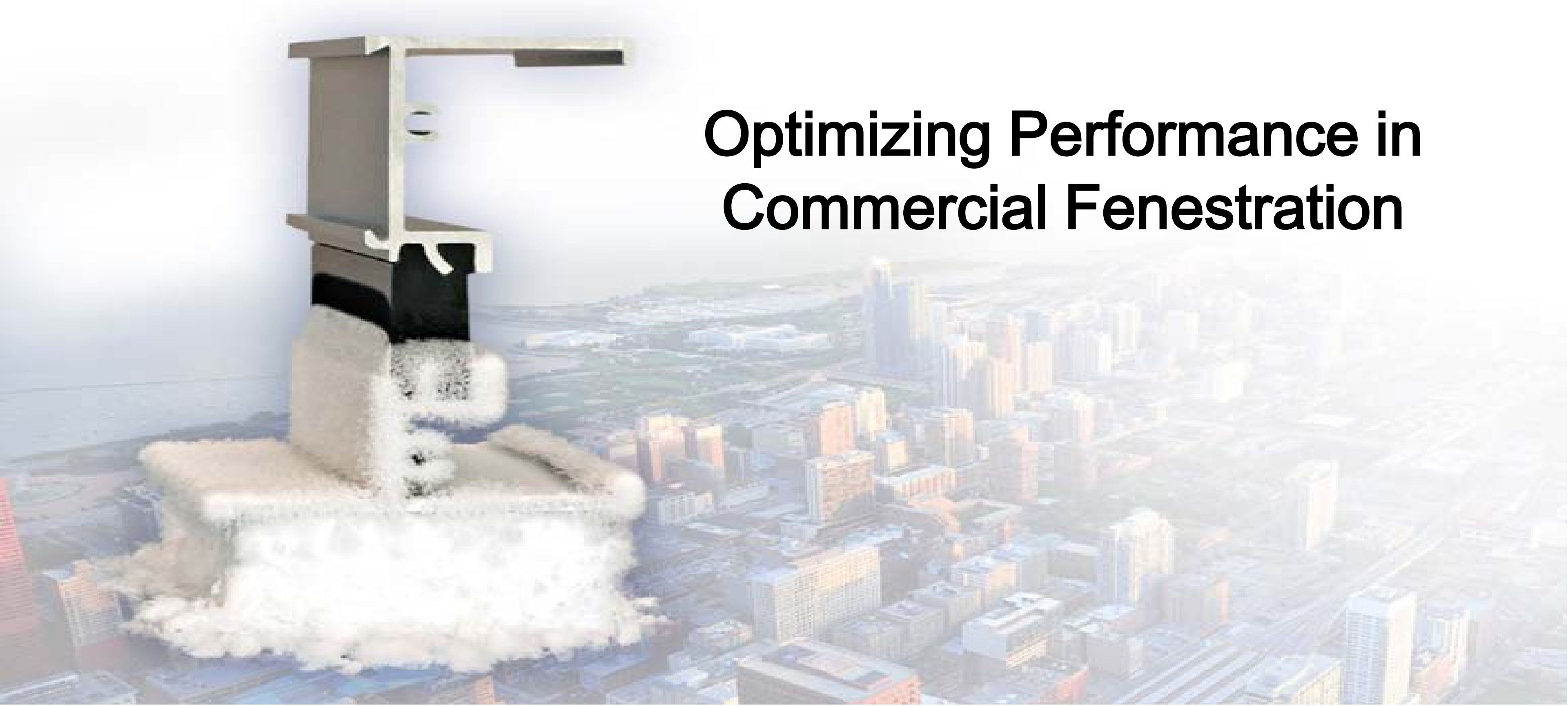
Optimizing Performance in Commercial Fenestration



Azon
643 W. Crosstown Parkway
Kalamazoo, MI 49008-1910
Tel: 269-385-5942
Fax: 269-373-9295
Toll-Free: 1-800-788-5942
Web: http://www.azonintl.com/

Azon | Provider number: K452 | Course number: AZON02

Optimizing Performance in Commercial Fenestration

Presented by: Azon
643 W. Crosstown Parkway
Kalamazoo, MI 49008-1910

Description: Provides an overview of optimizing commercial fenestration with thermal barriers and high performance glazing in aluminum window framing to maximize daylighting and thermal efficiencies in the building envelope.

Jeff Lurges
Business Development Representative
269-385-5942
jlurges@azonusa.com

Azon | Provider number: K452 | Course number: AZON02

Purpose and Learning Objectives

Purpose: Provides an overview of optimizing commercial fenestration with thermal barriers and high performance glazing in aluminum window framing to maximize daylighting and thermal efficiencies in the building envelope.

Learning Objectives:

At the end of this program, participants will be able to:

- discuss the sustainability, performance, and daylighting design benefits of optimized fenestration systems, including the life cycle of aluminum as a durable and recyclable frame material, and high performance glazing components to increase insulation in the overall window assembly
- describe the methods that measure heat transfer effects, condensation resistance, and ratings for the outdoor–indoor sound transmission values in thermal barrier window products
- explain the role of thermal barriers, and compare the performance of polyurethane polymer pour and debridge systems with polyamide strip systems, and
- observe a range of applications of optimized, energy-efficient commercial fenestration in built project case studies.

Advantages of Aluminum Fenestration

Aluminum Framing for Commercial Fenestration

Building designers look for a variety of attributes in a commercial fenestration system: structural performance, finish and color options, design capability, strength, and the ability to withstand climatic stress.

Aluminum windows are able to provide all these benefits:

- Excellent structural performance
- Narrow sightlines
- Recycled content
- 100% reusability
- Unlimited color finish options
- Contributions to green building program credits
- Catastrophic event protection: hurricane, blast, tornado, intrusion

Aluminum Framing for Commercial Fenestration

But among the attributes demanded by building designers, improving building thermal efficiency for long-term energy conservation typically tops the list. The use of a thermal barrier within the frame allows aluminum fenestration to provide better thermal performance, even while maximizing desired daylighting and views in large glazed areas.

Aluminum Sustainability

Everything manufactured comes from something that was mined from the earth or grown from its soil. As long as industry demands energy, chemicals, and metals, environmental factors are in question.

In addition to its performance characteristics as a material for window frames, aluminum is a highly sustainable metal. It is the third most abundant element in the earth's crust next to oxygen and silicon, and the most abundant metal in nature. Despite this, aluminum is not rapidly depleted because it is 100% recyclable and can be repeatedly recycled without any degradation of its physical properties. Of all the aluminum ever produced, 73% is still in use today.

Aluminum Sustainability

Recycling aluminum requires only about 5% of the energy required for primary aluminum production.

Annually, approximately 7.5 million tons of solid waste is diverted, and about 27 million tons of CO_2 equivalent of greenhouse gas emissions is avoided—equivalent to eliminating five, large (1,000 MW) coal-fired power plants. Aluminum has a high scrap value, which encourages recycling practices and keeps aluminum out of landfills.

Items made from aluminum are long-lasting and durable, and non-toxic even at high temperatures. Of all materials used for the fabrication of modern windows, aluminum is superior to vinyl, wood, and fiberglass in absolute terms of the life cycle story.

Other Benefits of Aluminum

Aluminum has a high strength-to-weight ratio so is ideal as a framing material for large, heavy glass spans. With the metal's long-lasting, low-maintenance qualities, aluminum frames can save money in upkeep and replacement costs. Aluminum frames are corrosion resistant when anodized and can be used in most environments.

Additionally, its great yield strength and resilience makes aluminum suitable for applications where impact resistance is a concern; aluminum will bend to absorb impact energy without breaking.

Designing with Aluminum Frames

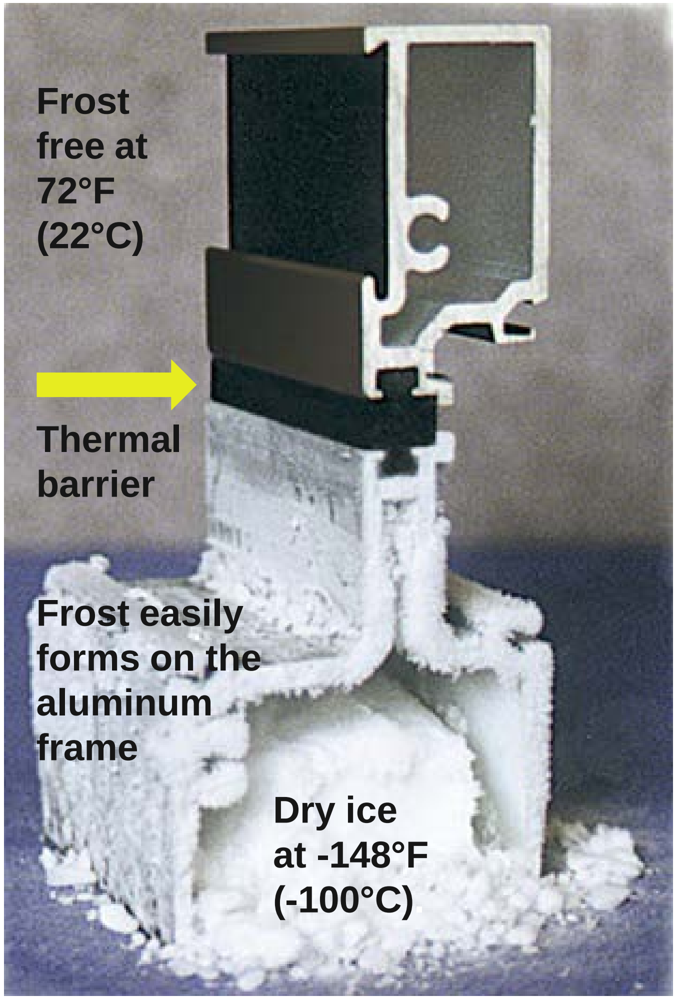
Aluminum frames also provide increased design flexibility over other framing materials. The thinner frames possible with aluminum make for narrow sightlines, enabling large expanses of glass to be supported with minimal aluminum material.

