



GP Georgia-Pacific

DensArmor Plus®

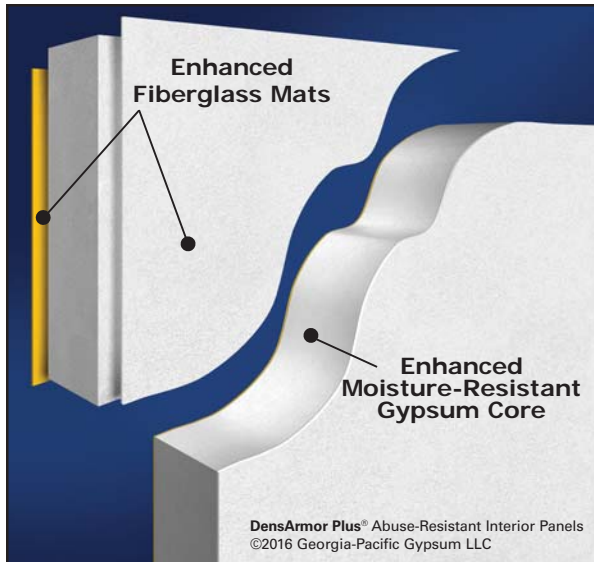
# TECHNICAL GUIDE

ABUSE-RESISTANT AND IMPACT-RESISTANT

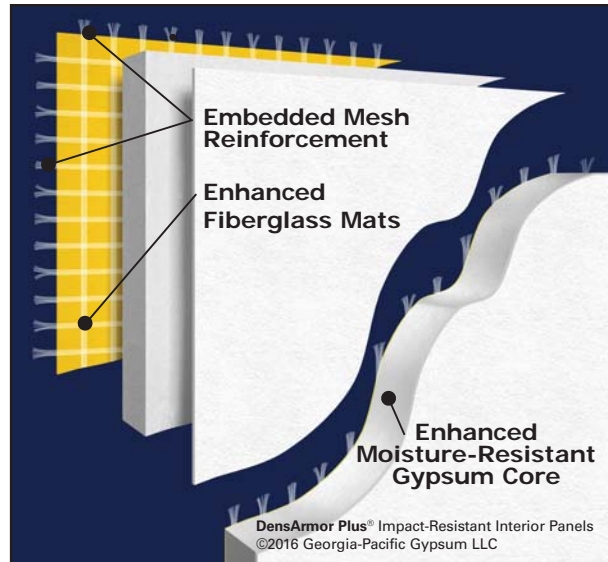


## Product Overview

**DensArmor Plus® Abuse-Resistant Interior Panel**



**DensArmor Plus® Impact-Resistant Interior Panel**



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Like DensArmor Plus® Interior Panels, DensArmor Plus® Abuse-Resistant and Impact-Resistant 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 abuse- and impact-resistant panels
- DensArmor Plus Abuse- and Impact-Resistant 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.

### 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.

DensArmor Plus Abuse-Resistant Interior Panels are perfect for hallways, dorm and hospital rooms and other high traffic areas where scuffing and abrasions may occur.



*DensArmor Plus® Impact-Resistant Interior Panels, with an embedded mesh for the ultimate performance, excel in ultra high traffic areas such as dorms and hospital corridors or secure areas such as correctional institutions.*

DensArmor Plus® Abuse-Resistant and Impact-Resistant Panels feature fiberglass mats on both sides for superior moisture protection. A revolutionary departure from traditional wallboard, the face of DensArmor Plus panels finishes in a similar manner to traditional abuse- and impact-resistant gypsum boards and offers superior performance in resisting moisture and mold growth.

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

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).

### **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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## Enhanced Construction Schedule

The unique moisture-resistant features of DensArmor Plus® Abuse-Resistant and Impact-Resistant Interior Panels allow builders to install gypsum assemblies when it's not feasible to wait until the building is dried in. Georgia-Pacific Gypsum DensArmor Plus® Interior Panels offer limited warranties against damage from exposure to normal weather conditions or humidity if they are stored and installed according to instructions. 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 move 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 limited warranty against manufacturing defects. For complete warranty details, visit [www.buildgp.com/warranties](http://www.buildgp.com/warranties).

