

# Fire-Resistance Treatment of Structural Insulated Panels (SIPs) for Commercial Roofing Systems



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International Barrier Technology Manufactures Blazeguard® Fire-Rated Sheathing

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**BLAZEGUARD.**  
FIRE RATED SHEATHING



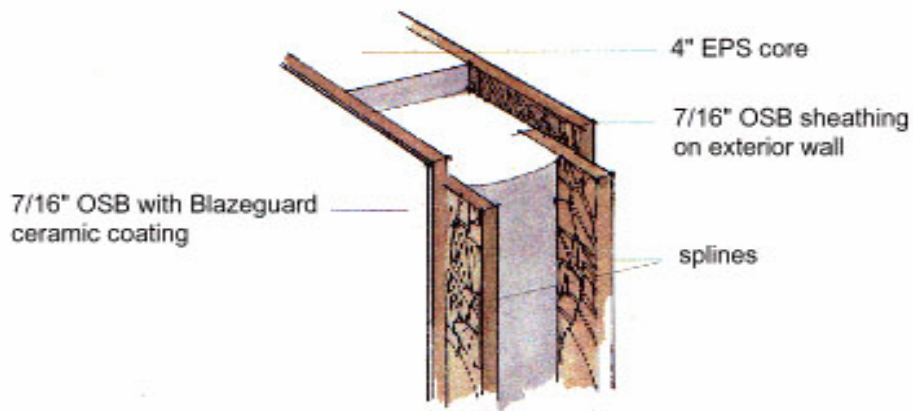
Barrier Technology is a supplier member of the Structural Insulated Panel Association (SIPA).

## Executive Summary – The Time is Right for SIPs (with Blazeguard) in Commercial Roofing

With the price of steel, other building materials and energy costs on the rise, the time is right for insulated commercial roofing systems that not only cost less to source and build, but save considerable money over time, reducing heating and cooling bills and dropping maintenance costs.

Forward-looking builders today are turning to Structural Insulated Panels (SIPs) as a way to quickly, economically and effectively build strong, durable and energy efficient roofs.

SIPs traditionally consist of two layers of sheathing bracketing a solid foam core (see diagram below). A SIP panel thus not only forms a more air-tight seal than a traditional stick-built or metal roof, it also insulates far better. Studies have shown that SIP construction can *reduce energy costs by between 25 and 50 percent per year*. Thus SIP roof construction represents significant bottom-line operating cost savings for the complete lifecycle of the building.



SIP structural panels are traditionally made utilizing oriented strand board (OSB) as structural skins. In most cases, the interior skin must be fire-treated to meet local and national building codes. Specifically, per the International Code Council (ICC), foam plastic insulation is required to have a 15-minute thermal barrier from the interior of a building (IBC Section 2603.4).

SIP panels may also be subject to fire-rated regulations from the exterior. Requirements for fire ratings from the exterior would be most common in roof decks, but may also come into play should the building be constructed in wildfire zones where limited-ignition materials are now being required by code.

There are at least three common ways to fire treat the interior face of SIP panels:

- Add ½” or thicker fire-rated (Type X) gypsum wallboard to the entire interior face.
- Apply an approved fire-retardant paint or coating in the field.
- Select SIPs built with Blazeguard Fire-Rated Sheathing.

The application of gypsum wallboard to the interior face of SIP panels (particularly in 18 to 30-foot ceilings) is labor intensive and costly. Gypsum crews must be scheduled, supervised, paid and insured. The total installed cost of applying gypsum wallboard to the interior of a SIP wall in commercial construction can be as high as \$3.00 to \$3.50 per square foot.

The use of fire-retardant paints is subject to local building code official interpretation of fire codes and fire tests. Fire-retardant paints are also only fire-rated “in the pail,” and few code officials will approve their application other than by a licensed applicator. Builders, moreover, assume the risk that a fire retardant paint applied in the field – presumably following manufacturer’s recommendations and under perfect conditions – will pass muster either with code officials or in any subsequent dispute over building, life and fire safety.

