GP

Georgia-Pacific
Gypsum

Building Reputations Together™

Dens**Armor Plus**®
High-Performance Interior Panel

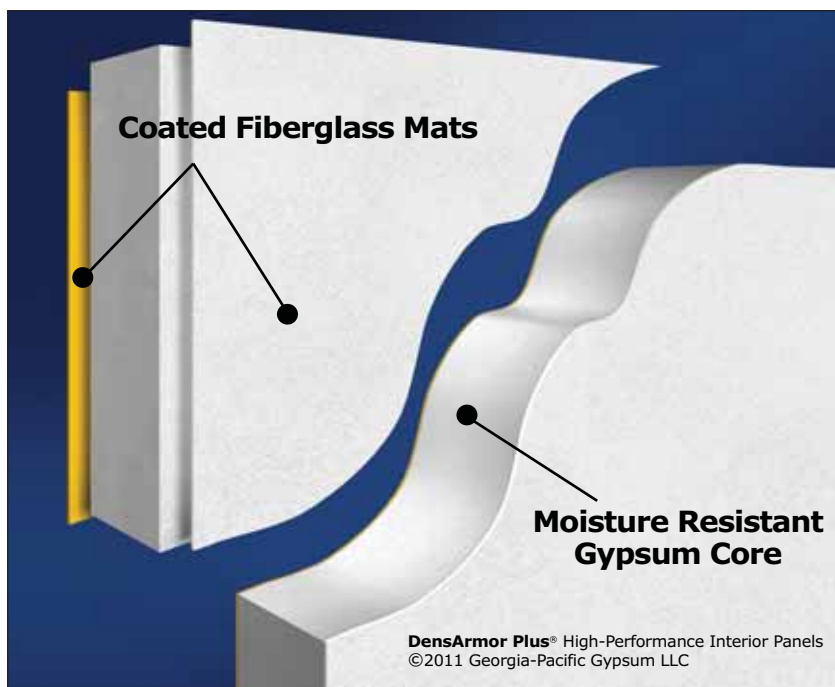# Product Overview

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 greenboard may have been specified in the past, such as laundry rooms, bathroom walls, kitchens, basements.

Coated Fiberglass Mats

Moisture Resistant Gypsum Core

DensArmor Plus® High-Performance Interior Panels
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DensArmor Plus® High-Performance 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 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.gpgypsum.com.*

When tested, as manufactured, in accordance with ASTM D 3273, DensArmor Plus® Interior Panels have scored a 10, the highest level of performance for mold resistance under the ASTM D 3273 test method. The score of 10, in the ASTM D 3273 test, indicates no mold growth in a 4-week controlled laboratory test. 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, Dens® Brand gypsum products provide increased mold resistance compared to standard paper-faced wallboard. For additional information, go to www.gp.com/safetyinfo.

DensArmor Plus Interior Panels are the first gypsum panels to be GREENGUARD Indoor Air Quality Certified® and GREENGUARD Children & Schools℠ Certified for low emissions of volatile organic compounds (VOCs) by a leading third-party organization, GREENGUARD Environmental Institute. In addition, DensArmor Plus Interior Panels are the first and only drywall listed as GREENGUARD microbial resistant. This listing means DensArmor Plus panels, which feature fiberglass mats instead of paper facings used on the surface of traditional gypsum board products, resist mold growth. The microbial resistant test is based on ASTM D 6329, a testing standard set by ASTM International, which develops testing guidelines and procedures for building materials, products, systems and services.

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 feature fiberglass mats on both the front and the back for the best in interior protection from moisture currently available. The moisture-resistant fiberglass mats make DensArmor Plus panels the ideal replacement for paper-faced greenboard. A revolutionary departure from traditional wallboard, the face of DensArmor Plus panels finishes in a similar manner to traditional wallboard and offers superior performance in resisting mold.

