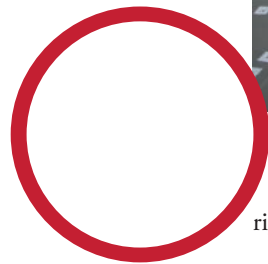


COVERING YOUR OPTIONS

Cover boards are available in a variety of sizes and materials

by Jason Wilen, AIA, CDT, RRO



Originally used to prevent blistering incidences with built-up roof (BUR) membranes, cover boards now are recognized as good roofing practice for low-slope roof systems. Cover boards are flat or tapered stock materials ranging in size from 2 by 4 feet to 4 by 12 feet with thicknesses from $\frac{1}{8}$ of an inch to 1 inch depending on material composition.

Cover boards often are used between roof membranes and rigid roof insulation in low-slope roof assemblies to enhance overall roof system performance. There are several cover board options available in the current roofing market.



BACKGROUND

On Aug. 10, 1978, NRCA issued Interim Alert Bulletin #4, “Membrane Blistering Over Foam Roof Insulation,” in response to blistering incidences on BUR membranes. The bulletin noted using hot bitumen over some polyurethane and composite polyurethane roof insulations created degassing and vapor release, resulting in a blistered roof, and recommended the following: “Over the top surface of the polyurethane insulation, install a thin layer of wood fiberboard, perlite board or glass fiber board insulation, staggering the joints from the layer below, and then apply the roof membrane as specified by the designer.”

On March 1, 1979, NRCA released Bulletin #7 and incorporated using cover boards to mitigate blistering of BUR roof membranes. Bulletin #7 indicated NRCA and the Roof Insulation Committee of the Thermal Insulation Manufacturers Association (RIC/TIMA) agreed on an in-depth study of in-service BUR systems’ insulation performance. Although they acknowledged other installation methods may be satisfactory, NRCA and RIC/TIMA reaffirmed using a cover board will mitigate

potential BUR membrane blistering as noted in Bulletin #4. Bulletin #7 also noted installing a base roofing ply as an additional measure would allow for venting.

In July 1981, NRCA issued Bulletin #9, “NRCA-RIC/TIMA Joint Statement on Blistering,” superseding Bulletin #7. Bulletin #9 stated roof membrane blistering between polyurethane insulation’s top facers and BUR membranes continued to be a concern for the roofing industry and the optional procedures for installing BUR membranes over polyurethane insulation outlined in Bulletin #7 were shown to be effective. To minimize potential for blister formation between polyurethane insulation’s top facer sheet and hot-applied BUR membranes, the most common installation at that time, the NRCA and RIC/TIMA joint bulletin recommended one of the following procedures:

- “1. Over the top surface of polyurethane insulation, a thin layer of wood fiber board insulation, perlite board insulation or glass fiber board insulation should be installed, staggering the joints from the layer below. The BUR membrane should then be applied as specified by the designer.

2. Over the top surface of polyurethane insulation, a venting type base ply should be installed in such a way as to allow for venting. The balance of the BUR membrane should then be applied as specified by the designer.”

In September 1988, NRCA revised Bulletin #9. The revised Bulletin #9 recommended using a cover board to minimize problems related to a range of issues. Based on field and laboratory tests conducted by NRCA and the Midwest Roofing Contractors Association (MRCA), the document states: “In order to minimize potential blister formation between the top facer sheet of insulation and the BUR membrane, minimize localized crushing of the insulation and minimize facer delamination, NRCA recommends the following procedure be followed:

Over the top surface of polyisocyanurate, polyurethane, or phenolic foam insulation, a thin layer of wood fiber board insulation, perlite board insulation or glass fiber board insulation should be installed, staggering the joints from the layer below. The BUR membrane should then be applied as specified by the designer.”