Selecting SIPs built with Blazeguard Fire-Rated Sheathing is the most economical and safest way to fire-treat SIP roof or wall construction. Barrier Technology’s Blazeguard has passed a litany of fire tests, and Blazeguard-coated SIP panels are delivered to a construction site ready for installation.

Each Blazeguard-coated SIP that arrives at the job site has been fully tested and run through quality-control procedures from ICC-certified third-party listing agencies such as Underwriters Laboratory (UL) or Intertek Labs, insuring code compliance per the International Code Council (Barrier Technology ICC-ESR 1365). Panels can simply be lifted by crane, placed into an existing roof deck and secured with splines in a one-step process.

One-step building speeds the construction process and saves considerable labor cost. SIPs crews can even “double-down” on labor and cost savings by using jumbo (8’ x 24’) SIPs. A construction crew in Ohio using Blazeguard-coated SIP jumbo panels estimated it was able to construct over 10,000 square feet of roof per day – an unheard-of number in the non-SIP roof construction world. The cost of everything from labor to the rental of overhead cranes was nearly cut in half on that job.

Architects, builders and contractors who want to build strong, safe and secure yet economical and energy efficient roofs will increasingly use Structural Insulated Panels (SIPs) in commercial roof construction. Their choice for the most code compliant, robustly tested and economical fire treatment is also clear -- Blazeguard Fire-Rated Sheathing.

## Fire Treatment of SIP Panels for Commercial Roof Systems

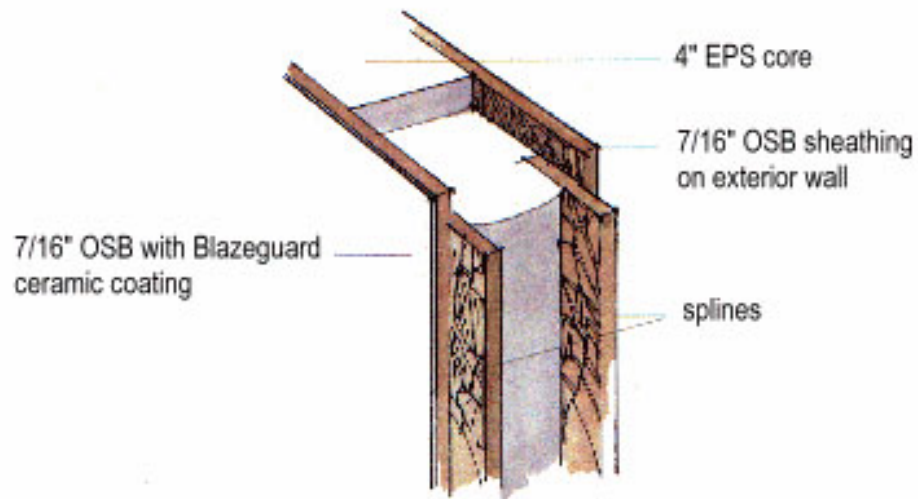
With the rising cost of building materials such as steel and polyisocyanurate foam, architects and building owners are increasingly looking for new ways to build strong, safe and economical roofs over commercial buildings.

Structural Insulated Panels (SIPs) offer builders an excellent alternative – factory-crafted panels featuring solid foam core insulation. SIPs offer significant economic and environmental advantages over other roofing systems – they are more uniform (constructed in the factory rather than on the job site), save considerable time and labor costs on-site and present outstanding insulative properties (R-values).

Building projects constructed with SIPs, though, require adequate fire protection. Since each SIP contains wood membranes (foam core insulation sandwiched between oriented strand-board (OSB) panels), SIPs often are required to be protected by fire-retardant materials.

Blazeguard Fire-Rated Sheathing offers the most economical and environmentally friendly way to fire-treat a SIP. Using the same value proposition as SIPs overall, Blazeguard offers the following advantages:

- Uniform coverage of fire treatment
- Controlled (factory) production and application
- Each panel certified and labeled for fire rating
- Environmentally friendly (no harmful fire chemicals)
- LOWEST installed cost of any SIP fire treatment



Structural Insulated Panel (SIP) with Blazeguard coating on one face.