For years, DensGlass® Sheathing has been proven tough in commercial construction—under the most challenging weather conditions. Now the same powerful protection is working on the inside as DensArmor Plus High-Performance Interior Panels.

Integrating DensArmor Plus panels into your specifications is part of an overall building solution that can help address the mold issue and reduces the time and expense of replacing alternative products if they become wet.

Georgia-Pacific Gypsum Products and LEED®

Our definition at Georgia-Pacific of sustainability is meeting the needs of society today without jeopardizing our ability to do so in the future. The Georgia-Pacific Gypsum manufacturing process is influenced by our concern for the environment, our commitment to the responsible use of natural resources and doing the right thing.

In the coming years, we will continue to focus on:

- Improving energy efficiency at our manufacturing plants, with innovative technologies, that will also result in reduced greenhouse gas emissions.
- Opportunities to reduce water use, to reuse water more effectively.
- Finding cost effective ways to further reduce air emissions.

By using recycled materials for nearly 50 years, we have found innovative ways to recover and reuse materials that otherwise would end up in landfills. We recover and reuse wallboard that does not meet our standards and are developing beneficial applications for the very small amount of material left over at the end of each production cycle.

Green building codes, programs and standards are establishing themselves all across the country. They all promote the use of products that contribute to both the building science performance of the structure and to minimize the environmental and human health impacts of the products used in construction and over the life of the building or home. Because we are embracing sustainable practices in the manufacture of our products, architects and owners can feel good about the structures they build with our products. It is all a part of being mindful of the environment, and the social and economic impact of our products from start to finish.

Many of our products may contribute to LEED credits. To find out more, please reference the Sustainable Materials Data Sheets (SMDS) at www.gpgypsum.com for recycled content, regional materials, low emitting materials and other potential categories for LEED credit contributions. For general information on sustainability, click the "Sustainability" tab on the website.

Reduce Costly Remediation with Proven Fiberglass Mat Technology

The unique moisture-resistant features of DensArmor Plus High-Performance Interior Panels allow builders to install gypsum assemblies when it's not feasible to wait until cladding is completed. Georgia-Pacific Gypsum Dens® Brand gypsum products offer weather exposure limited warranties against damage from exposure to normal weather conditions or humidity if they are stored and installed according to instructions from the manufacturer. Paper-faced products are often damaged by wind-driven rain and moisture during installation. By building from the inside out with these moisture-resistant gypsum products, general contractors potentially can complete projects ahead of schedule, and building owners have an opportunity to generate faster cash flow by moving paying occupants in more quickly. Not every project will realize such significant results, and cost savings will vary by project. DensArmor Plus panels offer a 12-month limited warranty that guards against delamination and deterioration when exposed to normal weather conditions during and after installation and a three-year warranty against manufacturing defects. For complete warranty details, visit www.gpgypsum.com.

Architectural Specifications

Georgia-Pacific Gypsum's 3-part guide specifications are downloadable, as rewritable Microsoft® Word documents, in both CSI and ARCOM MasterSpec® formats. Please visit www.gpgypsum.com for details. Downloadable specifications are also available online from Building Systems Design, Inc. at www.bsdsoftlink.com, and ARCOM Product Masterspec at http://www.arcomnet.com/users/masterspec_sections_manufacturers.php. Georgia-Pacific Gypsum specifications and 3-D Revit® compatible models can also be generated in the Georgia-Pacific Design Studio at www.gpdesignstudio.com.

