

GP Georgia-Pacific

DensArmor Plus®

# TECHNICAL GUIDE

## INTERIOR PANELS



DensArmor Plus®  
High-Performance Interior Panel

Mold



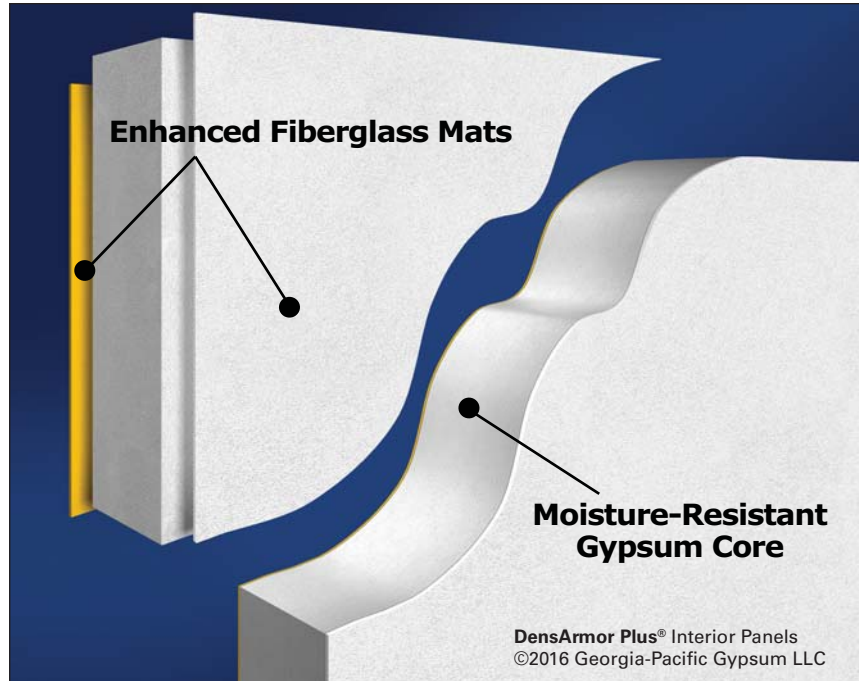
## Product Overview

### Beneficial Areas of Use

**Interiors of exterior walls,** where moisture intrusion is most likely.

**Pre-rock areas,** where the windows, doors or roof have not been installed, making moisture intrusion inevitable.

**Areas likely to be exposed to moisture,** where paper-faced moisture and mold resistant gypsum board may have been specified in the past, such as laundry rooms, bathroom walls, kitchens, basements.



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DensArmor Plus® Interior Panels have fiberglass mats for superior mold and moisture resistance compared to paper-faced drywall.

- Fiberglass mats, instead of paper facings, eliminate a potential food source for mold growth and may reduce remediation and scheduling delays associated with paper-faced drywall
- Replaces traditional paper-faced drywall
- Used in pre-rock, DensArmor Plus Interior Panels stand up to ambient moisture and incidental wettings during and after construction
- Backed with a limited warranty against delamination and deterioration for up to 12 months of exposure to normal weather conditions. For complete warranty details, visit [www.buildgp.com/warranties](http://www.buildgp.com/warranties).

DensArmor Plus Interior Panels are the first gypsum panels to be certified by UL Environment, an independent safety science company, as GREENGUARD and GREENGUARD Gold for low VOC emissions and are included in UL Environment’s Sustainable Product Guide. DensArmor Plus panels are also listed in the Collaborative for High Performance Schools® (CHPS®) High Performance Product Database as a low emitting product. CHPS is a national non-profit organization that works with school districts and their design teams to improve the quality of education by using products that have met requirements to receive CHPS credits.

DensArmor Plus Interior Panels, which feature fiberglass mats instead of the paper facings used on the surface of traditional gypsum board products, resist mold growth. When tested, as manufactured, in accordance with ASTM D3273, DensArmor Plus Interior Panels have scored a 10, the highest level of performance for mold resistance under the ASTM D3273 test method, a testing method set by ASTM International, which develops testing guidelines and procedures for building materials, products, systems and services. The score of 10, in the ASTM D3273 test, indicates no mold growth in a 4-week controlled laboratory test. In addition, the mold resistance of DensArmor Plus Interior Panels have been validated by UL Environment and listed in its Sustainable Product Guide utilizing microbial resistant testing based on ASTM Standard D6329-98. The mold resistance of any building product when used in actual job site conditions may not produce the same results as were achieved in the controlled, laboratory setting. No material can be considered mold proof. When properly used with good design, handling and construction practices, DensArmor Plus Interior Panels provide increased mold resistance compared to standard paper-faced gypsum products. For additional information, go to [www.buildgp.com/safetyinfo](http://www.buildgp.com/safetyinfo).

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### Georgia-Pacific Gypsum and Sustainability

Georgia-Pacific Gypsum's definition of sustainability is meeting the needs of society today without jeopardizing our ability to do so in the future. We are committed to using resources efficiently to provide innovative products and solutions that meet the needs of customers and society, while operating in a manner that is environmentally and socially responsible, and economically sound.

We continue to focus on:

- Improving energy efficiency at our manufacturing plants
- Seeking out opportunities to reduce water use, and to reuse water more efficiently
- Finding cost effective ways to further reduce air emissions
- Recovering and reusing materials that otherwise would end up in landfills.

Green building codes, standards and programs are establishing themselves across the country. They promote the use of products that contribute to the performance of the building, along with minimizing environmental and human health impacts over the life of the building or home. Because we embrace product performance and operate in an environmentally, socially and economically sound manner, owners and architects can feel good about the structures they build using our products.

Many of our products contribute to LEED® and other green building codes, standards or program credits or requirements. To find out more, please refer to [www.gpgypsum.com](http://www.gpgypsum.com) for recycled content, regional materials and low emitting materials information and use our on-line LEED calculator to calculate contribution for a specific credit. For general information on sustainability, visit [www.buildgp.com/sustainability](http://www.buildgp.com/sustainability).

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### Reduce Costly Remediation with Proven Fiberglass Mat Technology

The unique moisture-resistant features of DensArmor Plus Interior Panels allow builders to install interior gypsum assemblies when it's not feasible to wait until building is dried in. Paper-faced products are often damaged by wind-driven rain and moisture during installation. By building from the inside out with these moisture-resistant DensArmor Plus Interior Panels, general contractors potentially can complete projects ahead of schedule, and building owners have an opportunity to move paying occupants into the building more quickly. Not every project will realize such significant results, and cost savings will vary by project. DensArmor Plus Interior Panels are backed by a limited warranty against delamination and deterioration when exposed to normal weather conditions for up to 12 months after installation and a three-year limited warranty against manufacturing defects. For complete warranty details, visit [www.buildgp.com/warranties](http://www.buildgp.com/warranties).