It is very important at the beginning of the specification process to understand the types of abuse a singular structure must endure in daily operation, and in turn, specify the correct system for that application. A psychiatric hospital, designed to keep patients in, safe by themselves, and separate from each other may require different type construction than an elementary school, concerned about scuffs and dents. Both structures require durable gypsum products, but the most appropriate material should be specified. By understanding the short term requirements, long term money can be saved.

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## Abuse-Resistant vs. Impact-Resistant Interior Panels

“**High traffic**” is a relative term when it comes to any building project. Any commercial, institutional or residential building can include such a space. Regardless of the application, however, there are two types of potential damage that architects must consider when specifying a wall system for a high-traffic area:

**Abuse Resistance:** Abrasion or scuffing of the walls due to high traffic of daily operations and indentation of the wall surface; the occasional contact by humans, cleaning equipment and the gentle shoves of furniture. Generally used in high traffic areas, abuse-resistant gypsum board reduces lifecycle cost by significantly increasing the time period between periodic maintenance and improvement of the walls' appearance. Abuse resistance is an important design consideration for interior areas where a higher resistance to abrasion, indentation and impact penetration is required.

**Impact Resistance:** Damage due to continuous impact or high energy that can tear into the stud cavity. Using appropriate materials to resist damage not only contributes to long-term looks and appeal, but also decreases short term maintenance costs of repairing the dents in the wall surface, and/or the possibility of intrusion into the inside of the wall.

Georgia-Pacific DensArmor Plus Abuse-Resistant and Impact-Resistant panels provide architects with appropriate and cost-effective gypsum panel solutions that resist wall damage, while keeping design flexibility high. These materials, along with proper systems, have helped bridge the gap between design and strength.

The markets for Georgia-Pacific DensArmor Plus Abuse-Resistant and Impact-Resistant panels have grown over time. They are often placed together in one gypsum category by architects and those who specify material for a job. They are thought to be interchangeable. The truth is they are separate product lines with different applications. Because of the activities taking place inside a facility, one must specify gypsum panels for specific applications.

While abuse-resistant panels are now commonly used in hospitals, sometimes architects specify impact resistance for applications where a less expensive abuse-resistant board will do the job. If there is a concern about incidental damage, such as things or people accidentally banging into the walls, then DensArmor Plus® Fireguard® Abuse-Resistant panels are fine. The appropriate word is **accident**.

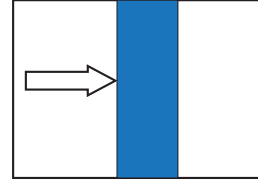
If people are purposely trying to destroy walls, such as prison inmates or patients in psychiatric wards, then DensArmor Plus Fireguard Impact-Resistant panels would be the best solution. The appropriate words are **intentional impact**.

**Industry Standards**

Another way to understand the difference between **penetration** and **surface damage** is graphically. At the most basic level, abuse resistance can be defined as the ability of a partition system to resist two primary types of wall damage.

**Surface Damage: Abrasion and Indentation**

This includes surface damage that can be caused by regular, ordinary contact with people and furniture, as well as contact with various moving objects such as a medical gurney, mail carts, vacuum cleaners and other cleaning equipment.

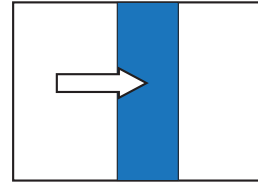


**Penetration: Both Hard-Body and Soft-Body**

Hard-Body: hard objects, machinery, tools

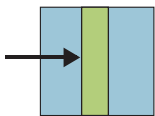

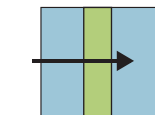
Soft-Body: human or animal

The impact of penetration through the partition into the wall cavity, causing damage that can be expensive to repair and in some instances dangerous.



**Applications and Levels**

There are three separate levels of abuse resistance to help building owners and/or design professionals determine the type and amount of durability needed for specific building applications. Each category is described below. Each category shown represents an improvement over standard interior drywall construction.