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[4]	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[4]	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[4]	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[1] nominal, lbs./sq. ft. (Kg/m^2)	2.02[1] (9.9)	2.0[1] (9.8)	2.5[1] (12.2)	2.4[1] (12.1)
Permeance,[7] Perms (ng/Pa•s•m^2)	>10 (570)	>10 (570)	>10 (570)	>10 (570)
Linear expansion with moisture change in/in %RH (mm/mm/%RH)	6.25 x 10^{-6}	6.25 x 10^{-6}	6.25 x 10^{-6}	6.25 x 10^{-6}
Coefficient of thermal expansion in/in/°F (mm/mm/°C)	8.5 x 10^{-6} (15.3 x 10^{-6})	8.5 x 10^{-6} (15.3 x 10^{-6})	8.5 x 10^{-6} (15.3 x 10^{-6})	8.5 x 10^{-6} (15.3 x 10^{-6})
Flexural strength, parallel, lbf.[3, 4] (N)	>80 (356)	>80 (356)	>100 (444)	>100 (444)
Flexural strength, perpendicular, lbf.[3, 4] (N)	>100 (444)	>100 (444)	>140 (622)	>140 (622)
R Value,[2] ft^2•°F•hr/BTU (m^2•K/W)	.56 (0.099)	.56 (0.099)	.67 (0.118)	.67 (0.118)
Combustibility[6]	Noncombustible	Noncombustible	Noncombustible	Noncombustible
Nail pull resistance, lbf.[3, 4] (N)	80 (356)	80 (356)	90 (400)	90 (400)
Hardness core, edges and ends, lbf.[3, 4] (N)	≥15 (67)	≥15 (67)	≥15 (67)	≥15 (67)
Water absorption (% of weight)[3, 4]	<5	<5	<5	<5
Surface water absorption[3, 5]	<1.6 grams	<1.6 grams	<1.6 grams	<1.6 grams
Surface burning characteristics (per ASTM E 84 or CAN/ULC-S102): flame spread/ smoke developed	0/0	0/0	0/0	0/0
Humidified deflection, inches[3,4]	2/8" (6.4 mm)	2/8" (6.4 mm)	1/8" (3 mm)	1/8" (3 mm)
Bending Radius[5]	6' (1829 mm)	6' (1829 mm)	8' (2438 mm)	8' (2438 mm)

[1] *Represents approximate weight for design and shipping purposes.*

[2] *Tested in accordance with ASTM C 518.*

[3] *Tested in accordance with ASTM C 473.*

[4] *Specified values per ASTM C 1658 and ASTM C 1177.*

[5] *Double fasteners on ends as needed.*

[6] *As defined and tested in accordance with CAN/ULC-S114 in combination with ASTM E 136.*

[7] *Tested in accordance with ASTM E 96 (dry cup method).*

Installation

DensArmor Plus® High-Performance 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 C 840 "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 C 840 "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 on walls.

4. Nails shall be driven with the heads slightly below the surface of the gypsum board, avoiding damage to the face and core of the board, such as breaking the fiberglass mat or fracturing the core.

5. 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.

6. 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.

7. 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.

8. 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 boards shall be placed not less than 1/2" (13 mm) away from abutting vertical surfaces. Do not allow water to pond on DensArmor Plus panels.

Maximum Framing Spacing for Single-Ply Construction[1]

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

[1] *DensArmor Plus panels to receive hand- or spray-applied water-based texture material, shall be applied perpendicular.*

[2] *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.*

[3] *When tiling over steel studs, minimum 20-gauge (30 mils) steel required.*

Ceiling Applications

DensArmor Plus® Interior Panels are the ideal choice for both interior ceilings and exterior soffits. They meet the requirements for CD® ceiling board.

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.

Traditional gypsum exterior ceiling board has paper facers. Paper is a potential food source for mold growth. DensArmor Plus panels have fiberglass mats on each side instead of paper and are moisture resistant.

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

Painted Ceilings and Soffits
Finished Joints

A. DensArmor Plus Interior Panel
B. 2" (51 mm) Fiberglass Mesh Tape
C. Drip Edge
D. Setting Compound*
E. Finish Coats

* Sandable setting compounds are not recommended.

