

Benefits of Multiple Polyiso Roof Insulation Layers with Staggered Joints

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)

Multiple layers of polyisocyanurate (polyiso) roof insulation with staggered joints is a well-known design and installation practice in low-slope roofing that produces many performance advantages. Leading roofing industry associations and research organizations, including International Institute of Building Enclosure Consultants (IIBEC), National Roofing Contractors Association (NRCA), Canadian Roofing Contractors Association (CRCA), and Oak Ridge National Laboratory (ORNL) recognize the benefits of this design and installation practice. The benefits include:

- Reduced thermal losses at insulation joints
- Reduced thermal bridging from fasteners (when adhering top insulation layer)
- Reduced air leakage
- Reduced moisture migration from inside the building to the underside of roofing membranes (which can otherwise lead to possible condensation)
- Reduced potential for membrane buckling and splitting

The multi-layered insulation approach may be used for any roof assembly on a new or existing building designed with above-deck polyiso insulation. Keys to achieving maximum performance benefits include:

- Attach the base layer (and any middle layers) of insulation to the roof deck with either mechanical fasteners or adhesive (see manufacturer's instructions and approved assemblies)
- Adhere the top layer of insulation (to reduce thermal bridging)
- Joints between boards of each layer should be staggered as recommended by the insulation manufacturer or listed design (See Image 1 for example demonstrating staggered joints)

Requirements in Energy Codes and Standards

In the United States, model building and energy codes¹ have evolved to include requirements for installation of roof insulation in multiple layers with staggered joints. These requirements apply to both new construction and roof replacements. Specific code provisions to stagger joints of continuous roof insulation, when installed using multiple layers, began with the 2012 Edition of the International Energy Conservation Code (IECC), in Section C402.2. The 2018 IECC revised installation provisions for continuous roof insulation (now Section C402.2.1) to require multiple layers of insulation

1. International Building Code (IBC) and International Energy Conservation Code (IECC)



Surround yourself with the best.



Image 1 – Courtesy Atlas Roofing Corp.

and to stagger the joints. The 2021 IECC maintains requirements for installing multiple layers of continuous roof insulation with staggered joints in Section C402.1.4.1.3. Consult with the local jurisdiction to verify what edition of the IECC is enforced and the specific requirements.

The IECC also prescribes compliance with the requirements of the ASHRAE 90.1² standard as an option to comply with the IECC's commercial building provisions. ASHRAE 90.1 has been a prescribed compliance option for energy efficiency of commercial buildings under the IECC since the code's 2003 edition. Requirements to stagger joints of multiple layers of roof

insulation first appeared in ASHRAE 90.1 in the standard's 2010 edition which is referenced in the 2012 edition of the IECC.

In Canada, by comparison, the model building and energy codes³ do not currently (as of the 2020 Edition) include requirements for installation of insulation in multiple layers with staggered joints.

Even when not specifically required under earlier editions of the IECC and ASHRAE 90.1, or Canadian model codes, multiple insulation layers with staggered joints remains an industry recommended design and installation practice.

Going Beyond Energy Efficiency Benefits

When it comes to performance and building code requirements other than energy efficiency, roof assembly designs incorporating multiple layers of polyiso roof insulation are available with classifications / ratings for fire (external and internal) and wind-uplift performance that comply with the requirements of the U.S. and Canadian building codes. Additionally, installations using multiple layers of polyiso roof insulation with staggered joints have been shown to provide improved performance over a single layer of insulation when evaluated for air intrusion and associated moisture transport into the roof assembly from building interior below.

Polyiso insulation manufacturers maintain third-party certifications for the performance of these roof assembly systems to various standards. Consult with the insulation manufacturer for specific information regarding available third-party certifications for the applicable ASTM, FM, and UL/ULC standards prescribed by U.S. and Canadian building codes.

From the industry best practice perspective, PIMA recommends installing polyiso roof insulation in low-slope above-deck applications in multiple layers with staggered joints. PIMA further reminds users that polyiso insulation board shall always be installed in accordance with the applicable codes and the manufacturer's installation instructions. Consult with the local authority having jurisdiction over a project's location to confirm the adopted building code and energy code or standard and associated requirements enforced.

2. ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings

3. National Building Code of Canada (NBC) and National Energy Code of Canada for Buildings (NECB)

Summary

Model building and energy codes, standards and industry best practices specifically recognize low-slope above-deck roof insulation systems using multiple layers of insulation with staggered joints. The immediate and long-term benefits provided by these installation practices promote the construction of a roof assembly that provides improved energy efficiency, durability and resiliency during its service life. PIMA recommends the use of multi-layered above-deck insulation systems with staggered joints for roof assemblies installed on new and existing buildings.

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