## Fire Codes and Building Codes

Roof and wall applications of SIPs may be required to meet fire codes or carry fire ratings. Those ratings may (and generally will) vary from location to location and building to building. Most likely, depending on the location and expected “use” of the building, structures constructed with SIPs utilizing OSB panel “skins” will need to consider meeting at least two types of fire ratings:

1. **An “inside-out” burn or thermal barrier rating** – How long the interior panel “skin” can withstand a fire from within the building. Generally tested according to UL 1713 (evaluation of thermal barriers) or UL 1715 (corner room burn).
2. **An “outside-in” burn** – The roof must be rated with respect to its ability to withstand fire from outside, including a burning ember falling on a roof, direct exposure to flame, etc. Generally tested according to ASTM E-108 (fire tests for roof coverings).

**Most Common Fire Tests for SIP Wall & Roof Applications**

Fire Test Type	Description	Tests Used
Thermal Barrier (“Inside-out” burn)	How long the interior panel “skin” can withstand a fire from within the building	UL 1713 (evaluation of thermal barriers) UL 1715 (corner room burn)
Fire Resistance (“Outside-in” burn)	How long can the roof withstand a fire from outside, including a burning ember falling on a roof, direct exposure to flame, etc.	ASTM E-108 (fire tests for roof coverings)

Prior to construction and in the design phase, architects and builders should confer with local building code officials to determine what local building codes and fire codes will apply to the structure being constructed.

## Blazeguard Fire Ratings

Barrier Technology has secured an evaluation services report (ESR) from the International Code Council (ICC) that confirms Blazeguard panels are code compliant in the following application:

**ICC ESR-1365, 4.2.d:**

*d. Thermal barrier for separating foam plastic insulation from the interior of a building (IBC Section 2603.4). The panels shall be installed with the Pyrotite™ facing the interior of the building.*

The same ESR lists Blazeguard as a code-compliant component of fire-rated roof assemblies:

**ICC ESR-1365, 4.4.1 and 4.4.2:**

*Class A and C Fully adhered, single-ply membrane roof covering assembly.\**

*\*These systems may have to be modified to specifically relate to SIPs panel construction.*

**Contact Barrier Technology for a full copy of the ICC ESR-1365.**

For any and all fire-rated coatings, ask vendors for **full documentation** and copies of their code reports and ratings **as they apply to your construction.**

## Fire Tests

To be considered code compliant or fire-rated, materials must pass a variety of fire and physical property tests. The best products will have passed a full battery of such testing protocols; Barrier Technology's test list is provided as an appendix to this report as well as on Barrier's Web site at [www.intlbarrier.com](http://www.intlbarrier.com). Barrier will always provide appropriate and complete test data, along with requested test reports, for qualified inquiries.

Not all fire tests are created equal. Builders and architects should always ask to see complete test results. Among the things to look for in any test results are:

- *Was the test done at an approved, accredited lab (UL, Intertek/Omega Point, FM?)*
- *What are the test protocols and conditions?*
- *What rating was achieved? (Simply "pass," or was there a time/duration level attained?)*
- *Who provided the samples? The company? Did the lab "witness" sample creation?*
- *Does the test apply to a specific **product** or to **an assembly**?*
- *Are the test results signed and certified? Do they make sense to you and do they fit your application?*

A single successful fire test may have little bearing on an application being approved by code officials. An ASTM E-84 flame spread test, for instance, can be for 10 minutes or extended to a full 30 minutes – you will need to know which tests the product passed, and which ones will be allowed by your code official. (For multiple locations, you will need to know who will accept which tests where).

Also find out whether the samples used in the test were **witnessed**. For the ICC to use a test, samples must be witnessed in their production by an independent laboratory representative. Otherwise, if the company supplied the samples, the lab simply rates the performance of the samples that were sent, leaving test results open to challenge in the field.

Also note that your application may need to be tested as part of an overall **assembly** (e.g., a SIP roof panel); it may not – and likely will not – suffice to simply have a fire rating **“in the pail,”** as would most fire-rated paints.