While maximizing daylighting provides both energy savings and health benefits, the same aluminum that makes large glazed areas possible is also a highly conductive material. The solution to aluminum's conductive properties is to be found with the use of thermal barriers. They eliminate the metal-to-metal bridge that acts as a conductor of hot or cold temperatures through the aluminum frame, replacing it with a very low conductive material, so that high thermal performance with expansive glazing is maintained.

Role of Thermal Barrier

The thermal barrier aluminum fenestration system becomes a strong composite, containing an element of low-conductance material which gives it thermal performance characteristics. It interrupts the flow of energy through the aluminum frame and provides structural strength in the envelope.

When a design calls for large windows to maximize daylighting benefits, aluminum's strength makes it ideal. The following project shows an example of how aluminum framing with thermal barriers can maximize the amount of daylighting in a space, while providing both benefits to the occupants and credits to green building programs.



Sangren Hall, WMU, Kalamazoo, MI

Sangren Hall is a LEED Gold® 230,000-square-foot facility completed in 2012 that contains the College of Education and Human Development and the Department of Sociology, located in the heart of the campus of Western Michigan University.

The large windows allow daylight to penetrate into the interior office spaces on every floor of the university building, saving electricity and providing a pleasant atmosphere for occupants.

Daylight must be properly integrated with the electric lighting system for its energy-savings potential to be realized. Sangren Hall employs occupant sensors to detect when a room is not being used, turning off lights or making adjustments to further reduce electricity use.


Photo: SHW Group

Sangren Hall, WMU, Kalamazoo, MI

This photo shows the exterior curtain wall that permits daylight to penetrate the space, allowing sufficient natural light to illuminate the interior during the peak hours that the school will be occupied.

Thermal barriers in the window framing ensure that the energy-saving benefits are not compromised.

Photo: Kalamazoo/Battle Creek Chapter of National Association of Women in Construction

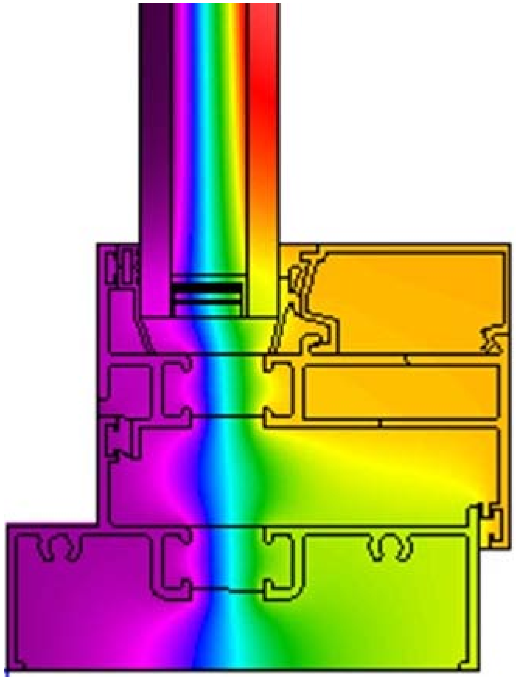
Aluminum Fenestration and LEED

Energy-efficient aluminum fenestration can potentially contribute points in several LEED categories.

Energy & Atmosphere: Larger natural daylight openings in the building envelope lower the dependence on electricity used to illuminate interiors. Likewise, because a window's thermal barrier reduces the flow of hot and cold through the fenestration, the heating and cooling costs of a building are reduced.

Materials & Resources: Aluminum frames can be fabricated with recycled content and are completely recyclable at end-of-use.

Indoor Environmental Quality: Windows with thermal barriers exhibit lower condensation, an important attribute toward improved health, comfort, and indoor air quality.

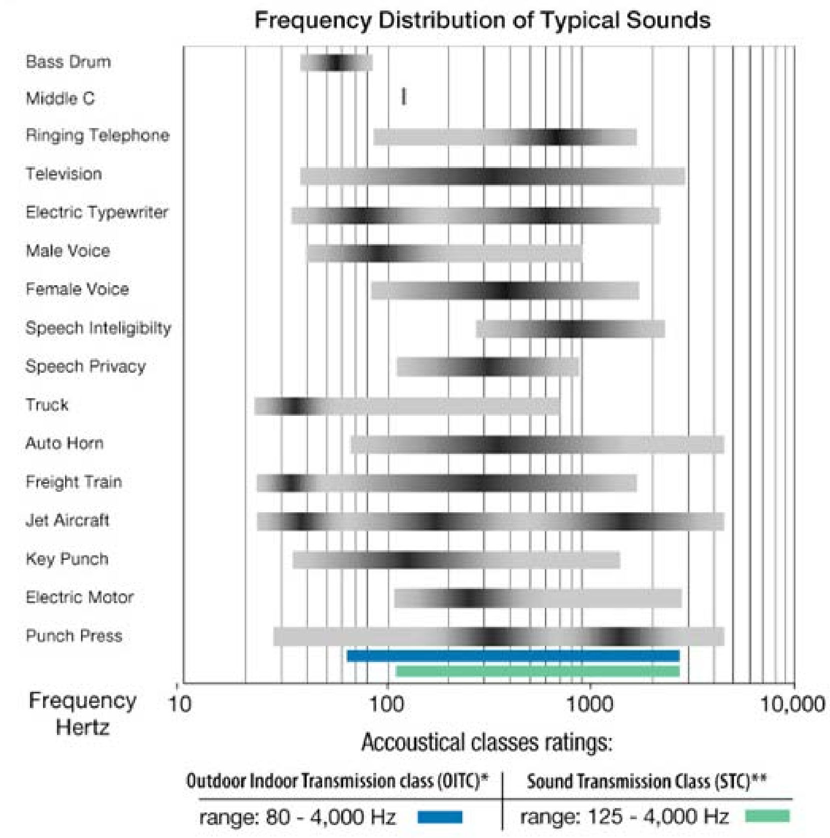


Optimizing Fenestration Performance

Sound Transmission

One characteristic of optimal window performance is minimized sound transmission. Building codes, owners, and architects are now requiring sound control for the entire fenestration system, rather than for the individual acoustical fenestration components.

Outdoor–indoor transmission class (OITC) is a standard used for indicating the rate of transmission of sound between outdoor and indoor spaces in a structure. Based on the ASTM E1332 Standard Classification for the Determination of Outdoor–Indoor Transmission Class, OITC utilizes a noise spectrum that considers frequencies down to 80 Hz and includes the lower frequencies produced by aircraft as well as rail and truck traffic.



Example: Minimizing Sound Transmission

Fenestration system components affect outdoor-indoor sound transmission in the exterior wall.

The Park Central Hotel New York is located in a busy traffic area near Central Park. Glazing includes a warm-edge spacer and polymer thermal barrier in the framing. The combined system is proven to contribute to overall sound transmission improvements.

High Strength

Maximizing window strength is another important consideration. Devoting sufficient attention to the building envelope design and material selection becomes especially important in regions prone to hurricanes, earthquakes, and other catastrophic occurrences. The high shear strength and load resistance of aluminum frames add safety elements to a structure.

Photo ©George Doyle, Thinkstock

In the fabrication of the frame, the thermal barrier must be able to adhere strongly to the finished substrate. When polyurethane is placed into an aluminum profile that has already been painted or anodized, additional measures must be taken to ensure the frame's strength is maintained. A process that abrades the cavity surface to create hooks holds the thermal barrier securely, mechanically locked in place, and is designed to provide years of reliable performance. The resulting aluminum polymer composite offers undiminished structural integrity over a long service life, even under extreme conditions and temperature changes.

Example: Maximizing Blast Protection

Improvements to the historical 1960s John F. Kennedy Federal Building in Boston added high security, comfort, energy efficiency, and long-term durability.

Nearly 5000 original windows—including bent corner units—were replaced with high-performance, energy-efficient, blast resistant windows. The JFK Building windows are intended to survive catastrophic events and protect occupants, and they exceed the industry standards for high shear and tensile strength. The material properties of the aluminum thermal barrier framing with a mechanical lock are ideal for use in government and public buildings where impact or blast hazard is at a high risk.

Maximizing Daylighting

Maximizing daylighting not only reduces lighting energy needs but provides health benefits to occupants. Worker productivity, student performance, and hospital patient recovery have all shown improvements in studies of the benefits of daylighting.

The strength of aluminum allows slim frame profiles to support a higher percentage of glass for improved daylighting and views.

To achieve the best possible daylight transmittance with the least amount of heat gain or loss, window performance is dependent on both the glazing and frame efficiency. How is fenestration thermal performance measured?

Heat Transfer and Condensation Resistance

Optimizing window performance must include minimizing heat transfer and condensation, while maximizing energy savings.

U-values or U-factors measure how well a product insulates and prevents heat from escaping a building. Heat transfer values are measured in $Btu/h \cdot ft^2 \cdot °F$ and generally fall between 0.15 and 1.20; the lower the U-factor, the better the window insulates. Lower U-values are particularly important during the winter heating season in colder climates, although they are also critical in hot climates in order to save energy required for air conditioning.

