

# HANDBOOK OF FIRE-RATED GLASS FOR SCHOOLS

2020  
EDITION



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# SAFE + SECURE: DESIGNING SCHOOLS FOR THE 21ST CENTURY

Back in 1967, Dan Valentine wrote, “School is a building of four walls... with tomorrow inside.”

According to the National Center for Education Statistics, there are more than 132,000 K-12 schools in the U.S., as well as 4,500 schools that grant post-secondary degrees. In total, these learning centers educate an estimated 76.4 million children and adults each year, says the U.S. Census Bureau.

That is a tremendous number of tomorrows.

Parents send their children to these schools trusting they are code-compliant, safe spaces in which students can learn and thrive. Yet all-too-frequent news stories highlight the inescapable reality: 21st century schools and campuses face unprecedented threats.

## How Safe is Safe?

The rise in active shooter events has alarmed the nation and generated demand for safer schools. In 2018 alone there were 94 school gun violence incidents—a record high since data has been collected on the topic and 59 percent higher than the previous record in 2006, according to Naval Postgraduate School.

But that isn't the only danger to students and school buildings, or even the most frequent. The National Fire Protection Association (NFPA) tracked fire department responses over the course of five years. Their findings showed that in an average year, there were nearly 5,000 responses to structural fires in educational properties. These fire events typically resulted in one death annually, 70 injuries and \$70 million in direct property damage.

Because schools house the youngest and most vulnerable members of society, designing with fire and life safety in mind is paramount. The good news is that advances in technology and manufacturing have produced some of the most innovative solutions in history to meet the increasing demands for protection.

## Protect with Glass

Glass is an essential element of safe school design. Many of today's educational facilities boast more open floorplans with extensive glazing. Studies, such as “Daylighting and Productivity” by Heschong Mahone Group, have repeatedly shown that students perform better when classrooms contain more windows. Such an environment requires glass that can withstand frequent impact by energetic students who might come in contact with it.

An equally important concern in such settings is the threat of fire. Ordinary window glass cannot withstand the high heat generated from structural building fires. It shatters and falls out of the frame. In previous generations, architects had to make the difficult choice of prioritizing one

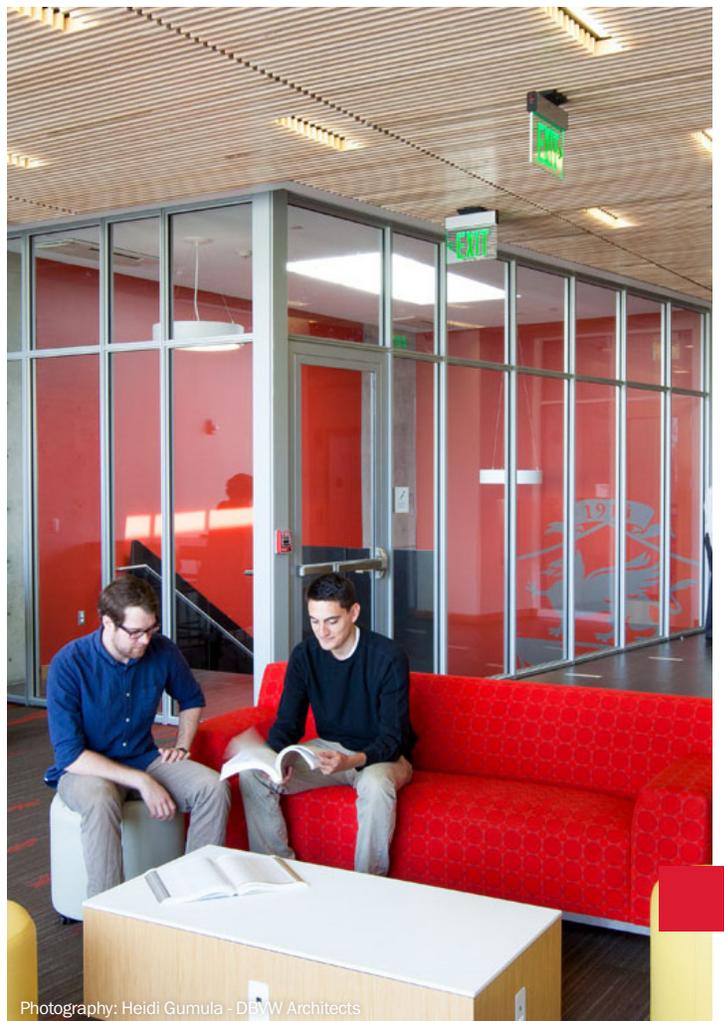
kind of safety over another, or leaving out glazing all together.