Blazeguard panels have passed a litany of fire tests. A complete list is available at [www.intlbarrier.com](http://www.intlbarrier.com). For SIP wall and roof assemblies, the most important ones may be:

Fire Test	Description	Blazeguard Rating
ASTM E-84 (extended to 30 minutes)	Spread of Flame/Smoke Developed	Class A
UL 1713	Thermal Barrier	20 minute rating
UL 1715	Corner Room Burn	15 minute test - pass

Please contact Barrier for a full report on any of these tests. If you are comparing Blazeguard to any other fire treatment for a SIP, make sure you ask for:

- FULL test documentation (where, when, and by whom was it tested).
- Test results done on witnessed samples.
- Tests as part of a finished or completed assembly.
- Examples of use in the field or fire code acceptance in the field.

DO NOT get swayed by a company touting its “full compliance” with codes or applications based on one or two successful tests on different types of materials; remember, one (or a few) successful tests may or may not have any bearing on acceptance of this fire coating in the field, particularly as that applies to the structural elements (roofs, walls) of a building.

Fire safety is, quite literally, a matter of life and death. Any company that cannot or will not provide you full and proper documentation and test results should be, at all costs, avoided.

Look for ratings or approval from testing labs such as:



## Factory vs. Field Applied Coatings

When working with fire-resistance coatings and materials, it can be as important – if not more important – to know where and how a coating is applied as to know about the product itself.

Builders commonly want to apply fire coatings in the field (at the job site). At first blush, this may seem sensible – after all, that is what is done with paint, wall coverings, mold treatments and other surface coating. Why can't it be done with fire coatings?

The answer is simple, and directly tied to building and life safety. If a contractor doesn't apply enough latex paint (or too much paint), no one gets hurt. The building owner (or contractor) may be unhappy with the job, but everyone is safe.

When it comes to fire protection, the risks are far greater. Apply too little fire-retardant paint, or spread it too thin, and life and building safety are compromised. If applied during times of relative high humidity, paint must be allowed additional "curing" or drying times – potentially throwing off construction schedules. If not done properly, again, building and life safety is compromised.

In a perfect world, fire code officials could watch over every field application, but that scenario is, at best, wildly improbable if not impossible. The closest most can come – realistically – is to insist on a licensed applicator and perform periodic "spot checks" to make sure the paint is going on uniformly and correctly, being allowed to dry properly and being finished appropriately. Even then, all a code official can truly do is attest to the fact that the coating was applied – to the best of their knowledge – in a manner consistent with manufacturer recommendations.

Subsequent challenges to the efficacy of a fire-retardant paint applied in the field would presumably be left to the local code official who approved the construction and/or to the builder who hired a contractor to apply the product. Builders or architects who choose and use field-applied products must be aware of this reality.

To expand on this point, any challenge to the efficacy of a field-applied fire coating would likely turn on several points of information about the product as well as its specific application.

Architects, designers and builders using or recommending field-applied coatings should ask themselves at least some – if not all – of the following questions:

1. *Do I know who will apply the treatment?*
2. *Do I know how and when they will apply it?*
3. *Can environmental conditions during application be controlled?*
4. *Is my applicator licensed? What is their experience?*
5. *Is the product rating applicable in the field or simply “in the pail.”?*
6. *Has this product ever “failed” for this applicator?*
7. *In the case of failure, who was found liable?*
8. *Does the product carry a warranty as an applied coating?*
9. *Am I insured against claims against the product or its application?*
10. *Will product application conflict with my building schedule?*
11. *Have I scheduled appropriate “drying” or “curing” times?*
12. *Can I trust estimates of total product cost/coverage? Is there “wobble room” built in for spills, delays, accidents, shortages, absences?*

And perhaps the most important question of all:

***“What do I know about this product in its applied state?”***

Which implies...

**Are it's ratings valid after application?**

**Does it cover the square footage the company claims?**

**What if I get a bad batch (pail)?**

**What if it won't stick?”**

...Builders and architects can fill in the rest.

## Blazeguard on SIPs

International Barrier Technology manufactures the most highly tested, robust and economical fire retardant coating available for SIPs today – Blazeguard Fire-Rated Sheathing.