## Physical Properties

Properties	1/2" (12.7 mm) DensArmor Plus®	1/2" (12.7 mm) DensArmor Plus® Fireguard C®	5/8" (15.9 mm) DensArmor Plus® Fireguard®	5/8" (15.9 mm) DensArmor Plus® Fireguard C®
Thickness, nominal <sup>4</sup>	1/2" (12.7 mm) ± 1/64" (0.4 mm)	1/2" (12.7 mm) ± 1/64" (0.4 mm)	5/8" (15.9 mm) ± 1/64" (0.4 mm)	5/8" (15.9 mm) ± 1/64" (0.4 mm)
Width, standard <sup>4</sup>	4' (1219 mm) ± 3/32" (2.4 mm)	4' (1219 mm) ± 3/32" (2.4 mm)	4' (1219 mm) ± 3/32" (2.4 mm)	4' (1219 mm) ± 3/32" (2.4 mm)
Length, standard <sup>4</sup>	8' (2438 mm) to 12' (3658 mm) ± 1/4" (6.4 mm)	8' (2438 mm) to 12' (3658 mm) ± 1/4" (6.4 mm)	8' (2438 mm) to 12' (3658 mm) ± 1/4" (6.4 mm)	8' (2438 mm) 12' (3658 mm) ± 1/4" (6.4 mm)
Weight <sup>1</sup> nominal, lbs./sq. ft. (Kg/m <sup>2</sup> )	2.0 (9.8)	2.0 (9.8)	2.5 (12.2)	2.4 (12.1)
Permeance, <sup>7</sup> perms (ng/Pa·s·m <sup>2</sup> )	>10 (570)	>10 (570)	>10 (570)	>10 (570)
Linear expansion with moisture change in/in %RH (mm/mm/%RH) <sup>8</sup>	6.25 x 10 <sup>-6</sup>	6.25 x 10 <sup>-6</sup>	6.25 x 10 <sup>-6</sup>	6.25 x 10 <sup>-6</sup>
Coefficient of thermal expansion in/in/°F (mm/mm/°C) <sup>9</sup>	8.5 x 10 <sup>-6</sup> (15.3 x 10 <sup>-6</sup> )	8.5 x 10 <sup>-6</sup> (15.3 x 10 <sup>-6</sup> )	8.5 x 10 <sup>-6</sup> (15.3 x 10 <sup>-6</sup> )	8.5 x 10 <sup>-6</sup> (15.3 x 10 <sup>-6</sup> )
Flexural strength, parallel, lbf. <sup>3,4</sup> (N)	≥80 (356)	≥80 (356)	≥100 (444)	≥100 (444)
Flexural strength, perpendicular, lbf. <sup>3,4</sup> (N)	≥100 (444)	≥100 (444)	≥140 (622)	≥140 (622)
R Value; <sup>2</sup> ft <sup>2</sup> ·°F·hr/BTU (m <sup>2</sup> ·K/W)	.56 (0.099)	.56 (0.099)	.67 (0.118)	.67 (0.118)
Combustibility <sup>6</sup>	Noncombustible	Noncombustible	Noncombustible	Noncombustible
Nail pull resistance, min. lbf. <sup>3,4</sup> (N)	≥80 (356)	≥80 (356)	≥90 (400)	≥90 (400)
Hardness core, edges and ends, lbf. <sup>3,4</sup> (N)	≥15 (67)	≥15 (67)	≥15 (67)	≥15 (67)
Water absorption (% of weight) <sup>3,4</sup>	<5	<5	<5	<5
Surface water absorption <sup>3,4</sup>	<1.6 grams	<1.6 grams	<1.6 grams	<1.6 grams
Surface burning characteristics (per ASTM E84 or CAN/ULC-S102): flame spread/smoke developed	0/0	0/0	0/0	0/0
Humidified deflection, inches <sup>3,4</sup>	≤2/8" (6.4 mm)	≤2/8" (6.4 mm)	≤1/8" (3 mm)	≤1/8" (3 mm)
Bending Radius <sup>5</sup>	6' (1829 mm)	6' (1829 mm)	8' (2438 mm)	8' (2438 mm)

<sup>1</sup> Represents approximate weight for design and shipping purposes. Actual weight may vary based on manufacturing location and other factors.

<sup>2</sup> Tested in accordance with ASTM C518.

<sup>3</sup> Tested in accordance with ASTM C473.

<sup>4</sup> Specified values per ASTM C1658.

<sup>5</sup> Double fasteners on ends as needed.

<sup>6</sup> As defined and tested in accordance with ASTM E136 or CAN/ULC S114.

<sup>7</sup> Tested in accordance with ASTM E96 (dry cup method).

<sup>8</sup> As stated by Gypsum Association GA-235.

<sup>9</sup> Tested in accordance with ASTM E228-85.

## Installation Instructions

DensArmor Plus® Interior Panels are installed in a similar manner to traditional paper-faced drywall. DensArmor Plus panels should be installed according to the most current versions of Gypsum Association Publication GA-216 “Application and Finishing of Gypsum Panel Products” and ASTM C840 “Standard Specification for Application and Finishing of Gypsum Board for Non-Fire Rated Construction.” For best results, abut DensArmor Plus panels against regular paper-faced drywall only at inside or outside corners to eliminate transitions in the field of a wall or ceiling. Adjust fastening tools to ensure that the fasteners are not over-driven through the face of the panel. Nails and screws should be driven with the heads slightly below the surface of the panel.

1. DensArmor Plus panels shall be installed in accordance with ASTM C840 “Standard Specification for Application and Finishing of Gypsum Board.”
2. For fire-rated installations, the installation and details shall be in conformity with those assemblies published in the Gypsum Association Fire Resistance Design Manual GA-600, UL and ULC Fire Resistance Directories. Please adhere to the most stringent fastening requirements per applicable testing.
3. Nails shall be spaced a maximum of 7” (178 mm) on center on ceilings, and a maximum of 8” (203 mm) on center for walls.
4. Screws shall be spaced not more than 12” (305 mm) on center along the framing members for ceilings and 16” (406 mm) on center for walls where the framing members are 16” (406 mm) on center. Screws shall be spaced not more than 12” (305 mm) on center along the framing members for ceilings and walls where framing members are 24” (609 mm) on center.
5. When using a combination of fasteners consisting of nails along the perimeter and screws in the field of the gypsum board, the spacing between a nail and an adjacent screw shall be not more than the spacing specified for screws.
6. Nails shall be driven with the heads slightly below the surface of the gypsum panel, avoiding damage to the face and core of the panel, such as breaking the fiberglass mat or fracturing the core. Screws shall be driven to provide screw head penetration just below the DensArmor Plus panel surface without breaking the fiberglass mat surface of the panel or stripping the framing member around the screw shank.
7. Suitable fascia and moulding shall be provided around the perimeter to protect the DensArmor Plus panels from direct exposure to water. Unless protected by metal or other water stops, the edges of the DensArmor Plus panels shall be placed not less than 1/2” (12.7 mm) away from abutting vertical surfaces. Do not allow water to pond on DensArmor Plus panels.