The solar heat gain coefficient (SHGC) measures how well an opening blocks heat from sunlight. The SHGC is the fraction of the heat from the sun that enters through a window, expressed as a number between 0 and 1. The lower the SHGC number, the less solar heat is transmitted.

Condensation resistance (CR) measures how well the window resists water build-up and is scored on a scale from 0 to 100. The higher the condensation resistance factor, the less build-up the window allows.

Example: Minimizing Heat Transfer and Condensation

Skidmore College in upstate New York had very specific fenestration requirements for their Arthur Zankel Music Center.

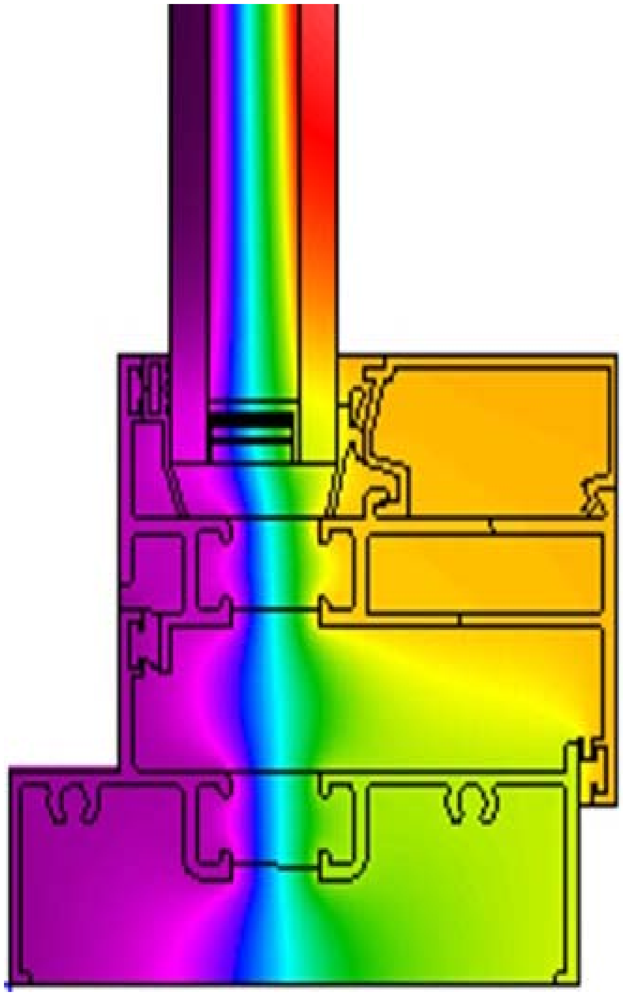
In this region, humidity can be relatively high in cold weather months, and condensation is of particular concern. The selection of triple insulating glass in large sizes maximized the outdoor views while providing a low U-factor. A CR factor of 81 means that moisture is not a problem in the facility.

Tools for Maximizing Thermal Performance

Almost all windows now have NFRC ratings which describe a number of performance characteristics of the window, including U-factor, SHGC, visible transmittance (VT), and CR. These performance characteristics are determined through the use of Lawrence Berkeley National Laboratory programs, WINDOW and THERM.

In WINDOW, the simulator creates the glazing systems the fenestration product could incorporate. The systems and unique attributes are then imported into THERM where the framing system is created and material properties assigned.

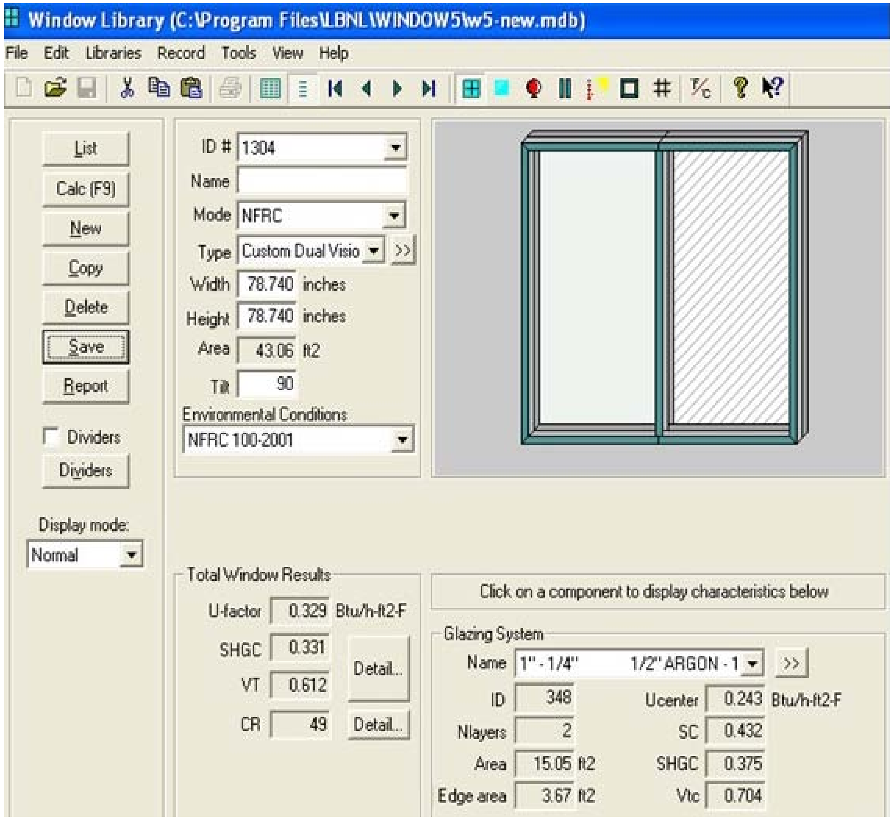
THERM models two-dimensional heat-transfer effects in windows and other products where thermal bridges are of concern. The THERM heat-transfer analysis demonstrates a product's energy efficiency and local temperature patterns.



Tools for Maximizing Thermal Performance

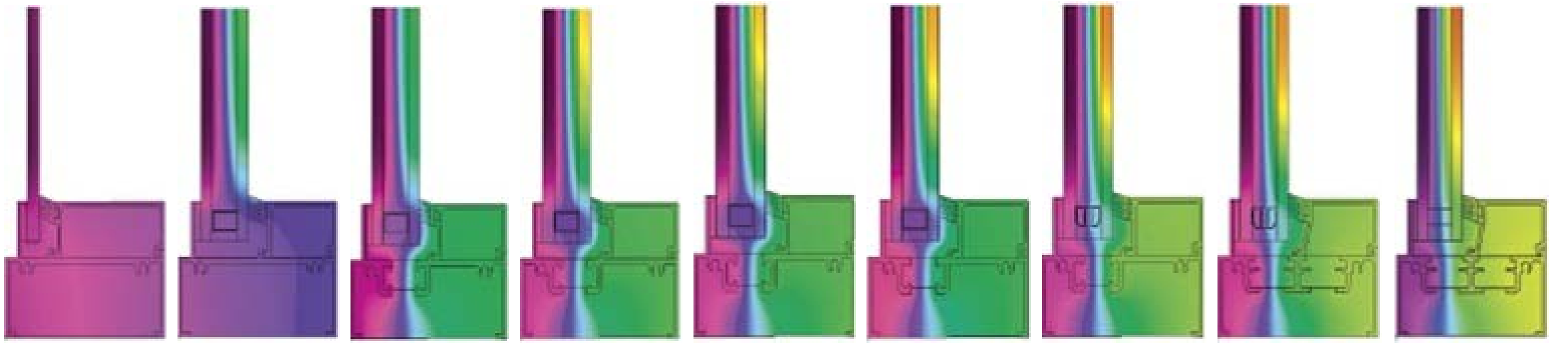
Once all of the framing profiles are simulated (jamb, sill, head, meeting rail, etc.) the THERM file is transferred back to WINDOW where the entire fenestration assembly is modeled and the total performance of the product is calculated.

The modeling tools can identify problem areas which may relate directly to issues with condensation, moisture damage, and structural integrity. Modeling and simulating software allows designers to see how changes in the profile design, thermal barrier material, and glazing options impact the overall performance of the fenestration system.



Evolution of Thermal Performance

This timeline shows how continuing improvements have resulted in greater fenestration thermal performance.



	1950	1960	1970	1980	1990	2000	2005	2010	2015
Overall U-Factor	1.00	0.66	0.50	0.44	0.41	0.39	0.37	0.32	0.29
CR	16	28	52	54	55	56	61	65	64
Center-of-Glass U-Factor	1.03	0.49	0.49	0.36	0.29	0.24	0.24	0.24	0.20

Evolution of Thermal Performance

Steel was the most common material used in metal window frames, and together with single panes, provided little or no energy savings as both were thermally inefficient and offered paths for condensation and frost.