Blazeguard panels consist of a layer of specialty, patented cement -- Pyrotite™ -- over an oriented strand board (OSB) substrate. As a component of SIP construction, the Blazeguard panel may be used on either the inside or outside skin of a SIP, or both. Blazeguard's non-combustible Pyrotite coating is factory-applied. Panels are delivered to a SIP manufacturer ready to assemble into finished SIPs. The Blazeguard coating is adhered to the "rough" side of an OSB panel, offering tenacious bonding to the OSB surface as well as an attractive and finishable surface.

Blazeguard coating offers specific and measurable advantages over ANY OTHER type of coating on a SIP roof panel:

- **Full 20-minute thermal barrier** -- exhaustively tested and documented
- **Easy installation** -- simply drop the finished panels into a roof deck
- **Clean white surface** – no finishing required on tall ceilings or many commercial or industrial buildings
- **Eco-friendly** – No paints or chemicals applied on-site; reduced waste; no additional transportation costs; product is used as delivered
- **Lower (in many cases significantly lower) installed cost**
- **Appropriate surface for bonding** single-ply roofing membranes with significant savings in glue usage



Workers place a Jumbo SIP panel.



SIP with Blazeguard (white) coating.

## Blazeguard SIP Seam Treatment

Among the most common questions about Blazeguard panels for roof decks is what to do about the seams or panel joints. For fire treatment and code compliance, a fire-treated spline is required (often Blazeguard strips that can be supplied as part of the panel package by a SIP manufacturer). For appearance purposes, the Blazeguard surface may be finished in the same manner as gypsum wall boards. An available option is to include “reveal joints” or to use batten systems to hide joints.

Builders may desire, or be required to treat seams for moisture or vapor infiltration; Blazeguard is code compliant as a fire treatment only. While Blazeguard’s perm rating for moisture or vapor is very low, Barrier makes no stated or implied warranty or coverage as a moisture or vapor retardant or barrier.



This shop garage has reveal seams.



A lake cabin resort ceiling with battens.

While Blazeguard is primarily used as a fire barrier on the “inside” facing side of a SIP panel, it can also be used facing “up” or “outside” a panel as part of a Class-A or fire rated roof assembly. By using Blazeguard on both the “ceiling” (facing inward) and “roof” (facing outward or up) side of a roof, manufacturers and builders are protecting from both and inside- and outside burn.

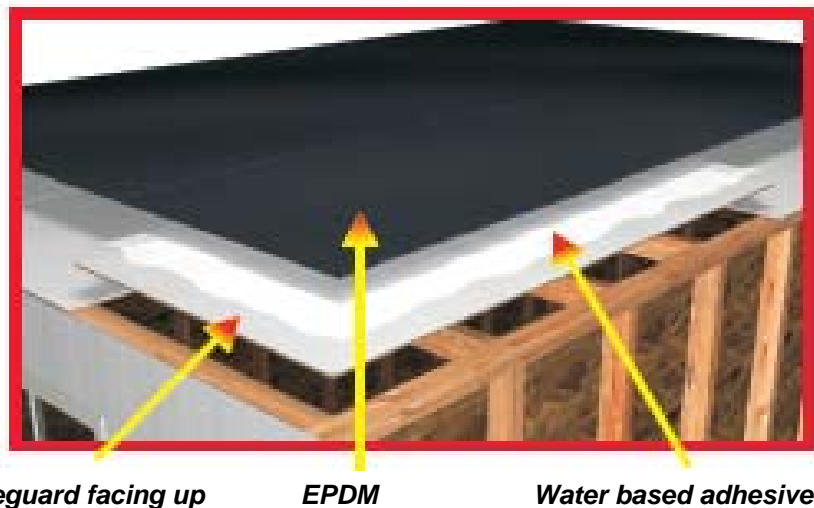
## Blazeguard for Exterior (Class A) Roof Assemblies

Recall what was said earlier in this paper about Blazeguard fire code ratings. In addition to providing a 20-minute thermal barrier on the interior face of a SIP, Blazeguard can be applied to the exterior face of SIP as well. In this construction type, Blazeguard performs as the fire barrier component of Class A or Class C rated, fully adhered, single-ply roof systems:

### **ICC ESR-1365, 4.4.1 and 4.4.2:**

*Class A and C Fully adhered, single-ply membrane roof covering assembly.\**

*\*These systems may have to be modified to specifically relate to SIPs panel construction.*



The diagram above shows a Class A rated roof assembly using Blazeguard; for a building with SIP roof panels, the construction would be the same, but with the SIP's Blazeguard side facing up as in the diagram. Note that the assembly's Class A rating would obviate the need to add Densdeck or any other fire retardant material to the top of the SIP.

In order to use Blazeguard in this configuration or construction, builders may be required to pass fire tests or gain code approval **on a SIP assembly**.

## Blazeguard vs. Gypsum/Densdeck

Blazeguard-treated SIPs offer considerable advantages over gypsum wallboard or a Densdeck-type panel added to the interior SIP surface. Following are just a few Blazeguard advantages:

**Jumbo Panels:** Gypsum is not available in jumbo (8' x 24') sizes. To cover the same area as one coating of Blazeguard on a jumbo SIP, builders must order, have delivered and install six sheets of 4' x 8' Type X gypsum.

**No Additional Materials or Labor:** Six sheets of gypsum (to replace one jumbo Blazeguard SIP) must be hoist to ceiling height, fastened and fire-taped, using up to 134 ft. of fire tape as well as 126 sheet rock screws. The panel seams must then be mudded, taped and sanded, all at a loaded rate of labor of up to \$100 per hour or more, after the cost of scaffolding, stilts and set-up.

**Single-Step Process:** Adding gypsum to a SIP is a multi-step process. Gypsum crews must be scheduled around framers or roofers, and all are dependent on one another. Blazeguard requires only one crew.

**Dimensional Spacing:** Gypsum adds an additional half-inch (or more) to the dimension of the SIP. Blazeguard adds less than 1/16 inch – less than 1/8 inch if both the interior (ceiling) and exterior (roof) side are coated.

**Impact Resistance:** Since Blazeguard is applied directly to OSB, a SIP's Blazeguard side is impact resistant. Gypsum is easily scraped, torn (the paper covering), perforated or soiled. A marred gypsum panel may be wasted.

**Added Strength:** Blazeguard coating adds strength to underlying boards or panels. Boards treated with Blazeguard are up to 66% stiffer than untreated panels.

**Reduced "Shrinkage":** A great deal of gypsum is wasted or lost on the job site. Bad cuts or blocks mean up to 20% of product never makes it onto walls. With Blazeguard SIPs, such "shrinkage" is significantly reduced if not eliminated.

**Environmentally Friendly:** Blazeguard is to a SIP what a SIP is to stick-built construction, taking the waste and inefficiency of on-site construction out of the picture. Within a factory setting, material costs can be accurately and closely calibrated, waste is reduced, fire ratings are certified and audited and materials are protected from weather damage or handling issues.

**Reduced freight and shipping:** While Blazeguard adds weight to a panel, that additional weight (approximately 0.7 pounds per square foot) is far less than the additional weight added by gypsum wall board. In fact, a 4' x 8' Blazeguard panel (including the OSB substrate) actually weighs a few pounds less than the same size panel of gypsum wall board alone. ***In construction and transportation, added weight means added cost (freight as well as labor).***

## Blazeguard vs. Field-Applied Paints

Blazeguard offers significant cost advantages over field-applied products such as fire-retardant paints:

**Inherent Cost Advantage:** In order to attain the fire ratings required by most building codes, any fire-rated paint must be applied in multiple coats. This, by definition, raises the cost of application, as successive layers of paint must be applied, dried, applied again, dried again and so on until the desired thickness is reached.

The ingredients in almost any fire-rated paint are well-known and (should be) well documented. It bears repeating – the **ONLY** way those ingredients can compete on an applied-cost basis with Blazeguard is if the paint is applied at a level thin enough to negate documented fire testing. Always – always – pay attention to the “spread rates” and “coverage rates” paint companies must disclose. Don’t be surprised if costs go way up (more than double) once a paint company discloses the true spread rate required to meet a fire-code test.