Finishing Method #1

Embed 2" (51 mm) wide fiberglass mesh tape in ToughRock® 90 Setting Type joint compound, or equivalent, over all joints. Prime with high quality, high build, exterior-grade primer and finish with two coats of high quality exterior-grade paint.
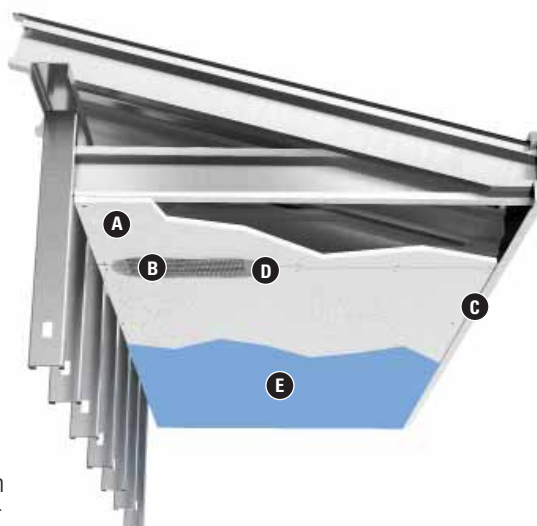
Soffit Applications, Fastening, Framing and Finishing continued

Exterior Ceilings and Soffits

A. DensArmor Plus® Panel

B. Drip Edge

C. Reinforcing Mesh/Base Coat*

D. Base Coat*

E. Finish Coat*

Finishing Method #2

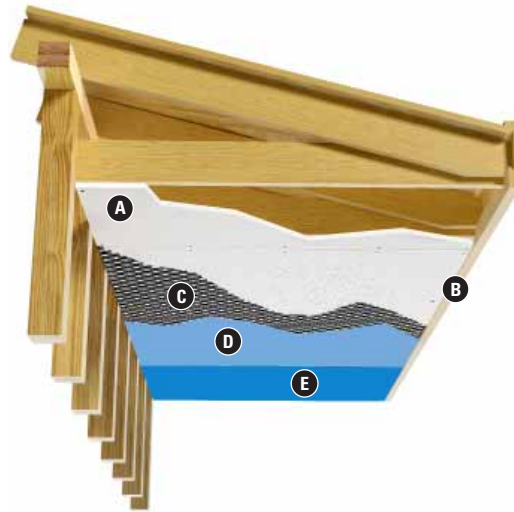* Apply a synthetic-type Direct Applied Finish System in accordance with the coating manufacturer's recommendation.

Special Conditions: (for both illustrations)

1. Control joints are recommended a minimum of 30' (9144 mm) or closer as specified by the design authority.

2. 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.

3. Sandable setting compounds are not acceptable for use over DensArmor Plus panels in exterior soffit applications.

4. Georgia-Pacific Gypsum's ToughRock® 90 setting compound is not available in all markets. It is permissible to use setting-type joint compounds from other manufacturers that are equivalent to ToughRock 90 setting compound.

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" (13 mm) away from abutting vertical surfaces. Do not allow water to pond on DensArmor Plus panels.

Decorative Finishes

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, semi-gloss or enamel 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.

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.

Decorative Finishes continued

Tile

Where DensArmor Plus® panels are to receive adhesively applied tile, the panel can be used on walls where 20-gauge (30 mils) steel or wood framing should be spaced no greater than 16″ (406 mm) o.c. for ½″ (12.7 mm) or 24″ (610 mm) o.c. for 5/8″ (15.9 mm). For ceilings where 20-gauge (30 mils) steel or wood framing is spaced not more than 12″ (305 mm) o.c. for ½″ (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 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.**

DensArmor Plus Panel Installation Instructions

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 minimum 2″ (51 mm) and maximum 4″ (102 mm) above curb. Do not use DensArmor Plus panels in the curb.