By 2000, polyisocyanurate insulation became the most popular rigid insulation used for low-slope roof assemblies. Around this time, NRCA received a significant number of reports of problems associated with polyisocyanurate roof insulation, including:

- Facer-sheet delamination
- Edge cavitation
- Cupping or bowing
- Shrinkage
- Crushing or powdering

In response, in March 2000, NRCA issued Bulletin 2000-3, “Use of Cover Boards Over Polyisocyanurate Roof Insulation,” and expanded its recommendations for using cover boards in low-slope roof assemblies. Although the bulletin acknowledged a majority of roof assemblies with polyisocyanurate roof insulation performed successfully, Bulletin 2000-3 stated: “NRCA has previously recommended the use of cover boards over polyisocyanurate insulation where hot-applied bituminous membranes are installed. ... NRCA is now expanding its recommendation for the use of cover boards to include all other low-slope membrane roof assemblies, including thermoset and thermoplastic single-ply roof assemblies in ballasted, mechanically attached and fully adhered configurations.”

As noted in the bulletin, using cover boards over polyisocyanurate roof insulation is intended to help reduce

problems directly related to the polyisocyanurate roof insulation manufacturing process or as a result of other causes.

Also in the bulletin, NRCA expressed concerns with shortcomings in the U.S. material standard for polyisocyanurate roof insulation, ASTM C1289, “Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board,” and problems with polyisocyanurate roof insulation reported in the field. Given these concerns, NRCA recommended “designers should consider the characteristics of the specific roof assembly and take into account the cover board’s compatibility with the assembly.”

As noted in the bulletin, using a suitable cover board over polyisocyanurate roof insulation in low-slope roof assemblies provides the following:

- It separates the membrane from the polyisocyanurate insulation, reducing the possible effects of facer-sheet delamination, edge cavitation, cupping or bowing, shrinkage and crushing, or powdering of the polyisocyanurate insulation.
- It allows for installation of the insulation board layers with staggered board joints, a practice known to reduce stress on the membrane and improve a roof assembly’s overall thermal performance.
- It may be required to achieve a fire-resistance classification for a roof assembly.

NRCA continues to recommend a suitable cover board be used over polyisocyanurate roof insulation in hot-applied BUR and polymer-modified bitumen roof assemblies. Although polyisocyanurate remains the most common low-slope roof insulation type used in the U.S., roof assemblies using other rigid roof insulation types also may benefit from using a suitable cover board over low-slope roof membrane assemblies. NRCA also recommends using a suitable cover board over rigid plastic foam insulation, such as extruded polystyrene or expanded polystyrene, before roof membrane installation.

Generally, using appropriate cover boards with a roof system, regardless of roof membrane type, should be considered. Additional benefits of using cover boards include:

- Increased roof membrane impact and puncture resistance
- Compatibility when membrane and primary insulation incompatibility is possible, such as PVC membrane and polystyrene insulation
- Protection when ballasting operations or construction traffic may damage low-density primary insulation

- A thermal break when installed between a roof membrane and primary insulation installed with fasteners
- A separation layer between an existing roof system and a new roof system in a re-cover situation

Roof membrane manufacturers typically do not require a cover board on every roof system type, but it is common for cover boards to be included in roof systems with mid-term and longer-term roofing warranty periods or for roof systems with potential compatibility issues. Consulting roof membrane manufacturers' technical staff is advised when selecting a suitable cover board, especially for complex assemblies or re-cover projects.

COVER BOARD TYPES

Common cover board types used with low-slope roof assemblies include:

- Wood fiberboard
- Perlite
- Glass-mat-faced gypsum
- Fiber-reinforced gypsum
- Mineral fiber
- High-density polyisocyanurate
- Cement
- Asphalt core

WOOD FIBERBOARD

The U.S. product standard for wood fiberboard roof insulation is ASTM C208, "Standard Specification for Cellulosic Fiber Insulating Board." There are six types of cellulosic-fiber insulating boards addressed by ASTM C208. Type II is listed in the standard as the roof insulation board for use in various roof systems. ASTM C208 Type II further divides products into Grades 1 and 2.