Fortunately, newer glazing options mitigate those kinds of risks and push design options forward.

Today, you can specify glass for schools that:

- Complies with strict fire codes
- Contains the spread of smoke and flames
- Provides essential visibility and light
- Prevents the transfer of heat
- Passes current impact safety standards
- Protects against forced entry
- Offers bullet resistance

What's more, these critical functions can be combined in customized ways and specified in a single product that performs on multiple levels. There's no need to compromise aesthetics for safety and security.



Photography: Heidi Gumula - DBVW Architects

# FIRE-RATED GLAZING BASICS

Since the Great Baltimore Fire in 1904, building codes in the U.S. have acknowledged that fire is one of the greatest enemies of buildings. Fire codes take top priority in modern construction. When these guidelines were first introduced, they didn't have much room for glass since the average window pane couldn't tolerate fire testing. No glass on the market offered any degree of protection.

However, it's neither practical nor desirable to design every building like a bunker with no visibility. Including openings in a design enhances visibility, as well as appearance. So manufacturers set about finding an alternative to float glass that could meet code requirements. The field of fire-rated glazing was born.

## What distinguishes fire-rated glass from ordinary glass?

Like most glass, fire-rated glazing allows light and visibility for aesthetic or security reasons. But fire-rated glass does something more: It acts as a barrier to the spread of flames and smoke, containing it within a limited space. In the world of fire protection, this is known as "compartmentation."

Unlike sprinklers or other "active" protection systems, fire-rated glass does not require activation in order to protect against fire. If there is a power failure, a loss of water pressure, or a human error that interferes with the sprinklers working properly, fire-rated glass will not be affected and will continue to perform as needed.

## CHOOSE SAFETY OVER SAVINGS IN FIRE-RATED EXIT CORRIDORS

In certain instances, the IBC grants an exemption for one-hour, fire-rated exit corridors in educational occupancies and does not require fire-rated materials when automatic sprinklers are in place.

Yet according to [National Fire Protection Association \(NFPA\)](#) data, **sprinklers fail approximately one-in-ten times.** If non-rated materials were used in construction and suppression systems don't operate as intended, a fire will be able to spread unchecked, further jeopardizing lives and property.

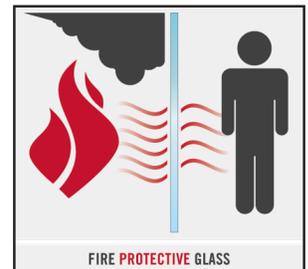
Since passive fire-rated building materials such as glass do not require activation to perform as intended, they can work to control a fire's spread with – or without – sprinkler systems. In the event that a sprinkler fails to perform as intended during a fire, these materials help ensure students and faculty can safely pass through the hall and out the door.

## What is the difference between fire-protective and fire-resistive glazing?

When looking at fire-rated safety and security in schools, there are two types of glazing systems to understand: "fire-protective" and "fire-resistive." While they sound similar, there are some distinct differences between the two.

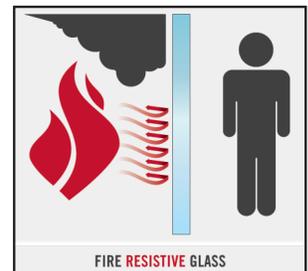
### Fire-Protective

Fire-protective glazing can be counted on to defend against the spread of flames and smoke for a designated amount of time, which is indicated by a fire rating. This type of glazing is available with fire ratings from 20 to 90 minutes depending on the glass.