For showers without curbs, apply waterproof membrane up walls minimum 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. Weep holes
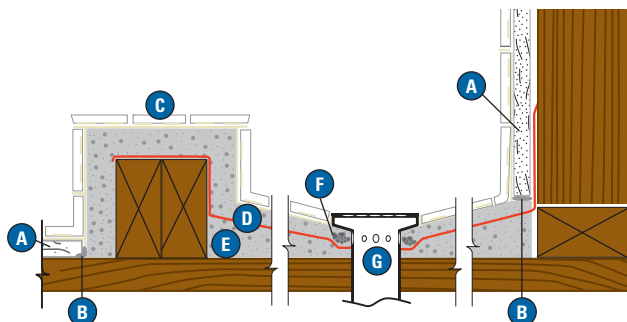
DS003 Bathtub Receptor

Apply DensArmor Plus panels either horizontally or vertically on walls as shown in DS001.

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 thinset mortar or mastic)

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 when required (by other trades)
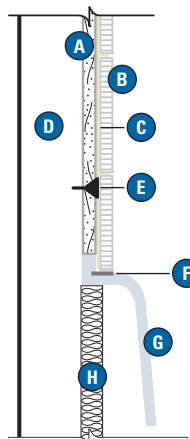
Priming and Painting

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 (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 (m²/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" (13 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 mildecide should be used.

6. High-quality flat or satin paint should be applied over the primer. Semi-gloss or gloss paints are not recommended.

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.

Primers on the market that provide best finishing results include:

a. ICI Paints Glidden® Gripper® Interior/Exterior Stain Killer Primer/Sealer GL3210-1200

b. ICI Paints Prep and Prime® Gripper MultiPurpose Interior/Exterior Water Based Primer Sealer 3210-1200

c. Pratt and Lambert Paints, SUPRIME® Interior Latex Enamel Undercoater Z1013/F1013

d. Do It Best® Interior Latex Wood & Wall Primer

e. Do It Best® Latex Stainblocker Primer

f. Sherwin Williams® Builders Solution®

Build surfacers that provide best finishing results include:

a. ICI Paints Prep and Prime Fill & Seal Equalizing Interior Water-Based Primer Sealer 1070-1200

b. Sherwin Williams® Prep Rite High Build Interior-Latex Primer Surfacer

c. Hamilton Prep Coat Plus

d. Dursystem™ Spray-Plast™ Wall and Surfacer

e. Variance® OmniCoat™ Acrylic Finishes

Note: Other paint manufacturers' primers may be acceptable. Consult paint manufacturer for additional recommendations.

Fire- and Sound-Rated Assemblies

DensArmor Plus® Fireguard® High-Performance and DensArmor Plus® Fireguard C™ interior panels are UL and ULC classified as **Type DAP** and **Type DAPC**, respectively, and 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 classified as "Type X" in accordance with ASTM C 1658 and may be used in generic fire-rated assemblies where Type X gypsum board (as defined in ASTM C 1658) 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 C 1658 for glass mat gypsum panels) for further information and significance of use.

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 DensAmor Plus panels, visit www.gp.com/safetyinfo.

1-Hour Fire Rating
Design Reference: UL U305, UL U309, ULC W301[1], GA WP 3605, cUL U305

2-Hour Fire Rating
Design Reference: UL U301, cUL U301

1-Hour Fire Rating
Design Reference: UL U465, ULC W415[1], GA WP 1081[2]

1-Hour Fire Rating
Design Reference: UL V450, GA WP 1411[2]
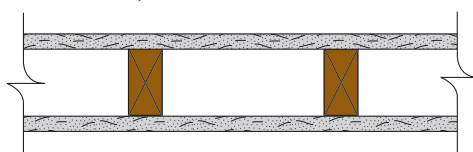
30-34 STC Sound Trans.

