

- Non-Nailable Roof Decks—On non-nailable roof decks, NRCA recommends applying perlite roof insulation boards in hot bitumen or manufacturers-approved adhesive over a properly prepared deck. Priming of the deck may be required to achieve adequate adhesion with this type of installation.
- Loose-laid Ballasted Systems—Perlite insulation is not recommended to be used directly under the membrane where the roof system is intended to be loose-laid ballasted.

2.4.4.6 Equipment and Construction Traffic

Improperly mounted equipment and construction traffic can compress perlite insulation boards, causing damage to the insulation and, in some cases, deflection in the roof deck, resulting in separation of the insulation boards from the deck. NRCA recommends that equipment be installed in penthouses or at ground level. Proper protection of the roof assembly must be provided before allowing construction traffic over any finished roof system.

2.5 Polyisocyanurate Foam Board Roof Insulation

2.5.1 Description

Polyisocyanurate foam board roof insulation is a rigid insulation material manufactured from closed cell, polyisocyanurate rigid foam sandwiched between two facers. Commonly used facers include aluminum foils; glass-fiber reinforced cellulosic mats; coated or uncoated polymer-bonded glass-fiber mats or other rigid board materials including perlite board insulation, wood fiberboard insulation and oriented strand board (OSB). Where rigid board materials are used as a facer, NRCA considers these products to be composite board insulation; see Section 2.8—Composite Board Roof Insulation for information about these products.

The ASTM standard for polyisocyanurate is ASTM C 1289, “Standard Specification for Faced Rigid Board Cellular Polyisocyanurate Thermal Insulation.” This standard includes the following applicable classifications:

–Type I—Aluminum-foil-faced on top and bottom sides:

- Class 1—Nonreinforced polyisocyanurate foam core
- Class 2—Glass-fiber reinforced polyisocyanurate foam core

–Type II—Mat-faced on top and bottom sides:

- Class 1—Faced with glass-fiber reinforced cellulosic mats or coated or uncoated polymer-bonded glass-fiber mats on top and bottom sides:
 - Grade 1—16 psi (110 kPa) minimum compressive strength polyisocyanurate foam core
 - Grade 2—20 psi (138 kPa) minimum compressive strength polyisocyanurate foam core
 - Grade 3—25 psi (172 kPa) minimum compressive strength polyisocyanurate foam core
- Class 2—Faced with coated polymer-bonded facers on top and bottom sides.

Type I, Class 1 and Type II, Class 1 polyisocyanurate foam board are generally used in roofing applications. It is generally understood that Type I, Class 2, and Type II, Class 2, products are used in wall sheathing applications and are not intended for use in roof assemblies

NRCA recommends polyisocyanurate foam board insulation used in low-slope membrane roof assemblies be manufactured to have a minimum of 20 psi (138 kPa) compressive strength and facer sheets that are compatible with the assembly method and other components of the roof assembly. Therefore, NRCA recommends the use of polyisocyanurate foam board roof insulation that complies with ASTM C 1289, Type II, Class 1, Grade 2. This classification designates polyisocyanurate foam board insulation with a minimum 20 psi (138 kPa) foam core and faced with glass-fiber reinforced cellulosic mats or coated or uncoated polymer-bonded glass-fiber mats on the top and bottom sides.

Furthermore, NRCA suggests designers who specify polyisocyanurate foam board insulation incorporate the following criteria into their designs:

- Board size: 4-foot by 8-foot (1.2-m by 2.4-m) maximum board size for loose-laid and mechanically attached insulation boards and 4-foot by 4-foot (1.2-m by 1.2-m) maximum board size for insulation boards adhered to a substrate.
- Board thickness: 2 inches (51 mm) maximum; when thicker total thicknesses are necessary, specify insulation boards in multiple layers to achieve total desired thickness. When multiple insulation layers are used, the insulation board's joints in the topmost layer (cover board) should be staggered vertically and offset from the joints in the underlying layers.

NRCA recommends an R-value of 5.6 per inch (25 mm) thickness be used to calculate the total thermal resistance of polyisocyanurate foam board roof insulation. This 5.6 R-value is based upon an in-service R-value.

Most manufacturers' currently published literature provides for R-value data for polyisocyanurate foam board roof insulation based upon the long-term thermal resistance (LTTR) method of determination. The LTTR method provides for reporting of R-value based upon a calculated 15-year time-weighted average. At this time, NRCA does not endorse or recommend the use of the LTTR method for determining the thermal resistance of polyisocyanurate foam board roof insulation.

The following recognized properties of polyisocyanurate foam board roof insulation make it an effective insulation material:

- Bitumen and adhesive compatibility

- Component compatibility
- Impact resistance
- Fire resistance
- Durability
- Moisture resistance
- Thermal resistance
- Attachment capability

2.5.2 Manufacturing Process

Polyisocyanurate foam board insulation is manufactured through a controlled chemical reaction. Primary chemicals are metered and mixed at a specific temperature, and the mixture is applied to a moving base platen. Once the mixture is combined, the chemical blowing agent reacts with a catalyst to cause the liquid to quickly rise and form into cellular foam. In a matter of seconds, the liquid mixture becomes a solid, lightweight, and thermally resistant material.

To create polyisocyanurate roof insulation, the closed-cell rigid foam stock is bonded to reinforcing facer material as the foam rises during the manufacturing process. Once the facers are bonded, the board stock is cut to size, and should be allowed to cure before distribution.

The following table shows the common sizes, thicknesses, k- and R-values for polyisocyanurate insulation:

Available Sizes	Available Thicknesses	Approx. k-value	Approx. R-value (per in. or 25 mm)
48 in. x 48 in. (1.2 m x 1.2 m) 48 in. x 96 in. (1.2 m x 2.4 m)	1 in. to 4 in.* (25 mm to 100 mm)	0.16	5.6
Taper 48 in. x 48 in. (1.2 m x 1.2 m)	Slopes: 1/6 in. 1/8 in., 1/6 in., 1/4 in., 1/2 in., 1/2 in. per foot (0.3, 0.6, 0.9, 1.2, 1.8, 2.4 degrees)	0.16	5.6

Although available in thicknesses up to 4 inches (100 mm), NRCA recommends that polyisocyanurate insulation be installed in layers 2 inches (50 mm) thick (maximum).

2.5.3 Guidelines for Use

2.5.3.1 Multiple-layer Insulation

The recommended specification is for multiple-layer insulation, especially when the total required insulation thickness is more than 2 inches (50 mm). NRCA recommends designers specify a suitable cover board over polyisocyanurate insulation in all low-slope membrane roof systems. Cover boards are considered to be components of a multiple-layer insulation assembly.

2.5.3.2 Joints

When double-layer insulation is used, the joints of the insulation boards in the top layer should be vertically staggered and offset from the joints in the underlying layer. The end joints of adjacent insulation boards should be staggered, and the edges of abutting insulation boards should be in moderate contact.

2.5.3.3 Storage and Handling Protection

During storage and handling, polyisocyanurate insulation should be protected from the weather. All roof system materials that are susceptible to retaining moisture or that may be damaged by moisture should be stored in a dry location before application.

When moisture-sensitive materials are stored outside, they should be placed on pallets or platforms that are raised off the ground or roof deck. Materials sensitive to moisture should be covered with water-resistant coverings that have been properly secured. Coverings that are “breathable,” such as water-resistant canvas tarpaulins, are preferred. Some insulation materials are extremely light and may need to be secured in storage.