PIMA Technical Bulletin #304

Energy Efficiency with Polyiso CI

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 polyisocyanruate 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.

Energy Efficiency

Heating and cooling can add significant costs to the operation of a home. The amount of energy required to heat or cool a home is affected by many variables – however, a poorly insulated building envelope can be a significant culprit for energy loss.

The building envelope is comprised of walls, roof and/or attic, windows, doors, and the foundation. These components all contribute to the overall energy performance of the structure. It is important to look at the entire building and all of its components when assessing a home's energy efficiency.

[1] Savings can vary. Find out why in the insulation sellers fact sheet on R-value. Higher R-values mean greater insulating power.

Energy Efficiency and Wall Framing

Polyiso CI on the exterior of wood or steel framing can greatly improve energy efficiency by reducing thermal bridges. In homes constructed without continuous insulation (i.e., insulation installed only between the framing members), energy losses can occur as a result of increased heat transfer through the more conductive wood and steel framing components. The thermal conductivity – a physical property that indicates the amount of heat flow through the material – is greater for wood and even greater for steel when compared to Polyiso CI. This means that more energy is transferred through wood and steel than through the insulation.

Wood Framing

The wood framing in a home represented by the studs, headers, top and bottom plates along with other structural components can cover 25% or more of the wall area. As a result, the wood framing contributes to higher energy transfer through these components. The use of Polyiso CI reduces these losses by insulating the framing members from the exterior environment **(Figure 2)**.

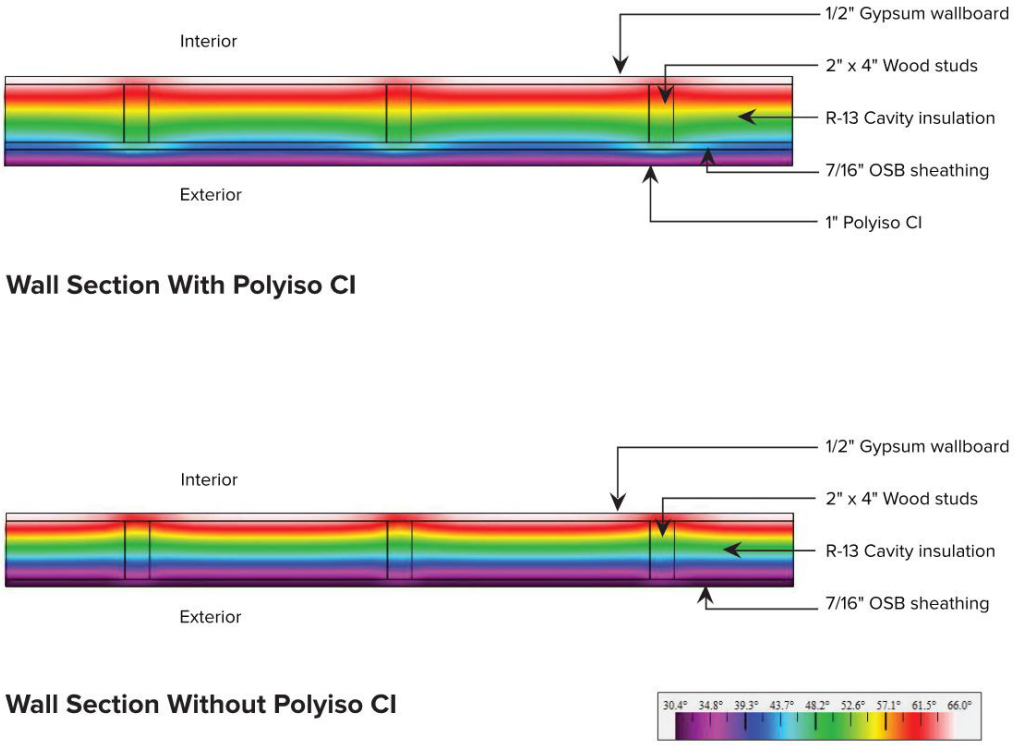

Figure 2. Temperature distribution profiles of wood framed wall assemblies with and without Polyiso CI. Computer modeling was conducted with the following boundary conditions: exterior temperature of 30°F and the interior temperature of 70°F.

Steel Framing

Steel framing, which is more conductive than wood framing, comprises a significant thermal bridge element in a wall system. Although the thickness profile of steel studs is relatively small compared to wood studs, the energy transfer is significantly greater and reduces the effectiveness of cavity insulation. This "reduction factor" results in an overall steel-stud assembly (without continuous insulation) performing at slightly less than half of the rated insulation R-value. Like in wood-stud assemblies, the effect of thermal bridges can be minimized through the use of Polyiso CI on the exterior of the framed walls **(Figure 3)**.