<p><b>Light Duty</b></p>	<p>For areas requiring a basic upgrade to standard drywall, with improved resistance to incidental surface and indentation damage.</p>	<p>Single-family homes Cafeterias/public areas in medical institutions Elementary school classrooms/stairwells</p>	<p><b>Incidental Damage</b></p> 
<p><b>Mild to Moderate Duty</b></p>	<p>For areas requiring a moderate resistance to incidental surface damage, indentation and penetration, damage from people and objects.</p>	<p>Middle/high school – classrooms, stairwells College lecture halls Multi-family stairways – common areas Mailrooms Shipping/receiving areas Shopping centers</p>	<p><b>Unintended Damage</b></p> 
<p><b>Extreme Duty</b></p>	<p>For areas requiring resistance to extreme levels of penetration and/or surface indentation, and damage from hard objects.</p>	<p>Court detention facilities Government/military installations Airports Sports facilities Hospital corridors Gymnasiums</p>	<p><b>Extreme Damage</b></p> 

**Testing Methods—Significance and Use**

Abuse-resistant systems are tested to ensure long-term performance in real world applications. Georgia-Pacific DensArmor Plus® Abuse-Resistant and Impact Resistant panels undergo testing to ensure that they meet exacting standards. Independent products and systems are tested in accordance with ASTM standards. ASTM International established abuse- and impact-resistance standards to measure the ability of gypsum panels to withstand surface abrasion, indentation and wall penetration.

The standard ASTM C1629, “Standard Classification for Abuse-Resistant, Non-Decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels,” is the result of an industry initiative for testing method unification.

Each abuse impact property of abuse-resistant wall panels is divided into three classification levels. The three levels of classification are: Level I, Level II and Level III.

The test methods specified are utilized to establish the abuse-resistance classification of an abuse-resistant wall panel. Each classification level requires a minimum overall specified performance. Any classified abuse-resistant wall panel can be used at a classification level which is rated lower than the highest level qualified.

It is critical to understand the ASTM testing methods, as well as the optimal usage for various enhanced gypsum wallboards; this is integral to maximizing durability, design flexibility and long-term cost efficiency of high traffic and high use areas.

## Performance Testing – Abuse-Resistance Testing Methods

To see in-house abuse and impact performance tests in action, visit [www.youtube.com/gpdens](http://www.youtube.com/gpdens).

### Surface Damage, Abrasion Resistance Modified—ASTM D4977

This test method measures the ability of a gypsum panel surface to resist scratches and scuff marks by subjecting the panel to 50 back and forth cycles with a brush. This test was intended for mineral-surfaced roofing products and was modified with additional weight for a total of 25 lbs. (11 Kg) to provide a suitable test of the abrasion resistance of wall panel products. In this test, the sample material is placed under a moving weighted wire brush. The value reported for the test reflects the number of cycles to which the partition can be exposed prior to failure. Failure is recorded as the depth of abrasion after 50 cycles.

**Interpreting Results: The board with the least amount of “rub” is the most abrasion resistant.**

### Surface Abrasion (Modified ASTM D4977)

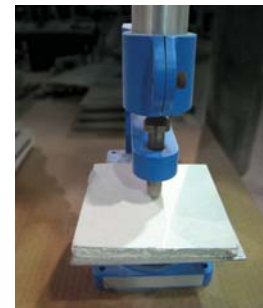


### Surface Damage, Indentation Resistance—ASTM D5420

This test method, sometimes referred to in the industry as the “Gardner Impact Test 1,” was originally used to measure the impact resistance or toughness of plastic material. This test was modified to test gypsum panels in the same manner. This test measures the ability of a gypsum panel to resist dents from small hard objects. In this test, an 8 lb. (4 Kg) weight is raised 9” (229 mm) above the material, then dropped onto a small 5/8” (15.9 mm) round die which hits the sample gypsum panel. The depth of the indentation is measured and recorded. The results are the average of three or more tests.

**Interpreting Results: The less penetration, the better.**

### Surface Indentation (ASTM D5420—Gardner Impact Test)



### Penetration Soft-Body Impact Modified—ASTM E695

This test method covers the measurement of the relative resistance of wall, floor and roof construction to impact loading. Sources of impact may include accidental impact from a human body due to pushing, shoving or falling; or moving heavy objects such as furniture. Soft-body impact resistance testing uses a 60 lb. (27 Kg) leather bag which is pulled away from the sample in 6” (150 mm) increments and released. The values reported represent the foot-pounds (joules) of energy required to produce failure of the partition.