## Maximum Framing Spacing for Single-Ply Construction<sup>1</sup>

Single-Ply DensArmor Plus Panel Thickness, in. (mm)	Application <sup>2</sup>	Maximum Framing Members on Centers Spacing, in. (mm)
Non-Tile Applications:		
<i>Ceilings:</i> 1/2” (12.7 mm)	parallel <sup>1</sup>	16” (406 mm)
5/8” (15.9 mm)	parallel	16” (406 mm)
1/2” (12.7 mm)	perpendicular	24” (610 mm)
5/8” (15.9 mm)	perpendicular	24” (610 mm)
<i>Walls:</i> 1/2” (12.7 mm)	perpendicular or	24” (610 mm)
5/8” (15.9 mm)	parallel	24” (610 mm)
Wet Area Tile Applications <sup>3</sup> :		
<i>Ceilings:</i> 1/2” (12.7 mm)	perpendicular	12” (305 mm)
5/8” (15.9 mm)	perpendicular	16” (406 mm)
<i>Walls:</i> 1/2” (12.7 mm)	perpendicular or	16” (406 mm)
5/8” (15.9 mm)	parallel	24” (610 mm)

<sup>1</sup> DensArmor Plus panels to receive hand- or spray-applied water-based texture material; shall be applied perpendicular.

<sup>2</sup> Nails for DensArmor Plus panels applied over existing surfaces shall have a flat head and diamond point, and shall penetrate not less than 7/8” (22 mm), nor more than 1-1/4” (32 mm) into the framing member.

<sup>3</sup> When tiling on DensArmor Plus panels over steel studs, minimum 20-gauge (30 mils) steel required. For equivalent or effective gauge studs, contact steel stud manufacturer for assistance. Refer to local building codes to determine acceptability of DensArmor Plus panels in wet areas with tile.

## Ceiling Applications

***DensArmor Plus® Interior Panels are the ideal choice for both interior ceilings and exterior soffits. They meet the requirements of ASTM C 1396, Section 12.***

Moisture-resistant DensArmor Plus® Interior Panels are the ideal choice for ceiling board applications over wet areas such as residential showers and in kitchen and interior garage areas. They have tapered edges for easy finishing and resist moisture that can cause problems with traditional ceiling board, which has paper facers.

## Soffit Applications, Fastening, Framing and Finishing

Moisture-resistant DensArmor Plus Interior Panels are the ideal choice for exterior soffits, porch and lanai ceilings, and drive-under garages. They have tapered edges for easy finishing.

Where DensArmor Plus panels are used for ceilings of carports, open walk ways, porches and soffits, or eaves that are horizontal or inclined downward away from the building, the DensArmor Plus panels shall be either 1/2" (12.7 mm) or 5/8" (15.9 mm) in thickness. Framing shall be not more than 16" (406 mm) on center for 1/2" (12.7 mm) thick DensArmor Plus panels and not more than 24" (610 mm) on center for 5/8" (15.9 mm) thick DensArmor Plus® Fireguard® panels. Suitable fascia and moulding shall be provided around the perimeter to protect the DensArmor Plus panels from direct exposure to water. Unless protected by metal or other water stops, the edges of the gypsum panel shall be placed not less than 1/2" (12.7 mm) away from abutting vertical surfaces. Do not allow water to pond on DensArmor Plus panels.

### *Special Conditions for all finishing methods*

- Control joints are recommended a minimum of 30' (9144 mm) or closer as specified by the design authority.
- Protection from the elements shall be provided prior to installing DensArmor Plus panels in horizontal applications to prevent moisture from ponding or settling on top of the panel.
- Sandable setting compounds are not acceptable for use over DensArmor Plus panels in exterior soffit applications.

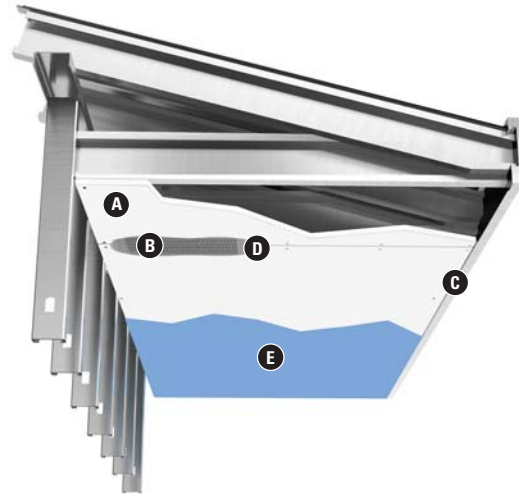
Thickness	Framing Spacing	Orientation	Screw Spacing
1/2" (12.7 mm)	16" (406 mm) o.c. max	Perpendicular	8" (203 mm) o.c. along framing
5/8" (15.9 mm)	24" (610 mm) o.c. max	Perpendicular	8" (203 mm) o.c. along framing

## Soffit Applications, Fastening, Framing and Finishing *continued*

### Finishing Method #1

1. Embed fiberglass mesh tape in setting type joint compound over all joints.
2. Prime with high quality, high build, exterior-grade primer and finish with two coats of high quality exterior-grade paint.

