in a code-compliant overall wall assembly and follow manufacturer instructions and approved building plans.

Why you need it

As noted above, continuous insulation is needed to achieve high-performance wall assemblies. More importantly, it will be increasingly needed for energy code compliance (see Figure 3 below) as mandated to all states that have accepted federal economic stimulus funds. As newer national, state and local energy codes continue to place a greater emphasis on energy conservation, code developers and experts are turning to a greater use of continuous insulation for its known ability to reduce thermal bridging and increase energy efficiency at reasonable first cost while providing operating cost paybacks through reduced energy bills. Examples of modern energy code requirements for wall insulation using continuous insulation are shown in Figure 3. A color-coordinated U.S. climate zone map is provided in Figure 4. Voluntary energy efficiency programs, such as the EPA's EnergyStar program, have been encouraging and rewarding use of continuous insulation for some time. Model building and energy codes are finally catching up with this **best practice** for wall insulation.

2012 IECC Residential Wall R-value

Installation	Wood Frame R-value	
	2009 IECC	2012 IECC
Climate Zone	2009 IECC	2012 IECC
1	R13	R13
2	R13	R13
3	R13	R20 or R13+5
4 exc. Marine	R13	R20 or R13+R5ci
4 Marine & 5	R20 or R13+R5ci	R20 or R13+R5ci
6	R20 or R13+R5ci	R20+R5ci or R13+R10ci
7 & 8	R21	R20+R5c or R13+R10ci

2012 IECC Commercial Wall R-value

Climate Zone	Wood Frame	Metal Frame	Metal Bldg	Mass
1	R13+ R3ci or R-20	R13+ R5ci	R13+ R6.5ci	R5.7ci
2	R13+ R3ci or R-20	R13+ R5ci	R13+ R6.5ci	R5.7ci
3	R13+ R3.8ci or R-20	R13+ R7.55ci	R13+ R6.5ci	R7.6ci
4	R13+ R3.8ci or R-20	R13+ R7.5ci	R13+ R13ci	R9.5ci
5/4 Marine	R13+ R3.8ci or R20	R13+ R7.5ci	R13+ R13ci	R11.4ci
6	R13+ R7.5ci or R20+ R3.8ci	R13+ R7.5ci	R13+ R13ci	R13.3ci
7	R13+ R7.5ci or R20+ R3.8ci	R13+ R7.5ci	R13+ R13ci	R15.2ci
8	R13+ R15.6ci or R20+ R10ci	R13+ R7.5ci	R13+ R13ci	R25ci

Figure 3. Modern energy code R-value requirements for commercial and residential building walls using continuous insulation.

Figure Notes:

1. IECC = International Energy Conservation Code published by the International Code Council, Inc. Refer to ASHRAE 90.1 for alternate code-compliant wall R-values.
2. Wall R-values are shown as cavity insulation alone or as XX + X where the first number is the cavity insulation R-value and the second is for continuous insulation. Continuous insulation "ci" R-values are shown in bold.
3. The commercial Wall R-values are based on all commercial building use groups, except R (residential) which may require additional continuous insulation R-value depending on climate zone.
4. Refer to climate zone map **on the next page** for geographic extent of climate zones listed above.
5. If using batt insulation instead of continuous insulation, the building will require 2x6 construction.