**Interpreting Results: The higher the level recorded, the better the soft-body impact performance.**

### Single Drop Soft-Body Impact (Modified ASTM E695)



### Penetration Hard-Body Impact ASTM C1629—Annex A1

This proposed test method is as follows: samples of drywall, 24” x 24” (610 x 610 mm), are mounted on 3-5/8” (92 mm) 20-gauge\* (30 mils) steel studs, 16” (406 mm) o.c.

A 2-3/4” (70 mm) diameter steel ram is driven into the board surface. The weight is increased until failure. A new panel is used for each impact. By increasing the weight of the ram, this increases the amount of impact energy which will impede the partition assembly. This is measured in foot-pounds. Hard-body impact resistance testing uses a weighted ram which is pulled away from the sample and released. The value reported is the maximum amount of impact force required to cause penetration into the partition cavity with a single blow (defined as failure of the system).

**Interpreting Results: The higher the level, the greater the resistance to hard-body impact.**

### Hard-Body Impact (ASTM C1629 A1)



\*For effective and equivalent gauge steel studs, we have no evaluation or installation recommendations.

**DensArmor Plus® Abuse-Resistant Interior Panels Test Results—Single Layer—ASTM C1629**

Test	General Description of Test	Test Result Criteria	Product Test Result
Surface Abrasion Surface Damage ASTM D4977	A wire brush is cycled across the board surface. Failure is recorded as the depth of abrasion after 50 cycles. The lower the number the better the abrasion resistance.	1. 0.126" (3.2 mm) 2. 0.059" (1.5 mm) 3. 0.010" (.3 mm)	Level 3
Surface Indentation Surface Damage ASTM D5420	An 8 lb. (3.6 Kg) weight is raised 9" (229 mm), then dropped onto a small 5/8" (16 mm) round die which hits the sample. The value reported is the average of 3 or more tests.	Indentation Resistance 1. 0.150" (3.8 mm) 2. 0.100" (2.5 mm) 3. 0.050" (1.3 mm)	Level 1
Soft-Body Impact Penetration ASTM E695	A leather bag filled with 60 lbs. (27 Kg) of shot is released against the surface of the board at increasing height until failure.	Soft Body 1. 90 ft lbs (122 J) 2. 195 ft lbs (265 J) 3. 300 ft lbs (405 J)	Level 1

**DensArmor Plus® Impact-Resistant Interior Panels Test Results—Single Layer—ASTM C1629**

Test	General Description of Test	Test Result Criteria	Product Test Result
Surface Abrasion Surface Damage ASTM D4977	A wire brush is cycled across the board surface. Failure is recorded as the depth of abrasion after 50 cycles. The lower the number the better the abrasion resistance.	1. 0.126" (3.2 mm) 2. 0.059" (1.5 mm) 3. 0.010" (.3 mm)	Level 3
Surface Indentation Surface Damage ASTM D5420	An 8 lb. (3.6 Kg) weight is raised 9" (229 mm), then dropped onto a small 5/8" (15.9 mm) round die which hits the sample. The value reported is the average of 3 or more tests.	Indentation Resistance 1. 0.150" (3.8 mm) 2. 0.100" (2.5 mm) 3. 0.050" (1.3 mm)	Level 1
Soft-Body Impact Penetration ASTM E695	A leather bag filled with 60 lbs. (27 Kg) of shot is released against the surface of the board at increasing height until failure.	Soft Body 1. 90 ft lbs (122 J) 2. 195 ft lbs (265 J) 3. 300 ft lbs (405 J)	Level 3
Hard-Body Impact Penetration ASTM C1629	A 2-3/4" (70 mm) diameter steel ram is driven into the board surface. Weight is increased until failure.	Hard Body 1. 50 ft lbs (68 J) 2. 100 ft lbs (136 J) 3. 150 ft lbs (204 J)	Level 2

**DensArmor Plus® Fireguard® Impact-Resistant Interior Panels Test Results—Double Layer—ASTM C1629**

Base Layer: 5/8" (15.9 mm) DensArmor Plus® Fireguard® panel or 5/8" (15.9 mm) DensArmor Plus Impact-Resistant panel;  
Face Layer: 5/8" (15.9 mm) DensArmor Plus Fireguard Impact-Resistant panel