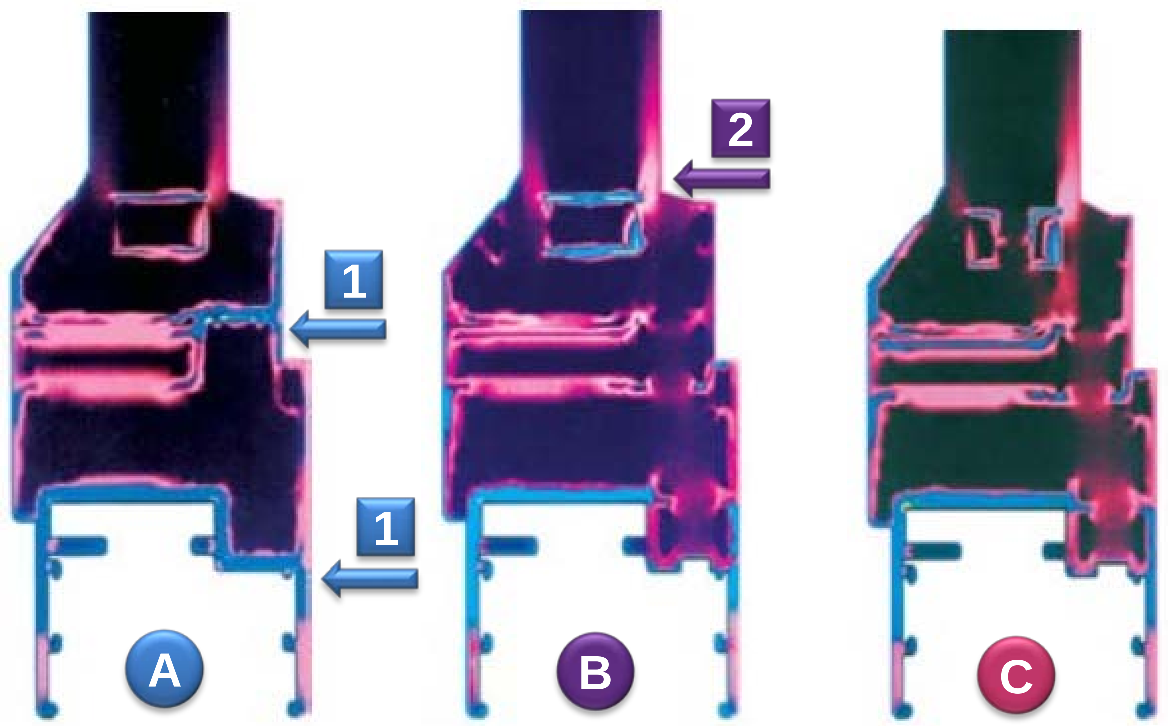
Beginning in the 1950s, single-pane products advanced into insulating glass, slowly replacing the once-popular storm panel applied to a single-glazed window. In these units, the cavity between the two glass panes acts as an insulator, preventing exterior climate conditions (whether hot or cold) from transferring in.

By the 1970s, the use of insulating glass in residential and commercial applications grew in popularity, making significant strides in energy conservation for windows. By replacing aluminum spacers with warm-edge spacers, and filling with inert gases such as argon or krypton, insulating glass units can reduce convection by as much as 10% compared to normal air.

With the introduction of insulating glass, the frame quickly became the most thermally inefficient component of the window.

Thermodynamic Imaging

These thermodynamic images show a comparison of good/better/best optimization possibilities. The images are based on an outside temperature of 0°F (-17.8°C) and an ambient indoor temperature of 70°F (21.1°C).



A Insulating glass unit with low-E, aluminum spacer, and aluminum frame. The heat flow is through the frame as shown in blue at **1**.

B The same low-E unit with an aluminum spacer and thermal barrier frame. The heat flow is now through the spacer as depicted in blue at **2**.

C Total performance package: a low-E unit with warm-edge spacer and a thermal barrier frame. There is no direct heat flow path.

Thermal Barrier Types and Comparisons

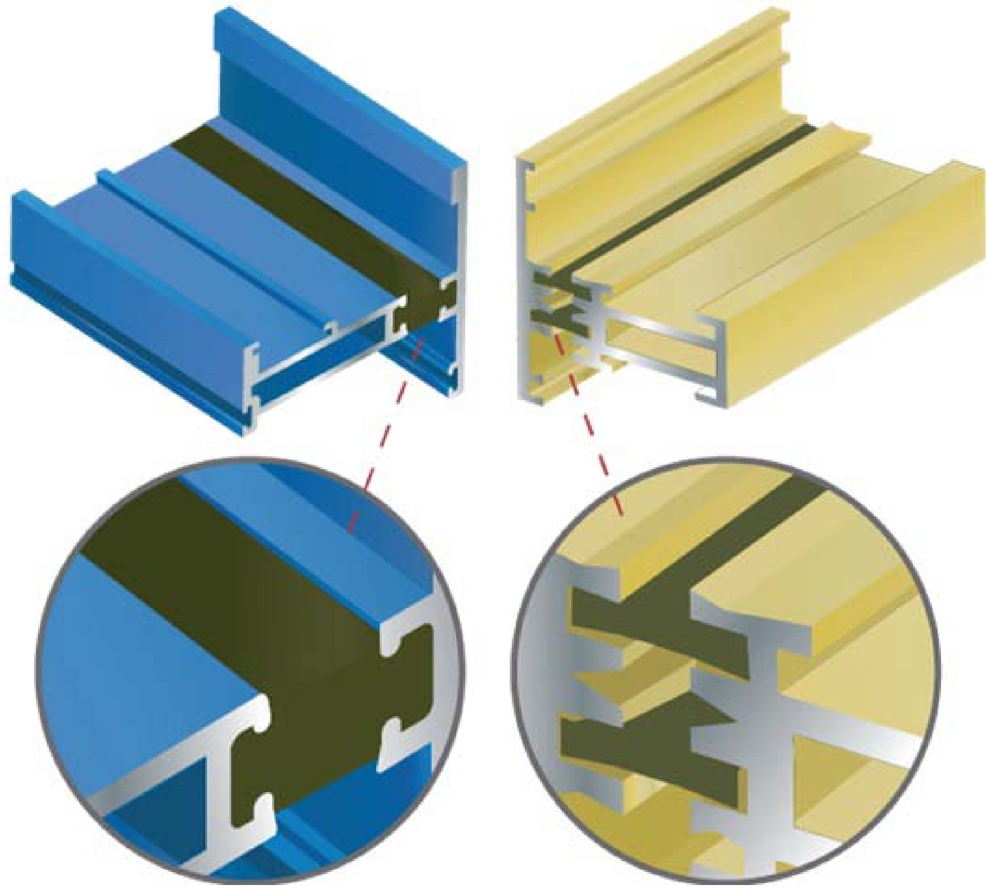
Thermal Barrier Types

The two most common types of thermal barrier for aluminum fenestration products are shown at right. The blue images show a pour and debridge system that uses a polyurethane polymer material.

The yellow images show a strip system, also called a strut system. This type of system incorporates a polyamide material.

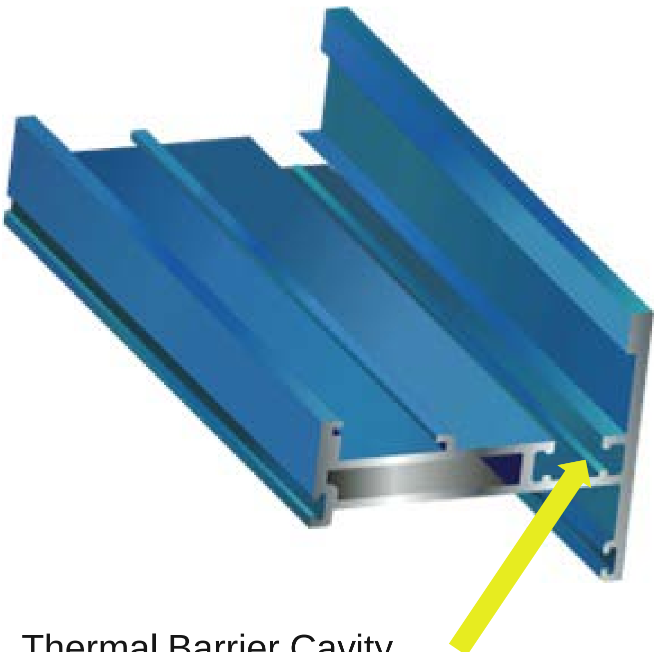
Polyurethane
Pour and Debridge System

Polyamide
Strut or Strip System

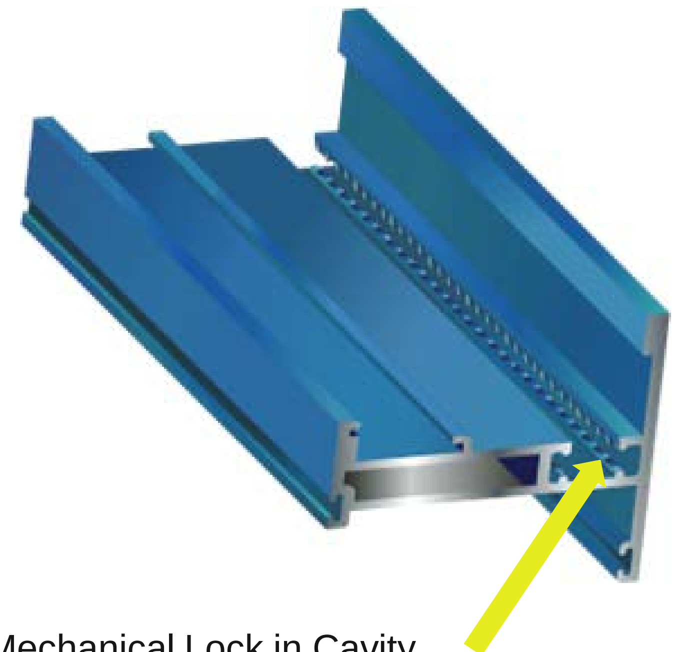


Thermal Barrier Fabrication: Pour and Debridge

The pour and debridge system starts with a single aluminum profile, designed and extruded with a cavity for the insulating polymer material (left image). After the profile is finished, a mechanical lock that will ensure proper bonding and adhesion of the polymer is prepared within the fill cavity of the aluminum profile (right image).