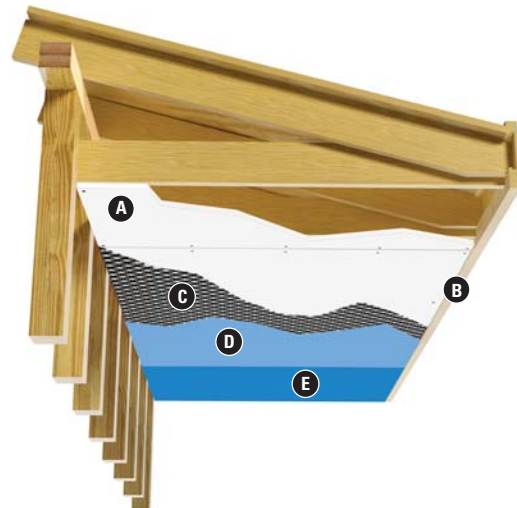
- A. DensArmor Plus® Interior Panel
- B. Reinforcing Mesh Tape
- C. Drip Edge
- D. Setting Type Joint Compound
- E. Finish Coats



### Finishing Method #2

1. Apply a synthetic-type Direct Applied Finish System in accordance with the coating manufacturer's recommendation.

- A. DensArmor Plus Panel
- B. Drip Edge
- C. Reinforcing Mesh/Base Coat
- D. Base Coat
- E. Finish Coat



### Finishing Method #3

1. Finish joints as described in method #1.
2. Apply a bonding agent to entire surface of DensArmor Plus Interior Panel.
3. Apply a 2-coat thin stucco system directly to the DensArmor Plus Interior Panel (2-coat system not to exceed 1/4" (6.4 mm) to 3/8" (10 mm) total thickness).

- A. DensArmor Plus Panel
- B. Drip Edge
- C. Reinforcing Mesh Tape
- D. Setting Type Joint Compound
- E. Bonding Agent to entire DensGlass® Sheathing surface
- F. 2 Coat Thin Stucco System not to exceed 1/4" (6.4 mm) to 3/8" (10 mm) total thickness



## Decorative Interior Wall and Ceiling Finishes

### Joint Finishing

The finishing and sanding of DensArmor Plus® Interior Panels should be performed in accordance with the most current version of Gypsum Association Publication GA-214 "Recommended Levels of Gypsum Board Finish." Joints between DensArmor Plus panels may be finished with either paper tape embedded with all-purpose joint compound or with fiberglass mesh tape and setting compound. Because of the enhanced moisture and mold resistant properties of DensArmor Plus panels, drying times for the joint and setting compounds may vary slightly. It is essential to allow each coat of compound to dry thoroughly before applying additional coats of compound. Care should be taken to ensure that all joints and fasteners are properly and adequately sanded to provide a smooth transition between the compound and the face of the panel.

### Critical (Severe) Lighting Areas and Gloss Paints

When using gloss or semi-gloss paint, or when working in a critical (severe) lighting area, always finish DensArmor Plus panels to a Level 5 finish as detailed in GA-214. Critical lighting areas include but are not limited to walls and ceiling areas near windows and skylights, long hallways and atriums with large surface areas exposed to artificial and/or natural light. Refer to GA-214 for additional examples.

### Adhered Wallcoverings

Because of the enhanced moisture- and mold-resistant properties of DensArmor Plus panels, drying times for the wallcovering adhesives and primers may vary slightly. Some wallcoverings, such as an unbacked vinyl wallcovering, require a Level 5 finish as detailed in GA-214 when applied over DensArmor Plus panels. Avoid the use of wallcovering material over a Level 4 finish if the material is lightweight, contains a limited pattern, has a gloss finish or any combination of these elements is present as detailed in GA-214. Always follow wallpaper and adhesive manufacturer's installation instructions.

### Tile

Where DensArmor Plus panels are to receive adhesively applied tile, the panel can be used on walls where a minimum 20-gauge (30 mils) steel stud or wood framing should be spaced no greater than 16" (406 mm) o.c. for 1/2" (12.7 mm) or 24" (610 mm) o.c. for 5/8" (15.9 mm). For ceilings where 20-gauge (30 mils) steel stud or wood framing is spaced not more than 12" (305 mm) o.c. for 1/2" (12.7 mm) thick panels and not more than 16" o.c. (406 mm) for 5/8" (15.9 mm) thick panels. DensArmor Plus panels can be used as a tile backer board in dry areas or areas with limited moisture contact such as areas adjacent to sinks and toilets, bathroom ceilings and areas above tile in residential shower areas. **In wet areas where 2006 or later codes (IBC - International Building Codes and IRC - International Residential Codes) have been adopted, Georgia-Pacific Gypsum recommends the use of DensShield® Tile Backer, which incorporates a built-in moisture barrier in wet areas and prescriptive to language in the IBC and IRC model codes.**

### DensArmor Plus Panel Installation Instructions for Use as a Tile Substrate for Showers

Install DensArmor Plus panels on walls according to installation instructions.

Shower pan or rubber membrane must be adequately sloped to the open drain or weep-hole detail to permit proper water drainage.

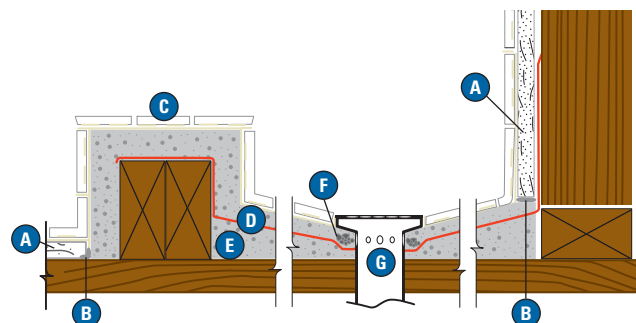
For showers with curbs, apply waterproof membrane up walls a minimum of 2" (51 mm) and maximum 4" (102 mm) above curb height. Do not use DensArmor Plus panels in the curb.

For showers without curbs, apply waterproof membrane up walls a minimum of 6" (152 mm) and maximum 8" (203 mm).

Wood or other satisfactory blocking should be applied at the bottom framing to support the vertical sides of the shower pan or membrane and DensArmor Plus panels.

**Do not place DensArmor Plus panels into a conventional shower pan mortar bed. Leave minimum 1/8" (3 mm) gap and fill with flexible sealant.**

- A. DensArmor Plus panels
- B. Flexible sealant into min. 1/8" (3 mm) gap
- C. Tiles
- D. Sloped rubber membrane
- E. Sloped mortar bed
- F. Crushed stone
- G. Drain with weep holes





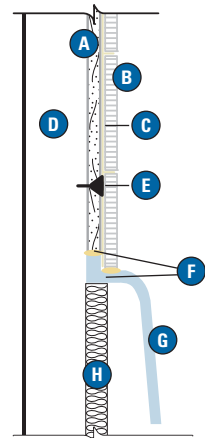
### DensArmor Plus® Installation Instructions for Use as a Tile Substrate Above Bath Tubs

Apply DensArmor Plus panels either horizontally or vertically on walls as described above.

To prevent water penetration, completely fill the space between tile and tub with a flexible sealant.

To compensate for the tub flange, some contractors add a furring strip to the framing members.