Test Reference: OR 64-8
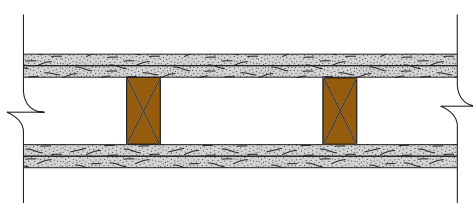Partition Thickness: 4-7/8" (124 mm)
Weight per Sq. Ft.: 7.0 (34 Kg/m²)

5/8" (15.9 mm) DensArmor Plus® Fireguard® or Fireguard C™ panel applied vertically or horizontally (W301[1] vertical only) to each side of 2 x 4 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.)
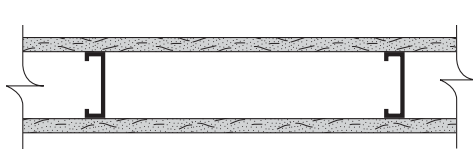
40-44 STC Sound Trans.

Test Reference: NGC-2363
Partition Thickness: 6-1/8" (156 mm)
Weight per Sq. Ft.: 12.0 (59 Kg/m²)

Base Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard or Fireguard C panel applied vertically or horizontally to each side of 2 x 4 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.

48 STC Sound Trans.

Test Reference: RAL TL99-103
Partition Thickness: 4-7/8" (124 mm)
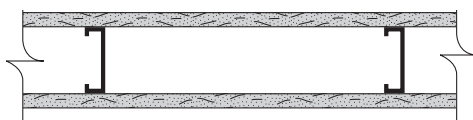Weight per Sq. Ft.: 6.0 (29 Kg/m²)

5/8" (15.9 mm) DensArmor Plus Fireguard or Fireguard C panel applied vertically (UL U465, ULC W415[1], GA WP 1081[2]) 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.

Sound Tested with 2-1/2" (64 mm) fiberglass insulation, friction fit in cavity

Partition Thickness: 4-7/8" (124 mm)
Weight per Sq. Ft.: 5.0 (24 Kg/m²)

5/8" (15.9 mm) DensArmor Plus Fireguard or Fireguard C gypsum board applied vertically to each side of 3-5/8" (92 mm) UltraSTEEL® studs 24" (610 mm) o.c. with 1" (25 mm) Type S drywall screws, 8" (203 mm) o.c. at edges and 12" (305 mm) o.c. at intermediate studs.

Important Notes:
1. ***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® High-Performance (Type DAP) interior panels. Please check with ULC for current information.*

2. ***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 above. Please consult the specified UL, cUL, ULC or other fire listing or test for a complete list of approved products.*

CAUTION: For product fire, safety and use information, go to gp.com/safetyinfo.

Fire- and Sound-Rated Assemblies continued

2-Hour Fire Rating

Design Reference: UL U411, cUL U411
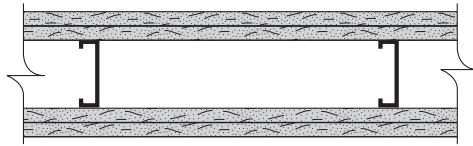
50-54 STC Sound Trans.

Test Reference: WHI 218-1
Partition Thickness: 5-1/8" (130 mm)
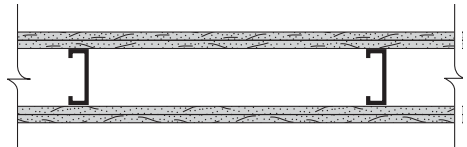Weight per Sq. Ft.: 10 (49 Kg/m²)

Base Layer: 5/8" (15.9 mm) DensArmor Plus® Fireguard® or Fireguard C™ panel applied vertically to each side of 2-1/2" (64 mm) steel studs 24" (610 mm) o.c. with 1" (25 mm) Type S screws 16" (406 mm) o.c.

Face Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard or Fireguard C panel applied vertically to each side with drywall adhesive or secured with 1-5/8" (41 mm) Type S screws 12" (305 mm) o.c. at top and bottom track, 16" (406 mm) o.c. at intermediate framing and edge joints. Stagger joints 24" (610 mm) each layer and side.

Sound Tested with 2-1/2" (64 mm) fiberglass insulation

2-Hour Fire Rating

Design Reference: UL U412, ULC W414

50-54 STC Sound Trans.