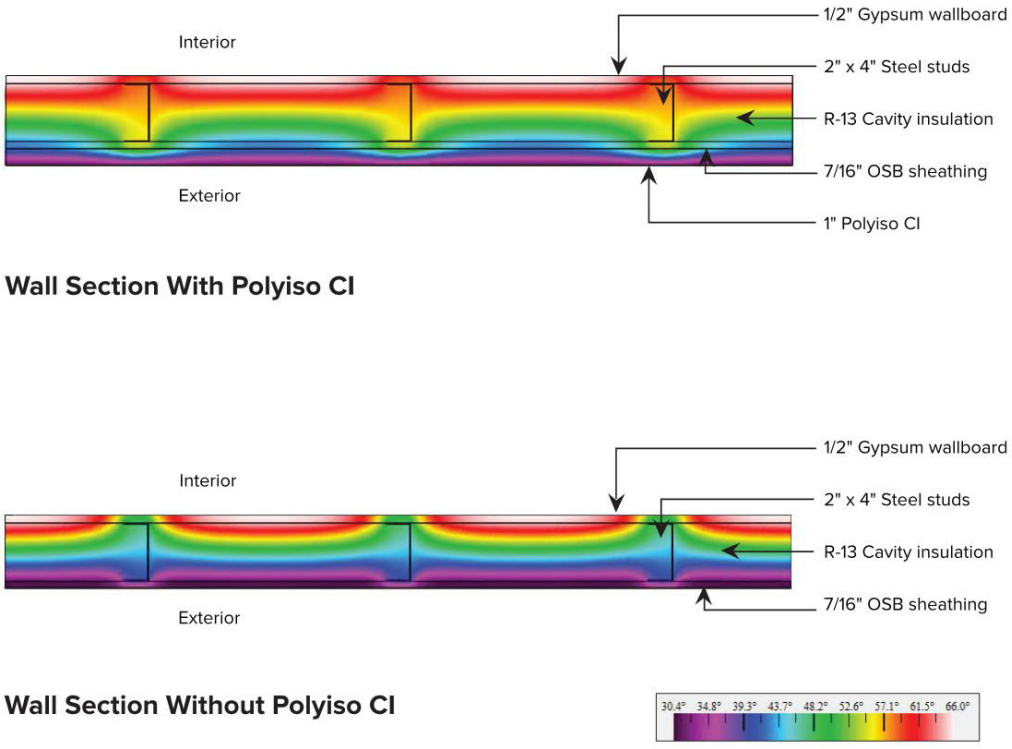

Figure 3. Temperature distribution profiles of steel framed wall assemblies with and without Polyiso CI. Computer modeling was conducted with the following boundary conditions: exterior temperature of 30°F and the interior temperature of 70°F.

Polyiso CI provides an energy efficient solution with an improved overall effective R-value (reduced U-factor) compared to a conventional wall (with the cavity insulation installed only between the framing members).

NOTE: Polyiso CI can be installed over traditional structural sheathing materials such as OSB or plywood. Polyiso CI also can be installed with a code-compliant let-in bracing solution or a proprietary insulated structural sheathing solution. *See* "PIMA Technical Bulletin #302 – Wall Bracing with Polyiso CI" for more information.

Attic/Roof

Traditional residential building designs include a vented attic insulated with batt or blown-in insulation, typically installed on the attic floor. Polyiso CI offers an energy efficient alternative to this design. Polyiso CI with a nailable base can be installed as part of the roof plane over sloped solid-wood and metal decks. Other Polyiso CI nailbase products include air spaces for ventilation. Incorporating insulation as part of the roof deck can provide an energy-efficient solution for vaulted or cathedralized ceilings. Specific Polyiso CI products may be used on the attic interior in exposed applications without a thermal barrier. Be sure to check individual product approvals for this application and local building code requirements.

Foundation/Slab

An important area to remember for energy efficient construction is the home's foundation and slab – the part of a home that is below-grade and out of sight. The basement walls and the underside of the slab should be insulated as required by the local energy code. Specific Polyiso CI products may be used on interior basement walls in exposed applications without a thermal barrier. Be sure to check individual product approvals for this application and local building code requirements. Additionally, Polyiso CI may be installed on the exterior of below-grade walls or below-slab per specific manufacturer installation instructions.

Windows and Doors

The selection of windows and doors is an important aspect of energy-efficient building design. Where continuous insulation is used, Polyiso CI's high R-value per inch can offer advantages over other solutions. A thinner insulation product can simplify design considerations such as window and door transitions. For additional information on window and door transitions, visit: https://www.continuousinsulation.org/residential-windows.

Meeting Building Code Requirements

The amount of insulation required for the building envelope (walls, roofs, foundations and slab) of a home will depend on the requirements of the local energy code. The energy code provides the *minimum* insulation requirements. For improved energy efficiency, a builder or homeowner should consider increased insulation levels.

KEY FACTS:

- Energy use can be a significant component of operating costs for a home.
- Increasing energy efficiency requirements and changes in architectural styles (e.g. vaulted ceilings) make Polyiso CI in residential construction a great choice.
- Polyiso CI can be used over the entire building envelope including roofs, walls, and foundations.
- Polyiso CI is an important consideration with any framed wall since framing components increase energy transfer through the assembly.

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

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