### Fire-Resistive

In addition to blocking flames and smoke, fire-resistive glazing products limit the transfer of heat through the glass. This adds another layer of safety and makes the glass suitable for use in doors, walls and other fire-rated assemblies that are required to block the passage of excessive heat, hot gases and/or flames.



This type of glazing can typically be used where building codes require an assembly designated "fire resistant" to enclose a space.

Fire-resistive glazing is tested to the same standards as solid barrier walls, and therefore is not limited to 25 percent of the wall as is fire-protective glass. This type of glazing is versatile in design since it eliminates the need for opaque materials such as masonry or gypsum in areas that require fire-rated walls and allows for virtually unlimited expanses of glass.

## When is impact-safety-rated glass required in fire-rated applications?

A school's fire-rated areas are subject to the same impact safety standards as non-rated areas. The chances of fire may be slim, but the danger of breakage looms daily. A door at the end of a school hallway may have to endure regular contact with students who push, press and slam their way through.

Glass in hazardous locations must meet impact testing requirements, as well as fire testing. As with fire ratings, impact safety ratings offer different levels of resistance, depending on the need. The highest rated products are strong enough to withstand the force of a full-grown adult running into them.

Today, architects can choose the exact combination of fire and impact safety ratings they need in a single product. There's no reason to settle for one or the other and, in fact, codes no longer allow it.

Even with all the advanced protection options, not every location needs both. In settings where human contact is not a concern (e.g., transoms and some windows), fire-rated glass products can be specified without any accompanying impact rating. These may be a more cost effective alternative when the addition of impact safety is unnecessary.

### Is there a difference between safety glazing and security glazing?

Safety and security may sound synonymous, but when it comes to glazing, they are technical terms that refer to separate categories of glass.

#### Safety Glazing

One of the most common forms of safety glazing is impact-safety-rated glass. As mentioned earlier, impact safety ratings measure a product's ability to offer protection against accidental human impact. This not only indicates that it will resist breakage—it also means that if broken, the glass will do so in a manner that will not leave dangerous shards. This is why at the scene of an auto accident you will find small beads of glass rather than large, sharp-edged pieces. The glass must break in such a way that it will not become a source of further injury.

Besides human impact, some forms of safety glazing also account for natural causes of breakage as well. These can include hurricanes, tornadoes, earthquakes and wind load.

#### Security Glazing

Like safety glass, security glass also offers protection. Specifically, security glazing is that which protects from forced entry, ballistics, and blast. This type of glass can also be bullet resistant and blast resistant.

For example, in the event of an intruder attack, forced entry glass gives students and staff the upper hand by taking away the element of surprise at access points and delaying ingress.

Security glazing is also available with fire ratings. It helps ensure the product meets all performance criteria, and isn't prioritizing security over safety, and vice versa.

### WHAT DO THE CODES SAY ABOUT SECURITY GLAZING AND SCHOOLS?

While building codes require the use of fire-rated glazing in specific applications, they do not currently mandate the use of security glazing in educational facilities. However, the industry is working to tighten regulations. In 2018, at least 53 new school safety laws were passed in states, and districts are spending millions of dollars to "harden" schools with improved security measures.

## CASE STUDY

### William Jones College Preparatory High School

Enhancing the student experience was at the heart of William Jones College Preparatory High School's new south campus and renovated north campus. The architects at Perkins+Will knew the impact environment has on students' ability to learn, so they wanted to increase the amount of daylighting in their facility, while at the same time meeting fire and life safety codes. To do so, they integrated FireLite Plus® clear and wireless fire-rated glass ceramic in areas of the building subject to fire and life safety codes. The glass ceramic's transparent makeup allows light to fill the school in areas that would historically have been limited to solid barrier walls for fire safety.

Since FireLite Plus is also impact safety-rated, the clear ceramic can handle the general wear and tear brought on by moving students.



Photography: James Steinkamp © Steinkamp Photography

**Project:** William Jones College Preparatory High School

**Location:** Chicago, IL

**Architect:** Perkins + Will and The Architects Enterprise, Ltd.

**Product:** FireLite Plus® fire-rated glass ceramic

# CODE ADAPTIONS FOR IMPROVED FIRE AND LIFE SAFETY

For decades, traditional wired glass was the de facto choice for fire and life safety in schools. This wasn't because it could withstand impact (the wires ironically made it more breakable than ordinary glass). It was simply the only form of glazing that offered any fire protection at the time. And, that took precedence over impact safety.