Test	General Description of Test	Test Result Criteria	Product Test Result
Surface Abrasion Surface Damage ASTM D4977	A wire brush is cycled across the board surface. Failure is recorded as the depth of abrasion after 50 cycles. The lower the number the better the abrasion resistance.	1. 0.126" (3.2 mm) 2. 0.059" (1.5 mm) 3. 0.010" (.3 mm)	Level 3
Surface Indentation Surface Damage ASTM D5420	An 8 lb. (3.6 Kg) weight is raised 9" (229 mm), then dropped onto a small 5/8" (15.9 mm) round die which hits the sample. The value reported is the average of 3 or more tests.	Indentation Resistance 1. 0.150" (3.8 mm) 2. 0.100" (2.5 mm) 3. 0.050" (1.3 mm)	Level 2
Soft-Body Impact Penetration ASTM E695	A leather bag filled with 60 lbs. (27 Kg) of shot is released against the surface of the board at increasing height until failure.	Soft Body 1. 90 ft lbs (122 J) 2. 195 ft lbs (265 J) 3. 300 ft lbs (405 J)	Level 3
Hard-Body Impact Penetration ASTM C1629	A 2-3/4" (70 mm) diameter steel ram is driven into the board surface. Weight is increased until failure.	Hard Body 1. 50 ft lbs (68 J) 2. 100 ft lbs (136 J) 3. 150 ft lbs (204 J)	Level 3

## Physical Properties

Properties	DensArmor Plus® Fireguard® Abuse-Resistant Panel	DensArmor Plus® Fireguard® Impact-Resistant Panel
Thickness, nominal	5/8" (15.9 mm) ± 1/64" (0.4 mm)	5/8" (15.9 mm) ± 1/64" (0.4 mm)
Width, standard	4' (1219 mm) ± 3/32" (2.4 mm)	4' (1219 mm) ± 3/32" (2.4 mm)
Length, standard	8' (2438 mm) to 10' (3048 mm) ± 1/4" (6.4 mm)	8' (2438 mm) to 10' (3048 mm) ± 1/4" (6.4 mm)
Weight <sup>1</sup> nominal, lbs./sq. ft. (Kg/m <sup>2</sup> )	2.8 (13.7)	3.0 (14.6)
Permeance, <sup>5</sup> perms (ng/Pa·s·m <sup>2</sup> )	>10 (570)	>10 (570)
Flexural strength, parallel, lbf. <sup>3,4</sup> (N)	≥100 (444)	≥100 (444)
Flexural strength, perpendicular, lbf. <sup>3,4</sup> (N)	≥140 (622)	≥140 (622)
R Value <sup>2</sup> ft <sup>2</sup> ·°F·hr/BTU (m <sup>2</sup> ·K/W)	.67 (0.118)	.67 (0.118)
Nail pull resistance minimum, lbf. <sup>3,4</sup> (N)	≥90 (400)	≥90 (400)
Hardness core, edges and ends, lbf. <sup>3,4</sup> (N)	≥15 (67)	≥15 (67)
Water absorption (% of weight) <sup>3,4</sup>	<5	<5
Surface water absorption <sup>3,4</sup>	<1.6 grams	<1.6 grams
Surface burning characteristics (per ASTM E84 or CAN/ULC-S102): flame spread/smoke developed	0/0	0/0
Humidified deflection, inches <sup>3,4</sup>	<1/8" (3 mm)	<1/8" (3 mm)
Combustibility <sup>5</sup>	Noncombustible	Noncombustible
Linear expansion with moisture change in/in %RH (mm/mm/%RH) <sup>7</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>8</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> )

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

<sup>6</sup> Tested in accordance with ASTM E96 (dry cup method).

<sup>7</sup> As stated by Gypsum Association GA-235.

<sup>8</sup> Tested in accordance with ASTM E228-95.