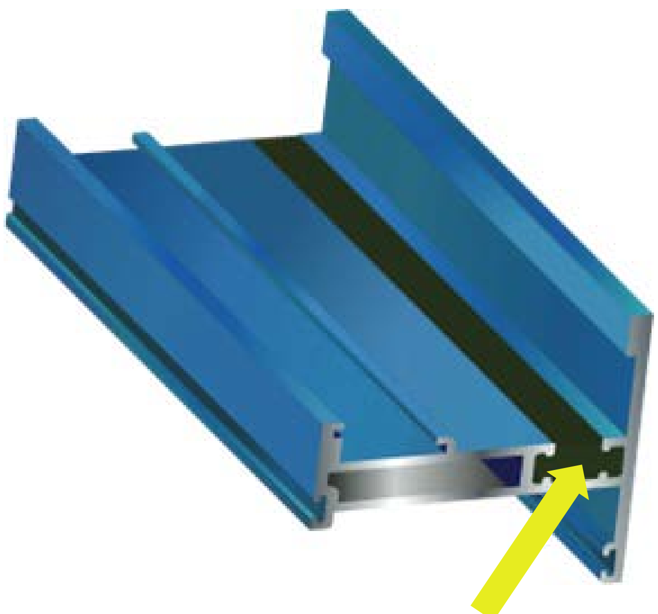
Thermal Barrier Cavity



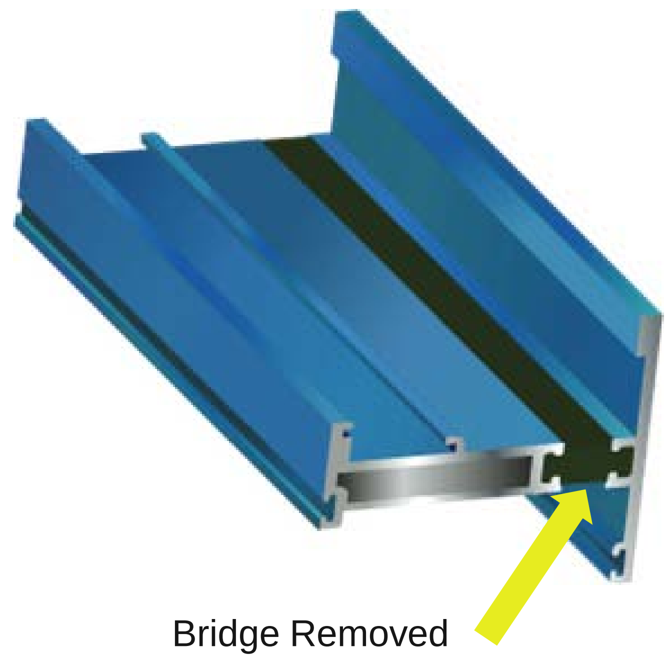
Mechanical Lock in Cavity

Thermal Barrier Fabrication: Pour and Debridge

Next, the cavity is filled with a liquid polyurethane polymer (left image), which solidifies within the aluminum cavity. Lastly, the bottom part of the aluminum cavity is removed. Removing this “bridge” from the bottom of the cavity forms a non-continuous aluminum profile. No metal-to-metal contact means the high conductivity of aluminum is no longer an issue. Heat now must pass through the very low conductive polyurethane polymer material, resulting in improved thermal performance of the unit.



Polyurethane Polymer



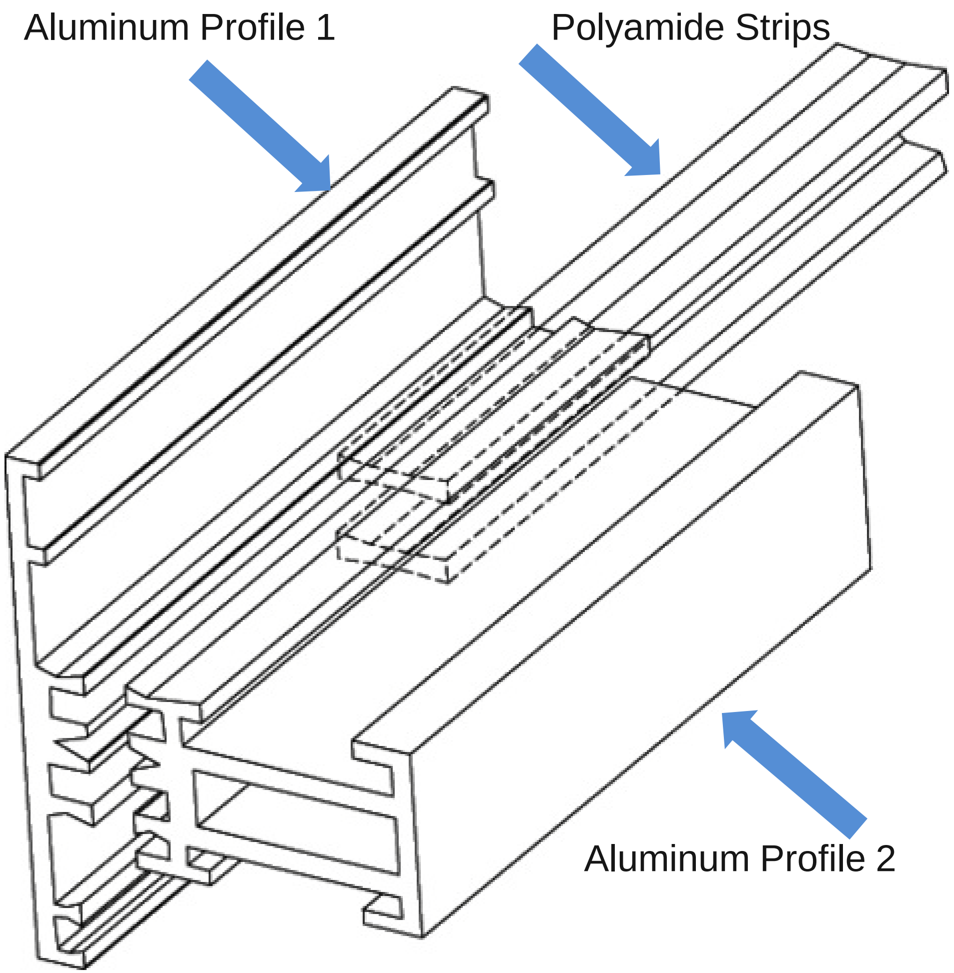
Bridge Removed

Thermal Barrier Fabrication: Strips

The polyamide strip system is composed of two separate aluminum profiles that are connected by the thermal barrier material.

The interior and exterior of the profiles are finished and then run through a knurling machine that puts ridges on the thermal barrier cavity of the aluminum profile.

The polyamide comes to the manufacturer in strips, and these strips are threaded into the cavities of the aluminum profiles.



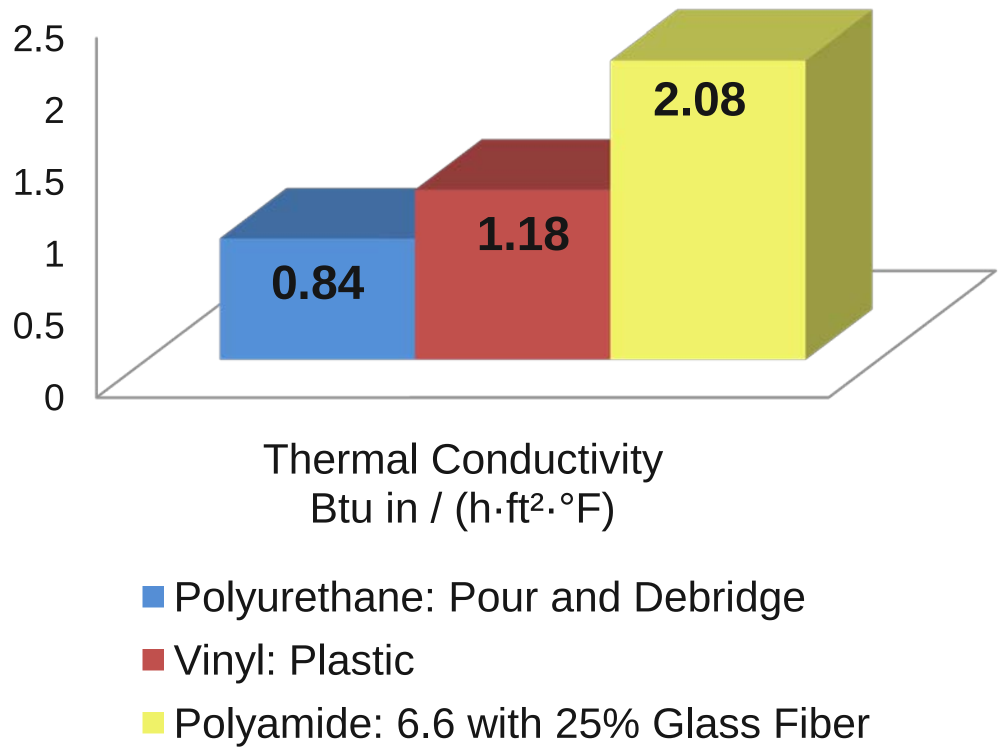
Thermal Barrier Fabrication: Strips

The aluminum cavities are then put through a crimping machine that presses the aluminum into the polyamide strips, which holds the system together.