The market remained relatively unchanged until the 1990s when entirely new types of fire-rated glazing materials came into development. These new options were able to surpass wired glass with increased fire protection AND impact safety. The pace of innovation has continued to accelerate, and the International Code Council (ICC) has been adapting regulations to reflect the new alternatives.

State legislatures and local municipalities vote building codes into law, but rarely adopt them on a uniform schedule. This makes it challenging to keep up with current requirements. The following timeline highlights

the major changes to fire-rated glazing requirements in the International Building Code (IBC).

The IBC was written specifically for the design and construction of new buildings. Other model codes govern renovation and remodeling of existing construction. Architects and designers will want to become familiar with the International Fire Code, the International Existing Building Code, and the National Fire Protection Association's Life Safety Code, NFPA 101.

Every locality has its own "Authority Having Jurisdiction" (AHJ) who adopts and enforces individual model codes for their region. Be sure to ascertain which codes apply to a particular project site.

1970s

## Traditional wired glass granted exemption in high-impact areas

Despite the inability of traditional wired glass to tolerate much impact, The Consumer Product Safety Commission (CPSC) grants it a special exemption from impact safety requirements since it is the only glass capable of providing reliable fire protection.

2003

## Exemption narrowed for traditional wired glass

The availability of wireless fire-rated glass options prompts the ICC to revise the long-standing impact exemption in the IBC. Traditional polished wired glass is now barred from use in hazardous locations in schools, athletic facilities and daycares.

2006

## Exemption revoked for traditional wired glass

IBC restriction extends to include hazardous locations in all types of buildings. Fire-rated doors, sidelites, windows near the floor and other areas at risk for impact must now also meet impact safety testing standards (IBC section 2406).

2012

## Simplified labeling for fire-rated glazing

The IBC unveils a streamlined set of markings that indicate where the product is allowed (doors, openings and walls); hose stream test compliance; temperature rise compliance; and the fire rating in minutes (2012 IBC Table 716.3).

## Use of automatic sprinklers disallowed during fire tests

The IBC bans the practice relied on by some glass manufacturers to achieve a fire rating through the use of supplemental suppression systems. Now glazing products must pass the test based on their own performance (2012 IBC section 703.4).

## Clarified requirements for fire-protective and fire-resistive glazing

Product tables in the IBC are revised to make it more clear where fire-protective and fire-resistive products are allowed or prohibited. It also specifies the required minimum ratings and how the glass should be marked (2012 IBC Tables 716.5 and 716.6).

# ACING THE TEST

Glazing products undergo rigorous evaluation to attain their fire and safety ratings and maintain compliance with building codes. Always look for a label from a credible, third-party testing agency such as Underwriters Laboratories, Inc. (UL) to ensure the product satisfies the proper standards.

## FIRE & HOSE STREAM TEST



Fire ratings are given in time increments that indicate how long a product can be expected to provide protection during a real-world fire. Laboratories assign ratings that range from 20 minutes to 3 hours.

Glass, framing and door components are installed in a large furnace, which is then heated to simulate a structural fire. That high temperature is maintained for the full time of the test. The assembly only earns its rating if it remains intact for the duration, with no flaming on the exposed surface.

While the glass and framing components are still in the furnace (and still hot), they are then blasted with a fire hose. For any rating higher than 20 minutes, passing the hose stream test is mandatory. Most glass cannot tolerate the thermal shock of being hit with cool water on one side when the temperature on the opposite surface is so hot. It will shatter and fall out of the frame.

This is critical because when sprinkler systems activate or firefighters begin dousing a blaze, the water can generate tremendous amounts of deadly smoke. Glass compromised by water would create an opening for that smoke and flames to travel, causing further damage and endangering lives.

## IMPORTANT FIRE TESTING STANDARDS

### ASTM E119

The standard for test methods for fire tests of building construction and materials. Measures transmission of heat and hot gases.