Test Reference: NRCC 798-NV
Partition Thickness: 4-1/2" (114.3 mm)
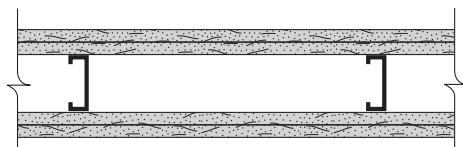Weight per Sq. Ft.: 9.0 (44 Kg/m²)
Sound Tested with 2-1/2" (64 mm) fiberglass insulation stapled in stud space

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 V450, GA WP 1944[2]
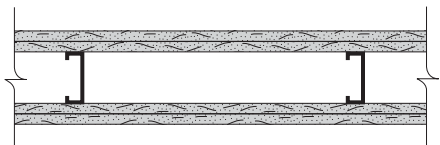
Partition Thickness: 4-1/8" (104.8 mm)
Weight per Sq. Ft.: 10 (49 Kg/m²)

Base Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard or Fireguard C panel applied horizontally to each side of 1-5/8" (41 mm) ULTRASteel® studs 24" (610 mm) o.c. with 1" (25 mm) Type S screws 24" (610 mm) o.c. with the first screw installed 1-1/4" (32 mm) from board edge and to the track.

Face Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard or Fireguard C panel applied horizontally to each side with 1-5/8" (41 mm) Type S screws spaced 16" (406 mm) o.c. with the first and second screws installed 1-1/4" (32 mm) and 8" (203 mm) from board edge, respectively and to track spaced 16" (406 mm) o.c. Horizontal joints on face layer staggered 12" (305 mm) from base layer.

2-Hour Fire Rating

Design Reference: UL V487, cUL V487

Partition Thickness: 4-1/8" (105 mm), Weight per Sq. Ft: 10 (49 kg/m²)

Base Layer: 5/8" (15.9 mm) ToughRock® Fireguard® or 5/8" (15.9 mm) DensArmor Plus Fireguard gypsum board 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) ToughRock Fireguard or 5/8" (15.9 mm) DensArmor Plus Fireguard gypsum board 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 in. (305 mm)


Important Notes:

2. **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 above. Please consult the specified UL, cUL, ULC or other fire listing or test for a complete list of approved products.

Shaftwall/Stairwell Design Summary Vertical

2-Hour Fire Rating

Design Reference: WHI GP/WA 120-01,
GA WP 7074[2]
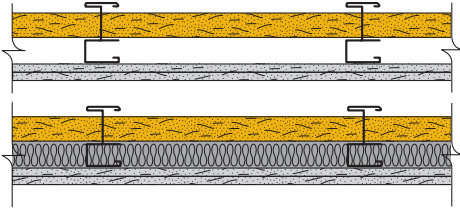
50 STC Sound Trans.

Test Reference: RAL TL 09-360
Sound Tested with 1-1/2" (38 mm) fiberglass insulation, friction fit in cavity
Approx. Weight: 9 psf (44 Kg/m²)

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™ 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[2]
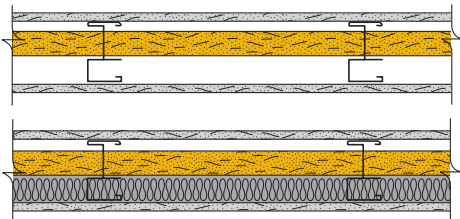
46 STC Sound Trans.

Test Reference: RAL TL 09-359
Sound Tested with 1-1/2" (38 mm) fiberglass insulation, friction fit in cavity
Approx. Weight: 9 psf (44 Kg/m²)

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 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, cUL V473
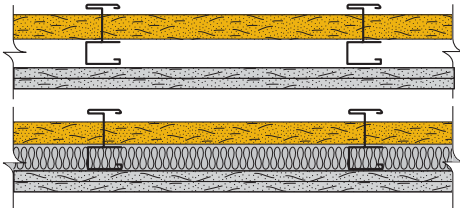
51 STC Sound Trans.

