

A Consultant's Guide To The Use of Siliconized Gypsum-Based Roof Boards

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FITTING WITHIN THE BROAD CATEGORY OF roof utility boards such as wood fiberboard, perlite board, and gypsum wallboard is a relatively new product known generically as glass mat gypsum board (GMGB). This product started out in 1987 as a weatherable gypsum-based sheathing board. Contractors and specifiers started incorporating this sheathing product into roofing applications as a replacement for gypsum wallboard. As a result, in 1988 the manufacturers made a version of the sheathing product produced and packaged specifically as a roof underlayment/overlayment board.

This product has become widely used in a broad array of roofing applications. Initially manufactured in only 1/2" and 5/8" thicknesses, acceptance was accelerated with the introduction of a lighter weight, more economical 1/4" thickness. In 1997, over 50MM square feet of GMGB were sold specifically for roofing, and projections are that usage will increase by 50% in 1998. It is sold through existing roofing products distribution houses. The manufacturers broadly recommend the product for use with built-up, modified asphalt, single-ply, metal systems, wood shingle and shake, tile and slate, as a recover board, as an overlayment/underlayment board for plastic foams, as a thermal barrier, and for fire protection.

Because of the distribution nature of the sale of this product and because the manufacturers are not manufacturers of roofing systems, they indicate they do not know where the majority of the product is specifically used. Further, the manufacturers state that the GMGB "is designed to act as a component of a properly designed roof system. The actual use of this product as a roofing component is the responsibility of the systems designing authority." Repeatedly, the specifier is advised to consult with the roof systems manufacturer for specific installation or use recommendations.

This paper has been provided to fill a need in providing broad technical guidance for the specifier. It is not the result of original research but is rather the result of literature review, manufacturer interviews, and a survey of the technical departments of most of the major roofing system manufacturers. As a result, recommendations are provided for the specifier for a variety of applications.

It is important to be aware of the author's basis for making these recommendations. First, one of the basic considerations for the specifier is the technical soundness of the application. The second basis for the following recommendations

is that the roof system manufacturer endorse the application. Commonly, a specifier requires that all roof system components be supplied by a single roofing system manufacturer. This is done to assure single source responsibility. This is not possible in this case because the manufacturer of GMGB is not a roof system manufacturer and very few reseller agreements have been entered. However, it is possible that the roof system manufacturer specifically include this product in their system's warranty since the manufacturer of the GMGB will back warrant their product for a period of ten years to the roof system manufacturer.

TECHNICAL DESCRIPTION OF GLASS MAT GYPSUM BOARD

Glass mat gypsum board is similar to gypsum wallboard in that the core of the product is gypsum. However, the core is modified with an increase in density for strength and fire resistance. The core is also modified with silicone for increased moisture resistance. Instead of paper facings as on wallboard, this product has surfaces of non-woven glass mats for strength, moisture resistance, and adhesion characteristics. ASTM Designation C-1177-95 is the standard specification for glass mat gypsum board. It is available in 1/4", 1/2", and 5/8" thicknesses with a standard width of 4 feet and a length of 8 feet.

First of all, this is **not** an insulation product. Thermal resistance is low, ranging from 0.28 to 0.67, depending upon thickness. At 500 psi, compressive strength is high, higher than normally required for roofing applications. Due mainly to the glass facers, flexural strength is excellent, allowing flute span of 2-5/8" with 1/4" thickness, 5" with 1/2" thickness, and 8" with 5/8" thickness. As with most gypsum-based materials, fire properties are excellent. Tested by ASTM E-84, the surface burning and flame spread/smoke generation is zero.

