PIMA Technical Bulletin #301

Polyiso CI Performance in Residential Wall Applications

About Polyiso Insulation

Polyiso is a rigid foam insulation used in more than 70% of commercial roof construction and offers a continuous insulation solution for commercial and residential wall assemblies. As one of North America's most widely used and readily available building products, Polyiso is a cost-effective insulation option for reducing building energy use and improving the overall service-life of roofs and walls.

The benefits of using Polyiso include:

- High R-value per inch of thickness
- Excellent fire test performance
- Extensive building code approvals
- Cost-effective continuous insulation (ci) solution
- Compatible with most roof and wall systems
- Dimensional stability
- Compressive strength
- Moisture resistance
- Thinner walls and roofs with shorter fasteners
- Long service life
- Preferred insurance ratings
- Virtually no global warming potential
- Zero ozone depletion potential
- Recyclable through reuse
- Recycled content (amount varies by product)
- Regional materials (nationwide production network)
- QualityMark^{CM} certified LTTR-values

POLYISO

Surround yourself with the best.

The Superior Insulation System – Polyiso CI

The use of polyisocyanurate continuous insulation (Polyiso CI) is a time-tested, yet advanced building concept. Utilizing Polyiso CI (with foil or coated glass facer) to provide a continuous layer of insulation on the exterior of a home is extremely beneficial when used with wood or steel framed construction to minimize thermal bridges. Providing insulation over the entire opaque wall surface significantly increases the overall thermal performance and energy efficiency of a home (Figure 1).[1]

Figure 1. A typical residential wood-frame wall constructed with OSB sheathing and Polyiso CI.

How Does Polyiso CI Work in Residential Walls?

- Insulates the exterior of framed walls, minimizes thermal bridging, and reduces energy losses;
- Reduces air infiltration and exfiltration when the exterior joints of Polyiso CI are taped;
- Minimizes risk for condensation by maintaining the wall structure above the dew-point temperature when the appropriate R-value of insulation is used;

1 Savings vary. Find out why in the seller's fact sheet on R-values. Higher R-values mean greater insulating power.

- Serves as a water resistive barrier (WRB) when the exterior joints are taped/sealed, resisting rainwater intrusion;
- Provides wall bracing when using certain construction techniques or composite Polyiso CI products with integrated structural components;
- In heating climates, helps control water vapor migration out of the building interior and reduce risk for moisture condensation in walls; and
- In cooling climates, helps control water vapor migration into the building interior.

Key Considerations in High-Performance Residential Walls:

Polyiso CI performs several critical functions in high-performance residential wall construction:

Thermal Insulation

Insulating the entire opaque surface of framed walls with Polyiso CI keeps energy losses and gains to a minimum. The continuous insulation plane reduces thermal bridges that are responsible for significant energy losses in typical home construction. Cavity insulation (installed between framing members) may not be required when using Polyiso CI depending on the required opaque wall assembly U-factor, climate zone, and thickness of product used. Polyiso CI manufacturer installation instructions should be followed to ensure proper attachment of the insulation to the framing prior to the installation of the cladding system.[2]

Water Resistive Barrier

Many Polyiso CI products with taped or sealed joints are classified as water resistive barriers (WRBs) that provide a drainage plane and a secondary line of defense against rainwater intrusion behind the cladding.[3] The joints between adjacent Polyiso CI boards should be taped or sealed with an approved product in accordance with manufacturer installation instructions. Sealing along the top and bottom plates of the wall, around all openings, and integrating window and door flashings is critical when Polyiso CI is installed as part a WRB assembly. Consult manufacturer installation instructions for guidance on WRB design, details, and accessories.

Air Barrier

Polyiso CI is considered an air barrier material when taped or sealed appropriately along the exterior joints. The model building codes list Polyiso CI as an air barrier material when installed at a minimum ½-inch thickness.[4] The use of Polyiso CI as part of an air barrier assembly reduces air infiltration and exfiltration.

As part of the air barrier system, Polyiso CI must be integrated with other materials to form a continuous air barrier system within the building envelope. See the manufacturer installation instructions for details on how to seal panel joints, penetrations, and interfaces with other building envelope materials.[5] Penetrations for plumbing, electrical, air conditioning, dryer vents, and other openings should be sealed with a sealant appropriate for the application to ensure long-term

2 It is critical to consider the use of Polyiso CI if structural sheathing such as OSB, plywood, or other proprietary products are used over the entire opaque wall area. The ½-inch or 7/16-inch thick plywood or OSB products have an approximate R-value of 0.5 (h·ft2·°F/Btu). As an example, using ½-inch thick Polyiso CI with an R-value of 3.2 (h·ft2·°F/Btu) delivers approximately 6 times the insulation value of OSB or plywood. This increased R-value reduces thermal bridges and improves the overall energy efficiency of the home. Additionally, the low R-value of wood structural panels excludes them from being considered a prescriptive insulating component in residential walls.

3 For more information on the use of Polyiso CI as a water resistive barrier visit: http://www.continuousinsulation.org/topical-library/water-resistive-barrier.

4 2018 International Energy Conservation Code (IECC), Chapter 4, Section C402.5.1.2.1.

5 Additional information on air barrier assemblies can be found at https://www.continuousinsulation.org/air-barrier and Polyisocyanurate Sheathing Used as an Air Barrier Material in an Air Barrier Assembly.

performance. Furthermore, attention should be paid to sealing the inside and outside corners and tying-in the air barrier at the roof-to-wall and wall-to-foundation transitions.

NOTE: Properly taped or sealed Polyiso CI can be a building code compliant WRB or air barrier material. Polyiso CI can eliminate material and labor costs associated with the installation of a separate WRB or air barrier products such as house wraps.