### NFPA 80

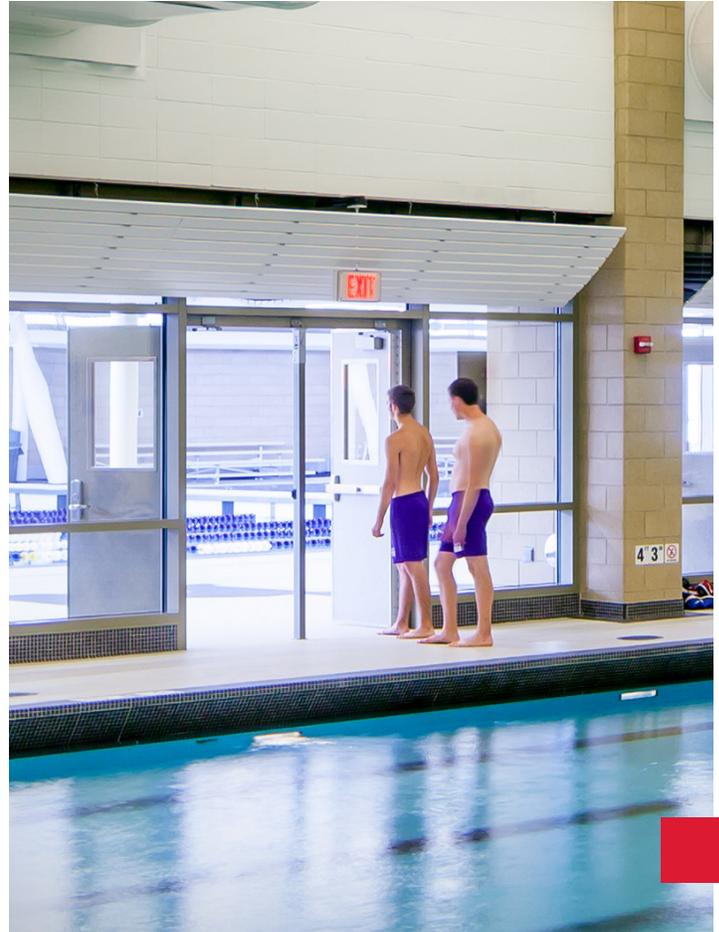
The standard for installation and maintenance of fire door assemblies and other opening protectives.

### NFPA 252

The standard for fire door systems.

### NFPA 257

The standard for windows, glass block and other light-transmitting assemblies.



## IMPACT SAFETY TEST



### How is impact safety determined?

The American National Standards Institute (ANSI) and the Consumer Products Safety Commission (CPSC) have set criteria for measuring the impact glass can tolerate and assigning safety ratings accordingly. Testing labs mount the glass in a vertical frame. A “speed” punching bag is filled with 100 pounds of lead shot and hung on a cable. The bag is then dropped, swinging like a pendulum against the glass. This process is repeated from increasing heights to determine the level of safety rating the glass can achieve.

When dropped from the highest point, the velocity of the bag mimics the impact of a full-grown adult running into the glass. This is the gold standard for impact safety (CPSC 16 CFR 1201, Cat. II). For the test to be considered successful, glass must either not break, or break in a safe manner (e.g., no large shards).

## Are there security tests for glass that pertain to schools?

More than 40 different voluntary tests apply to security issues, from forced-entry to ballistics to blast-resistance. However, building codes do not currently mandate security glazing in educational facilities.

With the groundswell of interest in making schools safer, task groups such as American Society for Testing and Materials, International (ASTM) are working diligently to reach consensus on a security test standard. And other parties (like the National Glass Association) are looking at ways to provide manufacturing guidelines for school security glazing in the interim.

Some school districts are not waiting for industry-wide standardization, but are adopting the voluntary security standards to enhance the

protection of their students. Of all the existing tests, ASTM E2395 is most applicable to slowing down unskilled or semi-skilled intruders. This test of window and door systems projects pieces of 2" x 4" lumber from an air cannon at the glass. The same glass is then struck multiple times with a ball-peen hammer.