Moisture resistance of GMGB requires greater scrutinizing. This product is specifically formulated to resist moisture penetration. *Table 1* shows moisture content at saturation of GMGB versus other roofing boards, expressed as a percent by weight as typically shown by the manufacturer. *Table 2* shows the same data, only as expressed as a percent by volume. This product has good moisture resistance, compared to porous insulations such as wood fiber or perlite or compared to gypsum wallboard. It compares poorly, however, to

Table 1

Glass Mat Gypsum Board (GMGB) Water Absorption (% By Weight, Maximum)	
GMGB	38%
1/2" Perlite Retro-fit Board	244%
3/4" Perlite	136%
HD Wood Fiberboard	181%

Table 2

Glass Mat Gypsum Board (GMGB) Water Absorption (% By Volume, Maximum)	
GMGB	32%
1/2" Perlite Retro-fit Board	47%
3/4" Perlite	26%
HD Wood Fiberboard	38%

a product such as glass mesh-faced cement board (used as tile backer, not roofing). GMGB is not waterproof, it is water resistant. Although it will not wick water like gypsum wallboard or wood fiberboard, it will become saturated if continuously left exposed to water. While wet, GMGB will lose strength, becoming vulnerable to mechanical damage. If allowed to dry prior to being damaged, GMGB will reportedly regain much of its strength and will retain its fire barrier characteristics. One BUR manufacturer reported on a roof in the South that had water trapped in the system and the GMGB was virtually gone when the roof was replaced.

The manufacturers of GMGB recommend that their product be protected from moisture during storage and that only as much product be installed as can be covered on a daily basis. This is good advice even though it is moisture resistant and will shed incidental water. Do not install where water is trapped in the system such as on a wet membrane in a recover situation.

In addition to purely technical considerations, economics are of obvious importance. Table 3 compares the approximate contractor costs for various utility boards purchased in the Georgia area. It is obvious that the introduction of 1/4" product and subsequent code approvals put GMGB in a more competitive position.

RECOMMENDED APPLICATIONS

A. THERMAL BARRIERS

The original GMGB used in sheathing was developed to replace gypsum sheathing by improving its strength and weatherability characteristics. It should be no surprise, then, that the initial use for GMGB in roofing was as a direct replacement for gypsum wallboard in roof systems requiring a thermal barrier or a heat sink. Bound water of hydration is driven out of gypsum products when exposed to fire in a

process called calcination, delaying the transfer of heat from one surface to the opposing surface. Because GMGB is manufactured to a higher density than gypsum wallboard, calcination takes slightly longer, allowing the use of thinner product. Both 1/4" thick GMGB and 1/2" gypsum wallboard have passed UL Test 1256 (Thermal Barrier). This is one application for GMGB that was universally endorsed by the roof system manufacturers surveyed.

Within hourly rated systems, under the "P" prefix in the UL Fire Resistance Directory, GMGB products have many listings as a substitution for gypsum wallboard. As a general statement, 5/8" GMGB is a type X product and can replace any generic type X gypsum board in any of the "P" constructions. In several cases, a thinner GMGB product is approved.

B. HOT APPLIED BUILT-UP ROOF AND MODIFIED BITUMEN SYSTEMS

There is a lot of confusion and hesitancy among roof system manufacturers when it comes to using GMGB in conjunction with hot applied BUR and modified bitumen systems. One area where there appears to be agreement, however, is the use of GMGB directly on the deck as a base for vapor retarders in high humidity applications. The good high humidity performance of GMGB combined with its low thermal resistance makes this a logical application. This is also true for Protected Roof Membrane (PMR) systems constructed with GMGB on steel decks. These systems benefit from the physical characteristics of GMGB during construction, and its low thermal resistance allows the roof membrane to function as a vapor retarder as well as the moisture barrier in later use.

The confusion expressed is in the area of direct mopping of hot roofing systems to the surface of GMGB. Some of the major manufacturers are currently not allowing this application, citing concerns about blistering of the membrane. There have been reported problems in this area although they are difficult to document. There are also examples cited with no problems. The concern about blistering apparently stems from frothing of hot-applied pitch or asphalt when it is mopped to the surface of GMGB. This frothing is the result of water vapor being driven out of the GMGB by the hot bitumen. When similar frothing occurs while mopping on concrete or other substrates such as perlite board, the

