Specifying specifics

NRCA recommends specifying polyisocyanurate by ASTM designation and thickness

by Mark S. Graham

Faced rigid board polyisocyanurate insulation is the most common type of thermal insulation used in the U.S. roofing industry; as such, the proper specification of polyisocyanurate insulation is an important consideration for successfully performing roof systems. Following are some considerations and NRCA's recommended guidelines for specifying polyisocyanurate insulation.

Considerations

The U.S. product standard for polyisocyanurate insulation is ASTM C1289, "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board." ASTM C1289 addresses 18 compositions of polyisocyanurate insulation by using specific types, classes and grades. Type and class designations generally define specific facers, and grade classifications indicate the minimum compressive strength of the polyisocyanurate foam. For example, polyisocyanurate insulation with reinforced, cellulosic mat facers that has a minimum 20-psi compressive strength is designated as ASTM C1289, Type II, Class 1, Grade 2.

Polyisocyanurate insulation is commonly available in 4- by 4-foot and 4- by 8-foot board sizes. 4- by 4-foot boards generally are used when the boards are adhered or serve as a substrate for adhered

membrane applications. 4- by 8-foot boards generally are used for loosely laid and mechanically attached membrane systems. Manufacturers' specific UL and FM Approvals certifications typically designate specific board size requirements.

Polyisocyanurate thermal insulation is available in thicknesses ranging from 1 to about 4 inches in 0.1-inch increments. Tapered polyisocyanurate insulation also is available. High-density polyisocyanurate cover boards typically are available in ¼-, ⅜- and ½-inch thicknesses.

Polyisocyanurate insulation's thermal resistance (R-value) correlates to its thickness. Polyisocyanurate insulation manufacturers generally use the long-term thermal resistance method for reporting R-values in product literature and markings. Minimum LTTR values typically are 5.6 per inch thickness for 1-inch-thick products, 5.7 per inch thickness for 2-inch-thick products, 5.8 per inch thickness for 3-inch-thick products and 5.9 per inch thickness for 4-inch-thick products.

Instead of using the LTTR method, NRCA recommends designers specifying polyisocyanurate insulation determine insulation R-value using an in-service R-value of 5 per inch thickness of polyisocyanurate insulation. This reduced R-value (from LTTR) accounts for known losses in polyisocyanurate insulation's R-value over time and in changing temperature conditions.

NRCA recommends polyisocyanurate insulation be installed in multilayer applications, especially when the total thickness of polyisocyanurate insulation is more than 2½ inches. NRCA's maximum 2½-inch-thick recommendation is based on dimensional stability and facer sheet delamination concerns.

NRCA also recommends designers specify a suitable cover board over polyisocyanurate insulation for all low-slope membrane roof systems.

The figure compares polyisocyanurate insulation thicknesses necessary to achieve specific roof system configuration and R-value requirements.

For articles related to this topic, see the Tech Today columns in the March 2013 and August 2013 issues.

Specifications

NRCA recommends designers specify polyisocyanurate insulation using the ASTM C1289 designation followed by the specific type classification and, if applicable, class and grade classifications necessary to identify the intended products' compressive strength and facers.

NRCA recognizes some designers will choose not to use NRCA's best practice in-service R-value, maximum board thickness and cover board recommendations. Although specifying polyisocyanurate insulation based on its LTTR, using manufacturers' available thicknesses and, sometimes, omitting cover boards are not consistent with NRCA's best practice guidelines, these should not be considered as unacceptable.

To avoid possible confusion, NRCA recommends polyisocyanurate insulation be specified based on its thickness and not its LTTR or R-value. Board size also should be specified.

Additional information regarding the use of polyisocyanurate insulation in membrane roof systems is provided in *The NRCA Roofing Manual: Membrane Roof Systems—2019*'s Chapter 4—Rigid Board Insulation, Section 4.9—Polyisocyanurate Insulation.