When it comes to bullet-resistant security glazing, UL 752 is the test standard most commonly referenced. Rounds of different types of ammunition are fired at the glass from a distance of 15 feet. A piece of corrugated cardboard is placed 18 inches behind the glass as a "witness plate." A successful test will not only mean the glass stopped the ammunition, but also no spalling from the glass reached the cardboard. Ratings are assigned in levels from 1 to 8, able to stop a 7.62 mm rifle lead core full metal copper jacket, military ball from a submachine gun or assault rifle.

## CASE STUDY

### Central Elementary School

The building team tasked with upgrading Central Elementary School in Dodge City, Kansas, faced a challenge: How could they maintain the beautiful, historic brick-and-glass look of the original 1927 school while raising the building to modern safety standards?

FireLite Plus® fire-rated glass ceramic from Technical Glass Products (TGP) was used to safeguard select areas along the perimeter of the school. The product was installed in stairwells, classrooms, the library and other locations overlooking the interior school courtyard. In appearance, FireLite Plus blends seamlessly with the non-rated glass systems used throughout the school. FireLite Plus is also impact safety-rated and helps protect against fire and impact on both sides of the glass.



© Essential Images Photography

**Project:** Central Elementary School

**Location:** Dodge City, Kansas

**Architect:** GLMV Architecture

**Glazier:** Wickham Glass Co

**Product:** FireLite Plus® fire-rated glass ceramic

# SAFE SOLUTIONS

Having more product options available for safe glazing in schools is unquestionably a tremendous advancement. However, the vast array of choices can make it challenging to find and specify the best product for a particular application. One tool for navigating the complexities of the market is to keep in mind the acronym S.A.F.E.S.T.



Photography: Heidi Gumula - DBWW Architects

## S ETTING

Consider all the factors that have a bearing on the opening you're going to fill with glass. Are you using it for daylighting? If heat transfer and energy loads are an issue, a fire-rated IGU could be in order. Is it in a location that will put the glass in regular contact with students? A glass laminated with film that might mar or peel might not be ideal.

## A ESTHETICS

As noted earlier, open environments have been shown to be more conducive to learning. Wired glass has its place, but it may create an undesirable, "institutional" feel in a school.

Beyond that, there are multiple options for clarity and opacity in fire-rated glazing today. Some can even be etched with designs or frosted for privacy concerns.

## F IRE & SAFETY

What are the building's required fire and life safety ratings? The door in a busy first floor corridor may need a different combination of ratings than an upper story transom. Clarify the specifics in terms of time duration for a fire label and category of impact for a safety label, as well as verify if protection against radiant and conductive heat transfer is required.

With the number of choices at your disposal, there should be no need for a product that seeks an exemption from being fully code compliant.

## E XTRA PRECAUTIONS

The codes may not require added security, but there may still be reason to choose it. Especially considering the vulnerable populations this glass needs to protect.

## S YSTEMS

Glass is not a stand-alone product. All glass and frame components must have the same or greater ratings to ensure the entire assembly provides the same level of defense during a fire. As with glazing, the options in fire-rated frames have also expanded, giving you more design freedom than ever.

## T OTAL SOLUTION

The bottom line is that no matter what combination of protection measures you are searching for, today you can find what you need in a single glazing solution. There's no need to compromise aesthetics for code compliance, and there's no need to sacrifice one form of safety for another.

# CHOOSE FIRE-RATED GLASS & FRAMING THAT MAKES THE GRADE

## What specific products do you recommend for consideration in schools requiring fire protection?

To select the best fire-rated glazing product for a given school, we recommend breaking down applications by their required fire and impact safety protection, performance and design standards.

### Fire Protection

In non-impact areas required to provide fire protection, we recommend FireLite® fire-rated glass ceramic. At only 3/16" thick, it easily fits into new or existing fire-rated frames to integrate with design schemes and save labor costs from custom orders. It can be cut locally throughout the U.S., Canada and the Middle East for quick delivery.

### Fire Protection & Impact Safety

For high traffic, "hazardous" locations that previously used wired glass to provide fire protection, we recommend FireLite Plus®. It meets the CPSC 16 CFR 1201 (Category II) impact requirements. The high impact laminating materials are sandwiched between two lites of clear glass ceramic, so both exposed surfaces are durable. FireLite Plus can also

be cut with normal glass cutting tools, which means it can be delivered quickly to school maintenance personnel or local glazing contractors.