Grade 1 is listed in ASTM C208 as "primarily for use under built-up and modified bitumen roof systems." Grade 1 products are less dense and have lower tensile strength compared with Grade 2 products. Wood fiberboard cover board products advertised as being manufactured to meet ASTM C208, Type II, Grade 1 include Georgia-Pacific Gypsum LLC's Commercial Roof Fiberboard (regular density) and International Bildrite Inc.'s Regular Density Grade 1 Roof Board.

Grade 2 is listed in ASTM C208 as "primarily for use under single-ply, built-up and modified bitumen roof systems." Grade 2 products generally are unprimed, denser

and have higher tensile strength compared with Grade 1 products. Wood fiberboard cover board products advertised as being manufactured to meet ASTM C208, Type II, Grade 2 include Blue Ridge Fiberboard Inc.'s Celotex Structodek® High Density Roofing Board; Firestone Building Products' FiberTop; GAF's EnergyGuard® High Density Fiberboard; GenFlex Roofing Systems LLC's Wood Fiber Roof Insulation; Georgia-Pacific's Commercial Roof Fiberboard (high density); International Bildrite's High Density Grade 2 Roof Rite; Siplast®'s High Density Fiberboard; and Versico Roofing Systems' Recovery Board.

Wood fiberboard is combustible, so contact with direct flames and high temperatures such as those produced by torches should be avoided. Also, the product is not considered to be moisture-resistant, so compatibility with water-based adhesives may be a concern. Wood fiberboard cover boards generally are available in a range of sizes from 2 by 4 feet, 4 by 4 feet or 4 by 8 feet and ½ of an inch or 1 inch thick.

PERLITE

The U.S. product standard for perlite board insulation is ASTM C728, "Standard Specification for Perlite Thermal Insulation Board." Products are divided into Types 1, 2 and 3.

Type 1 is listed in ASTM C728 as "Roof Insulation Board—A perlite based roof insulation cover board." Type 1 products typically are manufactured in ¾- or 1-inch-thick layers and laminated to achieve boards with thicknesses greater than 1 inch. Of the three types, Type 1 products have the lowest water absorption by volume but are less dense and have a lower compressive and tensile strength than Type 2 or 3 products. A perlite cover board product advertised as being manufactured to meet ASTM C728, Type 1 is Johns Manville's Fesco® Board.

ASTM C728 lists Type 2 as a "Roof cover or Recover Board—This is used primarily as a field-applied cover board over other roof insulations or in reroofing applications." Type 2 products are ½-inch-thick and have higher water absorption by volume than Type 1 products but are denser and have higher compressive and tensile strength than Type 1 products but not as high as Type 3 products. Perlite cover board products advertised as being manufactured to meet ASTM C728, Type 2 include Johns Manville's Fesco Board HD and Retro-Fit™ Board.

Beginning with its 2013 revision, Type 3 was added to ASTM C728. Type 3 is listed as "Roof Cover or Recover Board—A perlite based cover board that is field applied

over other roof insulations or in re-roofing and recover applications.” Type 3 products are ½-inch-thick and have the same water absorption by volume as Type 2 products (more than Type 1 products) but are denser and have higher compressive and tensile strength than Type 1 and 2 products. Perlite cover board products advertised as being manufactured to meet ASTM C728, Type 3 include Johns Manville’s RetroPlus™ Roof Board.

Perlite cover boards are not considered to be moisture-resistant, especially Type 2 and 3 products, so they are not compatible with water-based adhesives. Unlike wood fiberboard, perlite cover boards are considered noncombustible. Perlite cover boards typically are available in 2 by 4 feet or 4 by 4 feet and ½ of an inch, ¾ of an inch or 1 inch thick.

GLASS-MAT-FACED GYPSUM

The U.S. product standard for glass-mat-faced gypsum cover boards is ASTM C1177, “Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.” Glass-mat gypsum substrate and glass-mat gypsum substrate, Type X (special fire-resistant) are addressed by ASTM C1177. Both types of glass-mat-faced gypsum boards are used in roofing applications.