Thermal Barrier Conductivity Comparison

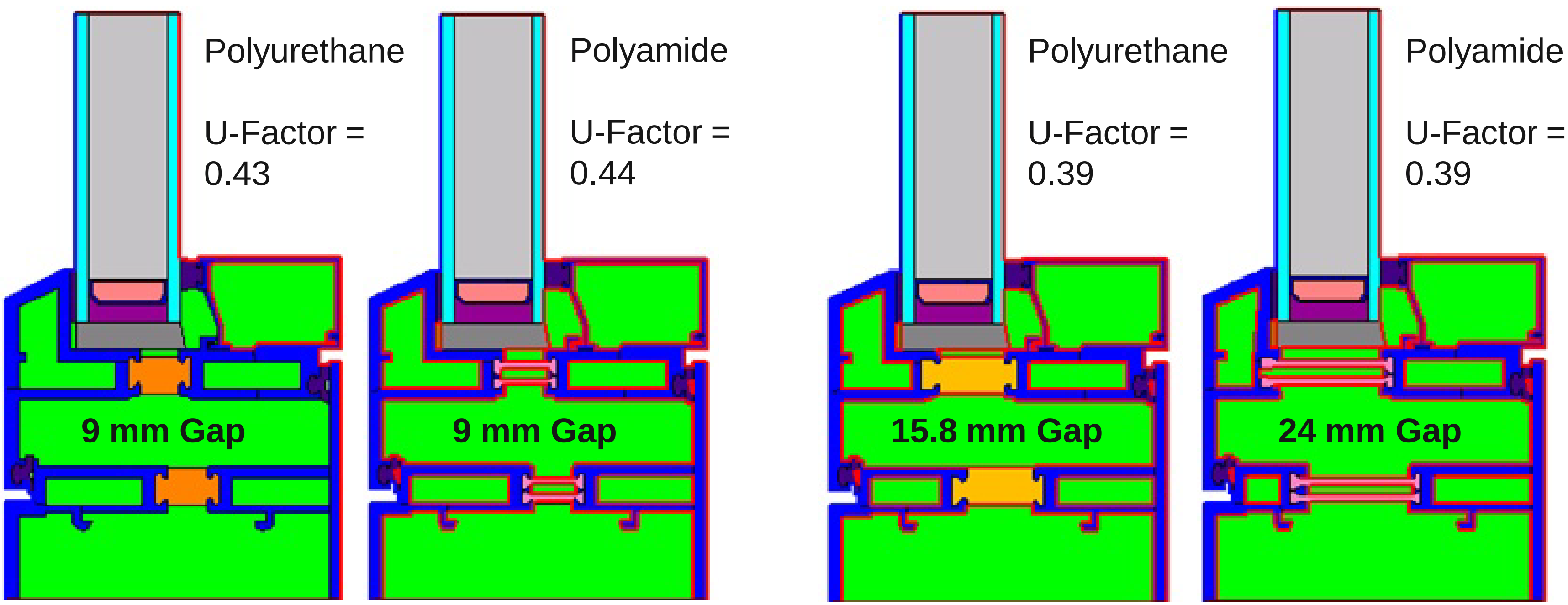
Thermal conductivity is crucial to how well a thermal barrier material insulates and is measured in Btu in/h·ft²·°F. The lower the thermal conductivity, or heat energy loss, the better the insulator.

The material properties shown in this chart are from the NFRC 101 material library and are used in the THERM program for thermal simulations of the aluminum profiles.



Thermal Barrier Gap Comparison

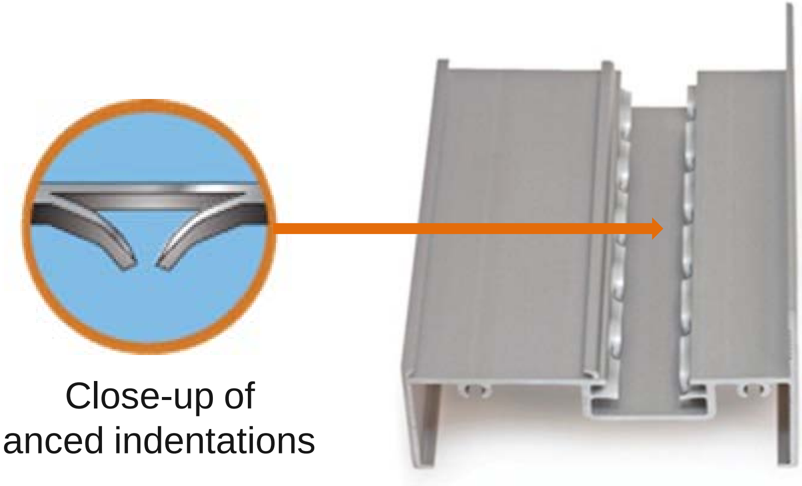
Along with thermal conductivity, the thermal performance can be improved by the gap in the thermal barrier, or the distance that the heat must flow through the low conductive material. Here you can see how polyurethane and polyamide perform similarly when the gap is 9mm for each. But a U-factor of 0.39 can be achieved with polyurethane in a 15.8 mm gap, while it takes a 24 mm to achieve the same with polyamide.



Wider Cavity Profiles

The wider gaps discussed on the prior slide provide energy savings, but the structure must remain strong. Lanced indentations that curve downward within the cavity provide more surfaces to mechanically lock and embed the polymer to the aluminum. The displaced metal creates a strong, bonded composite, allowing superior structural integrity with increased cavity size.

The fully encapsulated cavity design results in high shear strength and requires less aluminum by weight than windows manufactured with other types of barrier systems.

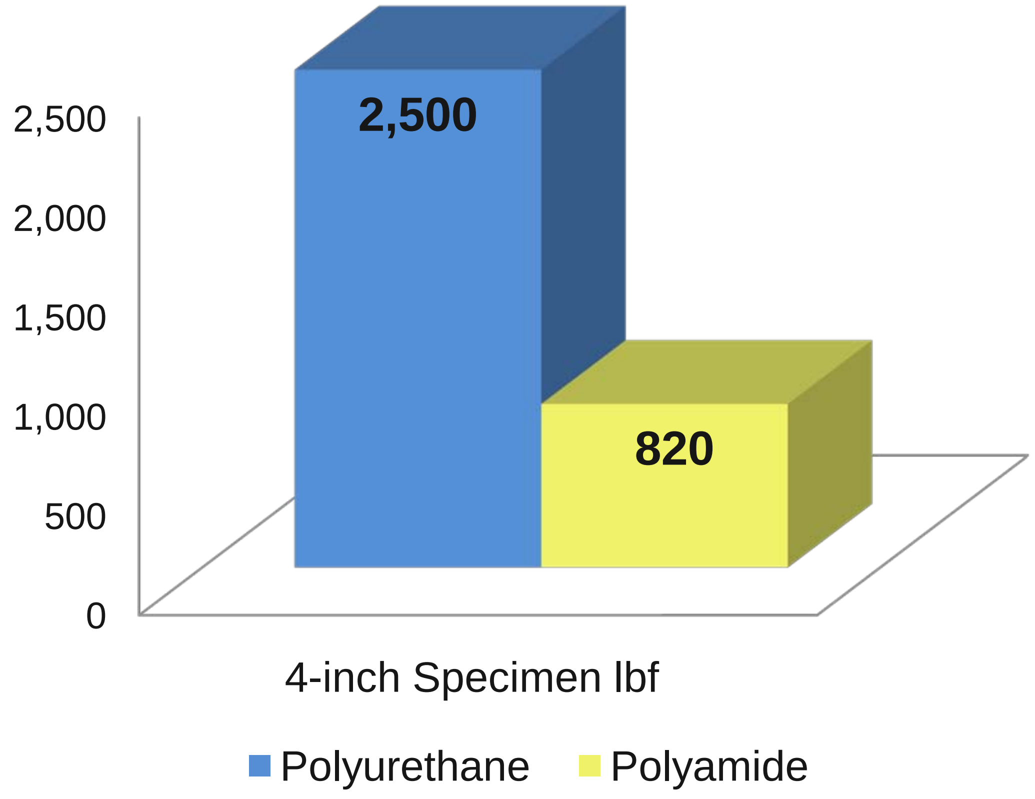


Close-up of lanced indentations

Composite added and bridge removed

Thermal Barrier Shear Strength Comparison

Shear strength is the ability of the thermal barrier material to resist slippage or tearing parallel to the line of application loading—in other words, the amount of force required to make the bond between the aluminum and the thermal barrier fail. This force is placed on one side of the metal profile, while the thermal barrier and the other side of the metal profile is held in place. The shear strength of the profile plays a large role in structural strength and affects spans and the ability to handle wind loads.



Thermal Barrier Structural Strength Comparison

The tables at right show the differences between the structural performance capabilities of polyurethane versus polyamide thermal barriers.

The material properties affect the overall design abilities of the fenestration products and therefore impact the overall look of the building.

Polyurethane		Polyamide	
Torsion	1,519 lbf	Torsion	519 lbf
Shear	1,901 lbf	Shear	1,437 lbf
Deflection	2,206 lbf	Deflection	1,821 lbf
Deflection weight force required to deflect an 84-inch extrusion ½-inch			

Thermal Barrier Design Comparison

If an optimal performance grade product with a 60 psf rating design pressure is required, then the opening span with polyamide can be at most 4 feet. Thus, a 22-foot opening using polyamide creates a “jailhouse effect.”

- 5 vertical mullions
- 18 insulating glass units
- Each 4 feet wide

Thermal Barrier Design Comparison

The same requirements can be met with an opening span of 5.5 feet if polyurethane is used.