## Installation Instructions

DensArmor Plus® Abuse-Resistant and Impact-Resistant 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.” Where applicable, 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 Abuse- and Impact-Resistant panels shall be installed on a minimum of 20-gauge (30 mils) steel studs, 16” (406 mm) o.c.
2. For fire-rated installations, the installation and details shall be in conformity with the appropriate assemblies, if any, incorporating these products published in the Gypsum Association Fire Resistance Design Manual GA-600, and UL and ULC Fire Resistance Directories.
3. For best results, screw locations shall be countersunk before screw application.
4. The diameter of the screw head will determine the size of the countersink bit. Countersink should not exceed the diameter of the screw head.
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” (610 mm) on center. When fire-rated assemblies are required, follow the more stringent fastening requirement.
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 not be 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 molding 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 the abutting vertical surfaces. Do not allow water to pond on DensArmor Plus panels.
9. DensArmor Plus Abuse- and Impact-Resistant panels are engineered to have higher density gypsum cores. In addition to enhancing the necessary physical properties to meet ASTM C1629 requirements, the core also enhances the product’s nail pull resistance. As with all gypsum products, it’s important to not over drive the fastener. Breaking the mat when the screw is applied does not affect the physical performance of the fire resistance of the panel.

## Decorative 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 Abuse-Resistant and Impact-Resistant 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 1/2" (12.7 mm) or 24" (610 mm) o.c. for 5/8" (15.9 mm). The panels can be used in ceilings with 20-gauge (30 mils) steel or wood framing, 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 IBC and IRC 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 both codes.**

*\*For effective and equivalent gauge steel studs, we have no evaluation or installation recommendations. Contact steel stud manufacturer for recommendations on steel when used with a tile finish.*

## 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 Abuse-Resistant and Impact-Resistant 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 (.043 mm) to 1.8 mils (.046 mm) 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" (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 mildicide should be used.
6. High-quality flat or satin paint should be applied over the primer.
7. Level 5 finish is recommended for semi-gloss or gloss paints or in critical lighting areas, 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 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® Abuse-Resistant and Impact-Resistant interior panels are UL and ULC certified as **Type DAP** and included in numerous assembly designs investigated by UL for hourly fire resistance ratings.

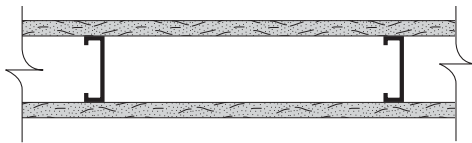
In addition, DensArmor Plus Fireguard Abuse-Resistant and Impact-Resistant interior panels are certified as “Type X” in accordance with ASTM C1658 and may be used in generic fire-rated assemblies where Type X gypsum board (as defined in ASTM C1658) is required. Generic systems in the GA-600 Fire Resistance 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 U465, ULC W415, cUL U465, GA WP 1081



### 45–49 STC Sound Trans.

Test Reference: RAL TL99-103

**Sound Tested** with 3” (76 mm) mineral fiber, 2.5 pcf (40.1 Kg/m<sup>3</sup>), in stud space.

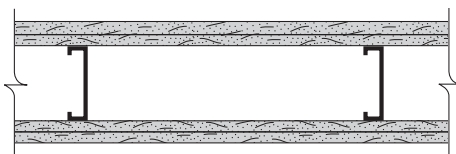
Wall Thickness: 4-7/8” (124 mm)

Weight per Sq. Ft.: 5 psf (24 Kg/m<sup>2</sup>)

Either 5/8” (15.9 mm) DensArmor Plus Fireguard® Abuse-Resistant or Impact-Resistant panel applied vertically (U465, W415, WP 1081) or horizontally (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” (305 mm) o.c. at intermediate studs.

### 2-Hour Fire Rating

Design Reference: UL U411, cUL U411, GA WP 1524



### 55-59 STC Sound Trans.

Test Reference: RAL TL09-331

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

Wall Thickness: 6-1/8” (155 mm)

Weight per Sq. Ft.: 10 psf (49 Kg/m<sup>2</sup>)

Base Layer: Any 5/8” (15.9 mm) DensArmor Plus Fireguard Interior Panel applied vertically to each side of 2-1/2” (64 mm) steel studs 24” (610 mm) o.c. with 1-1/4” (32 mm) Type S screws 16” (406 mm) o.c.