This enables them to hang the DensArmor Plus panels within 1/8" (3 mm) from the top of the tub.



- A. DensArmor Plus panels
- B. Tiles
- C. Tile adhesive (latex polymer modified portland cement mortar or organic adhesive)
- D. Wood or minimum 20-gauge (30 mils) metal studs
- E. Fastener
- F. Flexible sealant into min. 1/8" (3 mm) gap
- G. Bathtub
- H. Fireproofing and/or air barrier when required (by other trades)

## Priming and Painting

A mock up or test wall should be used to ensure the proposed decorative finish will produce an acceptable result. Proper installation, finishing and priming are critical. Skipping a step, such as the application of a primer, or taking shortcuts, such as not using proper sanding techniques, will negatively impact the quality of the final decorative finish.

**Because many factors that are unrelated to the manufacture of the panels can affect the acceptability of the final finish result, Georgia-Pacific Gypsum makes no warranty, express or implied, regarding the finish results to be achieved with DensArmor Plus panels.**

The following guidelines for priming DensArmor Plus Interior Panels have been developed by the Rohm & Haas Paint Quality Institute:

1. A high solids primer with at least 40% volume solids should be used. The primer can best be applied by roller at a higher film thickness in one coat vs. brush or spray applied.
2. For adequate coverage, the primer should be applied to a dry film thickness of 1.7 mils (0.043 mm) to 1.8 mils (0.046 mm) dry to ensure uniform coverage and appearance. The number of coats to achieve the dry film thickness will depend on the primer used. For instance, a primer with lower than 37% volume solids may need two coats for adequate coverage.

% Volume Solids of Primer	Spread Rate, square feet/gallon (m <sup>2</sup> /L)
37	330-350 (8.4-8.6)
40	355-380 (8.7-9.3)
43	380-400 (9.3-9.8)
47	420-450 (10.3-11)

3. For best results, apply the high solids primer with a 3/8" (10 mm) nap roller at a natural application rate.
4. It is possible to use a 1/2" (12.7 mm) nap roller and apply a thicker coat. However, the roller pattern is more pronounced and some may find it objectionable.
5. To maximize the mold-resistant benefit of DensArmor Plus panels, a 100% acrylic primer with mildeicide should be used.
6. High-quality flat or satin paint should be applied over the primer.
7. Level 5 finish should be utilized for semi-gloss or gloss paints, per GA-214.

If critical lighting cannot be avoided, the effects can be minimized by skim coating the gypsum board surfaces, by decorating the surface with medium to heavy textures, or by the use of draperies and blinds which soften shadows. In general, paints with sheen levels of gloss, semi-gloss, or eggshell, and enamel and dark paint finishes highlight surface imperfections, per GA-214.

Please contact the paint or build surfacer manufacturer for products they would recommend to meet the above referenced priming requirements.

## Fire- and Sound-Rated Assemblies

DensArmor Plus® Fireguard® and DensArmor Plus® Fireguard C® interior panels are UL and ULC certified as **Type DAP** and **Type DAPC**, respectively, and are included in numerous assembly designs investigated by UL and ULC for hourly fire resistance ratings.

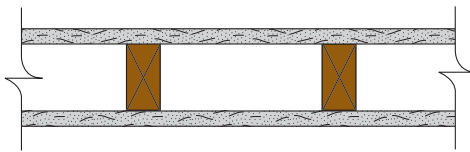
In addition, DensArmor Plus Fireguard and DensArmor Plus Fireguard C interior panels are certified as "Type X" in accordance with ASTM C1658 and may be used in generic fire-rated assemblies where Type X gypsum board (as defined in ASTM C1658) is required. Generic systems in the GA-600 Fire Resistance Design Manual are applicable to the products of any manufacturer, including Georgia-Pacific Gypsum, provided they meet certain standards set forth in such manual, such as Type X gypsum board per applicable ASTM standard with specified thickness and size described in the design. "Type X" as used in this technical guide designates gypsum board manufactured and tested in accordance with specific ASTM standards for increased fire resistance beyond regular gypsum board. Please consult the ASTM standard for the specific product (for example, ASTM C1658 for glass mat gypsum panels) for further information and significance of use.

**Proprietary GA-600 Designs:** Assemblies listed as proprietary in the GA-600 Fire Resistance Design Manual only list one product per manufacturer and may not include all products referenced in the illustrations below. Please consult the specified UL, ULC, cUL or other fire listing or test for a complete list of approved products.

**The following design assemblies are for illustrative purposes only. Consult the appropriate fire resistance directory or test report for complete assembly information. For additional fire safety information concerning DensArmor Plus panels, visit [www.buildgp.com/safetyinfo](http://www.buildgp.com/safetyinfo).**

### 1-Hour Fire Rating

Design Reference: UL U305, UL U309, ULC W301<sup>1</sup>, cUL U305, GA WP 3605



### 30-34 STC Sound Trans.

Test Reference: OR 64-8

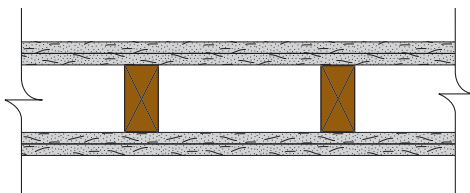
Partition Thickness: 4-7/8" (124 mm)

Weight per Sq. Ft.: 7.0 psf (34 Kg/m<sup>2</sup>)

5/8" (15.9 mm) DensArmor Plus® Fireguard® or DensArmor Plus® Fireguard C® panel applied vertically or horizontally (W301<sup>1</sup> vertical only) to each side of 2" x 4" (51 mm x 102 mm) wood studs 16" (406.4 mm) o.c. with 1-7/8" (48 mm) 6d coated nails spaced 7" (178 mm) o.c. Joints staggered. (UL U309, studs 24" (610 mm) o.c.)

### 2-Hour Fire Rating

Design Reference: UL U301, cUL U301



### 40-44 STC Sound Trans.

Test Reference: NGC-2363

Partition Thickness: 6-1/8" (156 mm)

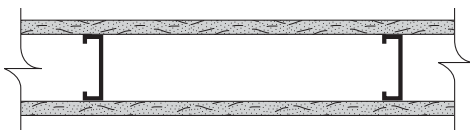
Weight per Sq. Ft.: 12.0 psf (59 Kg/m<sup>2</sup>)

Base Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard or DensArmor Plus Fireguard C panel applied vertically or horizontally to each side of 2" x 4" (51 mm x 102 mm) wood studs 16" (406 mm) o.c. with 1-7/8" (48 mm) 6d coated nails 6" (152 mm) o.c.