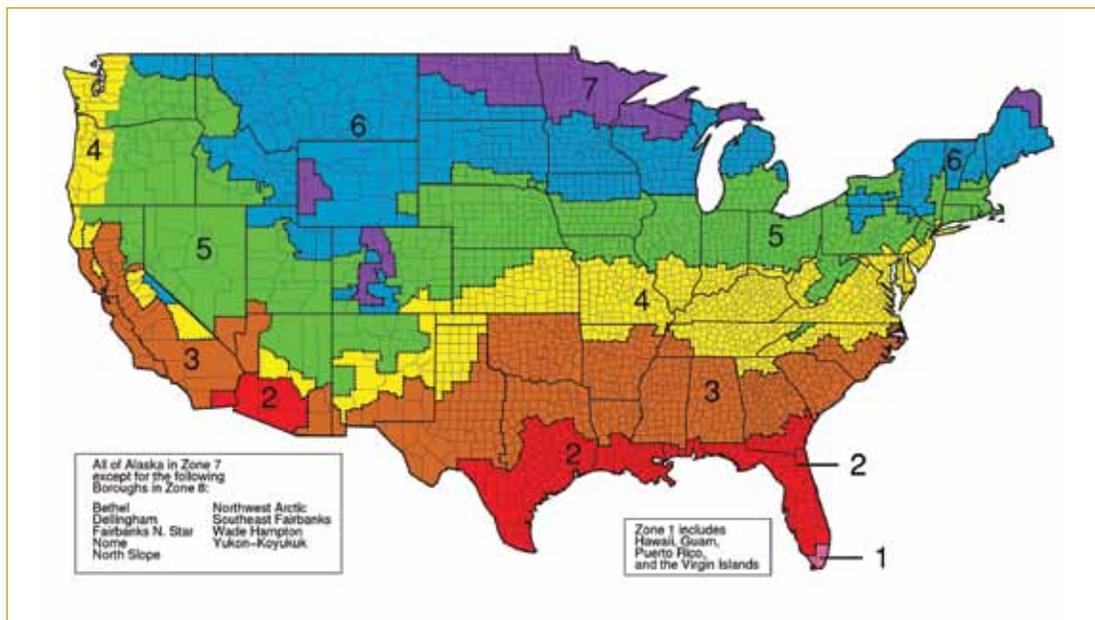


Figure 4. U.S. Climate Zone Map
Source: <http://resourcecenter.pnl.gov/>, 4/17/2011

Why choose polyiso?

Not all continuous insulation materials are equal. For example, the following two points demonstrate the superior value of polyisocyanurate insulation for continuous insulation on exterior wall assemblies:

- **The highest R-value in class**
Polyisocyanurate continuous insulation has at least 20% to 70% greater R-value per inch than other common types of continuous insulation (rigid foam plastic sheathing). This means more energy savings and/or more manageable wall thicknesses. With thinner, energy efficient walls using polyisocyanurate continuous insulation, there will be more usable floor area within the footprint of the building. Also, cladding materials are more easily installed over the thinner continuous insulation achievable by use of polyisocyanurate sheathing. Simply put, there's **more bang for the buck** with polyisocyanurate continuous insulation wall sheathing.
- **Code-compliant wind pressure resistance**
Foam sheathing industry testing² for code compliance at an independent laboratory has demonstrated that polyisocyanurate continuous insulation provides code-compliant wind pressure resistance for exterior wall sheathing.
- **Wall moisture-resistant design flexibility**
Polyiso is available with a variety of facer types to provide water resistive barrier performance or to provide water vapor permeability as required by climate or code-compliant wall design preferences.
- **Fire Test Compliant**
Polyiso, a thermoset material, stays intact during fire exposure in the ASTM E84 or "Tunnel Test." It forms a protective char layer and remains in place during this test, thereby meeting all building code requirements and contributing to a fire-safe building. For more information on polyiso's performance in fire tests, consult the Technical Bulletins section of polyiso.org.

² <http://www.foamsheathing.org/> (4/17/2011)

While not all continuous insulation materials are equal, continuous insulation as a product class offers many advantages over other types of wall sheathing. Some of these advantages were discussed earlier. For more information on the advantages of continuous insulation over other non-continuous insulation wall sheathing choices, refer to "Overview of Wall Sheathing Options: The Value of Foam Sheathing as a Wall Covering."³

³ http://www.foamshathing.org/tech_info/OverviewofWallSheathingOptions.pdf?PHPSESSID=5a3ak3njtrrqgtiuef6t77h0k0 (6/15/2011)

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



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