Test Reference: RAL TL 09-358
Sound Tested with 1-1/2" (38 mm) fiberglass insulation, friction fit in cavity
Approx. Weight: 9 psf (44 Kg/m²)

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 Fireguard C installed horizontally for base layer and vertically for face layer. 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	3-3/4" (95 mm)	5-1/4" (133 mm)	7-1/4" (184 mm)

Important Notes:

2. **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 above. Please consult the specified UL, cUL, ULC or other fire listing or test for a complete list of approved products.*

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-216-2010, Gypsum Association.

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® High-Performance 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 details, please go to www.gpgypsum.com and select DensArmor Plus High-Performance Interior Panels for warranty information.

- DensArmor Plus® High-Performance 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 until building has been properly closed in.

- 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 exterior 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. Do not allow water to 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 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 board 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

DensDeck® Roof Boards	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, too.
DensGlass® Sheathing	The original and universal standard of exterior gypsum sheathing offers superior weather resistance, with a 12-month weather exposure limited warranty. Look for the familiar GOLD color.
DensGlass® Shaftliner	Specially-designed panels for moisture-prone vertical or horizontal shafts, interior stairwells and area separation wall assemblies. 12-month weather exposure limited warranty. GREENGUARD listed for microbial resistance.
DensArmor Plus® High-Performance Interior Panel	High-performance interior panel accelerates scheduling because it can be installed before the building is dried-in. 12-month weather exposure limited warranty. GREENGUARD Indoor Air Quality Certified,® GREENGUARD Children & Schools℠ Certified. GREENGUARD listed for microbial resistance. Listed in CHPS® High Performance Product Database as a low emitting product.
DensArmor Plus® Abuse-Resistant Interior Panel	Same benefits as DensArmor Plus® High-Performance Interior Panel with added resistance to scuffs, abrasions and surface indentations. Ideal for healthcare facilities and schools. GREENGUARD Indoor Air Quality Certified,® GREENGUARD Children & Schools℠ Certified. GREENGUARD listed for microbial resistance. Listed in CHPS® High Performance Product Database as a low emitting product.
DensArmor Plus® Impact-Resistant Interior Panel	Even greater durability with an embedded impact-resistant mesh for the ultimate resistance in high traffic areas. Ideal for healthcare facilities, schools and correctional institutions. GREENGUARD Indoor Air Quality Certified,® GREENGUARD Children & Schools℠ Certified. GREENGUARD listed for microbial resistance. Listed in CHPS® High Performance Product Database as a low emitting product.
DensShield® Tile Backer	Acrylic-coated tile backer stops moisture at the surface. Lightweight and strong, built for speed on the job site. Conforms to requirements of IBC/IRC Code. GREENGUARD listed for microbial resistance.
ToughRock® Gypsum Boards	Paper-faced line of gypsum panels for a variety of applications including interior wall and ceiling applications, abuse-resistant boards, veneer plaster base systems, and panels for use in fire-rated assemblies. Listed in CHPS® High Performance Product Database as a low emitting product. Use Mold-Guard™ treated paper gypsum boards for enhanced mold resistance.

Some of our products have been certified by Scientific Certification Systems (SCS). SCS is an internationally recognized third-party evaluation, testing and certification organization. Its program spans a wide cross-section of the economy, including manufacturing and retailing, consumer products, the energy industry, and the home improvement and construction sectors. For details on specific Georgia-Pacific Gypsum products and plants, please contact our Technical Hotline at 1-800-225-6119.

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WARRANTIES, REMEDIES AND TERMS OF SALE –
For current warranty information for this product, please go to www.gpgypsum.com and select the product for warranty information. All sales of this product by Georgia-Pacific are subject to our Terms of Sale available at www.gpgypsum.com.

UPDATES AND CURRENT INFORMATION –
The information in this document may change without notice. Visit our website at www.gpgypsum.com for updates and current information.

CAUTION: For product fire, safety and use information, go to gp.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