Face Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard panel applied vertically or horizontally to studs over base layer with 2-3/8" (60 mm) 8d coated nails 8" (203 mm) o.c. Stagger joints 16" (406 mm) o.c. each layer and side.

### 1-Hour Fire Rating

Design Reference: UL U465, ULC W415<sup>1</sup>, cUL U465, GA WP 1081



### 45-48 STC Sound Trans.

Test Reference: RAL TL99-103

Partition Thickness: 4-7/8" (124 mm)

Weight per Sq. Ft.: 5.0 psf (24 Kg/m<sup>2</sup>)

**Sound Tested** with 3" (76 mm) fiberglass insulation, friction fit in cavity

5/8" (15.9 mm) DensArmor Plus Fireguard or DensArmor Plus Fireguard C panel applied vertically (UL U465, ULC W415, GA WP 1081) or horizontally (UL U465) to each side of 3-5/8" (92 mm) steel studs 24" (610 mm) o.c. with 1" (25 mm) Type S drywall screws 8" (203 mm) o.c. at edges and 12" (304.8 mm) o.c. at intermediate studs.

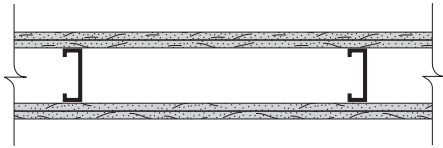
### Important Notes:

- DensArmor Plus Fireguard:** For certain proprietary ULC assemblies identified above, DensArmor Plus® Fireguard C® (**Type DAPC**) interior panels have not been approved by ULC for listing in such assemblies as of the date of this publication in lieu of DensArmor Plus® Fireguard® (**Type DAP**) interior panels. Please check with ULC for current information.

## Fire- and Sound-Rated Assemblies *continued*

### 2-Hour Fire Rating

Design Reference: ULC W414, GA WP 1546



### 50-54 STC Sound Trans.

Test Reference: NRCC 798-NV  
Partition Thickness: 4-1/2" (114 mm)  
Weight per Sq. Ft.: 9.0 psf (44 Kg/m<sup>2</sup>)

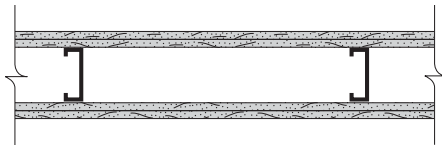
**Sound Tested** with 2-1/2" (64 mm) fiberglass insulation stapled in stud space

Base Layer: 1/2" (12.7 mm) ToughRock Fireguard C® gypsum board or 1/2" (12.7 mm) DensArmor Plus® Fireguard C® gypsum panels applied vertically to each side of 2-1/2" (64 mm) steel studs 24" (610 mm) o.c. with 1" (25 mm) Type S drywall screws 24" (610 mm) o.c.

Face Layer: 1/2" (12.7 mm) ToughRock Fireguard C gypsum board or 1/2" (12.7 mm) DensArmor Plus Fireguard C gypsum panels applied vertically to each side with 1-5/8" (41 mm) Type S drywall screws 12" (305 mm) o.c. Joints staggered 24" (610 mm) each layer and side.

### 2-Hour Fire Rating

Design Reference: ULC W414, GA WP 1546



### 50-54 STC Sound Trans.

Test Reference: NRCC 798-NV  
Partition Thickness: 4-1/2" (114.3 mm)  
Weight per Sq. Ft.: 9.0 psf (44 Kg/m<sup>2</sup>)

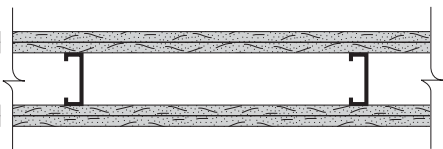
**Sound Tested** with 2-1/2" (64 mm) fiberglass insulation stapled in stud space

Base Layer: 1/2" (12.7 mm) DensArmor Plus Fireguard C panel applied vertically to each side of 2-1/2" (63 mm) steel studs 24" (610 mm) o.c. with 1" (25 mm) Type S drywall screws 24" (610 mm) o.c.

Face Layer: 1/2" (12.7 mm) DensArmor Plus Fireguard C panel applied vertically to each side with 1-5/8" (41 mm) Type S drywall screws 12" (305 mm) o.c. Joints staggered 24" (610 mm) each layer and side.

### 2-Hour Fire Rating

Design Reference: UL V487, ULC W482, cUL V487, GA WP 1948



Partition Thickness: 4-1/8" (105 mm)  
Weight per Sq. Ft.: 10.0 psf (49 Kg/m<sup>2</sup>)

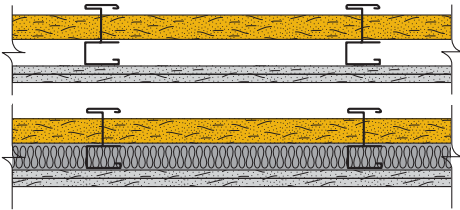
Base Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard panel applied horizontally or vertically to each side of 1-5/8" (41 mm) steel studs 24" (610 mm) o.c. with 1" (25 mm) Type S screws 12" (305 mm) o.c.

Face Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard panel applied horizontally or vertically to each side with 1-5/8" (41 mm) Type S screws 16" (406 mm) o.c. Vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Vertical joints in adjacent layers staggered one stud cavity. Horizontal joints need not be backed by steel framing. Horizontal edge joints and horizontal butt joints on opposite sides of studs need not be staggered. Horizontal edge joints and horizontal butt joints in adjacent layers staggered a min of 12" (305 mm).

## Shaftwall/Stairwell Design Summary Vertical

### 2-Hour Fire Rating

Design Reference: WHI GP/WA 120-01,  
GA WP 7054.4



### 50-54 STC Sound Trans.

Test Reference: RAL TL 09-360

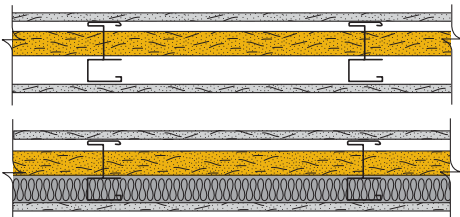
**Sound Tested** with 1-1/2" (38 mm) fiberglass insulation, friction fit in cavity  
Approx. Weight: 9.0 psf (44 Kg/m<sup>2</sup>)

Fiberglass sound insulation thickness is 1" (25 mm), 2-1/2" (64 mm) and 3-1/2" (89 mm) for C-T, C-H or I studs of 2-1/2" (64 mm), 4" (102 mm) and 6" (152 mm) respectively. Finished one side. Components: 1" (25.4 mm) DensGlass® Shaftliner panel, C-T studs and two layers of 1/2" (12.7 mm) DensArmor Plus® Fireguard C® panels installed horizontally or vertically. Edges and ends offset 24" (610 mm) o.c.