The standard states glass-mat-faced gypsum substrate, Type X (special fire-resistant) designates ASTM C1177-compliant glass-mat-faced gypsum substrates provide no less than a one-hour fire-resistance rating for substrates ⅝ of an inch thick or a ¾-hour fire-resistance rating for substrates ½ of an inch thick when tested as part of an assembly as specified in the standard.

Glass-mat-faced gypsum cover board products advertised as being manufactured to meet ASTM C1177, Type X (special fire-resistant) include CertainTeed Corp.’s GlasRoc® Roof Board; Georgia-Pacific’s DensDeck® Fireguard® Roof Board, DensDeck Prime Fireguard Roof Board and DensDeck DuraGuard Fireguard Roof Board; and USG Corp.’s SECUROCK® Glass-Mat Roof Board.

Products advertised as being manufactured to meet ASTM C1177 requirements but not Type X (special fire-resistant) include Georgia-Pacific’s DensDeck Roof Board, DensDeck Prime Roof Board and DensDeck DuraGuard Roof Board.

All glass-mat-faced gypsum board types are noncombustible and inherently fire-resistant as a result of gypsum calcination. NRCA is concerned with the potential for blister formation when applying hot- and torch-applied roof membranes directly over gypsum board substrates,

including glass-mat-faced gypsum boards. NRCA also is concerned about situations where high in-service membrane surface temperatures may cause calcination and facer-sheet delamination in adhered glass-mat-faced gypsum board products used directly beneath roof membranes. In situations where relatively high in-service membrane surface temperatures may be experienced, such as dark-colored membranes in southern climates, roof surfaces that experience reflected sunlight and adhered photovoltaic installations, roof system designers should be cautious when considering using glass-mat-faced gypsum cover boards.

Glass-mat-faced gypsum cover boards generally are available in sizes 4 by 4 feet or 4 by 8 feet and are ¼ of an inch, ½ of an inch or ⅝ of an inch thick.

FIBER-REINFORCED GYPSUM

The U.S. product standard for fiber-reinforced gypsum is ASTM C1278, “Standard Specification for Fiber-Reinforced Gypsum Panel.” Interior fiber-reinforced gypsum panels; water-resistant fiber-reinforced gypsum backing panels; exterior fiber-reinforced gypsum soffit panels; water-resistant exterior fiber-reinforced gypsum sheathing panels; interior fiber-reinforced gypsum underlayment panels; and fiber-reinforced gypsum roof board panels all are addressed by ASTM C1278. For roofing applications, fiber-reinforced gypsum roof board panels, Type X (special fire-resistant) generally are used.

The standard states fiber-reinforced gypsum panels, Type X (special fire-resistant) designates ASTM C1278-compliant fiber-reinforced gypsum panels provide no less than a one-hour fire-resistance rating for panels ⅝ of an inch thick or a ¾-hour fire-resistance rating for panels ½ of an inch thick when tested as part of an assembly as specified in the standard. A fiber-reinforced gypsum cover board advertised as being manufactured to meet ASTM C1278, Type X (special fire-resistant) is USG’s SECUROCK Gypsum-Fiber Roof Board.

Fiber-reinforced gypsum boards are noncombustible and inherently are fire-resistant as a result of gypsum calcination. Also, fiber-reinforced gypsum boards are susceptible to thermal expansion, so manufacturers’ instructions typically advise a minimum ⅛-inch-thick gap be provided between all edges in a typical installation. Other factors such as a large roof area or installation during temperatures below 50 F may require a wider gap be provided.

Fiber-reinforced gypsum cover boards typically

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Information about cover board types and their uses with common insulation materials and roof membranes is provided in *The NRCA Roofing Manual: Membrane Roof Systems—2011*, which is available at shop.nrca.net.

are available in sizes 4 by 4 feet or 4 by 8 feet and $\frac{1}{4}$ of an inch, $\frac{3}{8}$ of an inch, $\frac{1}{2}$ of an inch or $\frac{5}{8}$ of an inch thick.