**No Additional Costs:** Following are just some of the additional cost considerations to take into account for any field-applied fire-retardant paint:

- The cost of hiring a licensed applicator.
- The cost of transporting materials (paint, sprayers, tools) to the job site.
- The cost of potential delays if the applicator is called to another job.
- The cost of inspection/verification of on-site application.
- The cost of wasted materials (spilled paint, etc.) on-site.
- The cost of insurance for additional workers.
- The cost of time to wait between coats.
- The cost of possible equipment malfunction.
- The cost of defending or repairing an inadequate application.

**Controlled Spread Rates:** A critical variable in cost estimating a paint job is determining the spread rate – how many gallons it will take to cover x number of square feet. To attain fire ratings, most intumescent paints have to go on relatively thick. High spread rates (e.g. 200 to 250 sf/gal) look good on paper by lowering the number the gallons needed, but won’t look good to fire officials in the field.

Thus one of the key things to look for in any field-applied paint product is its recommended spread rate or dry mil thickness. A paint applied at 80 square feet per gallon will have a different fire rating than one applied at 300 square feet per gallon. A painted surface of 7 dry mils is very different from one of 14 dry mils.

By way of example, one particular fire-retardant paint company is promoting the use of its product at 14 dry mils, and advertises that it passes required tests when applied to OSB for a SIP panel. (Note that the test is on OSB only -- further testing may be required if the paint were to be used on an actual (foam-in) SIP assembly). In either case, the relative economics of paint versus Blazeguard make it an unattractive alternative:

**Fire Treatment for a 250,000 Square Foot Commercial Roof**

Paint cost per gallon	Thickness	# coats	# gallons	Material Cost	Cost / sf
\$50/gal	14 dry mil	2	3846	192,300	\$ .76
Blazeguard	Factory	n/a	n/a	125,000	\$ .50

The example above shows material cost only of paint priced at \$50 per gallon (volume rate – prices can often be \$65 per gallon or higher), compared to Blazeguard factory-applied treatment costs (estimated at .50 per square foot).

***The materials cost alone for treating the interior face of a SIP panel with enough fire-rated paint at \$50 per gallon is more than 50% higher than the cost of having the same panels treated with Blazeguard in the factory.***

To illustrate this point even further, the paint company that was promoting its use over OSB panels for SIPs had passed a fire test where its product was actually applied at 20 dry mils. Thus the fire test which was being applied rated an application that would have required 42% more product to get the thicker coverage. In this case, costs skyrocketed to more than twice what Blazeguard would have cost – and again this is paint cost alone!

**Rated Panels vs. Rating in the Field:** Finally, with Blazeguard, SIP manufacturers (and builders) know what they are getting when the panel is delivered; each Blazeguard panel is inspected in the factory and labeled compliant by an independent testing lab and agency. With fire-retardant paints, particularly on a larger commercial project, thousands of gallons of paint product must be shipped, stored, insured and applied on-site, sometimes in uncontrolled environments and with untrained or untested labor. The application *might* go perfectly or it might not – and building officials might approve it or they might not – there is no way to tell until paint hits the wall (or ceiling) so to speak.

## Blazeguard -- The Preferred Fire Treatment for SIPs

All things considered, nothing can match the performance or economy of fire-treating panels for SIP construction **BEFORE** they arrive on the job site.

Fire and building codes will change from site to site and from job to job. The stated performance characteristics and cost of fire-retardant materials applied in the field will also change from company to company, and from job to job.

One thing is constant -- Barrier Technology's patented Blazeguard Fire-Rated Sheathing is the only way to pre-treat (in the factory) SIPs so that they are "ready-to-use" and fire-rated when they arrive at the construction site.

For builders, the advantages can be considerable – greatly reduced labor rates on-site, more efficient work, faster construction and the peace of mind of knowing that the SIPs being used have already met and/or exceeded applicable fire tests.