C-T, C-H or I Stud	2-1/2" (64 mm)	4" (102 mm)	6" (152 mm)
Wall Thickness	3-1/2" (89 mm)	5" (127 mm)	7" (178 mm)

### 2-Hour Fire Rating

Design Reference: WHI GP/WA 120-02.  
GA WP 7073



### 45-48 STC Sound Trans.

Test Reference: RAL TL 09-359

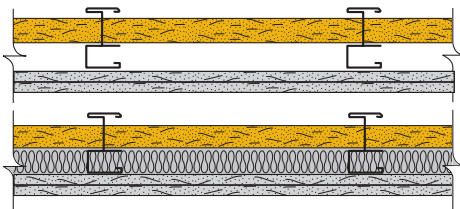
**Sound Tested** with 1-1/2" (38 mm) fiberglass insulation, friction fit in cavity  
Approx. Weight: 9.0 psf (44 Kg/m<sup>2</sup>)

Fiberglass sound insulation thickness is 1" (25 mm), 2-1/2" (64 mm) and 3-1/2" (89 mm) for C-T, C-H or I studs of 2-1/2" (64 mm), 4" (102 mm) and 6" (152 mm) respectively. Finished both sides with 1/2" (12.7 mm) DensArmor Plus Fireguard C panels installed horizontally or vertically. Edges and ends offset 24" (610 mm) o.c.

C-T, C-H or I Stud	2-1/2" (64 mm)	4" (102 mm)	6" (152 mm)
Wall Thickness	3-1/2" (89 mm)	5" (127 mm)	7" (178 mm)

### 2-Hour Fire Rating

Design Reference: UL V473, ULC W481,  
cUL V473, GA WP 7054



### 50-54 STC Sound Trans.

Test Reference: RAL TL 09-358

**Sound Tested** with 1-1/2" (38 mm) fiberglass insulation, friction fit in cavity  
Approx. Weight: 9.0 psf (44 Kg/m<sup>2</sup>)

Fiberglass sound insulation thickness is 1" (25 mm), 2-1/2" (64 mm) and 3-1/2" (89 mm) for C-T or C-H studs of 2-1/2" (64 mm), 4" (102 mm) and 6" (152 mm) respectively. Finished one side. Components: 1" (25.4 mm) DensGlass Shaftliner panel, C-T or C-H studs and two layers of 5/8" (15.9 mm) DensArmor Plus® Fireguard® or DensArmor Plus Fireguard C panels installed horizontally for base layer and vertically for face layer. Edges and ends offset 24" (610 mm) o.c.

C-T, C-H Stud	2-1/2" (64 mm)	4" (102 mm)	6" (152 mm)
Wall Thickness	3-3/4" (95 mm)	5-1/4" (133 mm)	7-1/4" (184 mm)

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## Delivery, Handling and Storage

All materials shall be delivered in original bundles bearing the brand name, if any; applicable standard designation; and name of the manufacturer or supplier for whom the product is manufactured. The plastic packaging used to wrap gypsum panel products for rail and/or truck shipment is intended to provide temporary protection from moisture exposure during transit only and is not intended to provide protection during storage after delivery. Such plastic packaging shall be removed immediately upon receipt of the shipment. **WARNING:** Failure to remove protective plastic shipping covers can result in condensation which can lead to damage, including mold.

All materials should be kept dry. Gypsum panel products shall be neatly stacked flat with care taken to prevent sagging or damage to edges, ends and surfaces. Gypsum panel products and accessories shall be properly supported on risers on a level platform, and fully protected from weather, direct sunlight exposure, and condensation. Gypsum panel products shall be stacked flat rather than on edge or end. **WARNING:** Gypsum panel products stacked on edge or end can be unstable and present a serious hazard in the workplace should they accidentally topple.

Refer to Handling Gypsum Panel Products, GA-801, for proper storage and handling requirements.

*Reference: Application and Finishing of Gypsum Panel Products, GA-216, Gypsum Association.*

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## Recommendations and Limitations for Use

The following recommendations and limitations together with the installation, handling, storage and other guidelines contained in this guide are important to ensure the proper use and benefits of DensArmor Plus® Interior Panels. Failure to strictly adhere to such recommendations and limitations may void the limited warranty provided by Georgia-Pacific Gypsum for such product. For additional warranty details, please go to [www.buildgp.com/warranties](http://www.buildgp.com/warranties).

- DensArmor Plus Interior Panels are resistant to normal weather conditions but are not intended for immersion in water. Cascading roof/floor water should be directed away from the panels.
- The use of forced air heaters creates volumes of water vapor, which, when not properly vented, can condense on building materials. The use of these heaters and any resulting damage is not the responsibility of Georgia-Pacific Gypsum. Consult heater manufacturer for proper use and ventilation. Avoid any condition that will create moisture in the air and condensation on the interior walls during periods when the exterior temperature is lower than the interior temperature.
- When using DensArmor Plus panels in a horizontal position, such as a ceiling, they should not be installed in pre-rock conditions if water can pond or settle on the panels.
- DensArmor Plus panels are not intended for roof applications. For roof applications consult our DensDeck® Roof Board brochure.
- DensArmor Plus Interior Panels are not intended for sheathing applications. For sheathing applications consult our DensGlass® Sheathing or DensElement™ Barrier System brochure.
- Georgia-Pacific Gypsum does not warrant and is not responsible or liable for the performance of any coating, finishing, covering or other materials applied over DensArmor Plus panels or any systems utilizing DensArmor Plus panels. The suitability and compatibility of any system is the responsibility of the system manufacturer or design authority.
- For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed. Openings and penetrations must be properly sealed. Failure to do so will void the warranty.
- Do not finish the panels until building has been properly closed in.
- Do not use DensArmor Plus panels as a base for nailing and mechanical fastening.