MINERAL FIBER

Mineral fiber cover boards are manufactured as rigid high-density boards. Some mineral fiber cover board products are impregnated with a surface layer of bitumen and typically are used with compatible torch- or mop-applied roof coverings.

The U.S. product standard for mineral fiber insulation used in roofing applications is ASTM C726, "Standard Specification for Mineral Fiber Roof Insulation Boards." Mineral fiber cover board products advertised as being manufactured to meet ASTM C726 include ROXUL® Inc.'s MONOBOARD® and MONOBOARD Plus.

Mineral fiber cover boards are noncombustible and typically are 4 by 4 feet and 1 inch thick.

HIGH-DENSITY POLYISOCYANURATE

Beginning with its 2012 revision, ASTM C1289, "Standard Specification for Faced Rigid Board Cellular Polyisocyanurate Thermal Insulation," which is the U.S. standard applicable to conventional faced polyisocyanurate insulation, provides material specification requirements for high-density polyisocyanurate board insulation, classified as Type II, Class 4, and is described as "faced with coated or uncoated polymer-bonded glass fiber mat facers on both major surfaces of the core foam." ASTM C1289 also lists three grades for Type II, Class 4 products, Grades 1, 2 and 3, indicating varying compressive strength minimums.

Type II, Class 4, Grade 1 products have a minimum polyisocyanurate foam core compressive strength of 80 psi. High-density polyisocyanurate cover board products advertised as being manufactured to meet ASTM C1289 Type II, Class 4, Grade 1 include Atlas Roofing Corp.'s ACFoam®-HS CoverBoard; Carlisle Syntec Systems' SecurShield™ HD Plus; GAF's EnergyGuard HD Plus; and Hunter Panels' H-Shield HD Composite CG.

Type II, Class 4, Grade 2 products have a minimum polyisocyanurate foam core compressive strength of 110 psi. A high-density polyisocyanurate cover board product advertised as being manufactured to meet ASTM C1289 Type II, Class 4, Grade 2 is Firestone Building Products' ISOGARD™ HD Cover Board.

Type II, Class 4, Grade 3 products have a minimum

polyisocyanurate foam core compressive strength of 140 psi. A high-density polyisocyanurate cover board product advertised as being manufactured to meet ASTM C1289 Type II, Class 4, Grade 3 is Johns Manville's Invinsa® Roof Board.

High-density polyisocyanurate cover boards are combustible and should not be exposed to direct flame or high temperatures. The product typically is available in sizes 4 by 4 feet or 4 by 8 feet and $\frac{1}{4}$ of an inch or $\frac{3}{8}$ of an inch thick.

CEMENT

Cement cover boards are a newer cover board product type. The U.S. product standard for concrete cover boards is ASTM C1325, "Standard Specification for Non-asbestos Fiber-mat Reinforced Cementitious Backer Units." The standard divides products into Types A and B. Only Type A is used for roofing applications.

Cement cover boards classified as Type A are intended for exterior applications as substrates for cladding materials or as an unfinished substrate for decoration such as natural stone, tile or coatings. Cement cover board products advertised as being manufactured to meet ASTM C1325 include National Gypsum Co.'s DEXcell™ Brand Cement Roof Board and USG's SECUROCK Cement Roof Board.

Cement cover boards are susceptible to thermal expansion, so manufacturers' instructions typically advise gaps between boards when used in long, uninterrupted runs. Cement roof cover boards are noncombustible and typically are 4 by 8 feet and $\frac{1}{2}$ of an inch or $\frac{7}{16}$ of an inch thick.

ASPHALT CORE

Asphalt-core cover boards are semirigid, relatively thin multi-ply panels constructed of a core of water-insoluble mineral filler with bituminous binder sandwiched between two reinforcing facings. The panel core commonly is composed of crushed limestone and air-blown asphalt binder or modified asphalt binder. The reinforcing facings typically are fiberglass mats.