Vapor Retarder

In heating or mixed climates, a continuous vapor retarder[6] is typically installed on the interior side of the framed wall to reduce water vapor transfer from the occupied space and thus reduce the risk for condensation in the wall system. An interior vapor retarder may not be necessary when a proper amount of Polyiso CI is installed on the exterior side of the wall. Good construction practice dictates that penetrations at electrical outlets should be sealed to provide moisture and air flow control. Always consult local building codes for vapor retarder requirements.

Structural

Polyiso CI alone is not a structural bracing material. As such, wall systems with Polyiso CI must be separately braced to resist lateral loads resulting from wind and seismic loads on the home. Many manufacturers offer composite structural foam sheathing products that can be used for bracing walls. Utilizing Polyiso CI in addition to these proprietary bracing products provides structural integrity and appropriate thermal resistance in the wall system. Alternatively, let-in bracing and other bracing strategies can be used. When this is done, some Polyiso CI systems may allow for the elimination of traditional exterior sheathing materials. Consult the local building code and manufacturer installation guides for specific bracing requirements since each home design presents different loading conditions. See PIMA Technical Bulletin #302 – "Wall Bracing with Polyiso CI" for more information.

Cladding

Any code approved cladding system may be used over Polyiso CI. Each cladding system typically requires specific installation details, attachment methods, and accessories. The cladding system manufacturer installation instructions should be followed as well as the requirements in Section R703.15 of the International Residential Code for One- and Two-Family Dwellings (IRC). The installer should exercise caution to prevent damage to Polyiso CI during installation. In some wood siding applications, furring strips may be required over Polyiso CI to provide ventilation and drainage prior to the installation of the wood siding. For information on the attachment of cladding to wood or steel studs through Polyiso CI, visit https://www.continuousinsulation.org/cladding-attachment.

Additional Considerations:

Cavity Insulation

Cavity insulation, if used, must be carefully installed. Batt insulation should be cut to accommodate a friction fit as recommended by the manufacturer installation instructions. Care should be taken to avoid creating uninsulated areas around service openings and penetrations. Blown-in-place or spray applied insulation products may also be viable cavity fill solutions.

Interior Wall Finish

Gypsum wall board is typically used to enclose the wall on the home's interior and should be installed and finished in accordance with manufacturer installation instructions and local building code requirements. The contractor installing the gypsum wall board should exercise caution to prevent damage to any interior vapor retarders, air barrier components, and should seal any wall penetration openings.

NOTE: Quality construction practices are essential in any building system. Always follow manufacturer installation instructions.

6 Class II or Class III vapor retarder. Be sure to check local building codes for requirements or use an approved alternate design.

KEY FACTS – POLYISO CI PROVIDES:

- **A wall system with a high R-value** – Increasing the energy efficiency of the home and significantly reducing heat transfer through the building envelope.
- **A continuous plane of thermal insulation** – Reducing thermal bridges and improving the energy efficiency of the home.
- **A reduction in air infiltration and exfiltration** – Increasing the overall performance of the wall and reducing heat losses and heat gains.
- **A reduced risk for water vapor condensation and moisture accumulation in the wall** – Maintaining the wall structure above the dew-point temperature when the appropriate R-value of insulation is used.
- **Enhanced value and differentiation for home builders** – Energy efficiency is a top ranked consideration with prospective home buyers.
- **Increased homeowner confidence** – Assurance of a quality home with state-of-the-art energy efficient construction techniques.

DEFINITIONS:

Continuous Insulation (CI): Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.

Dew-Point Temperature: The temperature to which air must be cooled to become saturated with water vapor. When further cooled, the airborne water vapor will condense to form liquid water.

R-Value (Thermal Resistance): The inverse of time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area (h·ft2·°F/Btu).

U-Factor (Thermal Transmittance): The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/ h·ft2·°F).

Resources

ContinuousInsulation.org has a wealth of tools and information, and new information is added frequently. Find the resources linked below as well as construction details, industry news articles, code and standard references, and much more.

Calculators – Compute U-factors and vapor retarder options for wood- and steel-frame wall assemblies using Polyiso CI. Easily verify thermal and moisture code-compliance for any climate zone.

- Steel frame wall calculator - https://www.continuousinsulation.org/steel-wall-calculator
- Wood frame wall calculator - https://www.continuousinsulation.org/wood-wall-calculator

Guides for Design and Installation – https://www.continuousinsulation.org/design-installation-guides

- Window Installation in Walls with Polyiso CI - Covers four common methods of installing flanged windows in wood wall framing.
- Cladding Attachment through Polyiso CI - Includes information on attaching to both wood and steel wall framing.
- Water Resistive Barrier System with Polyiso CI - Foam sheathing, properly taped or sealed, is a code-compliant and effective WRB.
- Air Space R-Value - How does one characterize the R-value of an air space?

Applications of Polyiso CI – https://www.continuousinsulation.org/applications

- Thermal Insulation/Thermal Bridging Reduction
- Water Resistive Barrier
- Air Barrier
- Water Vapor Control
- Fire Performance

PIMA

For more than 30 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's membership includes manufacturers of polyiso insulation and suppliers to the industry. The products of PIMA's members comprise the majority of the polyiso produced in North America.

PIMA produces technical bulletins to address frequently asked questions about polyiso insulation. These publications update and inform architects, specifiers, and contractors about and build consensus on the performance characteristics of polyiso insulation. Individual companies can provide specific information about their respective polyiso products.

For more information on polyisocyanurate insulation, visit www.polyiso.org

PIMA
POLYISOCYANURATE INSULATION MANUFACTURERS ASSOCIATION

ATLAS CONNECTING FUNCTION WITH FACILITY · CARLISLE CONSTRUCTION MATERIALS · Firestone Building Products · GAF · IKO · JM Johns Manville · MFM · SOPREMA