**COMMONLY USED METRIC CONVERSIONS**

**Gypsum Board Thickness**

1/4 in. – 6 mm  
 1/2 in. – 12.7 mm  
 5/8 in. – 15.9 mm  
 1 in. – 25.4 mm

**Gypsum Board Width**

2 ft. – 610 mm  
 4 ft. – 1219 mm  
 32 in. – 813 mm

**Gypsum Board Length**

4 ft. – 1219 mm  
 5 ft. – 1524 mm  
 8 ft. – 2438 mm  
 9 ft. – 2743 mm  
 10 ft. – 3048 mm  
 12 ft. – 3658 mm

**Framing Spacing**

16 in. – 406 mm  
 24 in. – 610 mm

**Fastener Spacing**

2 in. – 51 mm  
 2.5 in. – 64 mm  
 7 in. – 178 mm  
 8 in. – 203 mm  
 12 in. – 305 mm  
 16 in. – 406 mm  
 24 in. – 610 mm

**Temperature**

40°F – 5°C  
 50°F – 10°C  
 125°F – 52°C

## High-Performance Gypsum Products from Georgia-Pacific

<b>DensDeck® Roof Board</b>	Fiberglass mat roof board used as the ideal thermal barrier and cover board to improve resistance to wind uplift, hail, foot traffic, fire and mold in a broad range of commercial roofing applications. Look for DensDeck Prime and DensDeck DuraGuard Roof Boards, too.
<b>DensGlass® Sheathing</b>	The original and universal standard of exterior gypsum sheathing offers superior weather resistance, with a 12-month limited warranty against delamination or deterioration during exposure to normal weather conditions. Look for the familiar GOLD color. GREENGUARD listed for microbial resistance.
<b>DensGlass® Shaftliner</b>	These specially-designed panels are perfect for moisture-prone vertical or horizontal shafts, interior stairwells and area separation wall assemblies. 12-month limited warranty against delamination or deterioration during exposure to normal weather conditions. GREENGUARD listed for microbial resistance.
<b>DensArmor Plus® Interior Panel</b>	High-performance interior panel accelerates scheduling because it can be installed before the building is dried-in. A 12-month limited warranty against delamination or deterioration during exposure to normal weather conditions. GREENGUARD and GREENGUARD Gold certified for low VOC emissions. Listed in CHPS® High Performance Product Database as a low emitting product. GREENGUARD listed for microbial resistance.
<b>DensArmor Plus® Abuse-Resistant Interior Panel</b>	With the same benefits as the DensArmor Plus® Interior Panel, these also offer added resistance to scuffs, abrasions and surface indentations; ideal for healthcare facilities and schools. GREENGUARD and GREENGUARD Gold certified for low VOC emissions. Listed in CHPS® High Performance Product Database as a low emitting product. GREENGUARD listed for microbial resistance.
<b>DensArmor Plus® Impact-Resistant Interior Panel</b>	With even greater durability than abuse-resistant panels, these have an embedded impact-resistant mesh for the ultimate resistance in high traffic areas; ideal for healthcare facilities, schools and correctional institutions. GREENGUARD and GREENGUARD Gold certified for low VOC emissions. Listed in CHPS® High Performance Product Database as a low emitting product. GREENGUARD listed for microbial resistance.
<b>DensShield® Tile Backer</b>	Acrylic-coated tile backer stops moisture at the surface. Lightweight and strong, they are built for speed on the job site. Conforms to requirements of 2012 IBC/IRC Code. GREENGUARD listed for microbial resistance.
<b>ToughRock® Gypsum Board</b>	Paper-faced line of gypsum panels for a variety of applications including interior wall and ceiling applications, abuse-resistant boards, and panels for use in fire-rated assemblies. ToughRock products are GREENGUARD and GREENGUARD Gold certified for low VOC emissions. Listed in CHPS® High Performance Product Database as a low emitting product.
<b>ToughRock® Mold-Guard™ Gypsum Board</b>	ToughRock Mold-Guard Gypsum Board products have enhanced mold resistance in comparison to regular ToughRock® Gypsum Boards. They are GREENGUARD and GREENGUARD Gold Certified for low VOC emissions and are listed in the CHPS® High Performance Product Database as a low emitting product. The ToughRock Mold-Guard Gypsum Board is also listed as GREENGUARD microbial resistant.
<b>DensElement™ Barrier System</b>	DensElement Barrier System delivers the same advantages of DensGlass Sheathing while incorporating AquaKOR™ Technology, a water barrier system that maintains high vapor permeability mitigating the risk of moisture in the wall cavity. With this innovation built into its core, DensElement eliminates the need for additional barrier (WRB-AB) saving time, labor and materials.



### Georgia-Pacific Gypsum

U.S.A. Georgia-Pacific Gypsum LLC  
CANADA Georgia-Pacific Canada LP

#### SALES INFORMATION AND ORDER PLACEMENT

U.S.A. West: **1-800-824-7503**  
Midwest: **1-800-876-4746**  
South Central: **1-800-231-6060**  
Southeast: **1-800-327-2344**  
Northeast: **1-800-947-4497**

CANADA Canada Toll Free: **1-800-387-6823**  
Quebec Toll Free: **1-800-361-0486**

#### TECHNICAL HOTLINE

U.S.A. and Canada: **1-800-225-6119**



#### TRADEMARKS –

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#### WARRANTIES, REMEDIES AND TERMS OF SALE –

For current warranty information, please go to [www.buildgp.com/warranties](http://www.buildgp.com/warranties) and select the applicable product. All sales by Georgia-Pacific are subject to our Terms of Sale available at [www.buildgp.com/tc](http://www.buildgp.com/tc).

#### UPDATES AND CURRENT INFORMATION –

The information in this document may change without notice. Visit our website at [www.gpgypsum.com](http://www.gpgypsum.com) for updates and current information.

#### CAUTION: For product fire, safety and use information, go to [buildgp.com/safetyinfo](http://buildgp.com/safetyinfo) or call 1-800-225-6119.

#### HANDLING AND USE –

CAUTION: This product contains fiberglass facings which may cause skin irritation. Dust and fibers produced during the handling and installation of the product may cause skin, eye and respiratory tract irritation. Avoid breathing dust and minimize contact with skin and eyes. Wear long sleeve shirts, long pants and eye protection. Always maintain adequate ventilation. Use a dust mask or NIOSH/MSHA approved respirator as appropriate in dusty or poorly ventilated areas.

#### FIRE SAFETY CAUTION –

Passing a fire test in a controlled laboratory setting and/or certifying or labeling a product as having a one-hour, two-hour, or any other fire resistance or protection

rating and, therefore, as acceptable for use in certain fire rated assemblies/systems, does not mean that either a particular assembly/system incorporating the product, or any given piece of the product itself, will necessarily provide one-hour fire resistance, two-hour fire resistance, or any other specified fire resistance or protection in an actual fire. In the event of an actual fire, you should immediately take any and all actions necessary for your safety and the safety of others without regard for any fire rating of any product or assembly/system.

[www.gpgypsum.com](http://www.gpgypsum.com)