For SIP manufacturers, the advantages are also tremendous. By using Blazeguard panels, manufacturers are providing a valuable (and cost-saving) service. Rather than relying on builders to schedule and pay for the cost of fire-treating panels, manufacturers provide a value-added, all-in-one solution at a fraction of the cost of what builders would pay to hire and supervise crews to install gypsum wallboard or spray paints or coatings in the field.

Compared to any other way to treat fire-treat SIP panels for commercial construction, Blazeguard panels are:

- More highly tested and certified by independent laboratories and code agencies.
- Lower installed cost than any other fire treatment.
- Mold & mildew resistant.
- Stronger after treatment (increased shear/seismic ratings).
- Factory approved and code labeled.

The value proposition is clear – nothing can match Blazeguard Fire-Rated Sheathing as a fire-retardant coating for Structural Insulated Panels (SIPs).

#### FOR MORE INFORMATION:

Barrier Technology supports and endorses all efforts to use SIPs to improve building efficiency and economy. Additional copies of this paper, as well as further information, SIP case studies and price quotes can be gained by contacting us at:

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

**APPENDIX A: Blazeguard Fire Tests (as of 2008)**

Test Specification	Property	Results
ASTM-E84 (extended to 30 minutes)	Flame Spread	FSI=5, SDI=40, Maximum Progressive Advance (30 min) = 7.5 ft for DFPW
APA F-4	Adhesion Shield	Pass
MIL-L 19140 E	Corrosion	No contribution to metal corrosion, 0.069-0.138 mils/year for brass, 0.00 mils/yr for both steel and aluminum
ASTM G-53	Weathering (1,000 hrs.)	No deterioration
ASTM D-2247	Weathering (500 hrs.)	No deterioration
ASTM D-1037	Accelerated Aging – Bending Test	No deterioration of strength after 56 days in 170° F, 65% RH Chamber. MOR: (psi x 1,000) Blazeguard/DFPW = 4,240, OSB=4,960
ASTM D-2794	Impact Resistance	Pass – slight indent @ 160 lbs
ASTM D-790	Bending Strength	MOR (psi x 1,000): Pyrotite (MD) = 6.97, Pyrotite (XD) = 5.98 MOE (psi x 1,000,000): Pyrotite (MD) = 1.27, Pyrotite (XD) = 1.25
Special Protocol	Nail Penetration	No wood exposed
Special Protocol	Microbial/Fungal Growth	Pyrotite appears to be more resistant to microbial/fungal attacks than untreated wood products
Combustion Toxicity Test	Pittsburgh Smoke Toxic Potency	The toxic potency is equal to or less than untreated plywood, LC50 = 17.7 & 67.3 grams
ASTM D-2898	Weathering Exterior (1,680 hrs.)	After D-2898 procedure, ASTM R-84 extended for 30 minutes resulted in FSI=5, SDI=20
Freeze/Thaw	Soak 48 hrs., Freeze at -40°F for 8 hrs., then subject to ASTM D-1037 impact test	No brittleness effect at cold temperatures or failure due to freezing
Outdoor Storage of Blazeguard	Warp and Swell over 90 days	Incremental warp less than 3/8", no swell compared to unlaminated controls
ASTM D-2898 Modified	Accelerated Weathering of Blazeguard on Trusses	No measurable warping of Blazeguard after 96 hrs. of rain followed by drying (one cycle) for 12 cycles (2,304 hrs.). Suitable for exterior applications
ASTM E-96	Permeability	Passes Vapor, > 3 perms
ASTM E-119	One-Hour Fire Resistance Assembly (Structural)	Listed assemblies include both T-11 Blazeguard siding and pre-finished aluminum surface Blazeguard
ASTM E-119	Two-Hour Fire Resistance Assembly (Structural)	Listed assembly using Blazeguard fire-rated structural sheathing
ASTM E-119/UBC 17-3 and UBC 17-5	15-Minute Thermal Barrier	Listed as a thermal barrier. Blazeguard substrate = 7/16" OSB 20 Minute rating.
ASTM E-108	Relative Fire Characteristics of Roof Covering Materials	Class A and C systems including fully adhered single-ply membranes.