In the U.S., asphalt-core cover boards previously have been marketed for use with waterproofing systems and now also are being marketed as roof cover boards for use with asphalt-based roof systems. These products are touted as having excellent fire- and moisture-resistance. Currently, there is no recognized U.S. product

standard for asphalt-core board products for roofing use. Asphalt-core cover boards advertised as roof cover boards include HAL Industries Inc.'s Perma-Board, IKO Roofing Products' Protectoboard and Soprema® Inc.'s SOPRABOARD.

Asphalt-core roof cover boards are available in sizes 4 by 4 feet, 4 by 5 feet or 4 by 8 feet and 1/8 of an inch or 1/4 of an inch thick.

COVER BOARD SELECTION

Specific cover board selection should be based upon a number of factors, including the roof membrane type and installation method.

For BUR and polymer-modified bitumen roof systems, wood fiberboard and perlite cover boards have been traditional choices and used successfully for decades for hot-applied and cold-process roof systems. NRCA does not recommend wood fiberboard for torch-applied polymer-modified bitumen because of its combustibility, but it works well with hot mop-applied and cold-process systems. Perlite is noncombustible, so it is appropriate for torch-applied, hot mop-applied and cold-process roof systems.

Asphalt-core cover boards and mineral fiber cover boards with an impregnated surface layer of bitumen are potential options and are marketed as compatible with torch-applied polymer-modified bitumen roof systems, as well as hot mop-applied and cold-process BUR. Asphalt-core and mineral fiber cover boards also are marketed as moisture-resistant. These attributes are appealing; however, as with any newer product type, it is possible unforeseen issues will arise as these products are more widely used. Also, there is no recognized U.S. product standard for asphalt-core boards for roofing use, so comparing competing products is difficult.

Glass-mat-faced and fiber-reinforced gypsum cover boards are promoted for use with hot-applied bitumen systems; however, NRCA does not recommend their use in hot-applied systems because of concerns with blistering and facer delamination.

For cold-process BUR and polymer-modified bitumen roof systems, glass-mat-faced and fiber-reinforced gypsum cover boards are a reasonable option because of their fire- and moisture-resistance and relatively high compressive strength. Cement cover boards offer similar advantages. Fiber-reinforced gypsum and concrete cover boards require joint spacing between installed boards

in some situations to accommodate thermal expansion, so coordination with the cover board manufacturer and roof system designer is advised to determine gap spacing requirements.

For single-ply membrane roof systems, cover boards also may be used to increase roof system impact and puncture resistance; protect the typically lower-density high R-value primary roof insulation below; and when there are potential compatibility issues between the roof membrane or adhesives and substrate. Wood fiberboard, and more recently, glass-mat-faced gypsum cover boards, commonly have been used for single-ply roof systems. These products are dimensionally stable, generally compatible with mechanical and adhesive attachment systems and gypsum-based cover boards, and can enhance the roof assembly's fire resistance. Because wood fiberboard may be susceptible to moisture damage, using a water-based adhesive can be problematic.

Fiber-reinforced gypsum, cement, mineral fiber and high-density polyisocyanurate cover boards also are options for single-ply roof systems; all are moisture-resistant, and fiber-reinforced gypsum, cement and mineral fiber are noncombustible. Fiber-reinforced gypsum and concrete cover boards may require space between boards to accommodate thermal expansion as previously discussed. High-density polyisocyanurate cover boards primarily are used because they are relatively lightweight and compatible with most single-ply roof membrane adhesives.

FINAL THOUGHTS

As NRCA's history of technical bulletins demonstrates, using cover boards with low-slope roof membranes is good roofing practice. Before selecting a cover board, it's important to review a roof membrane manufacturer's literature or consult with its technical staff. Roof membrane manufacturers test roof assemblies for wind uplift and fire classification based on the entirety of the components within the assembly, including cover boards.

Also, extended warranty terms often depend on using a cover board beneath the roof membrane. Attachment method options, required fire-resistance classification, wind-uplift resistance and warranty terms are important considerations that should be reviewed before making a cover board selection. 🧠🔗

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