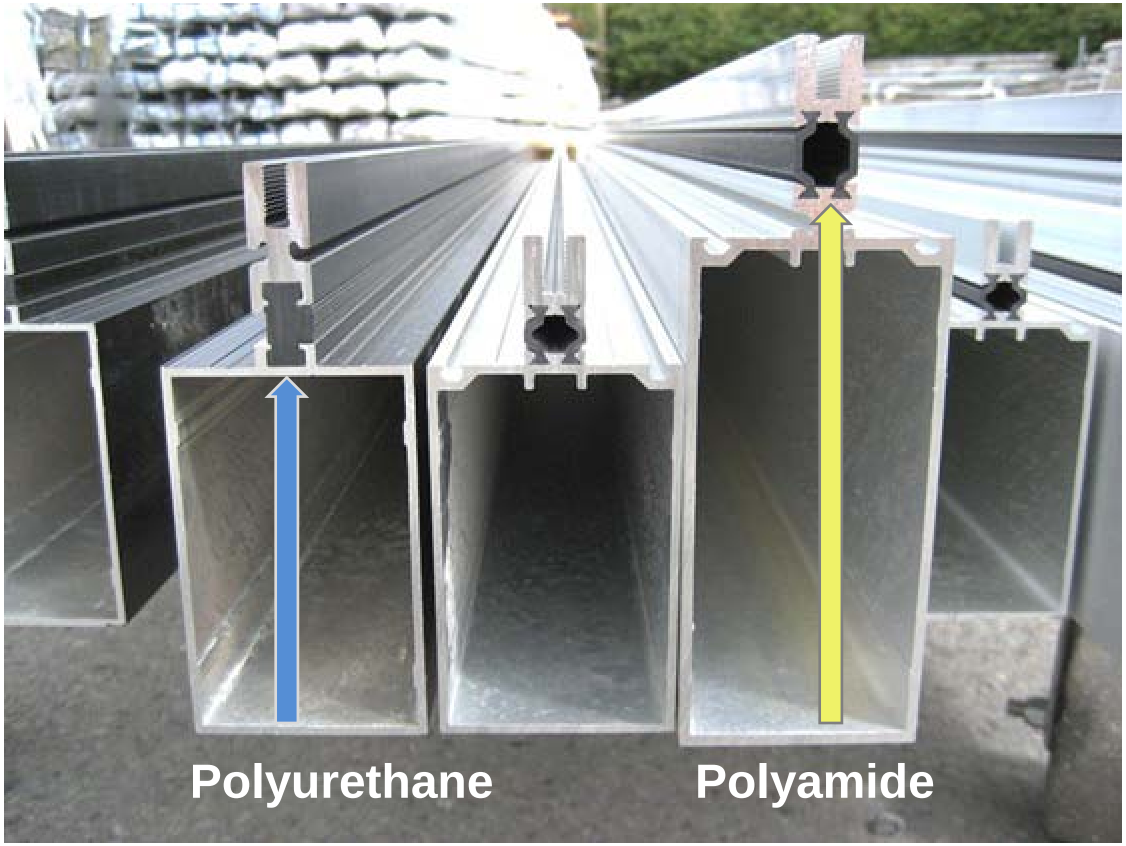
Polyurethane thermal barriers are desirable to a designer because they allow larger spans with:

- fewer horizontal and vertical aluminum framing members
- a less obstructed view
- more daylighting
- less material
- less difficulty to manufacture, and
- less cost.

- 3 vertical mullions
- 8 insulating glass units
- Each 5.5 feet wide

Thermal Barrier Cost Comparison

It is simply less costly to produce a polyurethane thermal barrier due to the fact that it starts with a single extrusion.



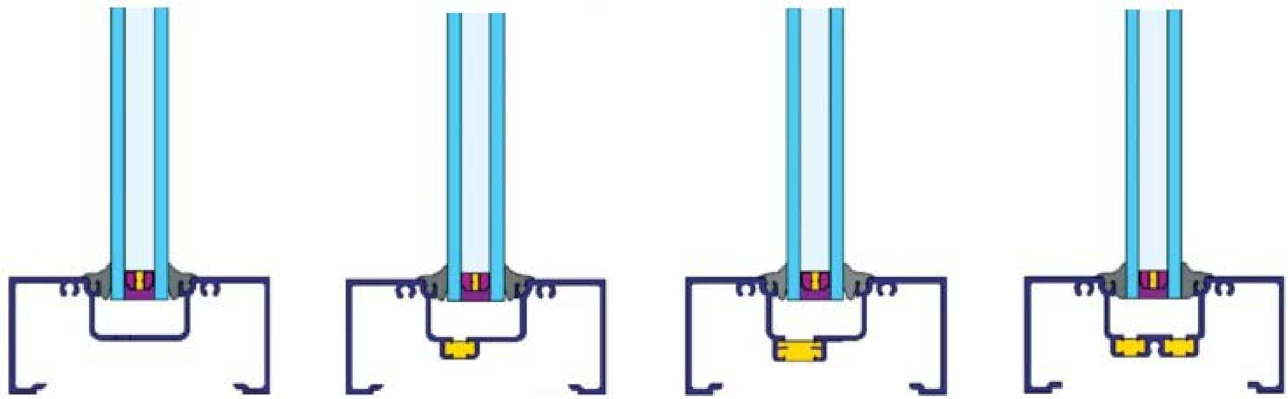
Dual Cavity Polyurethane

A double (dual) thermal barrier design will significantly reduce heat transfer, lessen exterior noise, and offer greater condensation resistance than single barrier designs. Separate dual thermal cavities next to one another allow for easier placement of screw bosses for anchoring the system during installation. Dual thermal barriers create lower sightlines, as well as longer vertical spans and horizontal spacing. They can be manufactured in a single pass for production efficiency.

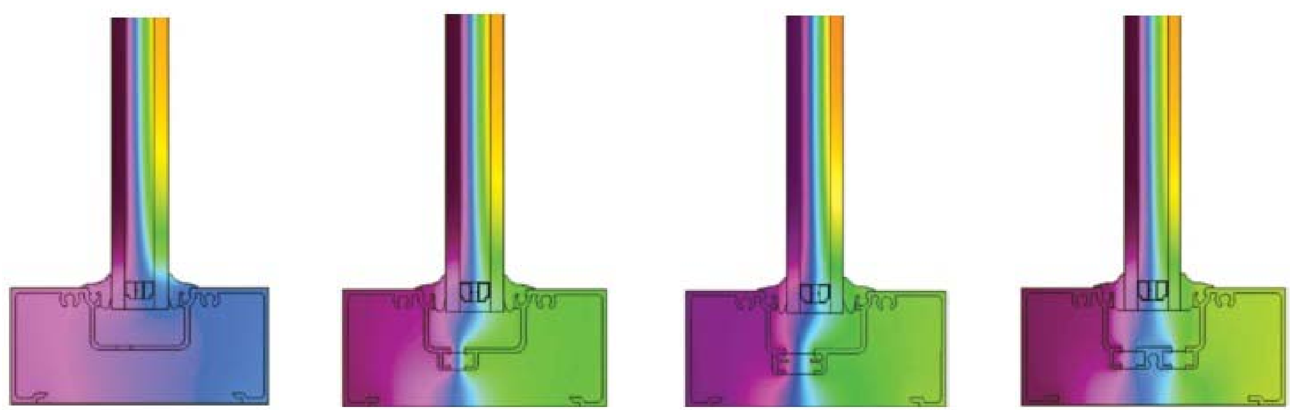
Dual Cavity Polyurethane Comparisons

Diagrams above and thermal images below compare dual cavity frames with other variations.

Temperatures are 0°F (-17.8°C) outdoors and 70°F (21.1°C) indoors. The aluminum frames are all fitted with insulating glass, argon filled, with warm-edge spacers.



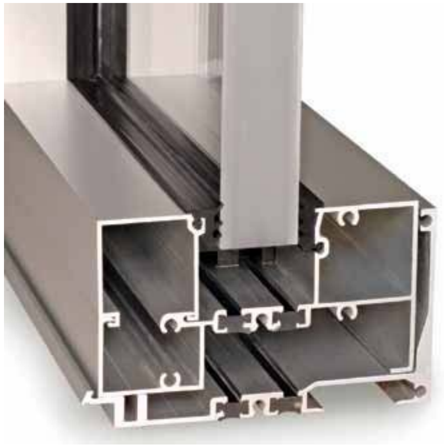
Conventional Frame	Conventional Frame	Optimized Frame	Optimized Frame
Non-Thermal	Single Cavity Thermal	Wide Cavity	Dual Cavity
U-Factor 0.62	U-Factor 0.41	U-Factor 0.33	U-Factor 0.32
Frame 21.1°F	Frame 38.1°F	Frame 43.8°F	Frame 44.5°F



Storefront and Curtain Wall Systems

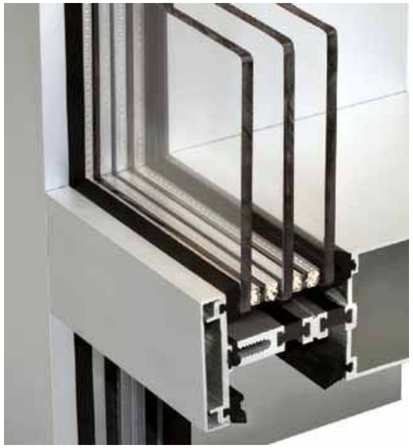
Both high performance storefront and curtain wall systems for commercial buildings are available in dual or single cavity designs. The lanced indentations that lock the thermal barrier in place improve the structural performance, allowing longer vertical spans and horizontal spacing. The dual cavity design can also be applied to operable windows and still provide room for assembly hardware.