WireLite® NT is another alternative. This 1/4" thick product is composed of wired glass and a high performance, fire-rated surface-applied film that allows it to meet Category I and II impact levels—which earlier forms of wired, fire-rated glass were not able to do. As with any glass product using a surface-applied film, a best practice is to install it in areas where heavy use or high traffic will not mar or damage its surface-applied film.

A third option is Pilkington Pyrostop®. The product is composed of multiple layers of low-iron, wireless glass with clear intumescent interlayers. It also meets the highest impact standards, comes in large sizes and is available with a broad range of fire ratings, depending on the make-up.

### Protection Against Heat Transfer

For areas requiring fire-resistance-rated construction (materials that block heat transfer during a fire), we recommend Pilkington Pyrostop®. Multiple options in its configuration make it ideal for interior and exterior use, with fire-resistance ratings from 60 to 120 minutes (where used as

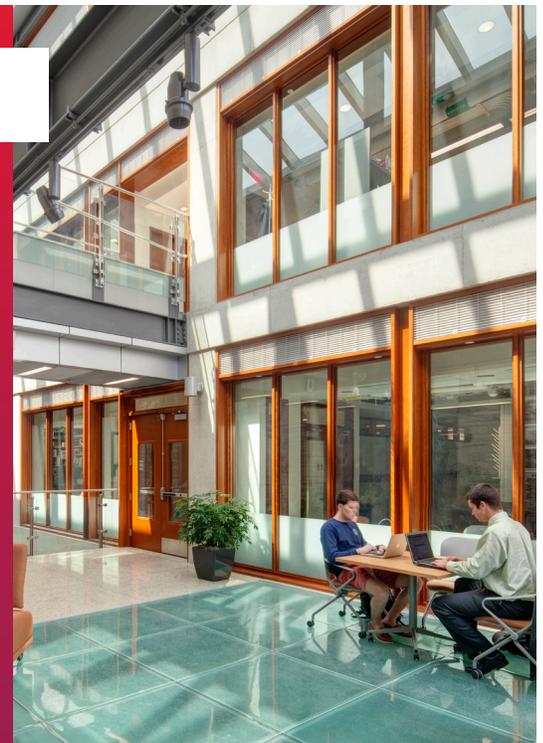
## CASE STUDY

### Northwestern University Engineering Life Sciences

Northwestern University's Engineering Life Sciences' expansion included infill to bridge two building wings, making for a bright space with collaborative gathering areas. Flad Architects was tasked with bringing a filtered amount of daylight down from the fifth floor to benefit student well-being while protecting fragile nuclear magnetic resonance lab equipment on the ground level. The floor system also needed to satisfy fire and life safety requirements. So the design team utilized Fireframes ClearFloor® System with two-hour fire-rated Pilkington Pyrostop® heat barrier glass.

"The fire-rated glass floor system allowed us to compartmentalize a very large volume of space without blocking off access to daylight," Matt Garrett, project architect explained.

While supporting loads up to 150 psf, the system additionally incorporates ceramic etched laminated glass for mild opacity. "The pattern on the glass creates just enough opacity to allow for the transfer of soft, even light," Garrett continued.



**Project:** Northwestern University Engineering Life Sciences

**Location:** Evanston, IL

**Architect:** Flad Architects

**Products:** Fireframes ClearFloor® System with Pilkington Pyrostop® and Fireframes® Hardwood Series frames

a transparent wall). This layer of defense can buy extra time for students and faculty to safely exit busy educational facilities even if a fire should rage on the opposite side of the glass.

When using fire-resistance-rated glazing such as Pilkington Pyrostop, it's important to remember the selected framing must also function as a barrier to heat transfer and meet ASTM E-119 and UL 263 test requirements. The IBC requires all glass and frame components to have the same or greater ratings than the required code minimums to ensure the entire assembly provides the same level of defense during a fire.

