GOT SKILLS?

ALLEVIATING THE INDUSTRY’S LABOR SHORTAGE

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When we think of high-tech innovations that have transformed the ways we live and work, our first thoughts probably turn to the smartphones in our pockets and the invisible networks traveling in the air around us. We might even think of self-driving cars or instantaneous video chat software. But some of the most ubiquitous, disruptive technologies that benefit us don’t get a lot of press coverage.

Sitting at our desks or lying in our beds, many of us are enjoying the comfortable indoor climate that comes from high-tech insulation products. Informed by sophisticated research and using advanced components, manufacturers are creating cutting-edge building materials that are thinner, stronger and more resilient than their predecessors. The manufacturing process that brings these products to market is full of engineering marvels carefully calibrated to produce consistently high-quality products.

Rigid polyisocyanurate insulation board is one of the most widely used types of insulation. The various products manufactured under the polyisocyanurate insulation family can be used to insulate walls and roof systems as well as used as a protective high-density cover board. I invite you to take a closer look at the remarkable process of manufacturing polyisocyanurate insulation products.
Polyisocyanurate insulation boards consist of a thermoset, closed-cell, rigid foam plastic that is manufactured in sheet form (typically 4 by 4 feet or 4 by 8 feet). Through a continuous lamination process, the liquid raw materials that make up the foam formulation are mixed, causing a rapid chemical reaction that transforms them into a rigid, thermally stable polymeric structure. This foam core is laminated between facing materials (or facers) that help determine the product’s final properties. Every step of this process is optimized based on data from research facilities and meticulously tested before large-scale production starts. Bringing it all together creates a finely tuned method to transform raw materials into useful, innovative building products.

Finished polyisocyanurate insulation board products all consist of a foam core sandwiched between two facers. The foam core is composed of closed-cell rigid polyisocyanurate foam produced through the chemical reaction of an A-side (methylene diphenyl isocyanate, or MDI) and a B-side (polyester polyol with various additives such as catalysts, surfactants and flame retardants) plus a blowing agent with low global warming potential (pentane). In preparation for production, these raw materials are delivered to a manufacturing plant via bulk shipment methods such as rail cars or large totes. The raw materials are unloaded into large tanks or totes for storage until manufacturing begins.

DID YOU KNOW?

• There are 36 U.S. and Canadian manufacturing plants that make polyisocyanurate insulation board products.
• Polyisocyanurate insulation boards offer high thermal performance per inch of thickness.
• Polyisocyanurate insulation boards often include recycled content and are recyclable through reuse.
• According to the Environmental Protection Agency, polyisocyanurate offers zero ozone depletion potential and low global warming potential.

FACER UNWIND

When production starts, rolls of facer material are loaded on the front end of the lamination line. Two rolls of material are unwound and fed toward the laminator. The material will become the top and bottom surfaces of the finished product. The three most common types of facers used to produce polyisocyanurate are:
• Glass-fiber reinforced cellulosic facer
• Coated polymer-bonded glass-fiber mat facer, which is composed of a nonwoven fibrous glass mat bonded with organic polymer binders and coated with polymer, clay or other inorganic substances
• Foil facer, which is composed of aluminum foil that may be plain, coated and/or laminated to a supporting substrate, and/or reinforcement.

COMPOUNDING

Under precise temperature control, the chemicals that form the polyl, or B-side, component of the product formulation are compounded and heated to be dispensed.
through a line to the mixing table. The isocyanate, or A-side of the product formulation, also is heated and transferred through a separate line. These proprietary mixtures give the finished properties their unique characteristics. Both lines are carefully calibrated to maintain the formulation volumes and optimal temperature that will properly initiate the chemical reaction when they are combined.

MIXING HEAD AND POUR TABLE

The A- and B-side components are mixed with the blowing agent at the mixing head under high pressure—nearly 2,000 pounds per square inch. At the pour table, the mixture is applied through the mixing head applicator and laid onto the bottom facer material. At this point, the chemical reaction begins, and the foam mixture is allowed to expand until it is brought into contact with the top facer material inside the laminator.

LAMINATOR

As it moves through the laminator, the reacting foam mixture expands and transforms into the rigid foam that will become the board’s core. The laminator also is used to control the flow of the still-soft foam and form it into the desired thickness and shape. Precise settings within the machinery determine how cells form within the foam and how the foam cures and adheres to the facer. Hydraulic presses within the laminator also can be adjusted with great accuracy to form any tapered characteristics and ensure a uniform flatness for finished polyisocyanurate insulation boards.

TRIM AND CUTTING

Once the raw materials are mixed and the chemical reaction starts, the product needs to be manufactured in a continuous process. As it exits the laminator, the sides must be trimmed for a smooth edge and the sheets cut into desired lengths of 4 or 8 feet. This task most often is accomplished by a cross-cut saw or gang saw, which cuts the boards while maintaining the production line speed.

ROBOT STACKER

The process of moving the boards through the trimming and cutting process is managed by a conveyor system that leads to the robot stacker. This is where boards are collected into organized bundles and an initial quality check is performed to discard any damaged or imperfect boards.

PACKAGING

Stacked bundles are transferred to a hooding machine where each bundle is individually wrapped with a plastic film that protects the product for warehouse storage and transport.

FOOT STATION AND WAREHOUSING

Once wrapped, product identification labels are applied to each bundle. The bundles are transferred with a forklift from the end of the line to warehouse storage. Polyisocyanurate insulation boards complete the curing process while stored in the warehouse.

QUALITY ASSURANCE AND CONTROL

In addition to the earlier visual inspection of boards on the production line, product samples are selected for various quality-assurance and quality control tests. The tests are performed against applicable standards and internal controls for physical properties such as compressive strength, dimensional stability and initial R-value. The test results are compared with internal controls and help ensure products meet the intended characteristics and applicable product standards and specifications.

Curing times can vary based on a number of factors, including the manufacturer of the product, product type and thickness as well as environmental conditions related to the manufacturing facility location and time of year or climate.

LOADING AND SHIPPING

After quality-assurance and quality control testing and storage in the warehouse, bundles are transferred to the loading dock. Bundles are loaded onto flatbed trucks and secured for transport to job sites or distribution locations.

AN EXACTING PROCESS

From raw materials to final delivery, the manufacturing process that brings polyisocyanurate insulation boards to market is data-driven and engineered to specifications that ensure consistent, high-quality products that builders, contractors, specifiers and their clients can rely on. Although it may not make as many headlines as the latest gadget or connectivity network, polyisocyanurate is teeming with high-tech innovations that make our buildings more resilient, energy-efficient and comfortable every day.

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