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	R-20		R-25		R-30		R-35	
	NRCA's recommendation[1]	Common configuration[2]	NRCA's recommendation[1]	Common configuration[2]	NRCA's recommendation[1]	Common configuration[2]	NRCA's recommendation[1]	Common configuration[2]
Cover board[3]	½ HD polyiso	None	½ HD polyiso	None	½ HD polyiso	None	½ HD polyiso	None
Polyiso layers	Two layers 1.75 inches thick	Two layers 1.75 inches thick	Two layers 2.3 inches thick	Two layers 2.2 inches thick	Three layers 1.9 inches thick	Two layers 2.6 inches thick	Three layers 2.2 inches thick	Two layers 3.1 inches thick

[1] NRCA's recommendation is based on use of a cover board and an in-service polyisocyanurate R-value of 5 per inch thickness.

[2] Common configuration is based on use of two layers of polyisocyanurate using LTTR.

[3] Cover board used in this example is ½-inch-thick HD polyisocyanurate having an R-value = 2.5. Other cover boards and cover board thicknesses are also recommended by NRCA, which may have different R-values, that can result in different polysiocyanurate thicknesses being needed to achieve the desired overall roof system R-value.

Illustration of polyisocyanurate insulation thicknesses necessary to achieve specific roof system R-value requirements

Photo courtesy of Built Robotics, San Francisco.

Robots can help meet the construction industry's needs

The construction industry increasingly is exploring the use of robots to boost efficiency, improve safety and alleviate labor shortages, according to www.forconstructionpros.com. Yet the use of technology to address construction labor shortages is not new.

"The use of single-task robots in the construction industry has been growing for some time," says Luke Christou, construction journalist for data analytics and consulting company GlobalData, London. "The use of robotics in construction dates back to 1970s Japan. As young workers turned their backs on manual labor in favor of less dangerous and physically demanding office jobs, Japan's largest architecture, engineering and construction companies turned to automation and robotics in an attempt to stem a labor shortage. Many of these technologies failed to break ground, and construction's labor issue persists."

Turner and Townsend's 2019 International Construction Market survey shows 66% of construction markets globally report a shortage of skills. Construction worker safety is another matter of concern.

"Lacking worker safety is another pressing issue, with construction the leading industry for workplace fatalities in many parts of the world," Christou says. "The industry seems largely in agreement that these significant advancements will first focus on removing humans from dangerous tasks. Automation is also likely to take over the tedious tasks, freeing up time for laborers to complete more fulfilling work."

For example, San Francisco-based construction robotics firm Built Robotics has developed an artificial intelligence guidance system that can be fitted to heavy equipment, allowing the equipment to operate autonomously and reducing the need for workers.

Stuart Maggs, CEO of Scaled Robotics, Barcelona, says the use of robots in construction can extend beyond labor reductions and safety enhancements.

"The end goal has to be not just automating tasks that human beings can do but developing new construction manufacturing methods that are only possible through robotics, opening up new possibilities for building design and performance," Maggs says.

Construction professionals desire integration between apps

Smartphones have been widely adopted as a tool by construction professionals, and a new study reveals the top apps workers rely on to complete their jobs, according to www.constructiondive.com.

The 2019 JBKnowledge ConTech report revealed more than 92% of respondents use smartphones for their work. Eighty-three percent of respondents said they use laptops and 64% said they use tablets. The use of smartphones by construction professionals has grown nearly 21% since 2014, according to Kara Dalton-Arro, marketing manager for JBKnowledge, a Bryan, Texas-based construction and insurance consulting firm.

Respondents reported most commonly using mobile apps for photo and video management, tool tracking, time management, BIM file viewing, and plan and project management. Apps designed to aid safety management experienced the largest increase in usage at 4%.

The study also revealed which apps construction professionals prefer for different tasks: Procore, Bluebeam Revu and PlanGrid were favored for daily report management; Bluebeam Revu, Procore and PlanGrid for photo and video management; Bluebeam Revu, Navisworks and BIM 360 Docs for BIM file viewing; and Procore, Bluebeam Revu and iAuditor for safety management.

With many apps available, app fatigue can plague smartphone users, according to the report. Users may end up relying on five or six apps daily despite having many more apps downloaded on their phones.

The lack of integration among apps also is problematic. Users frustrated by the need to switch between several apps during a task may revert to manual entry to complete the work.

To learn about the top 10 smartphone apps for construction work, go to www.professionalroofing.net.