Table 3

Comparative Utility Board Prices Roof Level - Atlanta, GA	
1/2" Oriented Strand Board (OSB)	\$25.25/sq
1/2" High Density Wood Fiberboard	13.00/sq
3/4" Perlite Board	18.25/sq
1/2" Gypsum Wallboard	20.25/sq
5/8" Gypsum Wallboard	22.75/sq
1/4" GMGB	19.20/sq
5/8" GMGB	37.00/sq

Table 4

Fully-Adhered Membrane Systems Fastener Density Requirements - GMGB (Fasteners Per 4' X 8' Board) ¹		
1/4" GMGB Used As Overlayment		
EPDM & Thermoplastic	60 psf = 16/Bd	90 psf = 18/Bd
BUR & Multi-ply Mod. Bit.	60 psf = 11/Bd	90 psf = 16/Bd
1/4" GMGB Used As Underlayment²		
EPDM & Thermoplastic	60 psf = 16/Bd	90 psf = 18/Bd
BUR & Multi-ply Mod. Bit.	60 psf = 11/Bd	90 psf = 16/Bd
1/2" & 5/8" GMGB Used As Overlayment		
EPDM & Thermoplastic	60 psf = 16/Bd	90psf=Not tested
BUR & Multi-ply Mod. Bit.	60 psf = 16/Bd	90 psf = 16/Bd
1/4", 1/2" & 5/8" Used As Overlayment/Underlayment Under Mechanically-Attached Sheet Membrane³		
Sheet Membranes	60 psf = 4/Bd	90 psf = 4/Bd
1. Fastening requirements based on tests conducted by FMRC. For 60 psf ratings, multiply fasteners per 4' x 8' board by 1.5 on roof corners and for 90 psf, multiply by 1.5 at roof perimeters. 2. 1/4" underlayment not tested because 1/2" or 5/8" GMGB is required for FM Class I. When 1/4" GMGB is used as underlayment in non-Class I assemblies, overlayment fastening pattern is advised. 3. Assumes membrane is mechanically fastened through insulation and GMGB to deck.		

presence of this moisture often leads to subsequent blisters. In the case of GMGB, the moisture evidenced by frothing may or may not lead to blistering, since the porosity of GMGB may allow the water vapor to be driven down rather than causing blisters. Regardless, roof system manufacturers are typically hesitant to endorse direct application of hot bitumen to GMGB, leaving the specifier vulnerable. At a minimum, the specifier should obtain approval from the hot-applied system manufacturer and specific inclusion in the warranty prior to specifying direct hot application on GMGB. I also anticipate further studies in this area to clarify the question of blistering.

In those instances when direct application is used, the roof system manufacturers generally recommend priming the GMGB surface prior to application. Although the manufacturers of GMGB have run tests indicating that taping of GMGB joints over polystyrene foam insulation is not necessary, roof system manufacturers who approve this application require taping of the joints. Perhaps most disconcerting was the response of one bituminous roof system manufacturer that they would consider direct application of hot systems depending on the specifier, the applicator, and the competitive situation. Not a comforting response.

C. TORCH OR MODIFIED BITUMEN SYSTEMS

There is less concern about torching to the surface of GMGB than direct mopping. No examples of blistering of torch-applied modified systems were cited. Where accepted, the manufacturers expressed the logic that even though surface temperatures are high during the torching process, there is not the same mass of hot materials as experienced in mop-in systems. The acceptance of this application by the roof system manufacturers is not universal, however, with some manufacturers taking a wait-and-see attitude. Two manufacturers stated they approve direct application of torch-on systems but only if two or more plies were installed. They would not torch-on single-ply systems.

Some manufacturers approve the use of GMGB as a recover board for torch-on systems. Where covering a stone-surfaced BUR system, though, they require a minimum thickness of 1/2", citing concern for breakage of thinner product. The GMGB manufacturers go a step further, stating that the existing membrane shall be free of debris and swept "smooth."