Operable Frame



Storefront, Dual Cavity

Storefront, Single Cavity



Curtain Wall, Dual Cavity

Curtain Wall, Single Cavity

Case Studies

Shady Grove Adventist Hospital

Description: When Shady Grove Adventist Hospital in Rockville, Maryland planned a 207,000-square-foot expansion and compared material properties for hospital furnishings—and in particular the fenestration—aluminum came to the forefront because of its ease-of-fabrication, recyclability, and ability to withstand weather and natural forces. But aluminum and the glazing that lets in daylight need improvement to be viable energy conservators, and the potential health effects of excessive water vapor must also be considered.

Action Plan: Maryland is located in a climate zone that relies on heating in the winter months. The building designers recognized the advantages of a high SHGC for this type of architecture and traded that advantage for a slightly higher U-factor.

Photo ©Shady Grove Adventist Hospital

Photo ©jiunlimited

Shady Grove Adventist Hospital

Fenestration: To help offset some of the difference in U-factor while keeping the SHGC and visible light transmittance high, warm-edge spacers were used in the insulating glass units. The materials in the fenestration assembly achieved a condensation resistance factor of 71. In doing so, Shady Grove conformed to recent studies showing the increased health benefits of natural daylighting and lower condensation in hospital settings.

Outcome: Healthcare providers employ a wide range of solutions within their healing environments in caring for patients. In the building envelope, systems that reduce condensation while providing energy-saving daylighting for building occupant comfort and health ensure healthy surroundings for all of the hospital's patients.

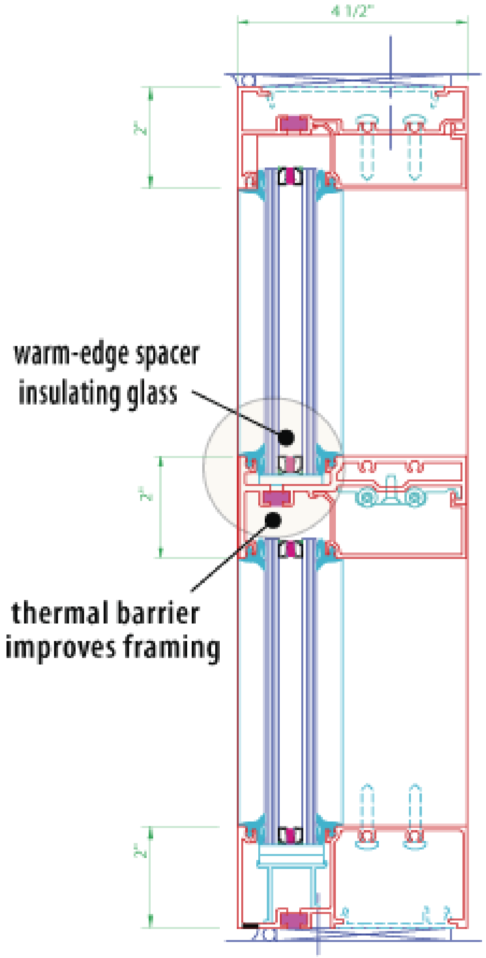


Photo ©Kawneer

David Brower Center

Description: The first building of its kind in Berkeley, California, and one of fewer than 10 such buildings in Northern California, the David Brower Center is LEED® Certified™, Platinum with a score of 55 out of 60 possible credits. The Brower Center includes 24,000 useable square feet of office space on its top three floors and is home to a wide range of non-profit groups working for environmental and social action.

Action Plan: The 50,000-square-foot new construction required 163 windows as part of the $28 million project, which took two years to complete. The rectangular building is only 65 feet wide, narrow for most office buildings, but ideal for bringing natural ventilation and daylight into the entire space.

Photo ©Mark Darley

David Brower Center

Action Plan, cont'd: The windows are actually different heights, changing in size from floor to floor to maximize natural daylight while reducing heat gain. The lowest office level gets the most shading from other buildings so has the biggest windows. The middle floor has a slightly lower floor-to-ceiling height. The windows on the top floor are the smallest and are shaded by photovoltaic panels on the cornice, which wraps around the top of the building.

Photo ©Kristan Lawson

Fenestration: The high-performance operable windows feature a polyurethane thermal barrier, and meet the industry's most stringent testing for air infiltration, water and condensation resistance, structural integrity, and thermal performance.

Outcome: Operable windows contribute to a healthy indoor environment and take advantage of the moderate climate in Berkeley (median annual temperature of 68°F). The center achieves 100% daylighting in all office areas. During the day, office workers typically do not need to use overhead lights.

Hyundai-Kia World Headquarters

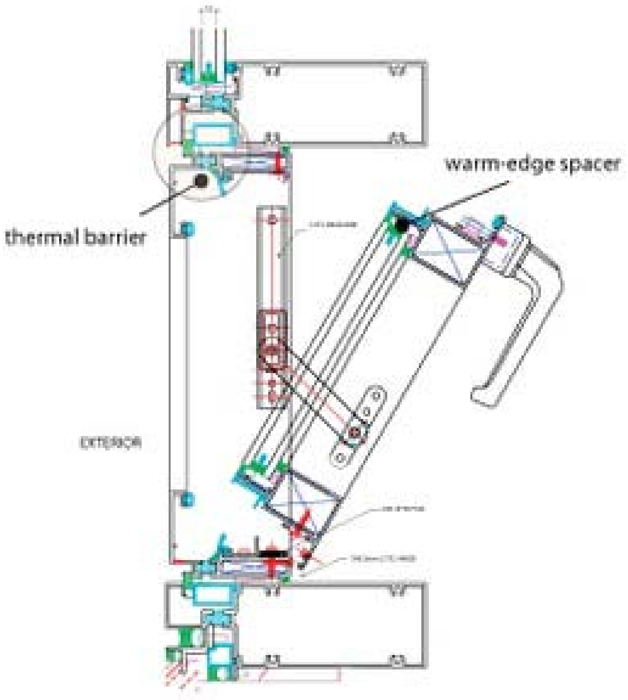
Description: After purchasing Kia Motors in 1998, the Hyundai-Kia Automotive Group was formed as the second largest automaker in Asia and one of the world's top four automakers. The world headquarters is located in Seoul, South Korea, and initially consisted of a 26,530m^2 high-rise. In 2005, the automotive giant's growth necessitated additional facilities, and Hyundai began designing an expansion project that would more than double the campus.

Action Plan: Phase I of the Hyundai-Kia Automotive Group World Headquarters building project opened in the year 2000. The fenestration products in Phase I consist of clear glass with an aluminum spacer and polyamide aluminum framing. In designing Phase II, a study compared the older fenestration system to modern, more advanced framing and glazing system components.

Hyundai-Kia World Headquarters

Fenestration: The insulating glass units in the Phase II tower were to include low-E glass and warm-edge spacers. The aluminum framing material would also utilize a polyurethane polymer, the thermal barrier system with the lowest conductivity of any insulant material used for that purpose.

Outcome: The completed comparison study resulted in a potential heating and cooling savings for the newest Hyundai-Kia Automotive Group tower in excess of $91,000 annually. Other benefits included saving non-renewable fossil fuels and a reduction in carbon emissions. Based on the significant energy cost savings potential demonstrated in the study, the improved fenestration system was chosen for the Phase II building project.



Hipp Hall, Furman University

Description: Herman N. Hipp Hall is a 35,000-square-foot newly constructed academic facility, part of Furman University in Greenville, South Carolina. It is the first building in the state to be LEED® Certified™, Gold.

Action Plan: The University needed to build in keeping with its existing architectural style, but at the same time, it needed to be innovative with the use of modern building technology to get the desired energy savings. The University designed an energy model to look at factors such as daylight penetration and the role that the building envelope played in heating and cooling for operational efficiency.


Photo ©Furman University

Hipp Hall, Furman University

Fenestration: The importance of daylighting and views is reinforced by their inclusion as a point contributor under the LEED Indoor Environmental Quality category. But large windows can reduce the building envelope's thermal efficiency, making the choice of frame and glazing very important to minimize heat transfer. For this project, single hung windows with aluminum frames, high performance one-inch insulating glass, fixed upper sash, and an operable lower sash were selected.

Photo ©Furman University

Outcome: The ultimate goal for building owners is to reduce costs by reducing a building's energy consumption, something that Hipp Hall has already done, saving Furman University about $12,000 per year and 30% more than other campus buildings since it was completed. The trustees were so happy with the results, they insisted that all new buildings on campus be built according to LEED guidelines.

http://www.freeimageslive.co.uk/free_stock_image/night-skyline-jpg

Summary

Summary

Aluminum commercial fenestration systems can meet all the attributes building designers look for, including structural performance, finish and color options, design capability, strength, and the ability to withstand climatic stress. The high strength of fully recyclable aluminum allows the construction of narrow frames that maximize daylighting and views. Thermally efficient glazing is required for complete performance; reducing sound transmission, and increasing blast or impact resistance are other considerations for optimizing fenestration.

Thermal barriers within the frame are another vital component to optimize fenestration; they eliminate the bridge of metal that acts as a conductor of hot or cold temperatures through the aluminum frame, thus maintaining energy efficiency and contributing to structural strength in the envelope. Polyurethane polymer pour and debridge systems outperform polyamide strip barriers in thermal conductivity, shear and structural strength, and design options.

Daylighting systems produced with structural thermal barrier technology for aluminum windows, and high performance glazing components for insulating glass, will yield a fenestration system capable of upholding the highest efficiency and sustainability standards.

Our Triple Bottom Line

It is our purpose that the impression Azon leaves in this world—whether it's through our manufacturing practices or our energy-saving products—is an expression of our goal for a sustainable and profitable future.

Conclusion