Energy Efficiency with Polyiso CI

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).

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).

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.

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.
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.

ABOUT PIMA

Since 1987, PIMA has served as the voice of the North American rigid polyiso insulation industry. PIMA is a leading advocate for safe, cost-effective, sustainable, and energy-efficient construction. The Association is comprised of polyiso manufacturers and industry suppliers, and represents the public policy interests of its membership at the local, national, and international levels to advance high-performance building practices.

PIMA produces technical bulletins to address key topics related to polyiso insulation. These publications inform architects, specifiers, and contractors about the performance characteristics of polyiso insulation. Always consult individual manufacturers for product specific information, including product data sheets and installation instructions.

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