### Daylight

In schools where it is important to support student and teacher wellbeing through daylighting design, we recommend using advanced glazing products like Pilkington Pyrostop that pass the test standards for solid walls and are not restricted to 25 percent of the total wall area. Building teams can use such glazing in interior and exterior floor-to-ceiling, wall-to-wall or multi-story curtain wall applications while protecting students and property from the high heat generated by building fires.

Fire-rated glass floor systems are another innovative way to transmit light between floors in applications where a fire barrier is required. In interior settings, products such as the Fireframes ClearFloor® System can support structural loads while at the same time block flames, smoke and heat.

### Fire-Rated Frame Aesthetics

Building and design teams can now select from numerous fire-rated glazing systems that align with a school's overall design theme. Whether it is important to complement non-fire-rated frames or make a design statement, we recommend selecting slender fire-rated framing systems with well-defined corners and crisp edges. TGP offers a variety of narrow-profile Fireframes® fire-rated framing systems. They are also available to be custom painted or powder coated to match virtually any color scheme, and are available with finished stainless steel or aluminum custom cover caps to provide design professionals with even greater aesthetic flexibility.

### Fire & Security Solutions

For schools needing a complete, integrated fire and security system, we recommend Pilkington Pyrostop laminated to School Guard Glass®.

Pilkington Pyrostop is a fire- and impact safety-rated glazing material that blocks radiant heat, while School Guard Glass is a laminated glass product with a security strengthened substrate core designed to slow down intruders. By combining these two proven products, the resulting glazing solution is fire rated for 45 to 120 minutes, impact safety-rated to meet Category I and II requirements and Level III bullet-resistance rated.

**For a complete listing of all of TGP's products, please see the Product Comparison Chart in the next section or visit [fireglass.com](http://fireglass.com).**



# A SAFE INVESTMENT



## Aren't multifunctional fire-rated products more expensive?

To be sure, the initial investment for high performance glazing materials is greater than traditional wired glass and baseline fire-rated glass offerings. The old saying, “you get what you pay for” holds true: As with most things in life, the greater the level of performance desired, the greater the cost.

However, when you consider that schools are designed to last more than 30 years, the expected life span of the glass also matters. Products that rely on surface-applied films will require more maintenance over that time.

When it comes to matters of safety and security, initial purchase price is less of a determining factor than reliable performance. Specifying the lowest cost option up front can leave the door open for costly accidents, injuries or repairs down the road. What matters most is knowing that the safety and security of students, staff and parents has been given the highest priority.

## PRODUCT COMPARISON CHART

	Product	Maximum	Offers impact safety	Passes hose stream test	Blocks heat transfer during fire	Complies with energy codes	Compatible with TGP framing	Provides acoustic barrier	Advantages/ Disadvantages
THIN	Fireglass® 20	20 min.	✓				✓		+ Moderate initial investment - Cannot withstand thermal shock
	Wired Glass	45 min.		✓			✓		+ Least expensive option - Institutional appearance - Lower impact resistance - Limited sizes
	WireLite®	45 min.		✓			✓		+ Moderate initial investment
	WireLite® NT	90 min.	✓	✓			✓		+ Surface-applied fire-rated film + Cat I and II impact safety + Withstands thermal shock + Passes hose stream test - Possible abuse to surface film
	FireLite®	90 min.		✓			✓		+ Heat resistance of ceramic - Low impact resistance
	FireLite® NT	3 hrs.*	✓	✓			✓		+ Surface-applied fire-rated film + High impact resistance - Possible abuse to surface film
	FireLite Plus®	3 hrs.*	✓	✓			✓		+ Durable laminated construction + High impact resistance
	FireLite® IGU	3 hrs.*	✓	✓			✓	✓	+ Energy efficient + Acoustic barrier + Wide choice of appearances
THICK	Pilkington Pyrostop®	2 hrs.*	✓	✓	✓	✓†	✓	✓	+ Floor to ceiling glass designs + Reduces heat transfer + Tested as a wall - Can be heavy

\* For doors. Consult product literature for maximum ratings in other openings.

\*\* Meets CPSC 16CFR1201 (Cat I or II)

† In an IGU make-up



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