D. SINGLE-PLY SYSTEMS

The acceptance and even desire to use GMGB is much greater in the single-ply arena. The biggest driving force for the use of GMGB with single-ply systems is the ability to obtain Class A fire ratings over combustible decks, either used as an overlayment or underlayment. The use of GMGB on plywood decks in the West is very popular. EPDM manufacturers claim that they can obtain a Class A rating over a fully-adhered standard sheet using GMGB overlayment.

Sheet membrane manufacturers like the smooth rigid surface for a base for their membrane. Direct adhesion for applicable adhered systems is approved, although at least one manufacturer claimed that additional adhesive is required due to porosity of GMGB. Welded and adhered seams are reportedly easier over a rigid substrate such as GMGB. It is recognized that the fastener plates are not recessed into the GMGB, but difficulties have not been experienced because of the use of galvanized plates with provisions for recessed screw heads.

As a recover board for those applications where additional insulation is not desired, single-ply manufacturers caution against entrapped moisture as well as cite concerns about breakage of thin product over rough surfaces. Because of previous roof system irregularities and the rigid nature of GMGB, some manufacturers stated a preference for more conforming type substrates such as isocyanurate insulation for recover applications.

With all fully-adhered single-ply and bituminous systems, it is important to properly fasten GMGB to the deck using approved fasteners or adhesives. GMGB is a rigid, strong board, but fastener density requirements depend upon GMGB thickness and required wind resistance. See Table 4

for typical fastener density and layout.

E. MISCELLANEOUS ROOFING APPLICATIONS

In addition to the above mainstream applications, there are some "niche" applications for GMGB which appear to be ideal. For example, 1/4" GMGB is gaining rapid acceptance on the West Coast as an underlayment for wood shingles and shakes, allowing treated shingles to obtain a Class A rating. The same is true with metal shingles and with more conventional metal roof systems.

GMGB is also used advantageously with spray-in-place polyurethane roof systems. In new and reroof applications, GMGB is installed on steel deck, creating an ideal flat surface for foam application. For similar reasons, GMGB is also used for a recover board over an existing BUR system.

Another niche application is the use of GMGB as a replacement for gypsum wallboard forms for the pouring of gypsum concrete decks.

RECOMMENDATIONS AND CONCLUSIONS

A. There are many ideal applications for GMGB in roofing systems. Where GMGB is installed under insulation on a deck, GMGB is generally considered part of the deck and as such is not included in the roof system warranty. However, for all fully-adhered membrane systems and in application directly under the membrane, it is advised to specify that the GMGB product be specifically included in the roof system manufacturer's warranty. The purpose in getting the manufacturer

to take a warranty position is not to obviate the design or installation oversight responsibility of the consultant but to make the approval of the roof membrane manufacturer obvious and to eliminate discussion in the event of membrane product malfunction.

- B. Because of expressed concern with blistering of hot-mopped systems, be cautious with this application. At a minimum, insist on roof system manufacturer's endorsement and warranty. Also, specify that materials are properly protected from moisture in storage and are dried-in on a daily basis.
- C. When using GMGB as a base for torch-on modified systems, prequalify your list of approved manufacturers in your specifications to ensure that the manufacturer endorses this application. As mentioned previously, insist on roof system manufacturer's inclusion of GMGB in system warranty.
- D. Although highly moisture resistant, recognize long-term moisture susceptibility and prevent entrapped moisture and water exposure during construction.
- E. Specify GMGB as a replacement for gypsum wallboard in roofing systems where applicable. The increased cost is justified by the benefits of increased durability and physical properties.

About The Author



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Owner of Roof Systems Consultants, Roswell, GA, **Gerard J. Teitsma** is a roofing and waterproofing consultant and a Registered Roof Consultant through RCI. He holds a bachelor's degree in Wood Technology and a master's in Construction Engineering from Michigan State University. Teitsma's career began at Dow Chemical, where he was responsible for development of the IRMA Roof System.

In the early 70s, Teitsma was an assistant professor in the Construction Management Dept. of the University of Nebraska, later doing research on the thermal performance of buildings in a jointly-sponsored program of Dow and the National Bureau of

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