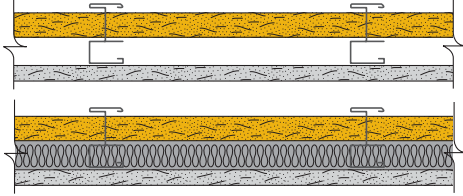
Face Layer: Either 5/8” (15.9 mm) DensArmor Plus Fireguard Abuse-Resistant or Impact-Resistant panel applied vertically to each side with drywall adhesive or secured with 1-5/8” (41 mm) Type S screws 12” (305 mm) o.c. at top and bottom track, 16” (406 mm) o.c. at intermediate framing and edge joints.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



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

### 1-Hour Fire Rating

Design Reference: UL V473, cUL V473, GA WP 6851



### 45-49 STC Sound Trans.

Test Reference: RAL TL 09-357

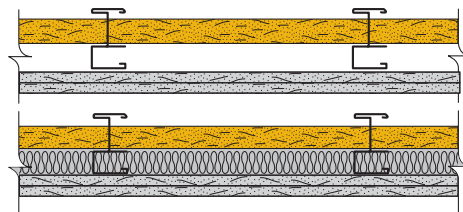
Approx. Weight: 7 psf (34 Kg/m<sup>2</sup>)

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, studs and one layer of any 5/8" (15.9 mm) DensArmor Plus® Fireguard® gypsum board installed vertically.

C-T or C-H Stud	2-1/2" (64 mm)	4" (102 mm)	6" (152 mm)
Wall Thickness	3-1/8" (75 mm)	4-5/8" (118 mm)	6-5/8" (168 mm)

### 2-Hour Fire Rating

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



### 50-54 STC Sound Trans.

Test Reference: RAL TL09-358

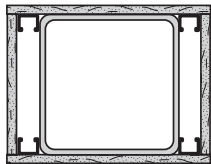
Approx. Weight: 9 psf (44 Kg/m<sup>2</sup>)

Fiberglass sound insulation thickness is 1" (25 mm), 2-1/2" (64 mm) and 3-1/2" (89 mm) for C-T and 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 studs and two layers of any 5/8" (15.9 mm) DensArmor Plus Fireguard panels installed horizontally for base layer and vertically for face layer. Edges and ends offset 24" (610 mm) o.c.

C-T or 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)

### 1-Hour Fire Rating

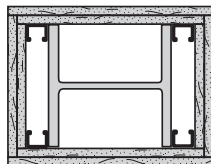
Design Reference: UL X528, cUL X528, GA CM 1851



One layer of any 5/8" (15.9 mm) DensArmor Plus Fireguard panel applied without horizontal joints and parallel to 1-5/8" (41 mm) steel studs located at each corner of TS8x8x0.250 tube steel column with 1" (25 mm) Type S drywall screws 24" (610 mm) o.c. Steel corner bead, 1-1/2" (38 mm) flanges, applied with 1" (25 mm) Type S drywall screws 12" (305 mm) o.c. in each flange. Joint compound 1/16" (2.0 mm) thick applied over corner bead.

### 2-Hour Fire Rating

Design Reference: UL X517, cUL X517, GA CM 2120



Two layers of any 5/8" (15.9 mm) DensArmor Plus Fireguard gypsum board screw-attached to 1-5/8" (41 mm) steel studs located at each corner of W10 x 49 column with 1" (25 mm) Type S screws 24" (610 mm) o.c. for base layer and 1-5/8" (41 mm) Type S drywall screws 12" (305 mm) o.c. for face layer. 1-1/4" (32 mm) steel beads at corners attached with 6d coated nails 1-3/4" (45 mm) long, 1/4" (6 mm) heads, 12" (305 mm) o.c.

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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.

*Reference: Application and Finishing of Gypsum Panel Products, GA-216, 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® Abuse-Resistant and Impact-Resistant interior panels. Failure to strictly adhere to such recommendations and limitations may void the limited warranty provided by Georgia-Pacific Gypsum for such products. For additional warranty details, please go to [www.buildgp.com/warranties](http://www.buildgp.com/warranties).

- DensArmor Plus® Impact-Resistant panels were tested in 20-gauge (30 mils) steel studs 16" o.c. Using higher gauge steel studs (thinner in thickness) or studs that are spaced greater than 16" o.c may impact published product performance.
- DensArmor Plus® Abuse-Resistant and Impact-Resistant 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.
- These panels are not intended for roof applications. For roof applications consult our DensDeck® Roof Board brochure.
- These 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 any 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.
- Do not finish the panel until building has been properly closed in.
- Do not use these panels as a base for nailing and mechanical fastening.

## 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)